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**on supporting the implementation of Directive 2009/148/EC on the protection of workers from the risks related to exposure to asbestos at work as amended by Directive 2023/2668**

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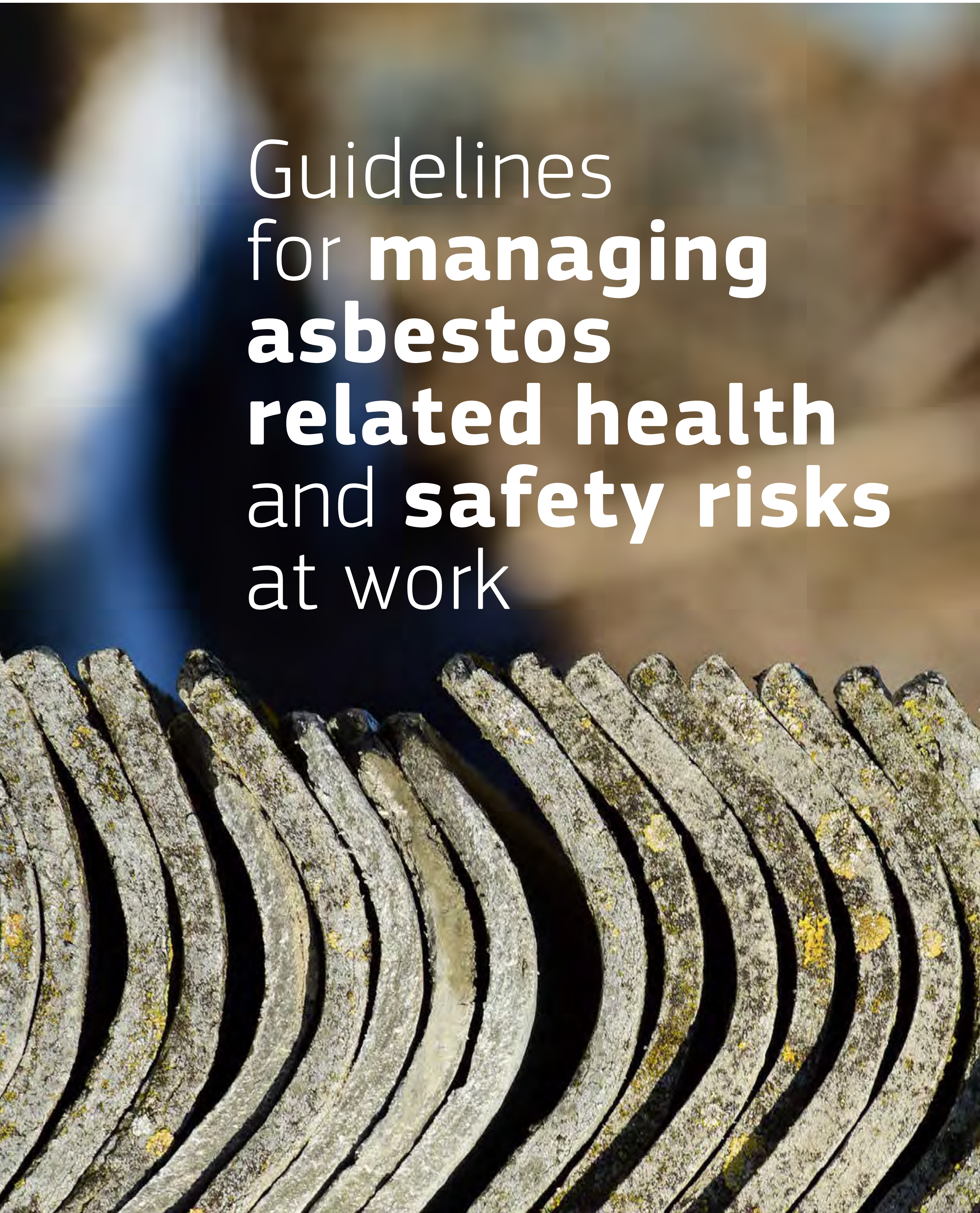
European Commission

*Employment, Social Affairs and Inclusion*

# Guidelines for **managing asbestos related health** and **safety risks** at work



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# Guidelines for **managing asbestos related health** and **safety risks** at work

PreventPartner RPA Europe RPA Risk & Policy Analysts RPA | PRG Amsterdam UMC DANISH TECHNOLOGICAL INSTITUTE EPRD Policy & Development IOM

# About this guide


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Following several wide-ranging calls for participation at different stages of the project, the following organisations volunteered to support the development of the guidelines by providing case-specific information and pictures:

- Admanstars B.V., Netherlands
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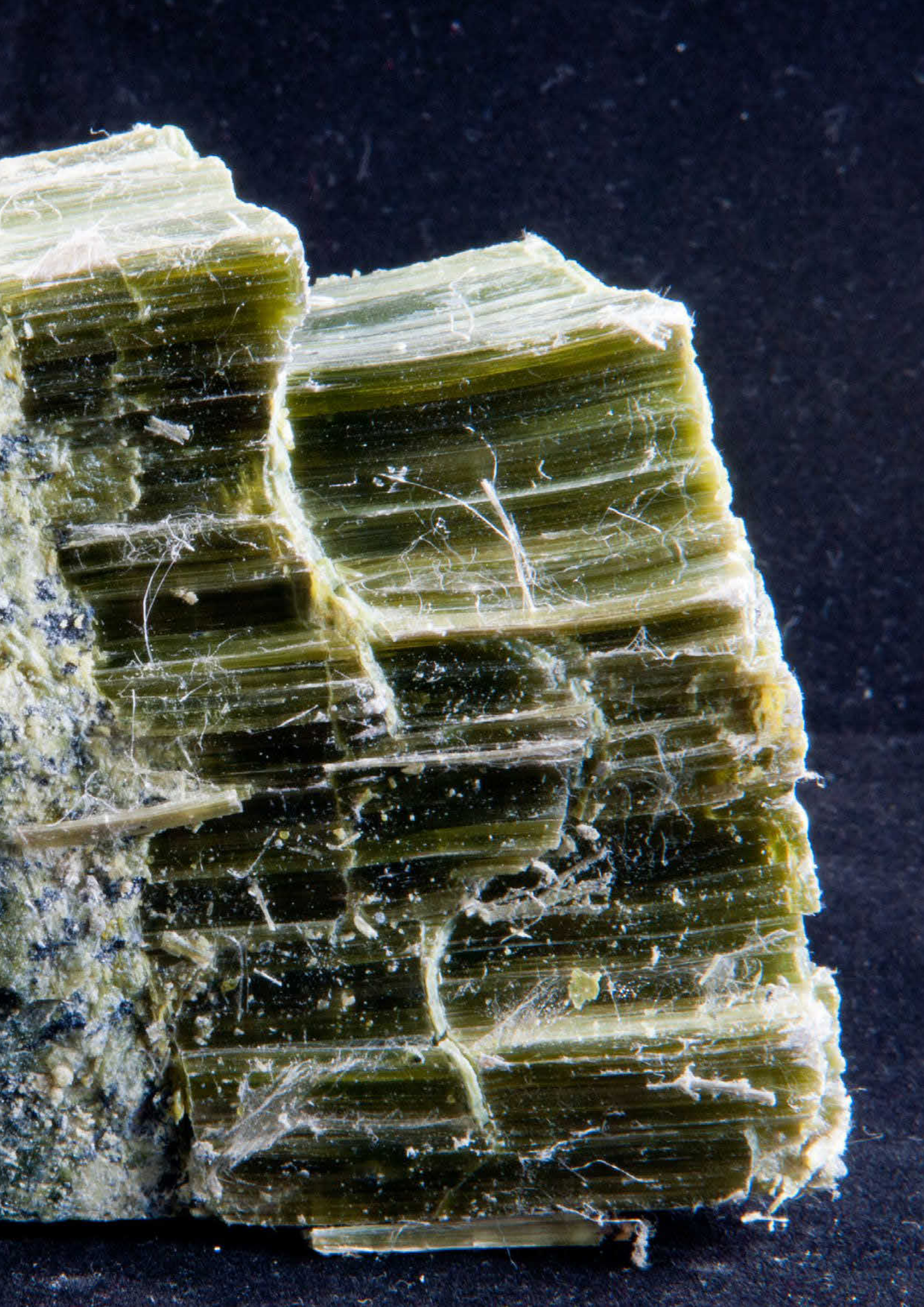
- Service d’incendie et de secours du Bas-Rhin – SIS 67, France

# Contents



# 1 Introduction

## 1.1 Why is managing exposure to asbestos so important?

### 1.1.1 Overview of asbestos use

Asbestos was widely used for decades across Europe in a wide range of applications, including in the construction sector, and can still be found in large quantities in buildings and infrastructure. It has long been recognised as a major occupational carcinogen. Airborne fibres are very resistant when inhaled and can lead to, among other conditions, mesothelioma, asbestosis, cancers of the lung, larynx and ovary, and other diseases.

At the EU level, asbestos use was banned via various Council directives, and then intentionally added asbestos was banned under the 2006 'REACH' Regulation (Annex XVII, entry 6) ([1]). This entry states that the manufacture, placing on the market, and use of asbestos fibres (crocidolite, amosite, anthophyllite, actinolite, tremolite and chrysotile) and of articles and mixtures containing these fibres added intentionally, are prohibited in the EU. However, this may not always prevent materials containing asbestos (MCAs) from entering the EU via manufactured goods from overseas, where local regulations may not be as stringent. For example, some goods may be marked as 'asbestos free' but still contain small amounts of asbestos.

Asbestos can still be found in natural sources or in existing products and infrastructure due to its historical use. Large numbers of workers continue to come into contact with asbestos during their work. They are involved in construction, refurbishment, maintenance and demolition activities (including waste management), mining, quarrying, civil engineering, maintaining ships, trains, aircraft, vehicles and machinery, and emergency services. Table 1-1 shows the estimated numbers of workers in the EU by exposure situation. Further exposure situations have been identified during the development of this guide, including gas and electricity networks, railway ballast, groundworks and pipelines.

([1]) Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (OJ L 396, 30.12.2006, pp. 1–849, ELI: http://data.europa.eu/eli/reg/2006/1907/oj).

**Table 1-1: Estimated total EU workforce exposed to asbestos by exposure situation**

| No | Exposure situation | Estimated number of exposed workers |
|---|---|---|
| **1** | Building and construction – exposure situations subject to notification | 300 000–500 000 |
| **2** | Building and construction | 3 500 000–5 500 000 |
| **3** | Building and construction – passive exposure in buildings | 200 000–1 000 000<br>Potentially millions |
| **4** | Exposure to asbestos in ships, trains, aircraft, vehicles and other machinery | 5 000–25 000 |
| **5** | Waste management | 50 000–200 000 |
| **6** | Mining and quarrying – naturally occurring asbestos | 5 000–20 000 |
| **7** | Tunnel excavation | 500–5 000 |
| **8** | Road construction and maintenance | 10 000–50 000 |
| **9** | Sampling and analysis | 10 000–25 000 |
| | **Total (rounded)** | **4 100 000–7 300 000** |

*Source:* For details, including methodological limitations, see Lassen, C., Christensen, F., Vencovska, J., Vencovsky, D., Garrett, S. et al., *Study on collecting information on substances with the view to analyse health, socioeconomic and environmental impacts in connection with possible amendments of Directive 98/24/EC (chemical agents) and Directive 2009/148/EC (asbestos) – Final report for asbestos,* Publications Office of the European Union, Luxembourg, 2021, https://op.europa.eu/en/publication-detail/-/publication/45581742-5e23-11ec-9c6c-01aa75ed71a1/language-en.

## 1.1.2 Health hazards

Asbestos fibres in the sense of Directive 2009/148/EC ([2]) (chrysotile, crocidolite, amosite, tremolite, actinolite and anthophyllite) are classified as Category 1A carcinogens in accordance with Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP Regulation) ([3]).

The main cancer effects associated with asbestos exposure are mesothelioma (tumours of the membrane linings of the lungs and abdominal cavities) and cancer of the lung, larynx and ovary. In addition, some studies have linked asbestos exposure with cancer of the pharynx, stomach and colorectum ([4]). Moreover, asbestosis (a form of pulmonary fibrosis) is the main non-cancerous disease associated with asbestos exposure. It can also cause pleural plaques ([5]).

Asbestos is a non-threshold carcinogen, meaning that it is not possible to identify a level below which

(2) Directive 2009/148/EC of the European Parliament and of the Council of 30 November 2009 on the protection of workers from the risks related to exposure to asbestos at work (OJ L 330, 16.12.2009, pp. 28–36, ELI: http://data.europa.eu/eli/dir/2009/148/oj).

(3) Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (OJ L 353, 31.12.2008, pp. 1–1355, ELI: http://data.europa.eu/eli/reg/2008/1272/oj).

(4) European Chemicals Agency: Committee for Risk Assessment (RAC), 'Opinion on scientific evaluation of occupational exposure limits for asbestos', ECHA/RAC/A77-O-0000006981-66-01/F, 10 June 2021, https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Final_Opinion_en.pdf/cc917e63-e0e6-e9cd-86d2-f75c81514277?t=1626256168788; RAC (2021), 'Annex 1 in support of the RAC for evaluation of limit values for asbestos at the workplace', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Annex1_en.pdf/ea272703-e495-8846-ae8c-ec2e4fc85f9f?t=1626256203202; recital 7 of Directive (EU) 2023/2668 of the European Parliament and of the Council of 22 November 2023 amending Directive 2009/148/EC on the protection of workers from the risks related to exposure to asbestos at work (OJ L, 2023/2668, 30.11.2023, ELI: http://data.europa.eu/eli/dir/2023/2668/oj).

(5) RAC (2021), 'Opinion on scientific evaluation of occupational exposure limits for asbestos', ECHA/RAC/A77-O-0000006981-66-01/F, 10 June 2021, https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Final_Opinion_en.pdf/cc917e63-e0e6-e9cd-86d2-f75c81514277?t=1626256168788, RAC (2021), 'Annex 1 in support of the RAC for evaluation of limit values for asbestos at the workplace', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Annex1_en.pdf/ea272703-e495-8846-ae8c-ec2e4fc85f9f?t=1626256203202.

exposure would not lead to adverse health effects. Thinner fibres (< 0.2 μm) are also carcinogenic (6).

Inhalation is the most relevant exposure pathway for asbestos fibres in the workplace. In addition, it cannot be ruled out that there could be risks when asbestos is swallowed (7).

When deposited in the lungs, clearance half-times (8) ranging from several months to many years are reported, depending on fibre type, geometry and other factors (9). Asbestos fibres are not readily eliminated by physical alteration (breakage, splitting) or chemical modification, and are thus considered biopersistent (10).

Asbestos fibres are so small that they are not visible to the naked eye. These fibres may be present in air that appears free of any dust. In addition, a worker who has inhaled asbestos fibres will not be aware that they have been exposed at the time (11).

The symptoms of ill-health usually appear many years after exposure (12). Long latency periods of at least 10 years (but up to 20–40 years or more) were described for respiratory tract tumours and mesothelioma to develop (13).

Tobacco smoking is an important co-factor for lung cancer induction (14).

Asbestosis, i.e. fibrotic changes of the lung due to prolonged exposure to asbestos fibres, is characterised by symptoms such as dyspnoea (shortness of breath), rales (clicking, bubbling or rattling sounds in the lungs), coughing and reduced lung function which, in severe cases, might be lethal.

### 1.1.3 What is the purpose of this guide?

Principle 10 of the European Pillar of Social Rights recognises every worker's entitlement to a safe, healthy and well-adapted work environment. The European Commission's 2021–2027 EU strategic framework on health and safety at work (15) highlights the ongoing need to safeguard workers from hazardous chemicals, including asbestos, in response to evolving occupational risks.

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(6) RAC (2021), 'Opinion on scientific evaluation of occupational exposure limits for asbestos', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Final_Opinion_en.pdf/cc917e63-e0e6-e9cd-86d2-f75c81514277?t=1626256168788; RAC (2021), 'Annex 1 in support of the RAC for evaluation of limit values for asbestos at the workplace', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Annex1_en.pdf/ea272703-e495-8846-ae8c-ec2e4fc85f9f?t=1626256203202.

(7) RAC (2021), 'Opinion on scientific evaluation of occupational exposure limits for asbestos', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Final_Opinion_en.pdf/cc917e63-e0e6-e9cd-86d2-f75c81514277?t=1626256168788; RAC (2021), 'Annex 1 in support of the RAC for evaluation of limit values for asbestos at the workplace', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Annex1_en.pdf/ea272703-e495-8846-ae8c-ec2e4fc85f9f?t=1626256203202.

(8) Time required for asbestos fibre concentration in the lungs to fall to 50 %. See: Churg, A. and Wright J. L. (1994), 'Persistence of natural mineral fibers in human lungs: An overview', *Environmental Health Perspectives*, Vol. 102, Issue 5, pp. 229-233, https://pmc.ncbi.nlm.nih.gov/articles/instance/1567279/pdf/envhper00401-0211.pdf.

(9) RAC (2021), 'Opinion on scientific evaluation of occupational exposure limits for asbestos', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Final_Opinion_en.pdf/cc917e63-e0e6-e9cd-86d2-f75c81514277?t=1626256168788; RAC (2021), 'Annex 1 in support of the Committee for Risk Assessment (RAC) for evaluation of limit values for asbestos at the workplace', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Annex1_en.pdf/ea272703-e495-8846-ae8c-ec2e4fc85f9f?t=16262; Directive (EU) 2023/2668, recital 7.

(10) Health Council of the Netherlands (2010), 'Asbestos: Risks of environmental and occupational exposure', No 2010/10E, https://www.healthcouncil.nl/documents/advisory-reports/2010/06/03/asbestos-risks-of-environmental-and-occupational-exposure; World Health Organization: International Agency for Research on Cancer (IARC) (2012), *Arsenic, Metals, Fibres, and Dusts – Volume 100C, A review of human carcinogens*, https://publications.iarc.fr/Book-And-Report-Series/Iarc-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans/Arsenic-Metals-Fibres-And-Dusts-2012.

(11) The worker may have difficulty believing that asbestos is present: they cannot smell or taste it, and it does not cause sneezing, irritation, a runny nose or any other minor symptoms, although they may experience these if other dust was present.

(12) Mayo Clinic (2022), 'Asbestosis – Overview', https://www.mayoclinic.org/diseases-conditions/asbestosis/symptoms-causes/syc-20354637; Watson, S. (2022), 'Asbestosis', Healthline, https://www.healthline.com/health/asbestosis.

(13) RAC (2021), 'Opinion on scientific evaluation of occupational exposure limits for asbestos', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Final_Opinion_en.pdf/cc917e63-e0e6-e9cd-86d2-f75c81514277?t=1626256168788; RAC (2021), 'Annex 1 in support of the RAC for evaluation of limit values for asbestos at the workplace', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Annex1_en.pdf/ea272703-e495-8846-ae8c-ec2e4fc85f9f?t=16262.

(14) RAC (2021), 'Opinion on scientific evaluation of occupational exposure limits for asbestos', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Final_Opinion_en.pdf/cc917e63-e0e6-e9cd-86d2-f75c81514277?t=1626256168788; RAC (2021), 'Annex 1 in support of the RAC for evaluation of limit values for asbestos at the workplace', https://echa.europa.eu/documents/10162/7937606/OEL_asbestos_Annex1_en.pdf/ea272703-e495-8846-ae8c-ec2e4fc85f9f?t=16262.

(15) European Commission, Communication from the Commission to the European Parliament, the Council, the European Central Bank, the European Economic and Social Committee and the Committee of the Regions, EU strategic framework on health and safety at work 2021–2027, Occupational safety and health in a changing world of work, COM(2021) 323 final of 28 June 2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52021DC0323.

Ensuring the effectiveness and suitability of the EU occupational safety and health (OSH) rules remains essential. This is anchored by the Occupational Safety and Health Framework Directive along with its individual and related OSH directives. In line with Europe's beating cancer plan ([16]), there is an emphasis on protecting workers from carcinogens, including asbestos. Enhanced safety measures for workers exposed to asbestos also play a crucial role in the green transition, including in the European Green Deal's renovation wave ([17]).

This guide aims to:

- update and further develop existing EU guidelines ([18]), taking into account recent technical, legal and scientific developments, including the 2023 revision ([19]) of the Asbestos at Work Directive (AWD) ([20]);
- increase awareness of the risks of asbestos among employers and workers;
- increase the uptake of good practice by providing examples of solutions for the management of asbestos in the workplace;
- reduce inequalities by providing additional information on good practice to stakeholders across the EU, including in Member States where comparatively less guidance is available.

This guide is an overview of good practice approaches to the management of asbestos in the workplace, providing practical ways to reduce workers' exposure to asbestos. The practical solutions mentioned in this guide are examples and should not be treated as the only possible ways to implement EU OSH legislation. The guide is designed for all types of organisations, public or private, and regardless of size.

# 1.2 Scope of the guide

## 1.2.1 Types of asbestos

Under the AWD, asbestos is defined as one of the six fibrous silicates listed in Table 1-2, with their Chemicals Abstracts Service (CAS) numbers. These are shown in the table with their molecular formulas.

Occupational risks arising from fibres other than the six fibrous silicates ([21]) listed in Article 2 of the AWD may also be relevant to the activities considered in this guide, even if they do not fall under the scope of the AWD. Specifically, this may include requirements established in EU legislation for carcinogens, mutagens or reprotoxic substances ([22]), other hazardous chemical agents ([23]) and other occupational risks ([24]).

([16]) European Commission (2022), *Europe's Beating Cancer Plan*, https://health.ec.europa.eu/system/files/2022-02/eu_cancer-plan_en_0.pdf.

([17]) European Commission (n.d.), 'Renovation wave', https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en.

([18]) European Union (2012), 'Practical guidelines for the information and training of workers involved with asbestos removal or maintenance work', https://ec.europa.eu/social/BlobServlet?docId=7478&langId=en.

([19]) Directive (EU) 2023/2668 of the European Parliament and of the Council of 22 November 2023 amending Directive 2009/148/EC on the protection of workers from the risks related to exposure to asbestos at work (OJ L, 2023/2668, 30.11.2023, ELI: http://data.europa.eu/eli/dir/2023/2668/oj).

([20]) Directive 2009/148/EC – Asbestos at Work Directive, ELI: https://eur-lex.europa.eu/eli/dir/2009/148.

([21]) Including but not limited to erionite, riebeckite, winchite, richterite or fluoro-edenite.

([22]) Directive 2004/37/EC of the European Parliament and of the Council of 29 April 2004 on the protection of workers from the risks related to exposure to carcinogens or mutagens at work (sixth individual directive within the meaning of Article 16(1) of Council Directive 89/391/EEC) (OJ L 158, 30.4.2004, pp. 50–76, ELI: http://data.europa.eu/eli/dir/2004/37/oj).

([23]) Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work (fourteenth individual directive within the meaning of Article 16(1) of Directive 89/391/EEC) (OJ L 131, 5.5.1998, pp. 11–23, ELI: http://data.europa.eu/eli/dir/1998/24/oj).

([24]) Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (OJ L 183, 29.6.1989, pp. 1–8, ELI: http://data.europa.eu/eli/dir/1989/391/oj).

Table 1-2: Six fibrous silicates within the scope of the Asbestos at Work Directive

| Fibrous silicate | CAS number | Molecular formula |
|---|---|---|
| **Serpentine group** | | |
| Chrysotile (white) | 12001-29-5 | $Mg_3(Si_2O_5)(OH)_4$ |
| **Amphibole group** | | |
| Actinolite | 77536-66-4 | $Ca_2(Fe^{2+}Mg)_5(Si_8O_{22})(OH)_2$ |
| Amosite (grunerite, brown) | 12172-73-5 | $(Fe^{2+}Mg)_7(Si_8O_{22})(OH)_2$ |
| Anthophyllite (azbolen) | 77536-67-5 | $(Mg,Fe^{2+})_7(Si_8O_{22})(OH)_2$ |
| Crocidolite (blue) | 12001-28-4 | $Na_2Fe_3^{2+}Fe_2^{3+}(Si_8O_{22})(OH)_2$ |
| Tremolite (amphibole) | 77536-68-6 | $Ca_2Mg_5(Si_8O_{22})(OH)_2$ |

## 1.2.2 Where can asbestos be found?

Asbestos fibres are naturally occurring silicate minerals made of long fibrous crystals that can be found in rock or soil formations; this is often referred to as ‘naturally occurring asbestos’ (NOA). Asbestos-bearing rocks may be present in various regions in Europe and should therefore be considered before commencing any activity that may result in disturbing rock or soil which may release dust from NOA into the air, and therefore lead to worker exposure (see Sections 5.2.2, 15 and 16).

Asbestos and MCAs were widely used for their heat resistance, insulation and reinforcing properties, with significant applications in construction across Europe and the rest of the world. MCAs were also commonly used in electrical, ventilation and security applications. For a detailed but non-exhaustive list of MCAs, see Annex 4.

## 1.2.3 General topics

This guide considers a wide range of general topics that apply to all exposure situations, including:

- Section 1: Introduction
- Section 2: Legal framework
- Section 3: Key elements of safety management – coordination, consultation, information and communication
- Section 4: Asbestos risk assessment and management
- Section 5: Identifying asbestos
- Section 6: Air monitoring – air sampling and sampling analysis
- Section 7: Passive exposure
- Section 8: Control measures – including elimination, technical measures, organisational measures and personal protective equipment (PPE), including respiratory protection devices
- Section 9: Training
- Section 10: Health surveillance
- Section 11: Incident management
- Section 12: Waste management.

### 1.2.4 Exposure situations

This guide considers a wide range of exposure situations, including:

- Section 13: Buildings – maintaining, renovating and demolishing buildings
- Section 14: Ships, trains, aircraft, vehicles and machines
- Section 15: Mining and quarrying
- Section 16: Civil engineering – major infrastructure works requiring earthworks (such as roads, railways, harbours and airports), civil engineering structures (such as bridges, tunnels, locks and dams) and networks (electricity and gas networks, water pipelines)
- Section 17: Emergency services – emergency responders (such as firefighters, police, paramedics, public health professionals, charity workers, humanitarian aid workers), including military personnel: after the emergency, the workers involved in clean-up and waste removal, insurance loss adjusters and service providers (gas, electricity and water).

### 1.2.5 Exposure concentration units

Throughout this guide, the concentrations of asbestos are given in fibres/$cm^3$. Two further concentration units are commonly used in Member States:

- fibres/$m^3$: 1 : 1 000 000 conversion rate with fibres/$cm^3$;
- fibres/litre: 1 : 1 000 conversion rate with fibres/$cm^3$.

A range of concentrations of asbestos given in fibres/$cm^3$ are converted to fibres/$m^3$ and fibres/litre in Table 1-3.

**Table 1-3: Conversion between fibres/$cm^3$, fibres/$m^3$ and fibres/litre**

| Fibres/$cm^3$ | Fibres/$m^3$ | Fibres/litre |
|---|---|---|
| 1 | 1 000 000 | 1 000 |
| 0.1 | 100 000 | 100 |
| 0.05 | 50 000 | 50 |
| 0.01 | 10 000 | 10 |
| 0.002 | 2 000 | 2 |
| 0.001 | 1 000 | 1 |

### 1.2.6 Exposure types

Examples of the terms used to describe the different types of asbestos exposure include the following.

- **Active exposure.** Workers who work intentionally or unintentionally with MCAs.
- **Passive exposure.** Workers who work either in the vicinity of someone working with MCAs or in premises where MCAs are degrading [25], see Section 7.
- **Secondary exposure.** People who are exposed to asbestos fibres brought home by occupationally exposed individuals, mostly from their clothing or hair [26]. Regarding secondary exposure to asbestos or MCAs, the OSH requirements provided for in the AWD are important means by which to avoid such exposure.

(25) Directive (EU) 2023/2668, recital 5 – amending AWD, ELI: https://eur-lex.europa.eu/eli/dir/2023/2668.
(26) Directive (EU) 2023/2668, recital 5.

# 1.3 Using the guide

## 1.3.1 Who should read this guide?

The guide provides relevant advice for employers [27], workers [28] and workers' representatives, including representatives with specific responsibility for the safety and health of workers [29]. It is modular in design and the sections that are relevant to each role are shown in Table 1-4. The sections relevant for each role group in Table 1-4 are shown in Table 1-5, which is coded as follows:

- green: this section is relevant to this role;
- yellow: this section is relevant for workers in specific exposure situations;
- pink: some of this section may be relevant to this role;
- clear/white: this section is not relevant to this role.

**Table 1-4: Roles typically involved with asbestos**

| Group | Role |
|---|---|
| **Lab** | Laboratory staff providing sampling and analysis. |
| **Specialist** | Trained (and possibly certified) professional who identifies, assesses, removes and/or otherwise handles asbestos or MCAs, see Annex 4. |
| **Non-specialist** | All asbestos non-specialist occupations that may encounter asbestos, including but not limited to electricians, plumbers, gas fitters, painters and decorators, joiners, shop fitters, plasterers, roofers, scaffolders, heating and ventilation engineers, telecommunication engineers, data cabling installers, fire and burglar alarm installers, architects, building surveyors, miners, civil engineers and other professionals. These could be workers that are renovating, demolishing, operating or maintaining premises which contain or might contain asbestos, see Annex 10. |
| **Emergency** | Emergency services workers. |
| **Waste** | Waste handlers or transporters. |
| **Passive** | Workers and workers' representatives in buildings that contain asbestos (such as education, health, government or office workers). |
| **Health** | Medical staff working with workers exposed to asbestos, including but not limited to occupational health doctors, general practitioners, pulmonologists, nurses and paramedics. |
| **Manager** | Employers, supervisors, coordinators, managers of workers and workers designated to carry out activities related to the protection and prevention of occupational risks for the undertaking and/or establishment. |

NB: Some workers may have more than one role.

(27) Directive 89/391/EEC, Article 3(b). Employer means 'any natural or legal person who has an employment relationship with the worker and has responsibility for the undertaking and/or establishment'.

(28) Directive 89/391/EEC, Article 3(a). Worker means 'any person employed by an employer, including trainees and apprentices but excluding domestic servants'.

(29) Directive 89/391/EEC, Article 3(c). 'Workers' representative with specific responsibility for the safety and health of workers means any person elected, chosen or designated in accordance with national laws and/ or practices to represent workers where problems arise relating to the safety and health protection of workers at work'.

**Table 1-5: Sections relevant to each role group**

| Section | Lab | Specialist | Non-specialist | Emergency | Waste | Passive | Health | Manager |
|---|---|---|---|---|---|---|---|---|
| **1** Introduction | Green | Green | Green | Green | Green | Green | Green | Green |
| **2** Legal framework | Green | Green | Green | Green | Green | Green | Green | Green |
| **3** Key elements of safety management | | Pink | | | | Pink | | Green |
| **4** Asbestos risk assessment and management | | Pink | | | | Pink | | Green |
| **5** Identifying asbestos | Green | Pink | | | | Green | | Green |
| **6** Air monitoring | Green | Pink | | | | Pink | | Green |
| **7** Passive exposure | Pink | Pink | | Pink | | Green | Green | Green |
| **8** Control measures | | Pink | | | | Pink | | Green |
| **9** Training | | Pink | | | | | | Green |
| **10** Health surveillance | | Pink | | | | Pink | Green | Green |
| **11** Incident management | | Pink | | | | | | Green |
| **12** Waste management | Pink | Pink | Pink | Pink | Green | | | Green |
| **13** Buildings | | Pink | Yellow | | Yellow | | | Yellow |
| **14** Ships, trains, aircraft, vehicles and machinery | | Pink | Yellow | | Yellow | | | Yellow |
| **15** Mining and quarrying | | Pink | Yellow | | Yellow | | | Yellow |
| **16** Civil engineering | | Pink | Yellow | | Yellow | | | Yellow |
| **17** Emergency services | | Pink | | Green | Green | | | Green |

NB: **Green** means all of this section is relevant to this role; **yellow** means this section is relevant for workers in specific exposure situations; **pink** means some of this section may be relevant to this role; **clear/white** means this section is not relevant to this role.

## 1.3.2 How to use this guide

This guide is not a legally binding document. It builds on existing EU legislation (listed in Section 2) but does not aim to interpret it. The information in this guide must be read in conjunction with national OSH legislation; it is not a substitute for a compliance check of national and EU legislation. The legislation referenced in this guide is not exhaustive: other legislation may apply at the EU, national or local level, see Section 2.2. Furthermore, there are many sector-specific guides in the Member States, see Annex 2.

The guide is divided into sections on general topics and specific exposure situations. The first 12 sections are general and apply to all exposure situations. Sections 13 to 17 cover specific exposure situations where asbestos can be found. There are several annexes providing a glossary and additional information.

Throughout the guide, the use of 'must' means that the references are covered by EU legislation and there is a footnote linking to the relevant legal provision. As EU directives are transposed into national legislation, everything that is accompanied by 'must' is a legal requirement in the EU. However, EU OSH legislation sets minimum requirements, and Member States are allowed to maintain or adopt more stringent protective measures. Therefore, statements that use 'must' may not be sufficient for ensuring compliance with all national legislation.

In addition, statements that use 'must' may not be sufficient for ensuring compliance with all applicable EU legislation, as this guide focuses on EU OSH legislation, but does not necessarily cover that or any other EU legislation exhaustively.

Throughout the guide, there are two types of boxes, as shown below: the blue boxes contain specific legislation and the yellow boxes are practical examples or case studies.

| **Light blue** |
| --- |
| EU legislation |

| **Yellow** |
| --- |
| Practice examples |

In this guide, all references to standards are meant as live references: the relevant standards are amended, supplemented, replaced or otherwise modified over time.

This guide does not address enforcement issues related to the AWD. This will be addressed in a dedicated guide for labour inspectorates, produced in the near future by the SLIC.

### 1.3.3 Disclaimer

This guide is:

- general in nature and not intended to address the specific circumstances of any particular individual or entity;
- a reflection of the knowledge available when it was written; new knowledge may lead to the development of more up-to-date guidance in the future;
- not legal or professional advice, and does not provide a comprehensive overview of all the applicable legal requirements; readers are thus strongly advised to familiarise themselves with all the relevant legal requirements in their Member States;
- focused on preventing and controlling risks from occupational exposure to asbestos; the information contained herein does not constitute a comprehensive overview of procedures for ensuring worker safety.

The methods, measures and tools presented in this guide are shown as examples. Other methods, measures and tools not mentioned in this guide could also be applied to achieve a comparable result.

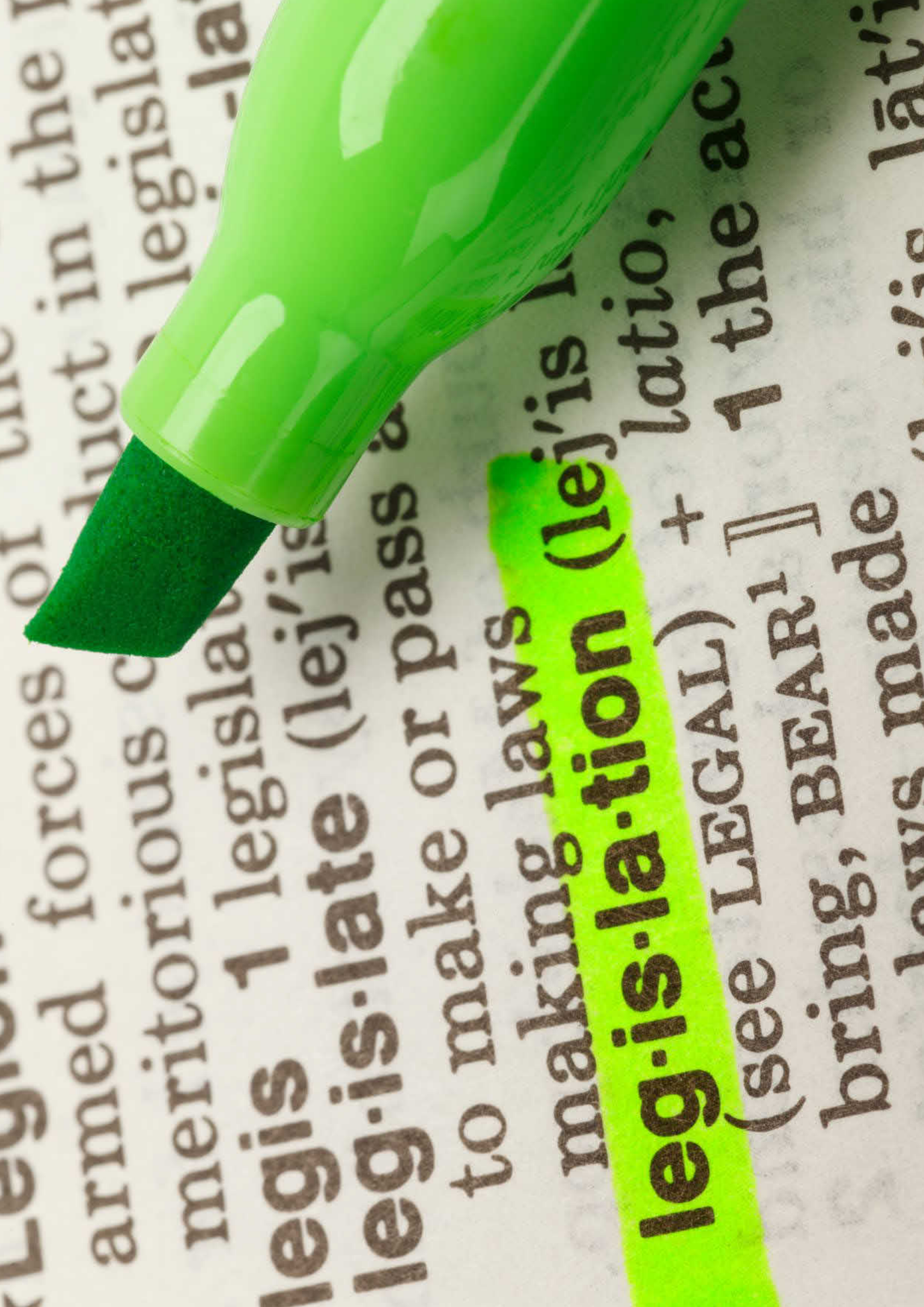
## 1.4 How was this guide developed?

This guide was developed with the extensive involvement of stakeholders. The consultation included:

- a review of existing guidance documents: 187 documents on the Member State, EU or international level were identified, of which 91 were classified as potentially relevant and screened in detail;
- ten online workshops: 956 potential participants were initially invited, of whom 468 were sent invitations to one or more workshops, and the total number of participants in the workshops was 848;
- consultation on the first draft of the guide: 133 stakeholders provided 505 responses with many responses containing several comments;
- discussions with stakeholders to develop examples of relevant practices;
- consultation on the second draft of the guide: 20 pilots, including nine site visits, took place with stakeholders from a range of asbestos exposure situations and engaged in a variety of (potential) exposure activities.

During the consultation, there were extensive discussions about how to protect workers from the risk of harm from asbestos exposure. A wide range of stakeholders were consulted, including trade unions, businesses and governments.

The process for developing this guide was overseen by a steering group set up by the Directorate-General for Employment, Social Affairs and Inclusion, with representatives from European Commission services, EU-OSHA, national government representatives, employer representatives and worker representatives.


leg·is·late
to make or pass
making laws
leg·is·la·tion (lej
(see LEGAL)
bring, BEAR¹

# 2 Legal framework

The EU directives and regulations underpinning this guide are listed below.

## 2.1 Occupational safety and health legislation

Directive 2009/148/EC: **AWD** (Asbestos at Work Directive [30]) lays down minimum requirements, including limit values for the exposure to asbestos fibres at work, in order to protect workers against risks to their health, including the prevention of such risks, arising or likely to arise from this exposure. Revised by Directive (EU) 2023/266.

Directive (EU) 2023/2668: **AMEND** amending Directive 2009/148/EC on the protection of workers from the risks related to exposure to asbestos at work [31].

Directive 2004/37/EC: **CMRD** (Carcinogens, Mutagens and Reprotoxic Substances Directive [32]) lays down minimum requirements for protecting workers against risks to their health and safety arising, or likely to arise, from exposure to carcinogens, mutagens or reprotoxic substances at work. As regards asbestos, the provisions of the CMRD apply whenever they are more favourable to health and safety at work [33].

Directive 98/24/EC: **CAD** (Chemical Agents Directive [34]) lays down minimum requirements for protecting workers from risks to their safety and health arising, or likely to arise, from the effects of chemical agents present at the workplace or as a result of any work activity involving those agents.

Directive 89/391/EEC: **OSH FD** (Occupational Safety and Health Framework Directive [35]) introduces measures to encourage improvements in the health and safety of workers at work. Amongst other provisions, it sets out obligations for both employers and workers to ensure the safety and health protection of workers. The OSH FD applies to all sectors of activity, both public and private, without prejudice to existing or future national and EU provisions which are more favourable to the protection of the safety and health of workers at work [36].

Directive 89/656/EEC: **PPED** (Personal Protective Equipment Directive [37]) lays down minimum requirements for the use of PPE by workers at work.

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(30) Directive 2009/148/EC – Asbestos at Work, https://eur-lex.europa.eu/eli/dir/2009/148.

(31) Directive (EU) 2023/2668 – Amending AWD, http://data.europa.eu/eli/dir/2023/2668/oj.

(32) Directive 2004/37/EC – Protection of workers from the risks related to exposure to carcinogens or mutagens at work, http://data.europa.eu/eli/dir/2004/37/oj.

(33) Directive 2004/37/EC, Article 1(4).

(34) Directive 98/24/EC, Chemical Agents at Work, https://eur-lex.europa.eu/eli/dir/1998/24.

(35) Directive 89/391/EEC, Occupational Safety and Health Framework Directive, https://eurlex.europa.eu/eli/dir/1989/391.

(36) Directive 89/391/EEC, Articles 1 and 2.

(37) Council Directive 89/656/EEC of 30 November 1989 on the minimum health and safety requirements for the use by workers of personal protective equipment at the workplace (third individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC) (OJ L 393, 30.12.1989, pp. 18–28, ELI: http://data.europa.eu/eli/dir/1989/656/oj).

Directive 92/58/EEC: **SIGN** (Health and Safety Signs at Work Directive ([38])) lays down minimum requirements for the provision of safety and/or health signs at work.

Directive 92/104/EEC: **SUMI** (Surface and Underground Mineral-extracting Industries Directive ([39])) lays down minimum requirements for the safety and health protection of workers in surface and underground mineral-extracting industries.

Directive 92/91/EEC: **MITD** (Mineral-extracting Industries Through Drilling Directive ([40])) lays down minimum requirements for the safety and health protection of workers in the mineral-extracting industries through drilling.

Directive 92/57/EEC: **TMC** (Temporary or Mobile Construction Sites Directive ([41])) lays down minimum safety and health requirements for temporary or mobile construction sites, including the duties of coordination and cooperation in the project preparation and execution stage.

## 2.2 Other relevant legislation and agreements

Regulation (EC) No 1272/2008: **CLP** (Classification, Labelling and Packaging Regulation ([42])) lays down uniform requirements for the CLP of chemical substances and mixtures according to the United Nations' Globally Harmonized System of Classification and Labelling of Chemicals. It requires companies to classify, label and package hazardous chemicals appropriately before placing them on the market.

Regulation (EC) No 1907/2006: **REACH** (Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation ([43])) establishes a comprehensive framework for the registration, evaluation, authorisation and restriction of chemicals placed on the EU market, with the aim of ensuring a high level of protection for human health and the environment. It places the responsibility on manufacturers, importers and downstream users to understand and manage the risks associated with chemical substances and mixtures throughout their lifecycle. The manufacture, placing on the market and use of asbestos fibres and of articles and mixtures containing these fibres is strictly restricted under Annex XVII to REACH.

Regulation (EU) 2016/425: **PPER** (Personal Protective Equipment Regulation ([44])) lays down requirements for the design and manufacture of PPE which is to be made available on the market, in order to ensure protection of the health and safety of users and establish rules on the free movement of PPE in the EU.

Directive 2008/68/EC: **Inland TDG** (Inland Transport of Dangerous Goods Directive ([45])) lays down rules for the safe and secure transport of dangerous goods within and between EU countries by road, rail or inland waterway.

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([38]) Council Directive 92/58/EEC of 24 June 1992 on the minimum requirements for the provision of safety and/or health signs at work (ninth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) (OJ L 245, 26.8.1992, pp. 23–42, ELI: http://data.europa.eu/eli/dir/1992/58/oj).

([39]) Council Directive 92/104/EEC of 3 December 1992 on the minimum requirements for improving the safety and health protection of workers in surface and underground mineral-extracting industries (twelfth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) (OJ L 404, 31.12.1992, pp. 10–25, ELI: http://data.europa.eu/eli/dir/1992/104/oj).

([40]) Council Directive 92/91/EEC of 3 November 1992 concerning the minimum requirements for improving the safety and health protection of workers in the mineral- extracting industries through drilling (eleventh individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) (OJ L 348, 28.11.1992, pp. 9–24, ELI: http://data.europa.eu/eli/dir/1992/91/oj).

([41]) Directive 92/57/EEC Council Directive 92/57/EEC of 24 June 1992 on the implementation of minimum safety and health requirements at temporary or mobile construction sites (eighth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) (OJ L 245, 26.8.1992, pp. 6–22, ELI: http://data.europa.eu/eli/dir/1992/57/oj).

([42]) Regulation (EC) 1272/2008, https://eur-lex.europa.eu/eli/reg/2008/1272/oj/eng.

([43]) Regulation (EC) 1907/2006, Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation https://eur-lex.europa.eu/eli/reg/2006/1907/oj/eng.

([44]) Regulation (EU) 2016/425 – Personal protective equipment, https://eur-lex.europa.eu/eli/reg/2016/425/oj/eng.

([45]) Directive 2008/68/EC of the European Parliament and of the Council of 24 September 2008 on the inland transport of dangerous goods (OJ L 260, 30.9.2008, pp. 13–59, ELI: http://data.europa.eu/eli/dir/2008/68/oj).

Agreement concerning the international carriage of dangerous goods by road: **ADR** ([46]) establishes harmonised rules for the safe international transport of dangerous goods by road, including hazardous substances, mixtures and waste. Its objective is to protect public health, safety and the environment through detailed provisions on classification, packaging, labelling, vehicle requirements and training obligations for all actors involved. The transport of asbestos is subject to strict requirements concerning packaging, labelling, documentation and handling. However, mixtures and articles in which asbestos is firmly bound by a natural or artificial binder or packaged in a manner that prevents the release of respirable fibres during normal conditions of carriage are exempt from the provisions of ADR.

Directive 2008/98/EC: **WFD** (Waste Framework Directive ([47])) lays down measures to protect the environment and human health by preventing or reducing the generation of waste, the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use.

Regulation (EC) No 1013/2006 on **shipments of waste:** this regulation applies to shipments of waste, whether in transit within the EU, between the EU and other countries or between different regions of the EU, in compliance with the provisions laid down in the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. Shipments of waste containing asbestos (WCA), or waste that has been contaminated by asbestos, must be subject to stricter controls to ensure the protection of human health and the environment ([48]).

Directive 1999/31/EC on the **landfill of waste** ([49]) has two main objectives: to reduce the landfilling of waste, in particular waste suitable for recycling; and to lay down strict and detailed technical requirements to prevent negative effects on the environment, including the pollution of surface water, groundwater, soil and air, and on the global environment, including the greenhouse effect, along with any resulting risk to human health. These rules apply during the whole life cycle of the landfill, from permitting to closure and after-care. This directive applies in combination with Council Decision 2003/33/EC ([50]), which lays down detailed waste acceptance criteria. Together they provide specific rules for the disposal of asbestos waste, including its allowable placement in hazardous or, under certain conditions, non-hazardous landfills, subject to management measures including to prevent fibre release.

Directive 2006/21/EC: **MWD** (Mining Waste Directive ([51])) provides for measures, procedures and guidance to prevent or reduce as far as possible any adverse effects on the environment and any resultant risks to human health, brought about as a result of the management of waste from the extractive industries. It sets requirements for waste management plans, monitoring and closure of waste facilities, emphasising environmental safety and accident prevention.

Regulation 2024/1252: **CRMA** (Critical Raw Materials Act ([52])) aims to improve the functioning of the internal market by establishing a framework to ensure the EU's access to a secure, resilient and sustainable supply of critical raw materials, including by fostering efficiency and circularity throughout the value chain.

([46]) United Nations Economic Commission for Europe (UNECE) (2021), 'Agreement concerning the International Carriage of Dangerous Goods by Road (ADR 2021)', https://unece.org/transport/publications/agreement-concerning-international-carriage-dangerous-goods-road-adr-2021.

([47]) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ L 312, 22.11.2008, pp. 3–30, ELI: http://data.europa.eu/eli/dir/2008/98/oj).

([48]) Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste (OJ L 190, 12.7.2006, pp. 1–98, ELI: http://data.europa.eu/eli/reg/2006/1013/oj).

([49]) Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste (OJ L 182, 16.7.1999, pp. 1–19, ELI: http://data.europa.eu/eli/dir/1999/31/oj).

([50]) Council Decision 2003/33/EC of the European Parliament and of the Council of 26 May 2003 on the approximation of the laws, regulations and administrative provisions of the Member States relating to the advertising and sponsorship of tobacco products (OJ L 152, 20.6.2003, pp. 16–19, ELI: http://data.europa.eu/eli/dir/2003/33/oj).

([51]) Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC – Statement by the European Parliament, the Council and the Commission (OJ L 102, 11.4.2006, pp. 15–34, ELI: http://data.europa.eu/eli/dir/2006/21/oj).

([52]) Regulation (EU) 2024/1252 of the European Parliament and of the Council of 11 April 2024 establishing a framework for ensuring a secure and sustainable supply of critical raw materials and amending Regulations (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1724 and (EU) 2019/1020 (OJ L, 2024/1252, 3.5.2024, ELI: http://data.europa.eu/eli/reg/2024/1252/oj).

# 3 Key elements of safety management

## 3.1 Introduction

The legislation on OSH, more generally ([53]) on asbestos ([54]) and often on construction sites ([55]), comes together to provide the main legal framework for the OSH management of the situations where workers are or may be exposed to asbestos. A more comprehensive overview of the legal framework is provided in Section 2.

In addition, the overall approach to safety management can include supplementary elements provided by voluntary systems and practices ([56]), thus leading to a holistic approach that permeates the whole organisation and proactively anticipates problems. The term 'safety culture' refers to shared attitudes and behaviours relating to safety and health within an organisation. In essence, it defines how an organisation prioritises and approaches safety and health in its daily operations. A strong safety culture encourages proactive safety measures, where individuals take ownership of safety issues and actively work to prevent accidents and occupational diseases. Without this soft underpinning, even the most robust OSH systems can be undermined by complacency, resistance or miscommunication. In essence, a safety-conscious culture transforms compliance into commitment, making safety and health a core organisational value rather than just a legal requirement.

This section non-exhaustively lists some relevant management elements that apply across many or all general topics in Sections 3 to 12 and many or all specific scenarios in Sections 13 to 17. It focuses on several examples of elements for effective safety management: coordination, consultation, information and communication.

## 3.2 Coordination

### 3.2.1 Coordination as a key element of effective occupational safety and health

The management of asbestos typically involves multiple actors responsible for commissioning, planning and carrying out works, such as renovation, demolition, repair and maintenance work, who should coordinate their efforts.

([53]) At the EU level, apart from Directive 2009/148/EC, mainly Directive 89/391/EEC and, depending on the situation, possibly other EU OSH directives, for example, Directive 89/656 on the use by workers of personal protective equipment at the workplace or Directive 2009/1004/EC on the minimum safety and health requirements for the use of work equipment by workers at work. See Section 2.

([54]) At the EU level, mainly Directive 2009/148/EC.

([55]) At the EU level, where relevant, mainly Directive 92/57/EEC.

([56]) See, for example, European Committee for Standardisation (CEN), 'EN ISO 45001:2023 – Occupational health and safety management systems – Requirements with guidance for use (ISO 45001:2018)', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:77524,3242181&cs=14D9A3FACCEE0408EC1CE624896C727AA.

For example, a project to renovate a building could include the following stakeholders:

- work sponsor, such as the building owner;
- architects, designers, engineers;
- lead contractor (or several lead contractors);
- subcontractors;
- safety and health coordinator (SHC) or coordinator for safety and health matters.

Where several undertakings share a workplace, employers must cooperate to implement OSH measures ([57]) and create efficient OSH management. For temporary or mobile construction sites, such as for buildings or public works, a framework for this cooperation is provided in Directive 92/57/EEC (TMC), see Box 3-1. These measures include risk prevention, protective action, risk communication and on-site monitoring. Employers must ensure that workers and/ or their representatives are properly informed of the associated risks ([58]).

It is useful for all the relevant actors to cooperate throughout all phases of asbestos management and removal. For requirements on information flow during asbestos identification, see Section 5.1. Cooperation and joint planning should begin at the decision stage (such as the decision to demolish, renovate or carry out maintenance), with the commissioning organisation taking a proactive role in the planning. The example in Box 3-2 illustrates how project sponsors are involved in asbestos management in France.

### Box 3-1: Cooperation between employers

**Article 5(1) of Directive 89/391/EEC (OSH FD):**

1. The employer shall have a duty to ensure the safety and health of workers in every aspect related to the work.

**Article 6(4) of Directive 89/391/EEC (OSH FD):**

4. Without prejudice to the other provisions of this Directive, where several undertakings share a workplace, the employers shall cooperate in implementing the safety, health and occupational hygiene provisions and, taking into account the nature of the activities, shall coordinate their actions in matters of the protection and prevention of occupational risks, and shall inform one another and their respective workers and/ or workers' representatives of these risks.

**Article 3 of Directive 92/57/EEC (TMC):**

1. The client or the project supervisor shall appoint one or more coordinators for safety and health matters, as defined in Article 2 (e) and (f), for any construction site on which more than one contractor is present.

2. The client or the project supervisor shall ensure that prior to the setting up of a construction site a safety and health plan is drawn up in accordance with Article 5(b).

The Member States may, after consulting both management and the workforce, allow derogations from the provisions of the first subparagraph, except where it is a question of:

– work involving particular risks as listed in Annex II

[...]

**Article 6 of Directive 92/57/EEC (TMC):**

The coordinator(s) for safety and health matters during the project execution stage appointed in accordance with Article 3(1) shall:

[...]

([57]) Directive 89/391/EEC, Article 6(4).

([58]) Directive 89/391/EEC, Article 6(4) and Directive 92/57/EEC, Article 12 and Article 6(d).

**Box 3-1: Cooperation between employers**

(d) organize cooperation between employers, including successive employers on the same site, coordination of their activities with a view to protecting workers and preventing accidents and occupational health hazards and reciprocal information as provided for in Article 6(4) of Directive 89/391/EEC, ensuring that self-employed persons are brought into this process where necessary.

[...]

**Article 12 of Directive 92/57/EEC (TMC):**

Consultation and participation of workers and/or of their representatives shall take place in accordance with Article 11 of Directive 89/391/EEC on matters covered by Articles 6, 8 and 9 of this Directive, ensuring whenever necessary proper coordination between workers and/or workers' representatives in undertakings carrying out their activities at the workplace, having regard to the degree of risk and the size of the work site.

**Box 3-2: Example of cooperation between different actors in France**

Since 2016, French law (*) requires the sponsor of a project to carry out a preliminary asbestos identification, starting in the project design phase and before appointing the contractors in charge of designing and/or carrying out the planned works.

This principle is similar to the provisions of Directive 92/57/EEC, particularly Article 4, which obliges the client or project supervisor to apply prevention principles in architectural choices and organisation of their building projects, and Article 11 of Directive 2009/148/EC, which envisages that, for asbestos identification in premises built before the entry into force of the Member State's asbestos ban, information is also obtained from the owner of the premises. However, the scope of this requirement in France is much broader, since it is mandatory whenever a project is planned, even in the absence of interfering activities, and in all fields of activity where asbestos exposure may occur (such as buildings, transport infrastructure and civil engineering structures, transport machinery and equipment, and soil and rock likely to contain asbestos).

The French authorities have decided to make the sponsor of the project responsible for preliminary asbestos identification for the following reasons.

- The sponsor of the project has an overview of the full scope of planned work and can best inform the contractor in charge of asbestos identification of the perimeter to be investigated.
- If asbestos is identified within the perimeter of the planned works, the sponsor can decide, before the design phase, to continue as planned, modify or abandon the project.
- If continuing, or if the new conditions of the project involve working on identified asbestos, the sponsor of the work has to integrate asbestos risk prevention into:
  - work budgeting (incorporating the cost of asbestos-related work into the general budget, whether for safe execution or downstream waste containing asbestos (WCA) management);
  - definition of the phasing of the work (to prevent work interference or organise the evacuation of the occupants);
  - contractor selection: (1) a company certified to remove or encapsulate asbestos, or (2) for lower risk work on materials containing asbestos (MCAs) without requiring removal, a company with safe working procedures (i.e. with a policy for assessing and preventing this occupational risk, to protect its workers and prevent environmental pollution).

The sponsor is required to attach the results of the preliminary asbestos identification to the contract or work order, enabling companies to conduct their own asbestos risk assessment, in particular by identifying the work situation(s) likely to give rise to exposure of their workers to asbestos fibres, and prepare prevention and protection measures in advance.

**Box 3-2: Example of cooperation between different actors in France**

If parts of the building, machine or equipment cannot be investigated before work begins, because the investigation involves the use of skills or equipment not available to the screening operator, their report will indicate to the sponsor the need for investigation during the relevant phase of the work. For example, a pipe buried under a concrete slab, with no access for the surveyor and no technical documentation to inform them of the possible presence of asbestos can only be investigated once access is gained during the project.

If no prior investigation is carried out, the company needs to assume asbestos is present and apply preventive and protective measures. These may only be lifted once investigations confirm the absence of asbestos in the component(s) concerned.

(*) French LAW No 2016-1088 of 8 August 2016 on work, the modernisation of social dialogue and the securing of career paths, Article 113, https://www.legifrance.gouv.fr/loda/id/JORFTEXT000033016237.

*Source:* French Ministry of Labour, Health, Solidarity and Families, personal communication, 2025.

Despite difficulties such as the presence of many actors, shift patterns, communication barriers or working across a large area, effective coordination in all types of environments (including but not limited to construction sites) is key to ensuring a high level of OSH. Effective coordination should be ensured in all settings where multiple actors are present, not only on construction sites. Asbestos-related planning should start at an early stage of the planning of the project and clear communication channels (including nominating specific contact people) should be established to facilitate communication.

## 3.2.2 Safety and health coordinators

At construction sites where work with asbestos is taking place, such as in buildings and civil engineering, one or more SHCs must be appointed for any construction site on which more than one contractor is present ([59]).

**Box 3-3: Safety and health coordinators**

**Article 3(1) of Directive 92/57/EEC (TMC):**

1. The client or the project supervisor shall appoint one or more coordinators for safety and health matters, as defined in Article 2(e) and (f), for any construction site on which more than one contractor is present.

Article 5 of Directive 92/57/EEC (TMC):

The coordinator(s) for safety and health matters during the project preparation stage appointed in accordance with Article 3(1) shall:

(a) coordinate implementation of the provisions of Article 4;

(b) draw up, or cause to be draw up, a safety and health plan setting out the rules applicable to the construction site concerned, taking into account where necessary the industrial activities taking place on the site; this plan must also include specific measures concerning work which falls within one or more of the categories of Annex II;

(c) prepare a file appropriate to the characteristics of the project containing relevant safety and health information to be taken into account during any subsequent works.

([59]) Article 3(1) of Directive 92/57/EEC; see also European Commission: Directorate-General for Employment, Social Affairs and Inclusion (2011), *Non-binding guide to good practice for understanding and implementing Directive 92/57/EEC on the implementation of minimum safety and health requirements at temporary or mobile construction sites*, Publications Office of the European Union, Luxembourg, https://data.europa.eu/doi/10.2767/31797.

**Box 3-3: Safety and health coordinators**

**Article 6 of Directive 92/57/EEC (TMC):**

The coordinator(s) for safety and health matters during the project execution stage appointed in accordance with Article 3(1) shall:

(a) coordinate implementation of the general principles of prevention and safety:

- when technical and/or organizational aspects are being decided, in order to plan the various items or stages of work which are to take place simultaneously or in succession,
- when estimating the period required for completing such work or work stages;

(b) coordinate implementation of the relevant provisions in order to ensure that employers and, if necessary for the protection of workers, self-employed persons:

- apply the principles referred to in Article 8 in a consistent manner,
- where required, follow the safety and health plan referred to in Article 5(b);

(c) make, or cause to be made, any adjustments required to the safety and health plan referred to in Article 5(b) and the file referred to in Article 5(c) to take account of the progress of the work and any changes which have occurred;

(d) organise cooperation between employers, including successive employers on the same site, coordination of their activities with a view to protecting workers and preventing accidents and occupational health hazards and reciprocal information as provided for in Article 6(4) of Directive 89/391/EEC, ensuring that self-employed persons are brought into this process where necessary;

(e) coordinate arrangements to check that the working procedures are being implemented correctly;

(f) take the steps necessary to ensure that only authorized persons are allowed onto the construction site.

### 3.2.2.1 Appointment of a safety and health coordinator

For any construction site on which more than one contractor is present ([60]), the client or the project supervisor must appoint one or more SHCs to oversee the coordination of safety and health matters during the project preparation and execution stages, and should ensure that the appointed SHCs have the means and authority to fulfil their duties. Any legal or natural person can carry out the coordinator role, provided they are competent and have the resources.

When making appointments, clients should be satisfied that those appointed are competent to carry out their safety and health-related roles and that they will devote sufficient resources to such tasks.

### 3.2.2.2 Cooperation of different actors with the safety and health coordinator

The client, project supervisor, designers, employers (contractor, subcontractors) and self-employed persons must cooperate with the SHCs during both stages and take into account their directions and suggestions to manage occupational risks related to asbestos ([61]).

### 3.2.2.3 Safety and health plan

The client or the project supervisor must ensure that, prior to setting up a construction site, a safety and health plan is drawn up ([62]). It must be drawn up (or caused to be drawn up) by the SHC and set out the rules applicable to the construction site, and

([60]) Directive 92/57/EEC, Article 3(1).
([61]) See in particular Directive 92/57/EEC, Article 3(1), Articles 5, 6 and 7, Article 9(b) and Article 10.
([62]) Directive 92/57/EEC, Article 3(2).

consider, where necessary, any industrial activities occurring on the site [63]. It must also include specific measures concerning, among other things, work that puts workers at risk from chemical substances constituting a particular danger to their safety and health or involving legal requirements for health monitoring [64].

The asbestos work plan and asbestos management plan (asbestos management plan (AMP)) should be integrated into the safety and health plan, see Section 4.5.

#### 3.2.2.4 The safety and health coordinator at the project preparation stage

Pre-planning is essential for the safe completion of construction works.

SHCs must be appointed at the project preparation stage [65]. They can:

- assist clients or project supervisors with feasibility studies on safety and health matters;
- help project teams to identify, eliminate or avoid hazards and risks;
- provide expert advice and assistance as required.

The main functions that SHCs must carry out at the project preparation stage are to [66]:

- coordinate the implementation of the general principles of prevention [67];
- draw up, or cause to be drawn up, safety and health plans;
- prepare safety and health files to be taken into account during the works.

#### 3.2.2.5 The safety and health coordinator at the project execution stage

SHCs have key responsibilities during the project execution stage, whether different contractors are working simultaneously or in succession.

SHCs must be appointed at the project execution stage [68]. Examples of their responsibilities [69] during execution are to:

- coordinate implementation of the general principles of prevention and safety when technical and organisational aspects are being decided and when estimating the period required for completing the work;
- coordinate implementation of the relevant provisions to ensure that employers and, if necessary, self-employed persons apply the principles of prevention of Article 8 of Directive 92/57/EEC in a consistent manner and, where required, follow the safety and health plan;
- organise cooperation between employers and self-employed persons, when necessary;
- coordinate arrangements to check that the working procedures are being implemented correctly;
- take steps to ensure that only authorised persons access the site;
- update safety and health plans (the asbestos work plan and AMP should be incorporated into the safety and health plan of the construction project) and the safety and health files.

(63) Directive 92/57/EEC, Article 5(b).
(64) Directive 92/57/EEC, Article 5(b) and Annex II.
(65) Directive 92/57/EEC, Article 2(e) and Article3(1).
(66) Directive 92/57/EEC, Article 5.
(67) Directive 92/57/EEC, Article 4.
(68) Directive 92/57/EEC, Article 2(f) and Article 3(1).
(69) Directive 92/57/EEC, Article 6.

## 3.3 Consultation of workers and/or their representatives

The employer must ensure that workers and/or their representatives are consulted, allowed to take part in discussions on all questions relating to safety and health at work, and have the right to make proposals ([70]). Consultation and information (see Section 3.4 and Section 3.5 respectively) are two distinct processes; information is one-way, while consultation is a two-way exchange. An example of good consultation practice is provided in Box 7-2 in Section 7.

Consultation of workers and/or their representatives is a crucial part of effective OSH management in general and of asbestos risks in particular, to ensure the involvement of workers and/or their representatives; it can be helpful for employers in their decision-making. The importance of worker involvement in the establishment, operation, evaluation and improvement of asbestos OSH policy for creating a high level of buy-in and risk awareness should be highlighted across all levels of management and among workers.

Workers and/or their representatives must be consulted on several aspects of asbestos-related OSH. These include the risk assessment ([71]) and the following:

- sampling carried out within the undertaking or establishment ([72]);
- the provision of regular breaks during work requiring the use of individual respiratory protective equipment ([73]);
- measures to be taken if the limit value is exceeded; in an emergency, workers and their representatives must be informed of the measures which have been taken ([74]).

In addition, for activities such as demolition, asbestos removal, repair and maintenance work, where it is envisaged that the relevant limit value ([75]) will be exceeded despite the implementation of all possible technical preventive measures, the employer must determine protective measures for workers involved ([76]). The workers and/or their representatives in the undertaking or establishment should be consulted on these measures before the activities concerned are carried out ([77]).

Participation of workers is key to achieving a high level of safety culture. To achieve effective participation, workers should be encouraged and feel comfortable to raise concerns and report incidents without fear of repercussions.

An example of a mechanism for workers' participation may include worker surveys and interviews to gather their views. The characteristics of the surveys could include:

- sufficient questions, including open questions, to capture a range of views and experiences and allow workers to express their opinions on matters they consider relevant;
- preferably anonymisation or phrasing that avoids perceived risk of reprisal;
- questions about workers' trust in senior managers' approach to health and safety, which increases accountability;
- questions about the availability of engineering controls and CE-certified PPE;
- questions about the availability of advice;
- assessing the accuracy of workers' perception of risk.

([70]) Directive 89/391/EEC, Article 11.
([71]) Directive 2009/148/EC, Article 3(5).
([72]) Directive 2009/148/EC, Article 7(3).
([73]) Directive 2009/148/EC, Article 10(3).
([74]) Directive 2009/148/EC, Article 17(2)(b).
([75]) Directive 2009/148/EC, Article 8.
([76]) Directive 2009/148/EC, Article 12.
([77]) Directive 2009/148/EC, Article 12.

## 3.4 Information

Providing information to workers is essential for ensuring risk awareness and prevention, promoting compliance with the chosen preventive and control measures, and ensuring safe behaviour and incident preparedness, along with fostering a culture in which workers have at their disposal sufficient information to appreciate the reasons for and the importance of the relevant control measures. Without effective provision of information, it is unlikely that a high level of safety culture that includes buy-in can be achieved or that the OSH system is working efficiently.

Employers must ensure that workers and their representatives receive adequate information, including on ([78]):

- potential risks to health from exposure to dust arising from asbestos or MCAs;
- the existence of statutory limit values and the need for the atmosphere to be monitored;
- hygiene requirements, including the need to refrain from smoking;
- precautions to be taken regarding the wearing and use of protective equipment and clothing;
- special precautions designed to minimise exposure to asbestos;
- access to results of asbestos-in-air concentration measurements, including explanations of the significance of those results;
- details about any exceedance of the limit value (see Sections 6.2.2 and 11);

The following information must be available to workers and/or their representatives:

- documents which are the subject of notification ([79]) concerning their own undertaking or establishment in accordance with national laws (see Section 4.3);
- access to the risk assessment plan (see Section 4.1) ([80]),
- access to the AMP (see Section 4.5.1).

In addition, workers and/or their representatives should have access to the following.

- Information and advice regarding any assessment of their health which they may undergo following the end of exposure ([81]).
- Information on the nature and duration of the activity, and the exposure to which workers have been subjected, must be held in a register by the employer. Workers must have access to the results in the register which relate to them personally. The workers and/or their representatives must have access to anonymised, collective information in the register ([82]).

Personal data must be processed lawfully ([83]).

## 3.5 Communication

Communication is an important part of the OSH management system and a crucial element in achieving an efficient safety culture. Communication focuses on the methods for transferring information efficiently. Good communication is a necessary tool for effective coordination, consultation and information. Without good communication, a high level of safety culture is unlikely to be achieved since the flow of information may not be timely and comprehensible.

([78]) Directive 2009/148/EC, Article 17; see also Directive 89/391/EEC, Article 10, and Directive 92/57/EEC, Article 11.
([79]) Directive 2009/148/EC, Article 4(4).
([80]) Directive 2009/148/EC, Article 3(5) and Directive 89/391/EEC, Article 10.
([81]) Directive 2009/148/EC, Article 18(4).
([82]) Directive 2009/148/EC, Article 19(2).
([83]) Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (OJ L 119, 4.5.2016, pp. 1–88, ELI: http://data.europa.eu/eli/reg/2016/679/oj).

The main pillars of communication are the target audience, the message and the channel. The target audience is the receiver of the communication; the message is the contents of the communication and the channel refers to the mechanism used to communicate. In this case, the target audience is the workers and the items to be communicated are defined in Section 3.5.1.

Barriers to communication should be minimised. For example, meetings should be organised to consider shift patterns and communication should be conducted in a language that workers and/or their representatives understand.

### 3.5.1 Message and target audience

The central element of communication is the message. A message may relate to:

- a specific event, such as a training course, a new AMP or a series of workplace measuring events;
- an awareness campaign aimed at increasing knowledge about wider topics, such as the risk management plan (see Section 4.5), health surveillance (see Section 10) or waste management (see Section 12).

Messages should be short, focused and designed to achieve a specific result.

All communication should be easily understood by the intended recipient. If any workers might not be proficient in the language used, or have low levels of literacy, communication should be carefully constructed to ensure that every targeted worker receives and understands it.

The target audience for a communication depends on the specific message. Workers with roles listed in Section 1.3.1 may handle asbestos and should be considered the starting point for any communication about asbestos exposure. However, most communications will be sent to a subset of these roles.

### 3.5.2 Channel

Communication should be delivered through the most appropriate channel to the workers concerned. Some communications can use more than one channel. Examples include:

- OSH signs
- email
- notices and posters – printed and placed on noticeboards or walls
- leaflets or printed documents
- webpages or other online forums
- videos
- internal newsletters – printed and online
- letters
- face to face – one-to-one discussions, meetings or committees
- pre-work briefings and post-work debriefings.

### 3.5.3 Timing and planning

The timing of communications may vary, for example:

- ad-hoc messages, such as for new staff;
- communication and events should take place at regular intervals;
- awareness campaigns could be a month-, quarter- or year-long awareness initiative on asbestos exposure.

The format and frequency of communication must conform with national legal requirements.


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# 4 Asbestos risk assessment and management

## 4.1 Asbestos risk assessment

### 4.1.1 Introduction

**Box 4 -1: Asbestos and materials containing asbestos identification**

**Article 3(2) of Directive 2009/148/EC (AWD):**

2. In the case of any activity likely to involve a risk of exposure to dust arising from asbestos or materials containing asbestos, that risk shall be assessed in such a way as to determine the nature and degree of the workers' exposure to dust arising from asbestos or materials containing asbestos and to prioritise removal of asbestos or materials containing asbestos over other forms of asbestos handling.

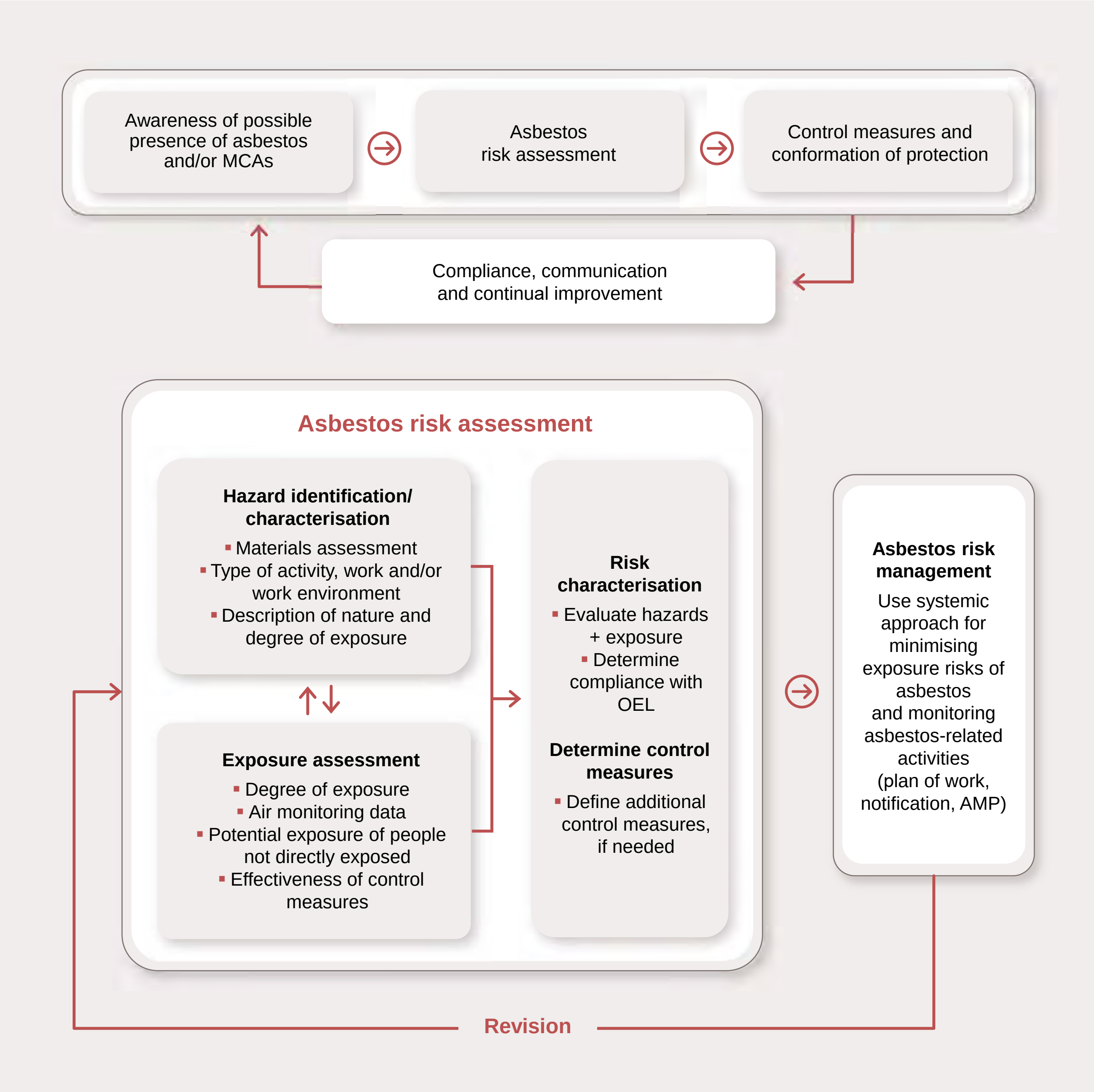
An asbestos risk assessment involves identifying the presence or likely presence of asbestos and materials containing asbestos (MCAs) (see Annex 4) in the workplace (e.g. in a building, vehicle, equipment or environment) and assessing the resulting risk to workers. In any activity where a risk of exposure to dust arising from asbestos or MCAs is likely, the risk must be assessed in such a way as to determine the nature and degree of exposure and prioritise removal of asbestos or MCAs over other forms of asbestos handling (84).

In all new activities involving asbestos or MCAs (e.g. maintenance, repair, demolition, refurbishment work, incidents), work can only begin after the activity's risk has been assessed and the necessary preventive and protective measures have been implemented.

A risk assessment is part of the overall approach to preventing, mitigating and managing risk associated with asbestos and MCAs. Figure 4-1 illustrates the role of asbestos risk assessment within the overall approach to risk management.

(84) Directive 2009/148/EC, Article 3(2).

**Figure 4-1: Illustrative role of an asbestos risk assessment within the overall approach to risk management**




*Source:* Adapted from Jahn, S. D., Bullock, W. H. and Ignacio, J. S. (eds), *A strategy for assessing and managing occupational exposures*, 4th edition, American Industrial Hygiene Association, 2015, https://www.aiha.org/education/marketplace/strategy-book-4th-edition.

The purpose of an asbestos risk assessment is to provide information to support decisions on appropriate asbestos risk management measures (including prevention and control, training and health surveillance). Two key terms, hazard and risk, apply and are defined below (85).

- **Hazard.** A source with a potential to cause injury and ill health; in this context, the presence of asbestos fibres.
- **Risk.** The combination of the likelihood of an occurrence of a hazardous event(s) and the severity of injury or ill health that can be caused by the event(s). In this context this refers to the level of exposure of workers to asbestos fibres and its associated ill-health effects.

The objectives of asbestos risk assessment are to:

- provide a detailed understanding of the current state of asbestos risks, by identifying and characterising the hazards and the potential level of exposure of workers;
- provide preventive and protective measures to minimise the risk of exposure of workers to dust arising from asbestos or MCAs to a minimum and, in any case, to as low a level as is technically possible below the relevant limit value (86) (occupational exposure limit or OEL) specified in Section 6.2.2 (87).

An asbestos risk assessment should be complete, reliable and reflective of the actual situation. It should be reviewed regularly and must be revised when there is reason to believe that it is incorrect or there is a material change in the work (88).

Working with or removing MCAs may involve other risks to the health and safety of workers than the potential risk of exposure to asbestos dust (e.g. working at height or in confined spaces, machine safety or the presence of other hazardous substances such as crystalline silica). A broader risk assessment is required under both the EU OSH Framework Directive (89) and specific EU OSH directives, such as the CMRD (90) and the CAD (91).

**Box 4-2: Examples of legislation in Belgium and France**

Belgian legislation requires the removal of asbestos whenever work affects or is likely to affect asbestos products: (1) in total or partial demolition, or (2) if asbestos material cannot remain intact during work. Asbestos is then required to be removed before work resumes, and disposed of in accordance with environmental legislation.

Similarly, French legislation requires buildings to be screened for asbestos prior to the start of any construction works. If asbestos is found, as soon as the work requires the removal of the materials and products in question, they have to be removed. Any decision to adjust the scope of removal needs to be documented in the building's asbestos technical file.

*Sources:* Belgium: environment.brussels (n.d.), 'Amiante: comment éviter les risques pour la santé?', https://environnement.brussels/citoyen/lenvironnement-bruxelles/renover-et-construire/amiante-comment-eviter-les-risques-pour-la-sante; France: Ministère du travail, de la santé, des solidarités et des familles (2025), 'La prévention des risques liés à l'amiante', https://travail-emploi.gouv.fr/la-prevention-des-risques-lies-lamiante (see section titled 'Cadre réglementaire sur le repérage préalable de l'amiante avant toute opération de travail: décret du 9 mai 2017').

(85) CEN, 'EN ISO 45001:2023 – Occupational health and safety management systems – Requirements with guidance for use (ISO 45001:2018)', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:77524,3242181&cs=14D9A3FACCEE0408EC1CE624896C727AA.

(86) Directive 2009/148/EC, Article 6.

(87) Directive 2009/148/EC, Article 6.

(88) Directive 2009/148/EC, Article 3(5).

(89) Directive 89/391/EEC, Articles 6(3) and 9(1).

(90) Directive 2004/37/EC, Article 3.

(91) Directive 98/24/EC, Article 4.

Figure 4-2: Example of the risk of working at heights during the removal of asbestos plates during the demolition of a power plant in Germany



In some Member States, such as the Netherlands ([92]), an alternative work method may be approved by a qualified expert if the asbestos work to be carried out involves serious non-asbestos-related risks. In such cases, the expert needs to clearly justify why the standard asbestos safety procedures cannot be followed and why the new method is necessary due to the other non-asbestos risks involved.

The asbestos risk assessment, including its results, must be subject to consultation with workers and/or their representatives, see Section 4.1 ([93]).

([92]) Staatscourant (2024), 'Announcement of the Minister of Social Affairs and Employment of April 8, 2024, reference 2024-0000091456, containing the publication of the amended Certification Scheme for the Process Certificates Asbestos Inventory and Asbestos Removal', https://www.ascert.nl/images/img-1713427410-6620d3d2139dc.pdf.

([93]) Directive 2009/148/EC, Article 3(5) and Directive 89/391/EEC, Article 11(1).

### 4.1.2 Responsibility and competences

**Box 4-3: Responsibility for risk assessment**

**Article 6(3)(a) of Directive 89/391/EEC (OSH FD):**

3. … the employer shall …:

(a) evaluate the risks to the safety and health of workers …

[…]

**Article 9(1)(a) of Directive 89/391/EEC (OSH FD):**

1. The employer shall:

(a) be in possession of an assessment of the risks to safety and health at work, including those facing groups of workers exposed to particular risks.

[…]

The employer is responsible for the asbestos risk assessment.

The asbestos risk assessment should be carried out by competent specialists. If the employer does not have the necessary expertise, they should enlist the assistance of competent specialists to perform the asbestos risk assessment.

The people conducting the asbestos risk assessment should typically have the following competencies (while complying with any applicable national rules and standards) ([94]):

- adequate knowledge, training and expertise to assess risks from asbestos and MCAs;
- an understanding of exposure related to asbestos and MCAs in the workplace, tasks performed, how and when exposure could occur, and health and safety regulations;
- the ability to navigate the complexity of the regulatory process and authorities involved.

National bodies in each Member State may regulate certification and accreditation schemes for asbestos specialists. Annex 7 provides an overview of such bodies by Member State.

### 4.1.3 Elements of asbestos risk assessment

Asbestos risk assessment is a process that should contain the elements shown below.

- **Element 1.** Materials assessment, evaluation of the presence of asbestos or MCAs and determination of its condition.
- **Element 2.** Description of type of activity, work and/or work environment.
- **Element 3.** Description of nature and degree of exposure.
- **Element 4.** Exposure assessment.
- **Element 5.** Risk characterisation.
- **Element 6.** Definition of control measures.
- **Element 7.** Review and revision of risk assessment, if needed.

The elements are clarified in the following subsections. The first three elements are considered 'hazard identification/characterisation'.

([94]) Such as the Italian standards UNI 11870:2022 (Materiali contenenti amianto – Criteri e metodi per l'individuazione e il censimento nelle strutture edilizie, nelle macchine e negli impianti), https://store.uni.com/ec-1-2024-uni-11870-2022; and UNI 11903:2023 (Attività professionali non regolamentate – Addetto al censimento dei materiali contenenti amianto – Requisiti di conoscenza, abilità, autonomia e responsabilità), https://store.uni.com/uni-11903-2023r; and the Netherlands Government Gazette (2024), 'Publication of the amended Certification Scheme for the Asbestos Inventory and Asbestos Removal Process Certificates', https://www.ascert.nl/images/img-1729681081-6718d6b900449.pdf.

The elements of the risk assessment process are relevant for all forms of occupational exposure.

#### 4.1.3.1 Materials assessment

A materials assessment identifies and determines the presence and the condition of the identified asbestos and MCAs and evaluates the likelihood of their releasing of harmful fibres ([95]).

In some Member States, a materials assessment is also referred to as an asbestos survey.

A materials assessment should include:

- a description of the minerals or MCAs assessed, see Annex 4;
- identification of the type of asbestos present;
- the concentration of asbestos in the materials;
- identification of the state of conservation of MCAs, i.e. the assessment of the physical condition of MCAs and their potential to release fibres;
- the quantity of the asbestos or MCAs present;
- an assessment of the possibility of degradation of the MCAs over time.

Materials assessment, including what it should contain, may vary by Member State ([96]). In some Member States, tools are used to support the materials assessment, such as Ireland (materials assessment algorithm), France and the Netherlands. Details for these tools are given in Annex 9.

##### *4.1.3.1.1 Sources of information*

The following sources may support data collection on the presence of asbestos or MCAs, type of activity, work environment and nature of exposure (non-exhaustive list):

- information from the property owners and other employers;
- documentation about the object or building;
- historical data and/or documents;
- incident reports, especially those involving fire, explosion, structural impact, subsidence or flooding;
- previous asbestos materials assessments / survey reports;
- health and safety plans;
- original equipment manufacturer (e.g. electric heaters, electrical assets for utilities);
- manufacturers of building materials (such as gaskets);
- manufacturer's owner/user manuals;
- information from inspection and monitoring tools;
- emergency response plans;
- relevant asbestos registers/inventories;
- worker feedback (e.g. from safety committees).

##### *4.1.3.1.2 Site-specific asbestos register*

The presence of asbestos and MCAs may be recorded in a site-specific asbestos register, which aims to list all identified (or assumed) asbestos on a given worksite. This ensures that the presence of asbestos or MCAs is documented.

Terminology for such registers varies across Member States. For example, 'asbestos inventory', 'asbestos risk register' or 'asbestos technical documentation'.

A site-specific asbestos register may be mandatory under national legislation. Responsibility for recording the presence of asbestos and MCAs in a site-specific asbestos register may vary across Member States. Where required by national legislation, the presence of MCAs has to be recorded in a central national asbestos register. Annex 8 provides an overview of Member States that operate such national systems.

A site-specific asbestos register should be accessible for workers that may be affected by the presence

([95]) The concentration of asbestos in MCA or an estimation of fibre release is not an obligatory part of the analysis in all Member States. In the Netherlands, the standard NEN 5896:2003 – Qualitative analysis of asbestos in materials, using polarized light microscopy, https://www.nen.nl/en/nen-5896-2003-nl-85541 includes an estimation of the asbestos concentration and the possibility to give an indication of the friability of MCAs. At the time of writing, NEN 5896:2003 is due to be replaced by NEN 5896:2024. See also VDI 3866 Blatt 5:2017-06 – Determination of asbestos in technical products – Scanning electron microscopy method, https://www.vdi.de/en/home/vdi-standards/details/vdi-3866-blatt-5-determination-of-asbestos-in-technical-products-scanning-electron-microscopy-method and ISO (2012), 'ISO 22262-1:2012, Air quality – Bulk materials – Part 1: Sampling and qualitative determination of asbestos in commercial bulk materials', https://www.iso.org/standard/40834.html.

([96]) In France, for example, identification of the state of conservation of MCAs is required for the daily use of the building, but not for the screening before work, for details see Annex A9.3. Screening before work does not include assessment of the material's condition.

of asbestos, including contractors (e.g. cleaners, technicians).

A site-specific asbestos register may include:

- the exact location of the asbestos/MCAs (room/area, building element);
- the type of material;
- accessibility (how easily the MCA can be accessed);
- encapsulation/sealant;
- the quantity of MCAs present (e.g. area of flooring, or length and width of pipework);
- the number of samples taken for the assessment;
- analysis results;
- the date of identification of the asbestos/MCAs;
- the type of asbestos;
- photographs of the asbestos/MCAs;
- the state of conservation of MCAs, for instance friable or non-friable, intact or damaged, see Section 5.2.1;
- potentially exposed workers (already exposed and at risk of being exposed in the future);
- action required;
- comments or recommendation.

#### 4.1.3.2 Description of type of activity, work and/or work environment

This element should include a description of:

- the type of activity or work (e.g. repair, removal, encapsulation of MCAs or maintenance and testing of the plant and equipment contaminated with MCAs);
- working methods, including tools and equipment used;
- the working environment and conditions, and PPE used.

A comprehensive list of exposure situations, both within the renovation and demolition sector and beyond, is provided in INRS (2012), 'Work situations involving exposure to asbestos' ([97]). A non-exhaustive list of non-specialist workers who may be exposed to asbestos (excluding renovation and demolition workers) is provided in Annex 10.

#### 4.1.3.3 Description of nature and degree of exposure

In addition to the materials assessment and the description of type of activity, work methods and/or work environment, the asbestos risk assessment should include a characterisation of exposure that may occur during the work activities:

- the number of people involved and potentially exposed ([98]), including sensitive risk groups / workers at particular risk ([99]);
- the nature and degree of exposure, a description of the expected level of exposure based on the size of the job (scale), how often the work will be carried out (frequency) and the expected duration of each task;
- determination of potential exposure of people passively exposed, due to activities involving MCAs.

It is important that the risk assessment considers all the relevant features and activities at the site and provides a clear basis for the definition of operational phases to be considered in the exposure assessment.

#### 4.1.3.4 Exposure assessment

In this element, the degree of exposure which may occur during work activities is assessed. The assessment should cover both active and passive exposure.

To identify possible active and passive exposure, the exposure assessment should consider the following:

- relevant air monitoring data from the actual site and/or from similar previous activities;
- evaluation of the effectiveness of existing control measures (e.g. dust suppression or the presence and quality of the containment).

([97]) INRS (2012), 'Work situations involving exposure to asbestos', https://www.inrs.fr/media.html?refINRS=ED %206005.

([98]) Examples: potentially exposed workers are those working in demolition and removal companies, in mines and quarries where asbestos can be present in mineral layers and those at risk of passive exposure working in environments where MCAs are present. Sensitive risk groups may be identified in health surveillance.

([99]) Directive 89/391/EEC, Article 9(1)(a) and Article 15; see also Directive 2004/37/EC, Article 3(4) and Directive 2009/148/EC, Article 18.

The European Standard EN 689:2018+AC:2019 provides guidance on the measurement of exposure to hazardous substances, including asbestos ([100]).

Other systems may be used in different Member States to perform the exposure assessment ([101]).

**Box 4-4: Example of a screening tool: Scol@miante tool**

As part of the risk assessment for potential asbestos exposure, it can be useful to apply screening tools that offer an early indication of likely airborne asbestos fibre levels. One such tool is Scol@miante, an online application developed in France by the INRS (National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases).

Scol@miante estimates potential concentrations of asbestos fibres in the air based on key factors such as the type of work performed (e.g. removal, drilling), the specific MCA involved and the conditions under which the work takes place (e.g. dry/humid techniques, local extraction). Using a structured and regularly updated database of scenarios and expert judgement, it provides a semi-quantitative risk estimate that supports early-stage decisions about protective measures and controls.

Although Scol@miante is not substitute for on-site air monitoring or a full exposure assessment, it provides a risk estimate that helps inform early-stage decisions on protective equipment, containment and work procedures.

An example of the output from Scol@miante is shown in Figure 6-1.

*Source:* INRS (n.d.), 'Scol@miante', https://scolamiante.inrs.fr/Scolamiante/Accueil.

#### *4.1.3.4.1 Background concentrations*

Background (ambient) levels of asbestos fibres in outdoor air vary depending on the local geology (see Section 5.2.2), the level of disturbance of soil or rock by human activities releasing fibres into the air and the gradual release of fibres from ageing MCAs in buildings into the surrounding environment ([102]). For example, certain Member States ([103]) and Member State regions ([104]) have geology formations containing naturally occurring asbestos (NOA). Symptoms of asbestos fibre exposure (including pleural plaques and mesothelioma) have been reported in areas where large-scale asbestos mining has never occurred, suggesting that ambient levels of asbestos fibres in the air were high enough to cause ill health ([105]).

### 4.1.3.5 Risk characterisation

In this element, the results of the hazard identification/characterisation and the exposure assessment are combined to characterise the risk for all relevant and realistic exposure scenarios.

Risk characterisation should consider the determination of compliance with exposure limit values. To verify this, air monitoring of asbestos fibres at the place of work must be performed ([106]). It should be carried out in compliance with technical standards, applicable technical requirements and/or technical good practice. For details of air monitoring and compliance with the OEL, see Section 6.

([100]) EN 689:2018+AC:2019 – Workplace exposure – Measurement of exposure by inhalation to chemical agents – Strategy for testing compliance with occupational exposure limit values, https://www.rivm.nl/bibliotheek/rapporten/2020-0098.pdf.

([101]) NF X43-050, Air quality - Determination of the asbestos fiber concentration by transmission electron microscopy - Indirect method, and the 'Assessment framework' of the Validation and Innovation Point for Asbestos (VIP), https://www.vipasbest.nl/en/the-main-points-of-the-procedure.

([102]) Asbestos fibres in ambient air were found to be about twice as high in an urban area (Megantic County in Quebec) than in rural areas, see: Graham, S., Blanchet, M. and Rohrer, M. (1977), 'Cancer in asbestos-mining and other areas of Quebec', *JNCI: Journal of the National Cancer Institute*, Vol. 59, Issue 4, pp. 1139–1145, https://doi.org/10.1093/jnci/59.4.1139.

([103]) Finland, France, Greece, Italy, Norway, Spain and Sweden all have geology formations with NOA, according to an (albeit incomplete) interactive geological map: www.europe-geology.eu. See: Hyskaj, A., Schimek, E., Weiszburg, T. M. and Harman-Toth, E. (2023), 'Naturally occurring asbestos in the asbestos-free European Union approach. Is asbestos exposure prevention being understood correctly?', presentation to the European Geosciences Union (EGU), General Assembly, Vienna, 23–28 April 2023, https://www.egu.eu/media/awards/ospp-award/2023/ambra_hyskaj.pdf.

([104]) Petriglieri, J. R., Capitani, G., Ballirano, P., Barale, L., Tomatis, M. et al. (2025), 'Naturally occurring asbestos in Southern Italy: Geological and mineralogical investigation of fibrous antigorite from Calabrian serpentinites in view of its hazard assessment', *Science of The Total Environment*, Vol. 970, 178970, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2025.178970; Bloise, A., Catalano, M. and Punturo, R. (2016), 'Occurring asbestos in agricultural soils serpentinite-metabasite derivate (Calabria, southern Italy)', *Rendiconti Online della Società Geologica Italiana*, Vol. 38, pp. 6–8, https://doi.org/10.3301/ROL.2016.03.

([105]) The regions and NOA include: Austria (tremolite), Bulgaria (anthophyllite and tremolite), Cyprus (chrysotile and tremolite), Finland (anthophyllite), Corsica, France (tremolite and chrysotile), Greece (tremolite) and Türkiye (tremolite). See Harper, M. (2008), '10th Anniversary Critical Review: Naturally occurring asbestos', *Journal of Environmental Monitoring*, Vol. 10, Issue 12, pp. 1394–1408, https://pubmed.ncbi.nlm.nih.gov/19037480/.

([106]) Directive 2009/148/EC, Article 7(1).

For more technical assessments, ISO 16000-27:2014 provides a standardised method for determining the concentration of settled fibrous dust on surfaces, including asbestos, using scanning electron microscopy (SEM) ([107]).

**Box 4-5: Example of a tool to assess and prioritise MCA removal from outside the EU**

The ACM (asbestos-containing material) risk calculator is a structured tool developed by the Victorian Asbestos Eradication Agency (VAEA) in Australia. It is designed to assess and prioritise the removal of MCAs from buildings, primarily to protect health and safety in workplaces and public environments. This risk calculator is central to their asbestos identification and rating system (AIRSystem), which consolidates asbestos data across thousands of government-owned buildings in Victoria, Australia.

**Key risk factors**

The ACM risk calculator uses a weighted scoring system based on four main risk factors.

- **ACM friability (35 %).** Measures how easily the material can release fibres if disturbed. Friable ACMs, which can be crumbled by hand pressure, present the highest risk.
- **ACM condition (15 %).** Assesses the current state of the material (intact, deteriorating or damaged).
- **Disturbance potential (25 %).** Evaluates the likelihood that the ACM will be disturbed by building occupants, maintenance or other activities.
- **Building rating (25 %).** Considers the building use, frequency and nature of public access, and operational factors (such as the use of mobile plant equipment).

Each factor is assigned a numerical value and the combined weighted score determines the overall risk posed by each ACM. The minimum possible risk score is 19 and the maximum is 100. No risk factor can score zero, reflecting the principle that there is no safe level of asbestos exposure. The ACM risk calculator (and its algorithm) are hosted by the VAEA's asbestos register database AIRSystem, which rates ACMs into phases 1 to 5 for the Victorian government's schedule for prioritised removal.

**How the calculator works**

- Data collection: information about each ACM (location, type, condition, friability and likelihood of disturbance) is gathered during building surveys, often by occupational hygienists.
- Risk scoring: the calculator applies the weighted formula to each ACM, generating a risk score.
- Prioritisation: ACMs are ranked into five removal phases based on their risk scores.
- Prioritisation: ACMs are ranked into five removal phases based on their risk scores.

| Removal phase | Risk category | Indicative ACM description |
|---|---|---|
| **Phase 1** | Most hazardous ACMs | Friable, poor condition, moderate to high disturbance potential, high-use buildings |
| **Phase 2** | Most hazardous ACMs | Friable, unknown or fair condition, low to moderate disturbance potential, high-use buildings |
| **Phase 3** | ACMs that may become more hazardous | Non-friable, fair to good condition, low to moderate disturbance potential, high-use buildings |
| **Phase 4** | Less hazardous ACMs | Non-friable, well-bonded, good condition, low to moderate disturbance potential, high-use buildings |
| **Phase 5** | Less hazardous ACMs | Non-friable, well-bonded, stable condition, low disturbance potential, low-use buildings |

([107]) International Organization for Standardization (ISO), ISO 16000-27:2014 – Indoor air – Part 27: Determination of settled fibrous dust on surfaces by SEM (scanning electron microscopy) (direct method), https://www.iso.org/standard/50104.html.

**Box 4-5: Example of a tool to assess and prioritise MCA removal from outside the EU**

The VAEA's risk calculator rates ACMs into 3 levels: high (ACMs receiving a risk score of 69 or above); medium (risk score between 50 and 69) and low (50 and under).

Phase 1 and 2 ACMs are prioritised for urgent removal; phases 3–5 may be scheduled for later removal or ongoing management, depending on their risk profile.

**Benefits and applications**

- Objective decision-making: the calculator standardises evaluations across a diverse building portfolio, removing subjective judgement.
- Targeted resource use: by focusing on the most hazardous ACMs first, it ensures that limited removal resources are used where they will have the greatest health impact.
- Dynamic updates: the system is regularly updated as new surveys are conducted, ACMs are removed or building conditions change.
- Regulatory compliance: supports legal requirements for asbestos management and helps organisations meet occupational health and safety obligations.

The effectiveness of the risk calculator depends on the quality of input data. Incomplete surveys, unknown ACM conditions or unverified assumptions can reduce accuracy. To address this, the VAEA recommends regular re-inspection, sampling and verification of ACMs, especially for buildings or assets previously determined to contain asbestos.

*Sources:* Victorian Asbestos Eradication Agency (n.d.), 'ACM risk calculator', https://www.vaea.vic.gov.au/acm-risk-calculator; Stevenson, S. P., Barron, O., Pakenham, A. and Hashinaka, M. (2023), 'Understanding and ending the lethal asbestos legacy', *sustainability*, Vol. 15, Issue 3, 2023, https://doi.org/10.3390/su15032507; Australian Government, 'National guide for asbestos surveys – Practical guidance on how to identify and assess asbestos containing materials in buildings and structures', https://www.asbestossafety.gov.au/sites/default/files/documents/2025-02/National %20Guide %20for %20Asbestos %20Surveys_4.PDF.

### 4.1.3.6 Definition of control measures

In this element, effective control measures will be defined (see Section 8). If existing control measures are not effective, alternative or additional control measures need to be defined

### 4.1.3.7 Review and revision of asbestos risk assessment

**Box 4-6: Revision of risk assessment**

**Article 3(5) of Directive 2009/148/EC (AWD):**

5. The assessment referred to in paragraph 2 shall be the subject of consultation with the workers and/or their representatives within the undertaking or establishment and shall be revised where there is reason to believe that it is incorrect or there is a material change in the work.

The asbestos risk assessment should be reviewed regularly to ensure that it remains up to date and that control measures are effective.

In reviewing asbestos risk assessments, the effectiveness of the control measures should be evaluated. Sources of information for this evaluation may include workers, incident reports and/or health surveillance data.

The review frequency of the risk assessment should be established in accordance with national regulations and industry best practices. This can be documented in the asbestos management plan (AMP) (see Section 4.5).

In addition to regular reviews, the asbestos risk assessment must be revised when there is reason to believe that it is incorrect or there is a material change in the work ([108]). Typical situations that may result in a revision include:

- disturbance, degradation or damage to MCAs;
- changes to fibre release control methods;
- doubts about the efficiency of control measures, for instance if technical or organisational measures are used to control airborne asbestos fibres during work, but recent air monitoring results show unexpected fibre levels in adjacent areas;
- substantial change in the use of the object/building, the type of work or method of work, work environment, workforce or occupancy levels and/or amount of asbestos found;
- identification of additional asbestos or MCAs at the workplace;
- air monitoring results indicate the exposure levels to be higher than previously assessed;
- incidents such as fire, explosion, structural damage, flooding or subsidence;
- reports of asbestos concerns from workers;
- health monitoring of workers indicates possible asbestos-related or asbestos work-related health effects or exposure;
- introduction of new legal or regulatory requirements.

**Box 4-7: Example of continual revision of asbestos risk assessment during renovation work (Netherlands)**

**Background and context**

A former office building, originally designed in the late 19th century and brought into use in 1905, holds the status of a monument and is classified as industrial heritage in the Netherlands. Over the years, it underwent various renovations, many of which involved MCAs. These included asbestos-insulated heating pipes, asbestos in the roof insulation, asbestos-containing panels in the glass roof and asbestos in components of the lightning protection system.

Due to the monument's cultural and historical significance, all interventions aimed to preserve its integrity as much as possible while complying with safety and environmental regulations. Renovation activities were preceded by formal notifications and documented work plans.

**Examples of relevant practices**

One major intervention focused on the roof, where the top insulation layer was originally planned to be replaced. During trial removal, it was discovered that the insulation was partly bonded to an underlying asbestos-containing roofing layer. Additionally, openings in the metal roof raised concerns about the possible spread of asbestos fibres into other parts of the building. As a result, the strategy shifted towards applying a long-term heatproof coating to encapsulate the asbestos. However, further trials revealed that the metal roof construction had deteriorated, rendering this solution unsafe and unsustainable.

In response, a new plan was implemented: the old non-asbestos insulation was removed, and a new wooden structure was built over the asbestos roofing to isolate it securely.

Another renovation targeted the stained-glass roof of the central hall. To shield it from weather elements, a secondary protective glass roof had previously been installed. The plan involved removing the secondary glass panels, preserving them, strengthening the steel dome structure and reinstalling the glass. However, during the pilot stage, previously unidentified asbestos materials were found between the original dome and the protective roof. Immediate action was taken: work was halted, wooden panels were installed for temporary protection, the asbestos inventory and risk assessment were updated and the scope of asbestos removal was expanded.

**Outcomes and lessons learnt**

The project highlighted the complexity and unpredictability of renovating heritage buildings containing MCAs. Key lessons include the following.

([108]) Directive 2009/148/EC, Article 3(5).

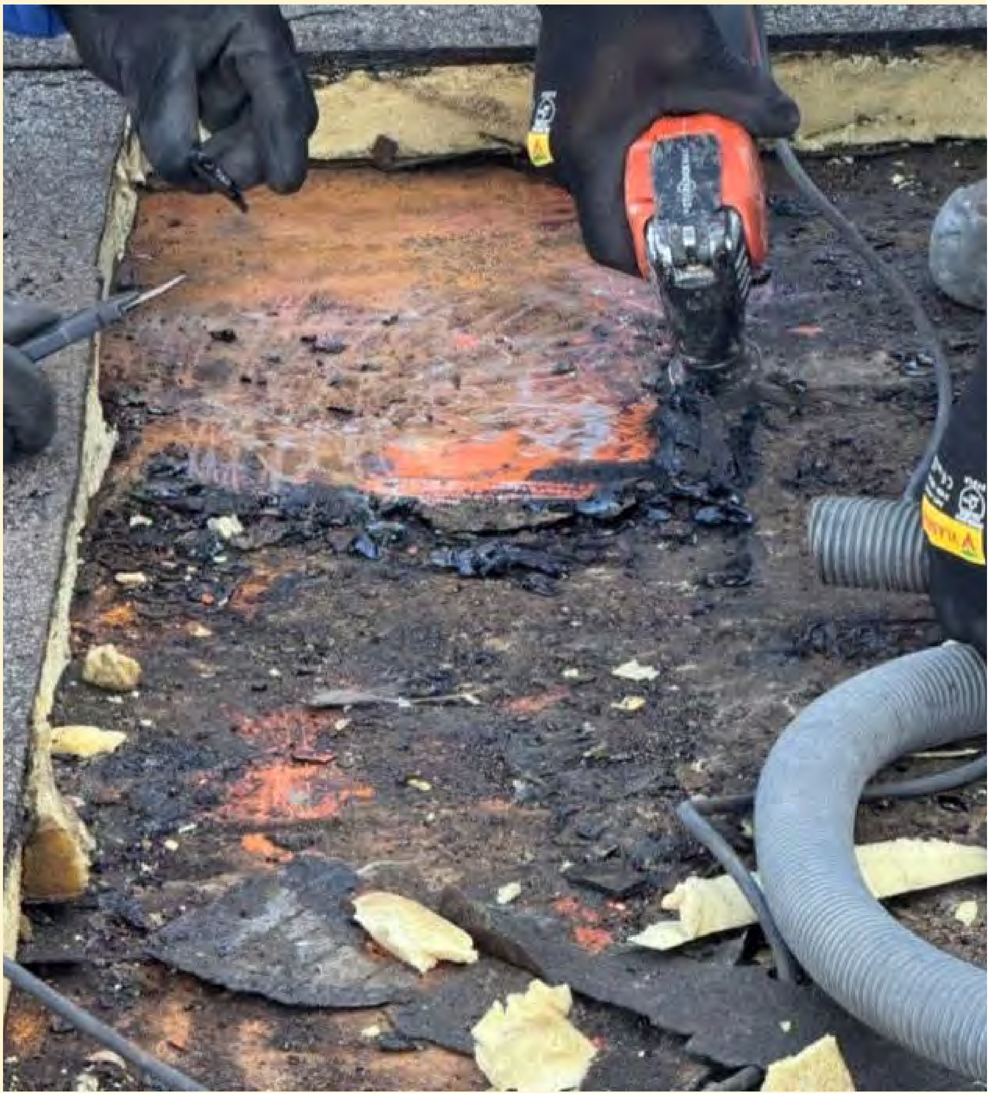
**Box 4-7: Example of continual revision of asbestos risk assessment during renovation work (Netherlands)**

- Adaptability is essential: technical surprises, such as deteriorated structures or unexpected asbestos locations, necessitated ongoing adjustments to work plans and safety procedures.
- Comprehensive stakeholder coordination: effective communication and decision-making among project managers, contractors, clients, supervisory authorities and regulators were vital for maintaining both safety and project momentum.
- Iterative risk assessment and planning: the asbestos risk assessments had to be revised multiple times, with corresponding updates to control measures and regulatory notifications. This reflects the dynamic nature of asbestos management in complex environments.

**Conclusion**

This case exemplifies the challenges of renovating historically significant buildings with a legacy of asbestos use. Even with thorough planning, such projects demand continual vigilance, flexibility and coordination to address unforeseen developments. Maintaining safety and historical value simultaneously requires a structured yet adaptable approach – especially around asbestos discovery, containment and removal. A dynamic AMP, responsive to evolving realities, proved to be a cornerstone of successful and responsible renovation in this context.

**Figure 4-3: Removal of roofing materials containing asbestos, with metal supportive roof visible**



**Box 4-7: Example of continual revision of asbestos risk assessment during renovation work (Netherlands)**

Figure 4-4: Workers removing asbestos plates on the roof

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## 4.1.4 Risk assessment report

The findings of the asbestos risk assessment should be documented in a risk assessment report. The report should include clear information on the need and urgency for MCA removal/management. A determination of the urgency of the measures to be taken (low, medium, high) should be defined according to the building use (e.g. work, home, public, school), planned renovation or demolition activities, results of the risk assessment and other relevant factors. A three-colour traffic light system can be applied for this ([109]).

A comprehensive asbestos risk assessment report may include the following sections:

- title, document owner, version control;
- executive summary;
- introduction;
- scope of the asbestos risk assessment;
- any studies/reports previously carried out (including from other agencies);
- methodology: asbestos risk assessment methods and sampling process;
- findings and observations from the materials assessment, description of the type of activity,

([109]) For example SUVA, FACH (2008), 'Asbest in Innenräumen. Dringlichkeit von Massnahmen' [Asbestos indoors, urgency of action], nr. 2891, https://www.suva.ch/de-ch/download/dokument/asbest-in-innenraeumen–dringlichkeit-von-massnahmen/asbest-in-innenraeumen–dringlichkeit-von-massnahmen–2891.D.

work and/or work environment, and description of the nature and degree of exposure;

- areas that could not be investigated: information on what was not included in the asbestos risk assessment [110];
- air monitoring results: fibre concentration data (if applicable);
- findings of exposure assessment;
- findings of risk characterisation;
- conclusions and recommendations, including additional control measures (if necessary and/or applicable);
- annexes: supporting documentation, including analysis certificates, calibration certificates of measurement equipment (where applicable) and photos;
- risk assessment reports, including conclusions and recommendations, written in clear, accessible language that non-experts can understand.

### 4.1.5 Sharing information

**Box 4-8: Sharing information**

**Article 6(4) of Directive 89/391/EEC (OSH FD):**

4. Without prejudice to the other provisions of this Directive, where several undertakings share a workplace, the employers shall cooperate in implementing the safety, health and occupational hygiene provisions and, taking into account the nature of the activities, shall coordinate their actions in matters of the protection and prevention of occupational risks, and shall inform one another and their respective workers and/or workers' representatives of these risks.

Where several undertakings share a workplace, the results of the risk assessment must be communicated to the other employers and their respective workers and/or workers' representatives [111], to support cooperation to prevent health risks to their workers and other people. For more information on coordination between different employers and other relevant stakeholders, see Section 3.2. Depending on the situation, the employer must supply the responsible authorities with various information, see for example Section 4.2 and Section 4.3.

[110] This procedure is common in asbestos risk assessment. For example, if a pipe made of asbestos cement crosses a stone wall into a shaft and is inaccessible. The pipe cannot be inspected without an inspection opening. Because of the risks that can be introduced by doing that, the competent investigator makes an annotation of this fact and assumes that the pipe will continue as a pipe made of asbestos cement. By doing so, the risk assessment is not incomplete; some parts are based on expert judgement and/or common sense. See NEN 2991:2015 nl – Air – Determination of asbestos concentrations in outdoor air and risk assessment in and around buildings, constructions or objects which contain asbestos materials, https://www.nen.nl/en/nen-2991-2015-nl-207667.

[111] Directive 89/391/EEC, Article 6(4).

## 4.2 Plan of work

**Box 4-9: Plan of work**

**Article 13 of Directive 2009/148/EC (AWD):**

1. A plan of work shall be drawn up before demolition work or work on removing asbestos and/or asbestos-containing products from buildings, structures, plant or installations or from ships is started.

2. The plan referred to in paragraph 1 must prescribe the measures necessary to ensure the safety and health of workers at the place of work.

The plan must in particular specify that:

(a) asbestos and/or asbestos-containing products are to be removed before demolition techniques are applied, except where this would cause a greater risk to workers than if the asbestos and/or asbestos-containing products had been left in place;

(b) the personal protective equipment referred to in point (a) of the first paragraph of Article 12 shall be provided, where necessary;

(c) when the demolition or asbestos removal work has been completed, the absence of risks of exposure to asbestos at the place of work shall be verified in accordance with national law and practice before other activities resume.

At the request of the competent authorities, the plan shall include information on the following:

(a) the nature and probable duration of the work;

(b) the place where the work is carried out;

(c) the methods applied where the work involves the handling of asbestos or of materials containing asbestos;

(d) the characteristics of the equipment used for:

(i) protection and decontamination of those carrying out the work,

(ii) protection of other persons present on or near the worksite.

3. At the request of the competent authorities, the plan referred to in paragraph 1 must be notified to them before the start of the projected work.

A plan of work must be prepared before demolition work or work on removing asbestos or MCA begins for buildings, structures, plants, installations or ships ([112]). In the case of buildings and infrastructure / civil engineering, this plan is typically integrated into the project's Safety and Health Plan (SHP) ([113]). The plan of work must specify the necessary measures to protect worker safety and health, including that ([114]):

- asbestos and/or MCAs are to be removed before demolition techniques are applied, except where this would cause a greater risk to workers than if the asbestos and/or asbestos-containing products had been left in place;
- PPE ([115]) must be provided where necessary;
- when the demolition or asbestos removal work has been completed, the absence of risks of exposure to asbestos at the place of work must be verified in accordance with national law and practice before other activities resume.

([112]) Directive 2009/148/EC, Article 13(1).

([113]) Directive 92/57/EEC, Article 3.

([114]) Directive 2009/148/EC, Article 13(2).

([115]) With regard to PPE, Directive 2009/148/EC, Article 13(2) refers to Article 12(1)(a): 'workers shall be issued with suitable personal protective equipment to be worn, which shall be appropriately handled and, in particular with regard to respiratory equipment, which shall be individually adjusted, including through fitting checks, in accordance with Council Directive 89/656/EEC'.

At the request of the competent authorities, the plan must include information on the following (116):

- nature and probable duration of the work;
- location where the work is carried out;
- methods applied where the work involves the handling of asbestos or MCAs;
- characteristics of the equipment used for:
  - protection and decontamination of those carrying out the work,
  - protection of other persons present on or near the worksite.

Additional Member-State-specific requirements for the plan of work may apply.

At the request of the competent authorities, the plan of work must be sent to them before the start of the projected work (117).

The French Labour Code (Article R4412-133, updated in February 2023) allows employers to draft a demolition, removal or encapsulation plan using an online teleservice. This service, accessible via a user account, is implemented by the Minister for Labour and is known as the DEMAT@MIANTE platform (118).

# 4.3 Notification

**Box 4-10: Notification requirement and derogation**

**Article 3(3) of Directive 2009/148/EC (AWD):**

3. Provided that worker exposure is sporadic and of low intensity, and if it is clear from the results of the risk assessment referred to in paragraph 2 of this Article that the relevant limit value as laid down in Article 8 will not be exceeded in the air of the working area, Member States may derogate from Article 4 where the work involves:

(a) short, non-continuous maintenance activities in which only non-friable materials are handled;

(b) removal without deterioration of non-degraded materials in which the asbestos fibres are firmly linked in a matrix;

(c) encapsulation or sealing of asbestos-containing materials which are in good condition;

(d) air monitoring and control, and the collection of samples to ascertain whether a specific material contains asbestos.

Article 4(2) and (3) of Directive 2009/148/EC (AWD):

2. The activities referred to in Article 3(1) must be covered by a notification system administered by the responsible authority of the Member State.

3. The notification referred to in paragraph 2 shall be submitted by the employer to the responsible authority of the Member State, before the work commences, in accordance with national laws, regulations and administrative provisions.

Employers must notify their relevant national authority before commencing any activity in which workers are or may be exposed in the course of their work to dust arising from asbestos or MCAs (119), unless the Member State concerned has derogated the relevant activities from the notification requirement (120).

This notification system ensures that authorities are informed about asbestos-related activities and can help ensure compliance with health and safety regulations and contribute to safeguarding workers' health.

(116) Directive 2009/148/EC, Article 13(2).
(117) Directive 2009/148/EC, Article 13(3).
(118) Ministère du travail et de l'emploi (n.d.), DEMAT@MIANTE platform, https://www.dematamiante.travail.gouv.fr/demat-amiante-frontend/#/auth/login.
(119) Directive 2009/148/EC, Article 4(2).
(120) Directive 2009/148/EC, Articles 4(1), 3(3).

The notification must include at least a brief description of the ([121]):

- location of the worksite and, where relevant, the specific areas where the work will take place;
- type and quantity of asbestos used or handled;
- activities and processes involved, including those relating to the protection and decontamination of workers, waste disposal and (where relevant) air exchange when working under confinement;
- number of workers involved, a list of the workers likely to be assigned to the site concerned, the workers' individual training certificates (see Section 9.6) and the date of their most recent health assessment ([122]);
- start date and duration of the work;
- measures taken to limit the exposure of workers to asbestos, including an overview of the equipment used.

A new notification must be submitted each time a change in working conditions is likely to result in a significant increase in exposure to dust from asbestos or MCAs ([123]).

The specific requirements for the notification, including who exactly needs to be notified, are determined nationally and may vary by Member State.

# 4.4 Permits

**Box 4-11: Permits for demolition or asbestos removal work**

**Article 15 of Directive 2009/148/EC (AWD):**

1. Undertakings that intend to carry out demolition or asbestos removal work shall obtain a permit from the competent authority before the start of the work. For that purpose, they shall provide that competent authority with at least proof of compliance with Article 6 and certificates indicating the completion of training in accordance with Article 14 and Annex Ia.

2. Member States shall make the list of undertakings that have obtained a permit pursuant to paragraph 1 publicly available, in accordance with national law and practice.

Employers intending to carry out demolition or asbestos removal work must obtain a permit from the competent authority before the start of the work, and provide that competent authority with at least proof of compliance that workers are adequately protected and certificates indicating the completion of training ([124]) (see Section 9.6).

# 4.5 Asbestos risk management

Managing asbestos is essential for minimising risks from exposure to asbestos. It involves a systematic approach to ensure the safe handling and management of asbestos and MCAs (see Annex 4), and follows a properly executed asbestos risk assessment (see Section 4.1). Through this approach, employers can effectively monitor asbestos-related activities, implement appropriate control measures and safety protocols, and maintain compliance with EU and national legislation and guidelines.

([121]) Directive 2009/148/EC, Article 4(3).
([122]) Directive 2009/148/EC, Article 18.
([123]) Directive 2009/148/EC, Article 4(5).
([124]) Directive 2009/148/EC, Article 15.

**Box 4-12: Asbestos management in the demolition and asbestos remediation of a coal power plant (Germany)**

**Background and context**

This power plant, a large coal-fired facility decommissioned in 2017, is undergoing a multi-year demolition and remediation process that started in June 2023. The site comprises over 150 buildings, many of which contain MCAs such as insulation, cement panels and gaskets. The demolition and remediation project is paying particular attention to the safe removal of MCA and ceramic wool.

**Examples of relevant practices**

- Comprehensive asbestos risk assessment
  - Initial risk assessment: a detailed site-wide asbestos risk assessment is conducted prior to any demolition or refurbishment work. This includes core sampling, visual inspections and laboratory analysis of suspect materials.
  - Documentation: all MCAs are catalogued in an asbestos register, which is made accessible to all relevant personnel and contractors.
  - Tailored asbestos risk assessment: each building and area is assessed individually, accounting for the type and condition of MCAs, potential for disturbance and proximity to occupied zones.
- Planning and communication (see Section 3 of this report)
  - AMP: a site-specific AMP is made, outlining safe work procedures, emergency response and ongoing monitoring. The AMP is regularly updated and changes are communicated to all stakeholders, including contractors, supervisors and the client.
  - Stakeholder coordination: responsibilities are clearly defined among the plant owner, contractors, supervisory organisations and competent authorities. A ‘four-eyes principle’ is adopted, requiring independent checks by both client and contractor experts before critical steps.
- Hierarchy of controls implementation
  - Elimination: where feasible, MCAs are removed prior to demolition. In cases where removal is not initially possible, materials are encapsulated or isolated.
  - Technical control measures: work areas are enclosed with negative pressure units and airlocks. Wet methods and high-efficiency particulate air (HEPA)-filtered vacuums are used to minimise fibre release.
  - Organisational control measures: work zones are clearly marked and access is restricted. Detailed work instructions and permit-to-work systems are enforced.
  - PPE: all workers wear disposable coveralls and gloves, suitable footwear (based on the risk assessment), safety glasses and respirators with HEPA filters. Face-fit testing is mandatory for respirator use. Gaps between the gloves and the overall are sealed with tape.
- Training and competency
  - Regular training: all personnel, including contractors and site managers, receive asbestos awareness and task-specific training, with refresher courses every three years.
  - Competency checks: only licensed and medically cleared personnel can perform asbestos removal, with health surveillance offered on a voluntary, lifelong basis.
- Monitoring and quality assurance (QA)
  - Air monitoring: background, personal and clearance air monitoring is performed before, during and after asbestos work, to ensure fibre concentrations remain below OEL.
  - Visual and analytical clearance: after removal, areas undergo visual inspection and air sampling before being cleared for further work or reoccupation.

**Box 4-12: Asbestos management in the demolition and asbestos remediation of a coal power plant (Germany)**

- Waste management
  - Double-bagging and labelling: waste containing asbestos (WCA) is double-bagged, placed in labelled, sealed containers and transported by licensed carriers to authorised disposal facilities.
  - Documentation of waste: all waste movements are tracked via a digital system to meet hazardous waste regulations.
- Decontamination
  - Decontamination: workers and tools are decontaminated before leaving controlled areas to prevent secondary contamination. Procedures are in place for vacuuming, removal and disposal of PPE.
- Emergency preparedness
  - Incident response: procedures are in place for accidental fibre release, including immediate area evacuation, containment and notification protocols for designated response personnel.

**Outcomes and lessons learnt**

- Zero incidents: as of May 2025, the project reported no significant asbestos exposure incidents.
- Continual improvement: regular audits, feedback loops and stakeholder engagement support ongoing refinement of procedures and rapid response to any emerging risks.

**Conclusion**

The project demonstrates that a structured, multi-layered asbestos management approach, rooted in thorough stakeholder management, asbestos risk assessment, planning, controls, worker training and WCA handling, is important for delivering asbestos OSH outcomes in complex and large-scale industrial settings.

**Main contractor's project manager**

'We always knew this was a huge project, with some complex technical problems to overcome. But the role of the SHC was much bigger and even more important than I anticipated, with many organisations involved from the owner, many contractors, asbestos specialists, occupational health and safety, and medical practitioners.'

'The adaptation of the four-eyes principle with independent expert checks for client and contractors helps us to realise the goals of the AMP and adjust it when necessary to prioritise the health and safety of workers.'

**Figure 4-5: Overview of part of the demolition process at a coal plant in Germany**



*Sources:* Study team visit to the demolition site; Federal Institute for Occupational Safety and Health (2007), 'TRGS 519 – Asbestos: Demolition, reconstruction or maintenance work', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-519.

### 4.5.1 Asbestos management plan

An AMP is a structured approach that can be key to safeguarding health and safety, ensuring compliance with legal obligations and enabling the effective long-term management of asbestos risks. By proactively managing asbestos, organisations can avoid exposure incidents, reduce liabilities and maintain a safe environment for all workers. An AMP is more specific than the general SHP plan for construction projects in buildings and infrastructure / civil engineering (see Section 4.2).

In some Member States, the information required for the notification, plan of work, compliance with additional national legal requirements and practical handling of asbestos and MCAs is collated in an AMP. An AMP sets out how asbestos or MCAs that are identified will be managed and/or what control measures will be implemented to control the exposure until the MCAs are removed, the building, structure or object is demolished and the asbestos-containing waste is removed. For information on the plan of work and notification, see Sections 4.2 and 4.3.

The responsibilities for setting up and managing an AMP vary between Member States.

An AMP should include the steps to be taken to control exposure to the lowest level technically achievable. The following items should be taken into consideration:

- technical and organisational control measures to prevent the spread of asbestos to the surrounding environment, see Section 8;
- provision, use and maintenance – including cleaning – of respiratory protective devices (RPDs) – including respiratory fit testing ([125]) – and other PPE, see Section 8.2.5;
- procedures for personal decontamination, see Section 8.2.2.2;
- procedures for dealing with incidents and emergencies, see Section 11 and Section 17;
- procedures for removal and disposal of waste, see Section 12;
- other risks that might arise in environments where asbestos is present, such as working at height, confined spaces, machinery, other hazardous substances than asbestos (such as crystalline silica), hazardous noise, fire and explosion risk and/or heat stress.

### 4.5.2 Content of an asbestos management plan

An AMP may include:

- purpose and objectives,
- asbestos risk assessment findings,
- roles and responsibilities,
- a system of usage restrictions of buildings, parts of buildings or environments containing MCAs,
- removal techniques,
- control measures,
- monitoring and inspection schedule,
- incident response procedure,
- emergency procedures,
- risk communication,
- training,
- plan of action (including prioritisation),
- review and revision,
- record-keeping.

Member States may have their own system in place for documenting asbestos management activities, for instance the 'Dossier technique amiante' in France ([126]).

([125]) ISO (2012), ISO 16975-3:2017j – Respiratory protective devices – Selection, use and maintenance, Part 3: Fit-testing procedures, https://face-fit.co.uk/wp-content/uploads/2016/03/282_28.pdf.

([126]) Direction Générale de la Santé, the central administration of the French Ministry of Health (2025), 'Asbestos detection in buildings', https://sante.gouv.fr/sante-et-environnement/batiments/article/le-reperage-de-l-amiante-dans-les-batiments.

### 4.5.3 Review and revision of the asbestos management plan

The frequency of the review of the AMP should be established, for instance every one or two years. The frequency of the review may be dictated by national regulations or industry best practices and should be documented in the AMP.

In addition to regular review, the AMP can be revised:

- whenever a new notification has to be submitted, see Section 4.3 ([127]);
- whenever a new plan of work is drawn up;
- if a new MCA is discovered;
- when the asbestos risk assessment is updated;
- after structural changes, meaning physical modifications or alterations to a building or facility that affect its structure, layout or stability;
- after changes in personnel responsibilities;
- if asbestos is removed, disturbed, sealed or enclosed at the workplace;
- after a dangerous incident, such as major exposure of workers, fire or impact of the building structure;
- if the plan is no longer adequate for managing asbestos or MCAs at the workplace;
- if a competent health and safety representative requests a review.

## 4.6 Record-keeping

The employer should ensure that key asbestos-related information, such as risk assessments, AMPs, notifications, plans of work, registers of exposed workers and results of health surveillance, are stored securely in a dedicated location, either digital or physical. This information should be made accessible to the extent needed and/or required for health and safety of workers, and in compliance with the relevant data protection requirements.

The employer must maintain a register of workers who are or may be exposed to dust arising from asbestos or MCAs during the course of their work. This information must indicate the nature and duration of the activity and the exposure to which they have been subjected. The information must be retained for at least 40 years following the end of the exposure period. If the employer ceases trading, the register must be made available to the relevant national authority ([128]).

Access to the register must be provided as follows ([129]):

- the doctor and/or authority responsible for medical surveillance must have access;
- workers must have access to the personal data relating to themselves;
- workers and/or their representatives must have access to anonymous, collective information in the register.

Record-keeping needs to comply with any applicable national legislation or guidance, which may differ between Member States.

([127]) Directive 2009/148/EC, Article 4(5).
([128]) Directive 2009/148/EC, Article 19.
([129]) Directive 2009/148/EC, Article 19(2).


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# 5 Identifying asbestos

## 5.1 Introduction

**Box 5-1: Identifying asbestos and materials containing asbestos**

**Article 11 of Directive 2009/148/EC (AWD):**

Before beginning demolition, maintenance or renovation work on premises built before the entry into force of the Member State's asbestos ban, employers shall take all necessary steps to identify presumed materials containing asbestos, in particular by obtaining information from the owners of premises, from other employers and from other sources, including relevant registers. If such information is not available, the employer shall ensure an examination, by a qualified operator in accordance with national law and practice, of the occurrence of materials containing asbestos and shall obtain the result of such examination before the start of the work. The employer shall make available to another employer, upon request and solely for the purpose of complying with the obligation laid down in this paragraph, any information obtained within the framework of such an examination.

If there is any doubt about the presence of asbestos in a material or construction, the applicable provisions of this Directive shall be observed.

An effective risk assessment requires the comprehensive and reliable identification of any presence of asbestos or materials containing asbestos (MCAs), see Annex 4. The objective is to ensure that all asbestos and MCAs are correctly identified, thereby supporting an effective approach to risk assessment and management. In many instances, reliable identification can require extensive research and communication with other stakeholders, such as building owners.

Asbestos identification is relevant both to exposure in buildings and to all other sectors where exposure to asbestos or MCAs can occur. In the following section, 'premises' refers to any environment where asbestos may be present, including buildings, vessels, vehicles or equipment. Asbestos may also be present in the natural environment; this is referred to as naturally occurring asbestos (NOA). Asbestos-containing rocks may be present in various regions in Europe and should therefore be considered before commencing any activity that may disturb rock or soil, potentially releasing NOA dust into the air and exposing workers.

Where there is any doubt about the presence of asbestos or MCAs in an environment, asset or premises, it must be assumed that asbestos is present, and the necessary preventive and protective measures taken [130].

The term asset is used in this section to encompass buildings, civil engineering, transport, mines and quarries.

[130] Directive 2009/148/EC, Article 11.

# 5.2 Where to find asbestos

## 5.2.1 Materials containing asbestos

MCAs were widely used due to their heat-resistant, insulating and reinforcing properties. Their usage began in the 1920s, with more extensive application in western Europe during the 1950s–1970s, and in general a more significant utilisation of asbestos in buildings and higher consumption in eastern Europe during the 1990s–2000s (where its utilisation has been mostly related to asbestos cement).

MCAs were produced by various manufacturers and marketed under different names. The same products can therefore be encountered under different designations.

Common MCA product groups include:

- technical and electrical installations;
- ventilation components;
- interior surface materials;
- roof products;
- façade elements;
- insulation and fire protection materials;
- panels and boards;
- special components and equipment.

A more detailed list of MCAs used historically in the EU construction sector is provided in Annex 4. This list is non-exhaustive, as asbestos can be found in unexpected locations. A list of suppliers, types of asbestos and uses is also available in the INRS (2014) ED 1475 ([131]).

Asbestos was also used in non-building applications, including:

- parts of ships, trains and vehicles (such as brake pads and gaskets);
- industrial equipment (such as heat-resistant textiles and insulation panels);
- safes, security devices and old electrical appliances and fireproof materials.

These asbestos-containing products can still be found in private, public, government and commercial properties and can pose a potential risk during maintenance, repair or relocation activities, or in case of emergencies, such as through destructive cutting or even non-destructive 'precision drill opening' of a safe ([132]). Effective identification begins with detailed profiling, supported by historical knowledge of asbestos-containing products, such as those manufactured before bans were implemented.

While some MCAs may have a lower likelihood of releasing fibres if left undisturbed (see Annex 4), they can have a significant potential for fibre release if damaged or disturbed or during maintenance and renovation activities. Even small-scale renovations or maintenance tasks, such as drilling into walls or replacing floor coverings, can pose significant risks. The term 'friable' has been used to refer to MCAs that can easily crumble or be crushed into a powdery form. This means that, all other things being equal, friable MCAs may pose a greater danger than non-friable MCAs. In France, the friable and non-friable distinction has been abandoned to avoid misunderstandings and incorrect risk assessments, see Box 5-2. A study found that dust levels are influenced more by the methods and tools used than by material friability ([133]).

([131]) French National Institute for Research and Safety (INRS) (2014), 'Asbestos: Products and suppliers', Information sheet, non-exhaustive list established by the INRS with manufacturers of products and MCAs that may be present in buildings or equipment, INRS ED 1475, https://www.inrs.fr/media.html?refINRS=ED %201475.

([132]) Health and Safety Authority (HSA) (2023), 'Asbestos risks in safes and fire resistant cabinets', https://www.hsa.ie/eng/your_industry/chemicals/legislation_enforcement/asbestos/asbestos_introduction/asbestos_risks_in_safes_and_fire_resistant_cabinets/.

([133]) INRS (2011), Campaign to measure exposure to asbestos fibres by analytical transmission electron microscopy (TEM).

When identifying MCAs, both visible and non-visible (such as asbestos-cement products or textured coatings) materials that could be disturbed during renovation or maintenance activities should be considered. Visual identification alone is not reliable for determining the presence of asbestos, as MCAs may appear identical to non-asbestos materials. If information on the presence of MCAs is not available, the employer must employ the services of a qualified operator to examine the occurrence of MCAs and obtain the result of this examination before work commences ([134]).

**Box 5-2: France – no differentiation between friable and non-friable asbestos**

Since 2012, French regulations have abandoned the distinction between friable and non-friable materials in favour of the notion of 'processes' or 'process' as the basis of the employer's asbestos risk assessment and control measures. This approach is based on asbestos fibres air measurements taken from operators during actual work activities.

In February 2009, AFSSET (now ANSES) published a report that highlighted the following points:

- the inherently carcinogenic nature of thin asbestos fibres;
- the systematic presence of thin asbestos fibres during workplace measurements, with a concentration that can be higher than those of long fibres in certain work situations;
- the inadequate performance of the analytical technique then used in France for measuring asbestos in the workplace (phase-contrast optical microscopy (PCM)), and the need to use an electronic analytical technique, preferably transmission electron microscopy (TEM), as this was identified in 2009 as the only method capable of accurately identifying all categories of asbestos fibres.

The French Ministry of Labor, supported by INRS and industry professionals, therefore commissioned an experimental TEM sampling and analysis campaign. This campaign covered 30 work situations, mainly in the building and public works sector. The results of this campaign (265 measurements), published in 2011, highlighted in particular:

- a significant underestimation by the PCM technique, both for the counting of long asbestos fibres, and more markedly for thin fibres;
- unexpectedly high results for several materials, including not only friable materials (such as asbestos plaster, which showed very high airborne fibre concentrations), but also materials classified as non-friable and subject to lighter regulatory treatment (such as asbestos glues or asbestos-cement sheets and pipes).

In addition, confirming the need to switch to TEM for workplace measurements (as AFSSET recommended in 2009), the campaign showed that the regulatory framework based on the nature of the material (i.e. friable or non-friable) was not appropriate. This was due to the strong influence of the intervention technique used and the preventive and protective measures implemented at the workstation to reduce the actual dust levels generated.

Since 2012, French regulations require employers undertaking asbestos-related work, whether removal, encapsulation or interventions on MCAs in place, to identify the various processes implemented by their workers. Each process is defined by the combination of:

- one type of MCA;
- one intervention technique;
- one or more collective protection measures at the workstation to reduce dust generated as far as technically possible (wet blasting, high-level filtration or continuous sedimentation of airborne particles in the workstation).

For each process, the employer is required to carry out exposure measurements on operators during real work situations, using accredited laboratories. The first measurement campaign aims to characterise the fibre concentrations generated by each process. These measurements must then be repeated at regular intervals to verify that the company can reproduce 'safe working procedures' and achieve the expected level of protection.

Each process is categorised into one of three regulatory fibre air concentration levels, associated with minimum regulatory requirements in terms of protection measures (these are reinforced at each dust level), and work is prohibited above an upper threshold.

*Source:* French Ministry of Labour, Health, Solidarity and Families (2025), personal communication.

([134]) Directive 2009/148/EC, Article 11.

The potential for asbestos to be present in unexpected locations underscores the importance of a thorough and systematic approach to asbestos identification and management. This approach should cover all areas of a building, site, facility or equipment, including those not commonly associated with asbestos use, or those that are not routinely accessed, such as crawl spaces and attics.

Information sources to be consulted include current and previous owners, who may have historical knowledge or documentation. The client and the project supervisor should also be consulted, as they may possess relevant information on the presence of asbestos. Other employers who have previously carried out work on the premises, along with any available national or local asbestos registers, should also be considered.

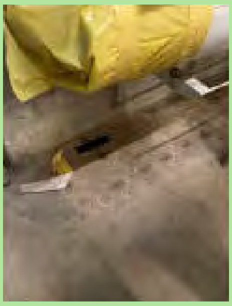
To ensure comprehensive identification, inventories and registers, pieces of equipment or workplaces should be regularly updated and maintained. These should include detailed information about the location, type and condition of MCAs throughout a building, site or piece of equipment. This is particularly important for reducing the risk of passive exposure to workers (see Section 7), as undetected, degrading MCAs may release fibres into the workplace environment and expose all staff present.

Asbestos inventories may have different scopes and focus, depending on factors such as the purpose of the assessment and whether the future of the asset has already been determined. In Figure 5-1, examples of asbestos inventories are shown. For example, if an asset is scheduled for demolition or renovation, the inventory typically focuses on identifying asbestos to ensure a safe working environment and to support correct waste management.

In other cases, the goal of the assessment is to determine whether asbestos is present in an asset still in use, so that the material can be removed or managed appropriately during occupation. During the remaining presence of the material, it is important to monitor the condition of the identified MCA at regular intervals.

Both types of assessments can be carried out, depending on the objective and the specific needs of the owner/employer.

**Figure 5-1: Example inventory to identify presence of asbestos by place, location, building structure part and material**

| Picture | ID | Place | Location | Building structure part | Material | Asbestos |
|---|---|---|---|---|---|---|
|  | 95-1 | Basement | Technical room | Floor | Dust | Not detected |
|  | 95-2 | Basement | Technical room | Floor | Dust | Detected |

These images are not available for reuse, see inside front cover.

*Source:* Danish Technological Institute, own internal report templates ([135]).

([135]) Danish Technological Institute (n.d.), 'Harmful substances in building materials', https://www.dti.dk/services/harmful-substances-in-building-materials/31476.

Before starting demolition, maintenance or renovation work on premises built before the relevant Member State's asbestos ban, employers must take all necessary steps to identify presumed MCAs, particularly by obtaining information from owners, other employers and other sources, such as relevant registers (136). When such information is unavailable, the employer must arrange an examination of the premises by a qualified operator, in accordance with national laws and practices (137). This helps ensure appropriate planning and the implementation of preventive and protective measures to safeguard health and safety. Upon request, the employer must make the results of the examination available to other employers (138).

## 5.2.2 Naturally occurring asbestos

NOA may be present in soil or rock and may occur in heterogeneous veins of various colours: blue (crocidolite); brown (amosite); green (anthophyllite, tremolite and actinolite); and white (chrysotile, tremolite and actinolite) (139). However, mineral colours are highly variable and depend on the host matrix rock or soil. Importantly, NOA in rock is not always visible to the naked eye.

NOA is often found as deposits in ultramafic rock (140), such as serpentine rock and near fault zones. Tremolite asbestos may occur in deposits of chrysotile, vermiculite and talc (141).

A deposit of NOA may contain one or more types of fibre orientation veins. The three types of asbestos fibre orientation veins include (142):

- cross-fibre asbestos: fibres occur crosswise in the sill/dyke, nearly at a right angle to the sill/dyke wall;
- slip-fibre asbestos: fibres form in sill-/dyke-like formations in shear zones;
- mass-fibre asbestos: bundles of fibres are mixed in a mass-like rock.

**Figure 5-2: Actinolite-albite vein in the metagabbros (France)**

This image is not available for reuse, see inside front cover.

(136) Directive 2009/148/EC, Article 11.

(137) Directive 2009/148/EC, Article 11.

(138) Directive 2009/148/EC, Article 11.

(139) IARC Working Group on the Evaluation of Carcinogenic Risks to Humans (2012), 'Arsenic, metals, fibres and dusts – A review of human carcinogens', in: IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, No 100 C, https://www.ncbi.nlm.nih.gov/books/NBK304374/.

(140) Ultramafic rocks are igneous or metamorphic rock with a very low silica content and more than 18 % magnesium oxide. See Holland, H. and Turekian, K. (2003), *Treatise on Geochemistry*, https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/ultramafic-rock; Mcnair, B. (2023), 'Ultramafic rocks examples and composition', Geology Base, https://geologybase.com/ultramafic/.

(141) US Agency for Toxic Substances and Disease Registry (ATSDR) (2001), 'Public Health Statement for Asbestos', https://wwwn.cdc.gov/TSP/PHS/PHS.aspx?phsid=28&toxid=4.

(142) Aurola, E. and Vesansalo, A. (1954) in: Kähkönen H. et al. (2019), *Asbestos risk management guidelines for mines*, Finnish Institute of Occupational Health, https://www.julkari.fi/handle/10024/143600.

**Figure 5-3: Chrysotile plated on serpentinites (France)**

This image is not available for reuse, see inside front cover.

**Figure 5-4: Chrysotile cross-vein in serpentinites (France)**

This image is not available for reuse, see inside front cover.

The ability of an asbestos-containing rock to release fibres is influenced by various independent factors, including the fibre content in the rock, fracture density, friability of the rock, type and intensity of human activities and extent of disturbance ([143]). Environmental changes over time can also affect fibre release potential.

**Figure 5-5: Alumino-magnesian metagabbros with tremolite asbestos**

This image is not available for reuse, see inside front cover.

([143]) INRS (2020), 'Travaux en terrain amiantifère. Opérations de génie civil de batiment et de travaux publics', Guide de prévention, ED 6142, https://www.inrs.fr/media.html?refINRS=ED%206142.

# 5.3 Asbestos ban in the EU Member States

At the EU level, asbestos use was banned via various Council directives, with the prohibition of intentionally added asbestos introduced under REACH Annex XVII entry 6 from 2006 ([144]).

Table 5-1 provides the year in which manufacture, import and use of all six asbestos types was prohibited in each Member State. However, in some cases, a transition period may have followed the implementation of the ban. These dates should therefore be interpreted with caution.

**Table 5-1: Year when manufacture, import and use of all six types of asbestos was prohibited**

| Member State | Ban year |
|---|---|
| Denmark, Sweden | 1986 ([a]) ([b]) |
| Austria | 1990 ([a]) |
| Italy | 1993 ([a]) ([e]) |
| Germany | 1993 ([c]) |
| Netherlands, Finland | 1994 ([b]) ([d]) |
| Slovenia | 1996 ([a]) |
| France, Poland | 1997 ([f]) ([a]) |
| Ireland | 1999 ([g]) |
| Belgium, Latvia | 2001 ([h]) ([a]) |
| Spain, Luxembourg | 2002 ([b]) |
| Bulgaria, Czechia, Estonia, Greece, Cyprus, Lithuania, Hungary, Malta, Portugal, Slovakia | 2005 ([a]) |
| Croatia | 2006 ([a]) |
| Romania | 2007 ([i]) |

*Sources:*

([a]) Kazan-Allen, L. (revised 2025), 'Chronology of asbestos bans and restrictions', International Ban Asbestos Secretariat, http://ibasecretariat.org/asbestos_ban_list.php.

([b]) European Commission: Directorate-General for Employment, Social Affairs and Inclusion, COWI, EPRD, FoBIG and RPA, *Study on collecting information on substances with the view to analyse health, socioeconomic and environmental impacts in connection with possible amendments of Directive 98/24/EC (chemical agents) and Directive 2009/148/EC (asbestos) – Study overview and key findings*, Publications Office of the European Union, Luxembourg, 2021, https://data.europa.eu/doi/10.2767/030815.

([c]) Hazardous Substances Ordinance, Annex I, No 3 Asbestos, Section 3.8 Transitional Periods for Prohibitions on the Marketing of Preparations and Products Containing Asbestos in Accordance with Section 2 of the Annex to Section 1 of the Chemicals Prohibition Ordinance of 14 October 1993 (Federal Law Gazette I p. 1720).

([d]) Occupational Safety and Health Administration Finland (Tyosuojelu.fi), 'Asbestos', https://tyosuojelu.fi/en/working-conditions/construction-industry/asbestos.

([e]) Italy, Official Gazette, Law No 257 of 27 March 1992, Rules relating to the cessation of the use of asbestos, https://www.gazzettaufficiale.it/eli/id/1992/04/13/092G0295/sg.

([f]) ANSES (2023), 'Asbestos: Still a very topical problem', https://www.anses.fr/en/content/asbestos-still-very-topical-problem.

([g]) Ireland Health and Safety Authority (n.d.), 'Asbestos (restrictions and exemptions)', https://www.hsa.ie/eng/your_industry/chemicals/legislation_enforcement/asbestos/legislation_and_guidance/restrictions_and_exemptions/.

([h]) Service Public Fédéral, Justice (2001), Arrêté royal limitant la mise sur le marché et l'emploi de certaines substances et préparations dangereuses (amiante), https://www.ejustice.just.fgov.be/eli/arrete/2001/10/23/2001022848/justel.

([i]) Decision of the Chamber of Deputies No 124 of January 30 2003, published in the Official Gazette of Romania (Articles 12 and 13).

([144]) Regulation (EC) No 1907/2006 – Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation, ELI: https://eur-lex.europa.eu/eli/reg/2006/1907/oj/eng.

Non-EU countries adopted bans on all six asbestos types later than Member States. These include Ukraine (2017), Monaco (2016), Serbia (2011), Türkiye (2010) and Gibraltar (2007) ([145]). Some countries have yet to enforce an absolute ban on asbestos, including Brazil, China, India, Russia and the United States ([146]). A list of countries that currently ban the manufacture, use and import of asbestos is provided in Annex 3.

When identifying the presence of asbestos or MCAs (see Annex 4), employers should also consider the following potential sources:

- unauthorised imports ([147]) of materials or products containing asbestos after the year indicated in Table 5-1 (or from countries where absolute bans on asbestos were introduced later than stated here, or are not yet in force);
- incomplete removal performed in the past (e.g. from buildings or means of transport);
- asbestos potentially present in recycled construction materials;
- asbestos contamination in land and soil;
- MCAs incorporated during maintenance or repair work conducted outside the EU, where asbestos regulations may be more permissive – this is particularly relevant for transport vehicles such as ships, trains and aircraft (see Section 14);
- premises constructed before the widespread use of asbestos may also contain MCAs, as these may have been introduced during later renovations carried out prior to the ban.

# 5.4 Who is responsible?

The typical activities undertaken by different stakeholders regarding the identification of asbestos and MCAs vary in accordance with the specific context and national regulations. However, in terms of protecting workers from occupational risks arising from exposure to asbestos dust in the workplace, including asbestos identification and risk assessment, the responsibility lies with the employer.

## 5.4.1 Triggers for the assessment of the presence of asbestos / materials containing asbestos

It is essential that asbestos and MCAs are identified before any work begins that might disturb them. Asbestos identification must occur before starting demolition, maintenance and renovation on premises built before the entry into force of the Member State's asbestos ban ([148]). Additional situations that may trigger a materials assessment include a change of ownership (when it is advisable, and in some countries mandatory, to conduct a materials assessment to inform new owners of potential asbestos-related risks) or requirements under specific national legislation (such as obligations to screen specific building categories by a given date under certain conditions).

## 5.4.2 Responsibilities of the main stakeholders

Employers have a duty to ensure the safety and health of workers in every aspect related to the work ([149]). In this context, they must identify and assess the risks related to exposure to asbestos or MCAs ([150]). Before beginning demolition, maintenance or renovation work on premises built before the

([145]) Kazen-Allen, L. (2025), 'Chronology of asbestos bans and restrictions', International Ban Asbestos Secretariat, http://ibasecretariat.org/asbestos_ban_list.php; Government of Gibraltar (2007), 'Control of Asbestos Regulations 2007', LN.2007/037, https://www.gibraltarlaws.gov.gi/legislations/control-of-asbestos-regulations-2007-1811/download.

([146]) EWG Action Fund (n.d.), 'Asbestos bans around the world', Asbestos Nation, https://www.asbestosnation.org/facts/asbestos-bans-around-the-world/.

([147]) In some cases, the presence of asbestos in imported products may not be labelled if the amount is below a certain content threshold.

([148]) Directive 2009/148/EC, Article 11.

([149]) Directive 89/391/EEC, Article 5(1).

([150]) Directive 2009/148/EC, Article 3(2).

entry into force of the Member State's asbestos ban, employers must take all necessary steps to identify presumed MCAs, particularly by obtaining information from the premises' owners, other employers and other sources, including relevant registers. If such information is not available, the employer must ensure that a qualified operator, in line with national law and practice, examines the occurrence of MCAs, and must obtain the result of such an examination before work begins ([151]). The employer must also provide, on request, any information obtained through such an examination to another employer, solely for the purpose of meeting this obligation ([152]).

In some Member States (such as Belgium (Flemish region), France and the Netherlands), certain premise owners are legally required to maintain an asbestos inventory. This inventory serves as a baseline for identifying the presence and location of MCAs on the premises. In some other Member States (such as Spain) the town hall is responsible for establishing an inventory of buildings containing asbestos.

In other Member States (such as France), the project owner/sponsor bears responsibility for asbestos identification before renovation or demolition work begins. As a result, multiple stakeholders may hold relevant information and coordinate efforts, see Section 3.2.

# 5.5 How to identify asbestos

Identifying asbestos involves a systematic approach combining historical knowledge (for MCAs) or geological knowledge (for NOA), visual inspection and scientific analysis. The general approach should always be conservative, i.e. assuming the presence of MCAs if the material is unidentified, especially in premises constructed or renovated before the national asbestos ban.

If there is any doubt about the presence of asbestos in a material, product or structure, the provisions of (the national legislation transposing) the AWD must be followed ([153]). Even in premises constructed after the national asbestos ban, the presence of MCAs should still be considered where there is suspicion of illegally imported materials or the use of secondary construction MCAs.

## 5.5.1 Identifying materials containing asbestos

The process of identifying MCAs typically includes the following steps:

- gather information about the premises, including year of construction, refurbishment history and material types, see Section 5.6;
- hire a competent person or company with appropriate training, qualifications and experience in asbestos identification to conduct thorough visual inspection(s), examining all areas, including hidden spaces where possible, and to arrange sampling and analysis of suspect materials by accredited laboratories, see Section 5.7.2 and Section 5.7.3;
- label identified MCAs and update relevant asbestos registers, such as site-specific inventories or local or national registers, see Section 4.1.3.1.2.

While these steps are described in more detail in other sections, the following principles should be kept in mind:

- even trained professionals may require time and experience to establish comprehensive asbestos inventories;
- visual identification alone is not reliable, as MCAs may appear identical to non-asbestos alternatives;
- always document inaccessible or unverifiable areas, stating any limitations of the inventory;

([151]) Directive 2009/148/EC, Article 11.
([152]) Directive 2009/148/EC, Article 11.
([153]) Directive 2009/148/EC, Article 11.

- treat asbestos inventories or registers as living documents, updating them whenever new information becomes available or site conditions change;
- unidentified or degrading MCAs pose a risk of passive exposure to all staff working in the asset.

### 5.5.2 Identifying naturally occurring asbestos

The process of identification of NOA typically involves:

- hiring a geologist to assess the site's geological characteristics, see Section 15.3.3.1 for a list of rock types that may contain NOA;
- conducting a visual inspection of rocks by a geologist (note: this cannot rule out the presence of NOA);
- performing analyses of soil or rock samples.

The determination of asbestos in soil is less well-established than monitoring asbestos fibres in air ([154]). Methods for quantifying asbestos in soil have been adapted from techniques used to analyse the presence of asbestos in other bulk matrices, and generally involve two stages:

- examining the soil sample under a low-power stereomicroscope and removing visible clumps of NOA, which are weighed to determine the percentage by weight ([155]);
- identifying and quantifying NOA within the clumps and in the soil by using electron microscopy (EM).

Sampling and analysis protocols for rock are discussed in more detail in Section 15.3.3.2.

## 5.6 Sources of information (including information sharing)

It is important to be aware that asbestos inventories may be available from other sources, such as:

- owners, duty-holders or construction project managers of the premises (such as site-specific asbestos inventories);
- previous employers who have carried out work in the premises;
- relevant asbestos registries where available (such as national or local databases of premises known to contain asbestos).

National or regional legislation may also impose stricter requirements for triggering asbestos screening in assets.

Establishing asbestos registries is considered good practice. In some Member States, certain premise owners are legally required to maintain an asbestos inventory, see Section 5.4.2.

Employers should actively seek out all potentially available information before beginning any work that may disturb MCAs. Where existing information is unavailable, outdated or inadequate, a thorough examination should be carried out before any work that may potentially involve exposure to asbestos, see Section 5.7.2.

Employers must also make asbestos-related information available to other employers to ensure the identification of all presumed MCAs ([156]). For example, this may apply where multiple employers operate on the same site. Clear protocols should be established for sharing information between parties. Some Member States may require written proof

([154]) Harper, M. (2008), '10th Anniversary Critical Review: Naturally occurring asbestos', *Journal of Environmental Monitoring*, Vol. 10, Issue 12, pp. 1394–1408, https://pubmed.ncbi.nlm.nih.gov/19037480/.

([155]) Please note that high levels of airborne NOA fibres can be generated from soils containing less than 1 % asbestos, according to activity-based sampling by the US EPA;, see: Harper, M. (2008), '10th anniversary ccritical review: Naturally occurring asbestos', *Journal of Environmental Monitoring*, Vol. 10, Issue 12, pp. 1394–1408, https://pubmed.ncbi.nlm.nih.gov/19037480/.

([156]) Directive 2009/148/EC, Article 11.

of such exchanges between employers. For more information on the importance of coordination, see Section 3.2.

In the context of demolition and renovation, another relevant concept is the pre-demolition or pre-renovation audit (PDA or PRA). This is typically commissioned by the owner of the construction works and conducted by a third party (not the demolition contractor). It results in an inventory of materials, construction products and waste expected to arise from demolition and renovation projects, along with options for their management and recovery.

PDAs and PRAs have a broad scope, identifying both hazardous substances (asbestos and other pollutants, such as metals and organic substances) and identifying resources that can be recovered before or during the demolition/renovation work. Their primary objective is environmental protection (including resource recovery and minimisation of waste and environmental impacts), rather than occupational health and safety. Nevertheless, they can serve as a useful tool within a wider strategy for asbestos identification.

# 5.7 Collection of samples to identify asbestos

## 5.7.1 Who should collect samples?

Materials assessment for the identification of MCAs requires the expertise of suitably qualified operators (157), whose qualifications requirements vary by Member State and must comply with national regulations. In some Member States, such as the Flanders region of Belgium, France (158), Italy (159) and the Netherlands, specific certification systems for asbestos operators are in place. These include training, examinations and ongoing assessment. See also the certification and accreditation schemes listed in Annex 7.

To maintain competence in this field, qualified operators should receive regular training and updates. Even qualified professionals may require time to build practical experience. This can be supported through mentoring systems, allowing new operators to gain experience under supervision. In France, for example, a new asbestos identification specialist (after completing a theoretical and practical assessment) should be mentored by an experienced professional. The mentor should supervise the mentee during five distinct asbestos identification missions carried out over a period of up to one year. This mentoring is overseen by the certification and training body and, upon successful completion, the operator receives a certificate of competence authorising them to work independently.

(157) Directive 2009/148/EC, Article 11.

(158) For built properties, see Decree of 1 July 2024 defining the certification criteria for diagnosticians working in the fields of asbestos, electricity, gas, lead and termite diagnostics, their training organisations and the requirements applicable to certification bodies, https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000049890008.
In other areas of activity (ships, boats, aircraft, industrial installations, transport infrastructure), there is no certification for individuals, but they are required to go through a professional training course, which includes tutoring. See Decree of 19 June 2019 on the identification of asbestos before certain operations carried out in ships, boats, floating devices and other floating constructions, https://www.legifrance.gouv.fr/loda/id/JORFTEXT000038689352/ (Annex I, paragraph 1.4.3); Decree of 13 November 2019 on the identification of asbestos before certain operations carried out in railway rolling stock, https://www.legifrance.gouv.fr/loda/id/JORFTEXT000039402652 (Annex I, paragraph 1.4.3); Decree of 22 July 2021 relating to the identification of asbestos before certain operations carried out in installations, structures or equipment contributing to the carrying out or implementation of an activity, https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000044035545 (Annex I, paragraph 1.4.4); Decree of 4 June 2024 on the identification of asbestos before certain operations carried out in buildings other than built buildings such as civil engineering works, transport infrastructure or various networks, https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000049834826 (Annex I, paragraph 1.4.3.3).

(159) Italian standard UNI 11903:2023.

## 5.7.2 Sampling protocols

Materials assessments for MCA identification can be the subject of national protocols (where available) and standards (such as EN ISO 16000-32:2014 ([160])). These can include the provision of collective and personal protective measures, see Section 8.

Examples of guidance on how to perform a materials assessment for the identification of MCAs are provided in Annex 9, and an example of an approach to sampling is shown in Box 5-3.

Materials assessments should be based on the gathered information about the assets' age and maintenance/renovation history, see Section 5.6. They should include a thorough visual inspection of all accessible areas and sampling of suspect bulk or soil materials for laboratory analysis, see Section 5.7.2.1 and Section 5.7.2.2.

If it is not possible to determine whether a material contains asbestos, for example due to inaccessibility, it must be treated as if it does ([161]), i.e. no maintenance or disturbance work should be carried out in these areas.

The examination should be tailored to its intended use, the specific premises and the type of work planned (such as maintenance, refurbishment or demolition), considering the potential for hidden materials to be disturbed.

Sampling should be carried out in unoccupied areas. This may include working during non-operational hours (such as weekends). Access should be restricted, including where necessary, by displaying prohibition and/or warning signs, see Section 8.2.4.1 and Annex 12.

**Box 5-3: Example of an approach to sampling**

**Overall approach to asbestos sampling in buildings**

Qualified operators approach sampling with a systematic methodology, combining both experience and building-specific issues:

- knowledge of MCAs, building techniques, construction periods and materials to identify common MCA locations, including hidden or less accessible spaces (such as a new floor installed over an older one);
- review of building documentation, such as plans, refurbishment records and previous survey reports, to assess building size and complexity, probability of MCA presence and typical MCA types;
- field inspection, looking for visual cues such as material uniformity, presence of junctions, changes in construction and signs of material replacement or repair.

**Sampling strategy**

Based on this information, the qualified operator determines the sampling strategy, defining the relevant sampling locations and number of samples. Important parameters for representative sampling include the following.

- **Building size and complexity.** Larger or more complex buildings (such as many rooms versus large open spaces) or those with many potential MCAs require more samples to achieve full coverage.
- **Material variability.** Where the same material is used in several locations (such as identical ceiling tiles in all classrooms), fewer samples may suffice (1–2 samples per classroom), if visual consistency is confirmed. Visible differences, such as junctions, edges, changes in colour, texture or signs of repair (patches) indicate possible heterogeneity (different material batches, ages or types) and require additional samples.
- **Assessment of homogeneity.** If there is uncertainty about whether visually similar materials are truly identical (due to, for example, differences in installation date or supplier), additional samples are taken to confirm or rule out variation.

([160]) CEN, 'EN ISO 16000-32:2014 – Indoor air – Part 32: Investigation of buildings for the occurrence of pollutants (ISO 16000-32:2014)', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:38614,6245&cs=1216659525BECC26A05BAE52684817698.

([161]) Directive 2009/148/EC, Article 11.

**Box 5-3: Example of an approach to sampling**

As a rule of thumb, one or two samples are taken from each visibly different material type in each area. For example, in a typical multi-room building (such as a school with 10 classrooms, two corridors and ancillary spaces), this may result in 10–20 samples to ensure adequate coverage of all material types and variations from each of the areas.

**Sampling techniques and handling of samples**

- Before sampling, verify the minimum sample size required with the analysis laboratory.
- Carefully cut out small pieces (approximately 5 × 5 cm) of the material.
- Lightly moisten the sampling areas to reduce dust.
- Place samples in double plastic bags, seal them and clearly label with sample number, location and material.

**Protection measures**

- Use gloves and PPE when sampling to avoid exposure.
- Treat all samples as potentially containing asbestos, from sampling to analysis.
- Clean tools and the sampling area after collection to prevent contamination.
- Samples must be stored securely and transported to an accredited laboratory.

#### 5.7.2.1 Bulk sampling

Bulk sampling involves the collection of samples from any suspect MCAs. At least one sample should be taken from each type of suspect MCA and analysed, see Section 5.2.1 and Annex 4. If asbestos is identified in the sample, other similar materials used in the same way can be strongly presumed to contain asbestos.

Sampling should not be carried out without first assessing potential risks to the workers taking the sample and others nearby (and adopting relevant precautions). This includes evaluating whether sampling might compromise the integrity of a roof, gutter, pipe or other facilities or equipment ([162]).

When taking samples, care should be taken to minimise disturbance to MCAs and any dust and debris that might be present. Surfaces should be protected (e.g. using polythene sheets ([163])) and cleaned after sampling by wet-wiping or using a suitable H-Class vacuum cleaner ([164]).

Several considerations when conducting bulk sampling are:

- Inspection should assess visible material variation, including repaired/damaged areas, colour/shade, surface texture/roughness, sound emitted on knocking, depth, temperature and coating ([165]).
- Repaired and replaced materials should always be sampled, in addition to the original items.
- Asbestos debris and other suspect visible contamination should also be sampled.
- The number and surface area of samples collected should be representative of the material and sufficient to establish whether asbestos is present ([166]).
- For homogeneous samples, one sample may be sufficient. For less homogeneous samples, a greater number of samples will be required.
- Samples should have an approximate size of 3–5 $cm^2$ across the full depth of the sample (including backing paper, if present). However, for materials with uneven asbestos distribution (such as textured coatings or sprayed fireproofing, where asbestos is typically distributed heterogeneously), a greater surface area is needed.

([162]) HSE (2012), *Asbestos: The Survey Guide*, HSG 264, https://www.hse.gov.uk/pubns/priced/hsg264.pdf.
([163]) HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.
([164]) ISO (2012), 'ISO 22261-1:2012 – Air quality – Bulk materials – Part 1: Sampling and qualitative determination of asbestos in commercial bulk materials', https://www.iso.org/standard/40834.html.
([165]) HSE (2012), *Asbestos: The Survey Guide*, HSG 264, https://www.hse.gov.uk/pubns/priced/hsg264.pdf.
([166]) ISO, ISO 22261-1:2012.

### 5.7.2.2 Soil sampling

Soil and made ground should be sampled when there is reason to believe that asbestos may be present and pose a risk to workers. Examples include sites where NOA may be present, former industrial sites or areas containing demolition waste, including sites potentially affected by illegal dumping.

As with bulk samples, appropriate safety precautions to the risks present should be put in place prior to sampling, to protect both the workers taking the sample and others nearby.

Several considerations when conducting soil sampling are shown below ([167]).

- Asbestos distribution in soil and made ground is likely to be variable and unpredictable.
- Samples may consist of MCA debris and asbestos fibres embedded in soil, mixed with vegetation, stones, bricks and crushed building rubble.
- Other materials (such as rubble) may need to be removed to access the area to be sampled.
- Obtaining a representative sample is challenging. However, the number and volume of samples should aim to be representative of the site and sufficient to establish whether asbestos is present.
- Sites are typically separated into approximately 1 $m^2$ areas, representative soil samples are taken from the top 1–2 cm of soil of each area, and a 1 litre representative sample for laboratory analysis is obtained by coning and quartering.
- A depth profile of the asbestos content may be required, which can be achieved by successive excavations.

For NOA, two sample types should be considered ([168]):

- coherent (massive) samples: a targeted strategy for sampling should be developed similar to that outlined for soil sampling (i.e. samples taken at various depths and locations);
- non-coherent (friable) samples: representative samples should be taken for laboratory testing.

### 5.7.2.3 Contextual information

Each sample should be sealed in an individual container, which is then sealed in a second container ([169]). The outer container should be labelled to indicate that it potentially contains asbestos. Each sample should be labelled with a unique identifier, which is also recorded in the materials assessment documentation, records and site plans, to allow the sample origin to be traced. The sampling location on site may also be labelled with the same identifier.

**Figure 5-6: Labelling of samples taken for analysis, showing the two-container system**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([167]) HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.

([168]) Lahondère, D. et al. (2021), 'L'amiante dans l'environnement naturel : Éléments de compréhension et d'aide à l'identification et à la caractérisation – Rapport final', BRGM/RP-70343-FR, https://infoterre.brgm.fr/rapports/RP-70343-FR.pdf.

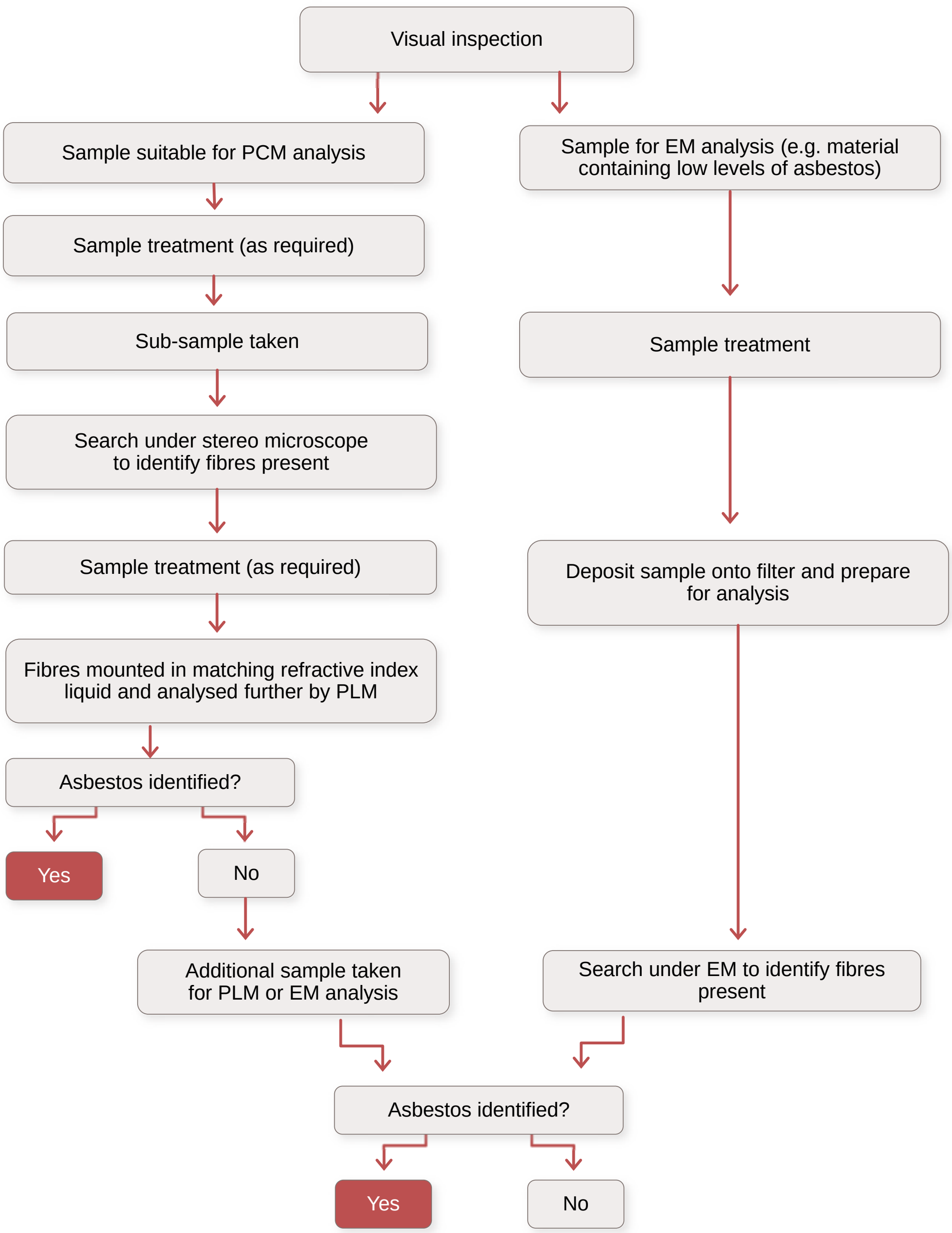
([169]) HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.

### 5.7.3 Sample analysis

Samples should be analysed by suitably competent laboratories. Any specific Member State requirements concerning sample analysis should also be checked.

EN ISO/IEC 17025:2017 (170) is an international standard that sets out general requirements for the competence, impartiality and consistent operation of laboratories. Accreditation to the standard plays an important role in supporting the provision of accurate and reliable results. This accreditation is not specific to asbestos but requires laboratories to demonstrate that they operate competently and generate valid results, see Section 6.7.

**Figure 5-7: Polarised light microscopy analysis**




*Source:* Developed with due consideration of ISO 22262-1:2012 and ISO 22262-2:2014.

(170) CEN, 'EN ISO/IEC 17025:2017 – General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2017)', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:59387,17372&cs=19F4B31D8AF7B1488AE101E46D9E7419F.

Asbestos in bulk and soil samples (as described previously in this section) is identified using polarised light microscopy (PLM) and/or EM with energy dispersive X-ray analysis (EDXA), using methods outlined in standards such as ISO 22262-1:2012 (alternative standards are listed in Annex 5). The limit of detection (LOD) using these methods depends on several factors, such as the nature of the sample, sample preparation, analysis time and method used. When appropriate techniques are applied, the LOD can be < 0.01 %, as typically validated through proficiency testing schemes, see Annex 6.

Quantification of asbestos in MCAs can be estimated based on the material type, as outlined in ISO 22262-1:2012, or can be quantified using methods such as those described in ISO 22262-2:2014 ([171]), which is suitable for asbestos mass fractions < 5 %.

PLM is suitable for asbestos identification, where fibres are typically observed in bundles (except for materials containing only thin or short fibres of asbestos, such as vinyl asbestos tiles). However, this method is not suitable for air monitoring samples, see Section 6.7.

The PLM method is suitable for most MCAs and can usually distinguish asbestos fibres from elongate mineral fragments or other materials. However, limitations may arise in:

- identifying fibres in materials containing short fibres or those below about 1 μm in width (such as vinyl floor tiles);
- identifying fibres in materials with a very low asbestos concentration (< 1 % asbestos content, such as natural samples like talc and vermiculite);
- distinguishing between tremolite and actinolite, or between tremolite and anthophyllite.

In such cases, EM with EDXA and/or electron diffraction techniques should be used to provide additional information and better limits of quantification (LOQ). For samples with very low asbestos concentrations, indirect analysis methods may be preferred. These typically involve sample treatments to break up fibre bundles, increasing the likelihood of fibre detection during EM analysis. However, this process, particularly when using sonication, may reduce fibre size and width, leading to dimensions that do not represent the raw sample.

In some Member States (such as France), due to PLM's inability to detect thin fibres (those < 0.2 μm in width), the use of EM methods is mandatory in addition to the PLM method.

A potential approach may involve performing EM analysis on non-friable organically bound materials (such as vinyl tiles) and some NOA materials (such as talc and vermiculite), where PLM has provided a negative result. These materials often contain small, thin fibres that PLM may not detect. Therefore, to increase the sensitivity and reliability of the result, EM methods should be used.

**Box 5-4: Example of EM methods being used to supplement PLM analysis in France**

**Overview**

EM has been routinely used to supplement PLM for MCA identification in France since 1996. While PLM is effective at detecting large fibre bundles, particularly in friable materials, EM enables the detection of fine asbestos fibres. EM methods such as TEM, energy dispersive spectroscopy (EDS) and selected area electron diffraction (SAED), are well-suited for their automation and productivity gains.

A laboratory interviewed for the development of the guide felt that the PLM + EM combination enables the rapid and reliable detection of asbestos fibres in materials.

**Achievements and impact**

Since 1996, PLM + TEM/EDS/SAED and PLM + SEM combinations have been used in France. Since 2018, only the PLM + TEM/EDS/SAED combination has been applied. Initially, this approach supported the protection of workers in the building sector through better MCA identification (1996–2017). Since 2017, it has been extended to all sectors, including buildings, ships, trains, mining, roads, soils, industry and aircraft.

Coupling PLM and EM techniques allows for the early termination of approximately 10 % of PLM analyses, either due to a negative or positive result for fibrous materials. This method is fast (requiring minimal sample preparation) and pairs effectively with EM analysis.

([171]) At the time of writing, ISO 22262-2:2014 is expected to be replaced within the coming months by ISO/PRF 22262-2 Air quality – Bulk materials Part 2: Quantitative determination of asbestos by gravimetric and microscopical methods', https://www.iso.org/standard/56773.html.

**Box 5-4: Example of EM methods being used to supplement PLM analysis in France**

The process works particularly well for insulation, flocking, thermal insulation, suspended ceilings, fibre cement, black adhesives and paper-cardboard products. The combined PLM/EM approach increases the detection rate of the finest asbestos fibres.

For the analysis of NOA, laboratories also apply International Mineralogical Association (IMA) principles, enabling mineralogical analysis to be conducted on the same grid.

**Transferability and lessons learnt**

EM methods, particularly TEM/EDS/SAED, when used in combination with PLM as a preliminary step, offer high potential for automation in both sample preparation and analysis.

Materials that may be mistaken for asbestos in PLM analysis include:

- polyethylene fibres, leather swarf fibres, macerated aramid fibres, spider webs and talc fibres, which can all resemble chrysotile;
- fibrous brucite (nemalite), fibrous wollastonite and diatomaceous earth, which may all resemble amphibole asbestos fibres.

Analytical protocols are designed to minimise the risk of misidentification. In addition, laboratories reduce the likelihood of misidentification through the use of appropriate contextual information and QA and quality control (QC) procedures.

## 5.8 Record-keeping

Detailed documentation of the presence, location, type and condition of MCAs should be maintained, for example in a site-specific asbestos inventory.

This inventory should incorporate:

- all materials assessment findings, including sampling locations and laboratory results;
- records of risk assessments and AMPs;
- details of any remedial action taken, so that the situation after the remediation is clearly described.

The documentation should be clear and accessible to all relevant parties entitled to use it (such as workers and contractors) and updated whenever relevant changes occur in the use of the premises or condition of the MCAs. This should also include records of negative results and uninspected areas (e.g. where access was not possible), clearly state any limitations or assumptions of the conducted materials assessment and, where appropriate, include photographs and diagrams to support identification of MCAs. These records should be retained for the lifespan of the asset or as required by national regulations.

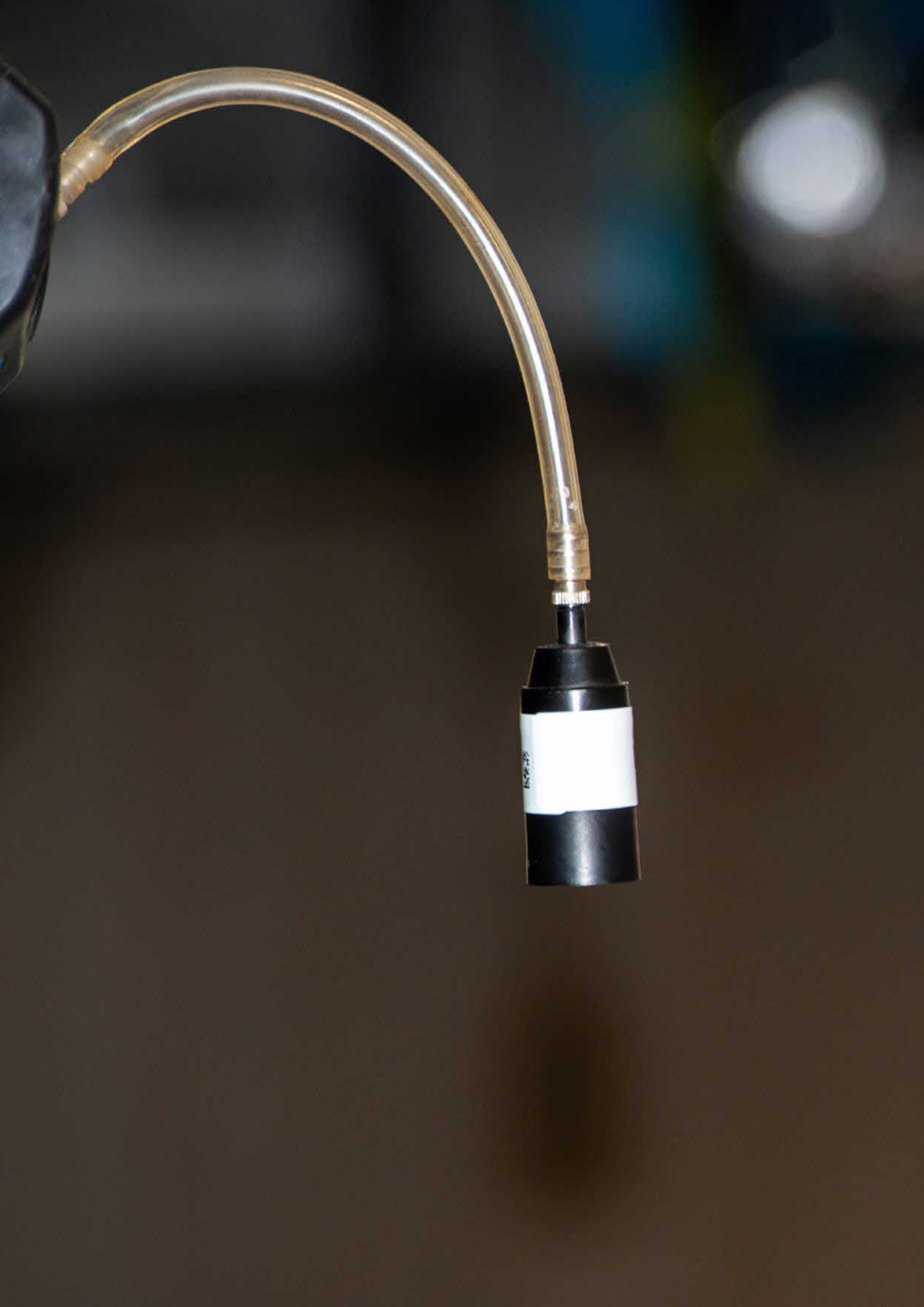
Visual records, such as marked-up plans and/or photographs, are effective for recording sampling positions and MCA locations. For large-scale materials assessments such as soil sampling, maps can be used to plan the materials assessment and to record the position, amount (such as number of MCA fragments and/or surface area of the MCAs found per square metre) and a description of the forms of the MCAs found.

The documentation should include:

- a comprehensive inventory of all identified or presumed MCAs (such as due to uninspected areas) and any negative results;
- detailed location information, including building plans where possible;
- the condition of the MCAs and any risk assessment outcomes;
- results of air monitoring, where applicable/ available;
- details of any removal, encapsulation or remediation work carried out, including cases where MCAs have not been completely removed;
- the date when the information was last updated.

The level of detail in the documentation should reflect the size and complexity of the site and always be sufficient to enable effective asbestos risk management.

The use of digital documentation systems could facilitate updates to the information and improve access to available documentation.



# 6 Air monitoring

## 6.1 Introduction

**Box 6-1: Objectives of air exposure measurement**

**Article 6 of Directive 2009/148/EC (AWD):**

… the exposure of workers to dust arising from asbestos or materials containing asbestos at the place of work shall be reduced to a minimum and in any case to as low a level as is technically possible below the relevant limit value as laid down in Article 8 …[…]

**Article 7(1) of Directive 2009/148/EC (AWD):**

1. Depending on the results of the initial risk assessment, and in order to ensure compliance with the relevant limit value as laid down in Article 8, the measurement of asbestos fibres in the air at the place of work shall be carried out at regular intervals during specific operational phases.

**Article 10(1) of Directive 2009/148/EC (AWD):**

1. Where the relevant limit value as laid down in Article 8 is exceeded, or if there is reason to believe that materials containing asbestos which are not identified prior to the work have been disturbed so as to generate dust, work shall stop immediately.

Work shall not be continued in the affected area until adequate measures have been taken for the protection of the workers concerned.

Where the relevant limit value as laid down in Article 8 is exceeded, the reasons for the limit value being exceeded shall be identified and appropriate measures to remedy the situation shall be taken as soon as possible.

Air monitoring is required for various purposes (see Section 6.3), including to comply with OELs and to support the preparation of risk assessments. In all cases, it is important that any air monitoring reflects the actual work activity being carried out.

Air monitoring involves the collection of particulates from a measured volume of air, by drawing air through a filter using a sampling head attached to a pump. The filter is examined by microscopy and the number of collected airborne fibres is determined. This quantitative measurement of fibres in the sampled air is referred to as the airborne respirable fibre concentration.

The fibre concentration measured in a sample may not always be representative of the true personal exposure, as control measures such as PPE and respiratory protective devices (RPDs) may be in place, or samples may have been collected in a static location.

In some cases, the airborne asbestos fibres may be present due to natural background (ambient) levels of asbestos, rather than from workplace activities.

## 6.2 Occupational exposure limit definitions

### 6.2.1 Fibre definition

In Directive 2009/148/EC, the fibre definition for OEL measurement currently applies to fibres with a length of more than 5 µm, a breadth of less than 3 µm and a length/breadth ratio greater than 3 : 1 ([172]).

### 6.2.2 Exposure limits

**Box 6-2: Exposure limits**

**Article 8 of Directive 2009/148/EC (AWD):**

1. Until 20 December 2029, employers shall ensure that no worker is exposed to an airborne concentration of asbestos in excess of 0.01 fibres per cm³ as an 8-hour time-weighted average (TWA).

2. From 21 December 2029, employers shall ensure that no worker is exposed to an airborne concentration of asbestos in excess of:

a) 0.01 fibres per cm³ as an 8-hour TWA in accordance with Article 7(7), second subparagraph; or

b) 0.002 fibres per cm³ as an 8-hour TWA.

3. Member States shall ensure that employers are subject to at least one of the limit values set out in paragraph 2.

**Article 7(7) of Directive 2009/148/EC (AWD):**

7. For the purpose of measuring asbestos fibres in the air, as referred to in paragraph 1, only fibres with a length of more than 5 micrometres, a breadth of less than 3 micrometres and a length/breadth ratio greater than 3 : 1 shall be taken into consideration.

Notwithstanding the first subparagraph of this paragraph, fibres with a breadth of less than 0.2 micrometres shall also be taken into consideration for the purposes of Article 8(2), point (a), from 21 December 2029.

The exposure of workers to dust arising from asbestos or materials containing asbestos (MCAs) must be reduced to a minimum and, in any case, to as low a level as is technically possible below the OELs described in Box 6-2. ([173])

From 21 December 2029, employers will need to apply one of the two OEL options (see Box 6-2), depending on whether fibres with a breadth of less than 0.2 µm are included in the measurement ([174]). If fibres with a breadth of less than 0.2 µm are included, the OEL is 0.01 fibres/cm³ as an 8-hour TWA; if they are not included, the stricter OEL of 0.002 fibres/cm³ applies.

Directive 2009/148/EC does not set a lower limit for fibre breadth. However, some Member States define 'thin asbestos fibres'. For example, France describes them as fibres with a diameter between 0.01 and 0.2 µm (with 0.01 µm reflecting the analytical detection limit, not a health-based threshold) ([175]). A study by INRS illustrates the impact of excluding thin fibres in air sample analyses ([176]).

([172]) Directive 2009/148/EC, Article 7(7).

([173]) Directive 2009/148/EC, Article 6.

([174]) Directive 2009/148/EC, Article 7(7).

([175]) INRS (2011), 'Asbestos exposure measurement investigation using analytical transmission electron microscopy (ATEM)', www.inrs.fr/dam/inrs/PDF/META-synthese-EN.pdf.

([176]) INRS (2011), 'Campagne de mesures d'exposition aux fibres d'amiante par microscopie électronique à transmission analytique (META) – Rapport final' [Campaign to measure exposure to asbestos fibres by analytical transmission electron microscopy (TEM) – Final report], https://www.inrs.fr/dam/jcr:0bf4a968-28df-4f2e-95a1-5cb100f4bc73/META-rapport-final.pdf.

## 6.3 Purpose of air monitoring

Air monitoring serves several important purposes within the framework of preventing and controlling occupational exposure to asbestos:

- supporting risk assessments;
- ensuring compliance with the OEL for asbestos, see Box 6-2;
- verifying compliance with the exposure minimisation requirement, see Box 6-1;
- designing and validating control measures to confirm their effectiveness in controlling exposure to asbestos;
- verifying the appropriate selection of an RPD;
- identifying incidents and lapses in control procedures, both regarding exceeding the OEL (see Box 6-2) and incidents leading to very high exposure;
- verifying the effectiveness of decontamination procedures;
- identifying workers subject to passive exposure, see Section 7;
- assessing the need for health surveillance, see Section 10.

## 6.4 Who is responsible for exposure assessment?

Employers are responsible for assessing exposure to asbestos. They must ensure that no worker is exposed to an airborne asbestos concentration in excess of the relevant OEL ([177]), with exposure levels also being reduced to as low as possible (see Article 6 of Directive 2009/148/EC). In cases involving exposure in buildings, employers may need to collaborate with building or project owners, project designers and those responsible for coordinating health and safety, to ensure they are aware of the presence and condition of any asbestos in the building. See Section 5 for further details on the identification of asbestos.

Air sampling must be carried out by suitably qualified personnel ([178]) with sufficient training and experience in occupational hygiene principles (hereafter referred to as an 'appraiser'). In some Member States (such as Ireland), specific qualifications for this role are required.

## 6.5 When to carry out air monitoring

The timing of air monitoring will depend on its intended purpose, see Section 6.3.

Any activity likely to involve a risk of exposure to dust from asbestos or MCAs (see Annex 4) must be subject to a risk assessment to determine the nature and degree of worker exposure ([179]). Air monitoring supports this process by informing the risk assessment and helping to determine appropriate control measures.

An initial (but not precise) indication of potential asbestos dust levels can be determined using existing monitoring data from literature or national databases (such as the Scol@miante tool used in France) ([180]). However, such data should only be used as an initial indication to guide the selection of control measures and to support the development of the initial risk assessment.

([177]) Directive 2009/148/EC, Article 8.
([178]) Directive 2009/148/EC, Article 7(4).
([179]) Directive 2009/148/EC, Article 3(2).
([180]) INRS (n.d.), 'Scol@miante', https://scolamiante.inrs.fr/Scolamiante/.

### Box 6-3: Example of using existing monitoring data from national databases

The Scol@miante tool can be used to carry out an a priori assessment of asbestos exposure in work situations involving MCAs: https://scolamiante.inrs.fr/Scolamiante/.

It is based on individual collected air sample measurements of asbestos dust on construction sites and analysed by TEM. The tool is updated annually.

Scol@miante is accessible to anyone wishing to assess a priori the potential asbestos fibre dust levels generated by work involving the removal or encapsulation of MCAs or interventions on asbestos materials.

The user is asked to select choices from drop-down menus for five criteria:

- activity
- material
- treatment technique
- wet work
- source capture.

Below is an example output for removing asbestos plaster; manual breaking, chiselling, tapping or demolition with a hand tool; with material wetting by spraying the materials and misting or nebulising; and suction at the source.

**Figure 6-1: Example of output generated using the Scol@miante tool**

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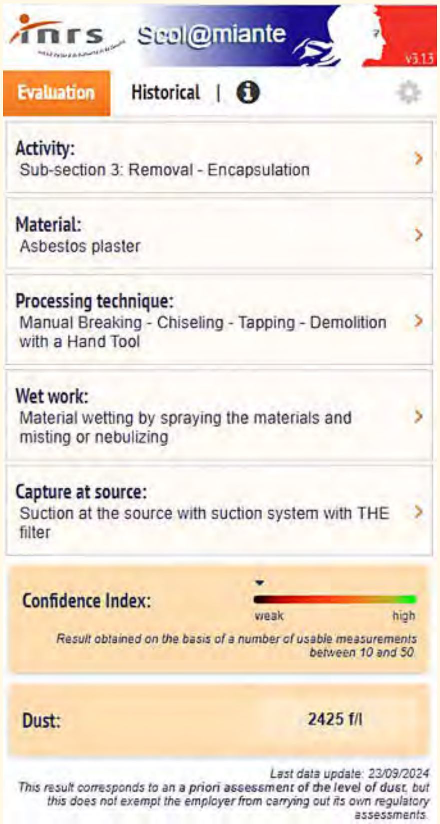



The result is the 95th percentile of the data entered for the criteria entered. A confidence index is also displayed, indicating the robustness of the evaluation.

Confidence index:

- low: cursor in black zone, between 10 and 50 measurements;
- average: cursor in red zone, between 50 and 150 measurements;
- good: cursor in orange zone, between 150 and 1 500 measurements;
- very good: cursor in green zone, more than 1 500 measurements.

There is a link to the INRS website for general prevention recommendations.

In this example, the assessed fibre concentration is 2 425 fibres/litre and the confidence index is weak. The results of the assessment are also accompanied with a statement that the result corresponds to an a priori assessment of the dust level and does not exempt the employer from carrying out their own regulatory assessments.

The French National Institute for Research and Safety (INRS) presented an analysis of the results of asbestos fibre dust measurements carried out as part of regulatory controls of exposure to asbestos fibres between 1 July 2012 and 31 December 2023. These measurements were entered and validated in the SCOLA database and extracted from the database on 27 May 2024 (*).

(*) INRS (2024), 'Extraction base de données SCOLA', https://travail-emploi.gouv.fr/sites/travail-emploi/files/2024-09/Mesures-exposition-amiante-META-Rapport-activite-2012-2023-Extraction-SCOLA-INRS-Juin-2024.pdf.

*Source:* INRS (n.d.), 'Scol@miante', https://scolamiante.inrs.fr/Scolamiante/.

Further, depending on the results of the initial risk assessment (see Section 4.1) and to ensure compliance with the relevant OEL (see Section 6.2.2), airborne asbestos fibre measurements must be carried out at regular intervals during specific operational phases ([181]). If any significant changes are made to the workplace conditions, such as work practices, processes, control measures, frequency and duration of exposure, an assessment should be carried out to determine whether renewed air sampling is required ([182]).

# 6.6 Air sampling strategy

## 6.6.1 Complying with the defined occupational exposure limit

Air sampling must reflect the personal exposure of the worker to asbestos dust or dust from MCAs ([183]). Sampling must be carried out in consultation with the workers and/or their representatives within the undertaking or establishment ([184]).

Relevant standards, such as EN 689:2018+AC:2019, describe a strategy for testing compliance with OELs, which can also be applied to inhalation exposure of asbestos fibres. Member States may provide alternative documents addressing air sampling on membrane filters to determine the concentration in number of fibres (per $cm^3$) using microscopy techniques, see Annex 5.

**Box 6-4: Example of defining the level of dust in a process**

The INRS provides guidance to specialist asbestos contractors on how to define the level of dust during MCA removal or encapsulation processes.

**Test site**

The test site is the initial location where dust suspected of containing asbestos is assessed. The aim is to sample potential MCAs, assess treatment techniques or evaluate source-level emission reduction measures. The test site assessment should be conducted when a process is first implemented and is used to verify the preliminary asbestos dust concentration estimates, often based on existing data from the Scol@miante tool.

**Validation**

If the dust levels measured at the test site align with the estimated values, the employer should proceed to validate the results at a worksite under the same conditions as those at the test worksite.

The validation phase must yield three results over a 12-month period, ideally obtained by different teams to capture variability. If the dust levels at the test site and the three different validation sites are consistent, this finding is recorded in the risk assessment documentation. If the dust level at any of the validation sites is lower than that of the test site, the process is still classified at the highest dust level recorded.

**Periodic inspection**

Once validated, the dust levels are periodically checked. The company must conduct periodic air monitoring, ensuring that a minimum of three results are collected over a 12-month period, to verify that the process classification remains valid.

*Source:* INRS (2020), 'Asbestos: defining the level of dust in a process "Subsection 3"', https://www.inrs.fr/media.html?refINRS=ED %206367.

([181]) Directive 2009/148/EC, Article 7(1).

([182]) British Standards Institution, 'British Standards Document – BS EN 689 – Workplace exposure. Measurement of exposure by inhalation to chemical agents. Strategy for testing compliance with occupational exposure limit values', https://landingpage.bsigroup.com/LandingPage/Undated?UPI=000000000030394628.

([183]) Directive 2009/148/EC, Article 7(2).

([184]) Directive 2009/148/EC, Article 7(3).

#### 6.6.1.1 Which workers who are at risk of asbestos exposure to sample

**Box 6-5: How to carry out air concentration measurements**

**Article 7(2) to (6) of Directive 2009/148/EC (AWD):**

2. Sampling shall reflect the personal exposure of the worker to dust arising from asbestos or materials containing asbestos.

3. Sampling shall be carried out after consultation of the workers and/or their representatives within the undertaking or establishment.

4. Sampling shall be carried out by suitably qualified personnel. The samples taken shall be subsequently analysed, in accordance with paragraph 6, in laboratories equipped for fibre counting.

5. The duration of sampling shall be such that representative exposure can be established for an 8-hour reference period (one shift) by means of measurements or time-weighted calculations.

6. Fibre counting shall be carried out by electron microscopy or by any alternative method that provides equivalent or more accurate results.

Any worker at risk of asbestos exposure should have their personal exposure assessed. For examples of potentially exposed workers other than those in demolition and renovation, see Annex 10.

Workers can be grouped into a similar exposure group (SEG) if their typical work tasks, frequencies and work conditions result in similar exposure profiles. For example, all members of a team involved in removing asbestos insulating board from one particular building could be classified as an SEG.

As per EN 689:2018+AC:2019, the following sampling strategy applies for SEGs:

- a range of 3–5 valid measurements are required for the preliminary test to determine compliance with the OEL;
- more than six valid measurements are needed to allow for statistical evaluation of the exposure results.

#### 6.6.1.2 Which activities to measure

The activities measured should be representative of typical working tasks. If representative sampling is not possible, a reasonable worst-case scenario should be assessed.

#### 6.6.1.3 Measurement duration and flow

To ensure compliance with the selected OEL, a minimum (and maximum) air sampling volume may be set, specific to each analytical technique. To meet this sampling volume, the sampling strategy must consider both the measurement duration and pump flow.

Sampling must be conducted for a duration sufficient to establish representative exposure for an 8-hour reference period (one shift). This may be done either through direct measurement or via time-weighted calculations ([185]). A TWA calculation refers to the average air concentration over a continuous period (in this case eight hours). If the actual sampling time is less than eight hours, assumptions are made about exposure during the unsampled period to calculate the full 8-hour TWA ([186]). Sequential sampling may however be needed in high-dust environments, to prevent the filters becoming overloaded and uncountable ([187]).

Air sampling is conducted during activities where there is a risk of exposure. Periods of inactivity are generally excluded. The minimum sampling duration is typically one hour. Task-based sampling (i.e. sampling one specific step in an activity) is often used as a reasonable worst-case estimate.

([185]) Directive 2009/148/EC, Article 7(5).
([186]) HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.
([187]) HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.

To ensure the sampled air volume is sufficient to detect fibre concentrations at or below the OEL, the pump flow should be matched to the expected sampling time. Where the goal is to detect low concentrations (equivalent to air concentrations ≤ 0.01 fibres/cm³), it is recommended to sample the largest possible air volume during periods when workers are likely to be exposed to asbestos.

**Box 6-6: Example of how to select suitable pump flow and sampling duration when analysing air samples**

A report from the Netherlands Organisation for Applied Scientific Research (TNO) describes how to assess whether a given method to determine compliance with a set OEL is suitable. The example used involves SEM, but the same approach can be followed for any relevant analytical method.

The following table is an extract from the report and illustrates the applicability of SEM for testing compliance with two OELs (10 000 and 2 000 fibres/m³) depending on the LOD, as defined by sampling characteristics (flow and sampling duration) and the surface area of the filter that is analysed.

**Figure 6-2: Applicability of scanning electron microscopy for testing compliance with two occupational exposure limit values (10 000 and 2 000 fibres/m³) depending on the limit of detection as defined by sampling characteristics (flow and sampling duration) and the surface area of the filter that is analysed**

| Sampling characteristics | | | Limits of detection with varying surface areas being analysed | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | OELV 2 000 fibres/m³ | | | | OELV 10 000 fibres/m³ | | | |
| Flow (litres/ minute) | Sampling duration (hours) | Volume air (m³) | 1 mm² (*) | 2.5 mm² (**) | 5 mm² | 10 mm² | 1 mm² (*) | 2.5 mm² (**) | 5 mm² | 10 mm² |
| 8 | 1 | 0.48 | 2 400 | 950 | 480 | 240 | 2 400 | 950 | 480 | 240 |
| | 2 | 0.96 | 1 200 | 480 | 240 | 120 | 1 200 | 480 | 240 | 120 |
| | 4 | 1.92 | 590 | 240 | 120 | 60 | 590 | 240 | 120 | 60 |
| | 8 | 3.84 | 290 | 120 | 60 | 30 | 290 | 120 | 60 | 30 |
| 4 | 2 | 0.48 | 2 400 | 950 | 480 | 240 | 2 400 | 950 | 480 | 240 |
| | 4 | 0.96 | 1 200 | 480 | 240 | 120 | 1 200 | 480 | 240 | 120 |
| | 8 | 1.92 | 590 | 240 | 120 | 60 | 590 | 240 | 120 | 60 |
| 2 | 2 | 0.24 | 4 700 | 1 900 | 950 | 480 | 4 700 | 1 900 | 950 | 480 |
| | 4 | 0.48 | 2 400 | 950 | 480 | 240 | 2 400 | 950 | 480 | 240 |
| | 8 | 0.96 | 1 200 | 480 | 240 | 120 | 1 200 | 480 | 240 | 120 |

***Green:*** both preliminary (3–5 measurements) and statistical tests (≥ 6 measurements) are possible for compliance with OELV (based on EN 689).

***Orange:*** only statistical tests (≥ 6 measurements) are possible for compliance with OELV (based on EN 689).

***Red:*** no testing of compliance with OELV possible (based on EN 689).

(*) Minimal filter surface area to be analysed as recommended in ISO 14966.

(**) Minimal filter surface area commonly applied by TNO.

**Source:** TNO innovation for life, 2021.



Colour coding in the table above indicates whether the LOD resulting from a particular combination of sampling characteristics (flow rate and sampling duration) and surface area analysed is suitable for comparison with the two different OEL options (10 000 and 2 000 fibres/m³, relating to 0.01 and 0.002 fibres/cm³ respectively).

**Box 6-6: Example of how to select suitable pump flow and sampling duration when analysing air samples**

Therefore, this table can be used to select suitable sampling conditions to ensure the measurement method is sensitive enough to confirm compliance with the appropriate OEL.

For example, if worker exposure is measured over a full 8-hour shift, and 3–5 samples are collected at a flow rate of 8 litres/minute, the results will be suitable for assessing compliance to either OEL. However, it would not be possible to demonstrate compliance with a 0.002 fibres/cm$^3$ OEL using a flow rate of 2 litres/minute and sampling over four hours.

*Source:* TNO (2021), 'Annex: Information on the measurement method(s) for asbestos and difficulties measuring asbestos in relation to a low occupational exposure limit value (OELV) value or in a dusty (work) environment in view of lowering the European OELV for asbestos', https://perosh.eu/wp-content/uploads/2022/06/Memorandum-Measuring-Methods-Asbestos_TNO-R12180-Nov-2021.pdf.

## 6.6.2 Other sampling techniques

### 6.6.2.1 Static (area) air monitoring

Static air monitoring is carried out by positioning the sampling devices in fixed places, without the participation of a worker. Static air monitoring can be used, for example, when personal monitoring is not feasible, to verify the effectiveness of decontamination (the concentration of asbestos fibres in the air after cleaning should be sufficiently low and, in any case, below the relevant limit value), see Figure 6-3.

While OELs apply to samples that reflect personal exposure, static sampling can provide valuable information on likely exposure levels in a given location. Therefore, OELs should still be considered for interpretive context, even if the values are not directly comparable.

The considerations described above for personal exposure sampling strategies can also be followed for static monitoring. However, static sampling allows greater flexibility, such as:

- measurements can be conducted when staff are not on site (if appropriate);
- the position of the sampling device is less restricted;
- sampling duration is not restricted by shift patterns;
- pump flow can be higher as the pump does not need to be attached to a person.

Figure 6-3: Static air monitor

### 6.6.2.2 Wipe sampling

Wipe sampling is an optional approach to supplement air monitoring. Wipe samples can be collected from surfaces that are not cleaned regularly to identify asbestos, including naturally occurring asbestos (NOA), in settled dust. Wipe sampling can also be used to evaluate the adequacy of cleaning regimes or to help prioritise locations for further air monitoring or updates to the asbestos inventory. This may include identifying new MCAs and assessing the condition of previously identified MCAs. However, there is no correlation between the detection of asbestos in a wipe sampling and the concentration of asbestos in the air.

**Box 6-7: Example of collecting wipe samples**

In France, a method for collecting wipe samples is described and has been implemented in settings such as libraries to supplement air monitoring. This analysis is cost effective and can be used to analyse dust in indoor environments, for example dust on shelves that are not regularly cleaned.

The procedure is summarised as:

- moistened wipes should be used to collect surface samples from pre-determined sampling locations;
- wipes should be stored and labelled consistently;
- photographs should be taken to record sampling locations;
- work should be carried out on a polythene sheet;
- on completion of sampling, all waste, including polythene, should be placed in a waste containing asbestos (WCA) bag and disposed of correctly.

*Source:* Secrétariat général (France) (2023), 'Guide de prévention du risque amiante dans la gestion des bâtiments', https://www.solidairesfinances.fr/images/Doc/2023/2023_04_guide-amiante-sg.pdf.

## 6.6.3 Strategies to deal with filter overloading

When sampling in dusty environments, relatively low sample volumes are collected, in order to prevent overloading of the filter. In such cases, it could be possible to use a larger filter (such as 47 mm rather than the usual 25 mm), take successive shorter measurements or change the air flow (see Section 6.6.1.3), and combine these into a collective result.

Both direct and indirect analysis methods are available:

- direct methods involve analysis of the filter sample as received;
- indirect methods involve some level of sample treatment, which can be advantageous for saturated samples, where fibres may be more difficult to detect and may result in underestimation of the fibre concentrations.

Indirect methods typically reduce analysis time, as the sample will have fewer interfering particles/fibres, allowing for easier analysis. However, these methods can alter the characteristics of the sample. For example, fibres may be broken down, resulting in greater numbers of smaller or thin fibres, especially if sonication is applied (in France, sonification of air samples is forbidden). Therefore, the sample may not be reflective of the inhaled aerosol. Additional sample treatment can introduce greater uncertainty into the analytical result.

See Section 6.7 for information on sample analysis.

## 6.6.4 Analysing samples on site

Mobile units equipped with PCM are commonly used for on-site analysis during asbestos removal. Recently, mobile SEM options have become available, offering enhanced on-site testing capabilities and the potential for faster alerts.

A well-distributed network of laboratories over the geographical area can also support rapid analysis turnaround times. As technology advances and the availability of EM methods increases, the turnaround time for laboratory results will decrease, as already observed in countries where this is usual practice. For example, in France, local access to TEM analysis is available nationwide, enabling results to be delivered within 24 hours, which can overcome the requirement for on-site analysis.

## 6.6.5 Equipment necessary for air sampling collection

Equipment is described in national methodology (if available) or standards (see Annex 5) for sampling and analysis. Once sampling is complete, suitable decontamination procedures should be followed for all equipment, see Section 8.2.2.2.2.

### 6.6.5.1 Sampling head

The sampling head should be selected to comply with the appropriate analytical methodology, see Section 6.7.1.

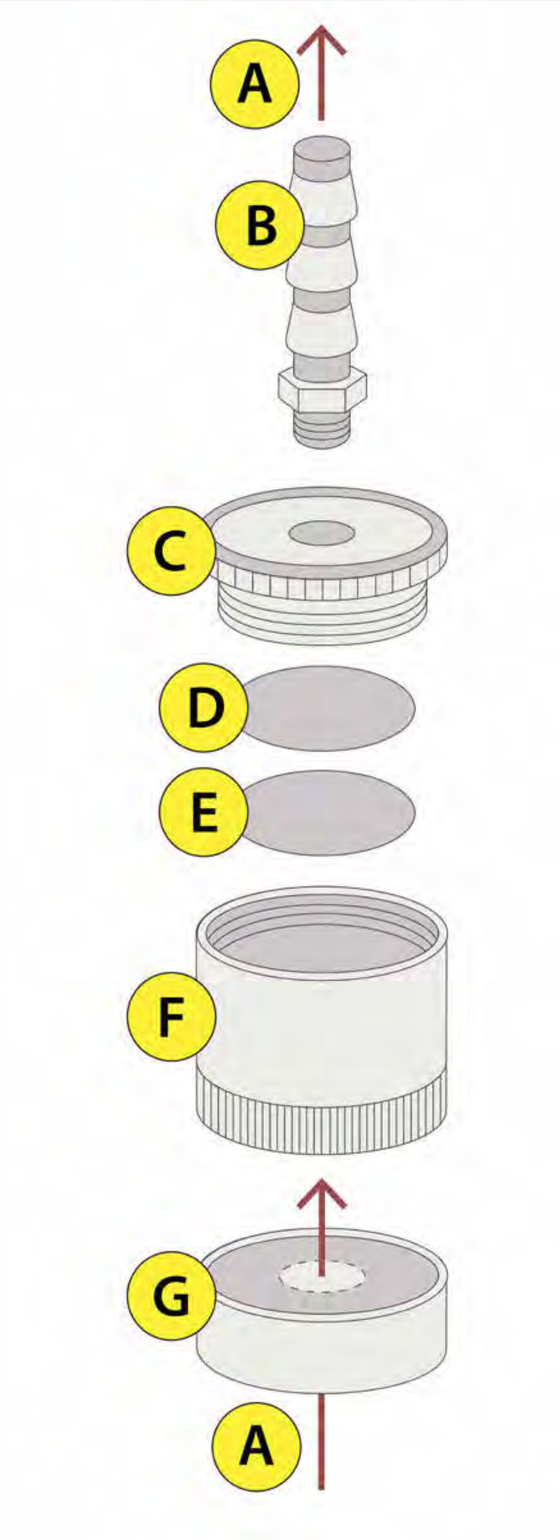



**Figure 6-4: Sampling head schematic**

**A:** Airflow

**B:** Outlet stub

**C:** Sampler base

**D:** Back-up pad

**E:** Filter

**F:** Cowl

**G:** End cap

*Source:* Adapted from HSG248:2021 in Appendix 1, https://www.hse.gov.uk/pubns/books/hsg248.htm.

The following general requirements should be considered:

- the sampling head should be anti-static;
- the filter holder should be open-faced;
- the cowl should be pointed downwards during sampling;
- when sampling to assess compliance with the OEL, sampling should be taken from the breathing zone of a worker – the sampling should not be covered by PPE or placed inside the RPD;
- the position of the sampling head should not hinder the worker when carrying out their work;
- flexible tubing is required to connect the filter holder to the pump;
- care should be taken to keep the samples dry;
- during transport, a cap or bung should be placed over the entrance to the filter holder to prevent contamination.

**Figure 6-5: Position for personal sampling**

**A:** Sampling pump

**B:** Full-face respirator

**C:** Sampling head


### 6.6.5.2 Filters

Filter types depend on the subsequent analysis method. For example, polycarbonate filters, mixed cellulose ester filters or cellulose nitrate filters can all be utilised for TEM analysis; for SEM, analysis is carried out on polycarbonate filters, but mixed cellulose ester filters are also commonly used for sample collection. Details will be provided in applicable national methodology (if available) or standards, see Section 6.7.1 and Annex 5.

The following general requirements should be considered:

- a minimum filter diameter of 20 mm;
- the effective filter area (i.e. the filter deposit area) needs to be determined for the filter chosen, as this is important for calculating the LOQ, see Section 6.7.2.2;
- half filters may be analysed to allow multiple analytical methods on one sample; this should be considered when selecting filter types.

Field blanks are used to assess contamination on site during sampling and during transportation for analysis. These are collected by briefly removing the cap from a loaded cowl in the sampling area (they are never attached to the pump and have not had air drawn through them). The sampling organisation is responsible for initiating and labelling field blanks and for ensuring their traceability.

## 6.6.6 Sampling pumps

Pumps used for air sampling may vary depending on the purpose of air monitoring (i.e. adhering to OEL or static monitoring) and the environment in which sampling is carried out.

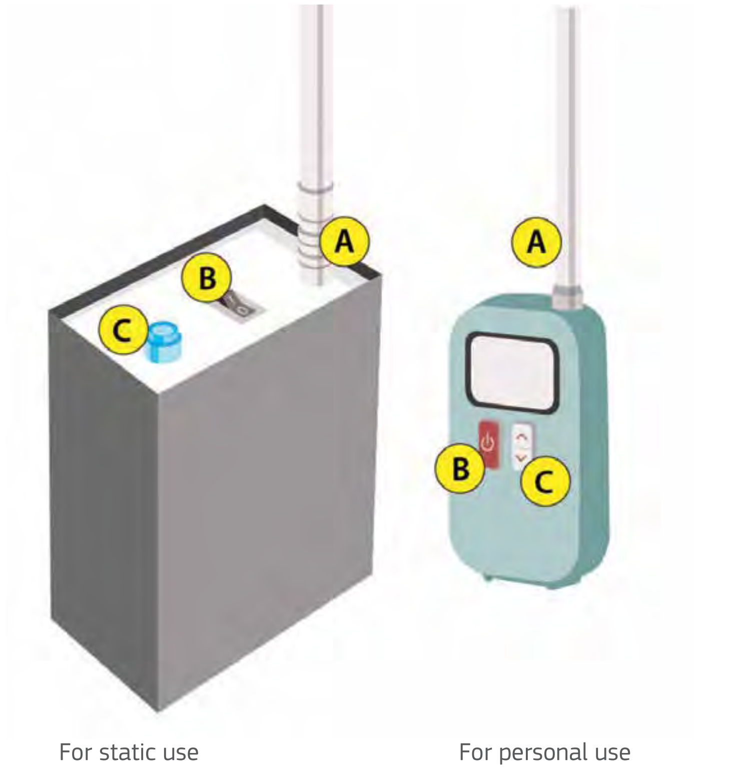



**Figure 6-6: Sampling pumps for static and personal use**

**A:** Pump inlet

**B:** On/off power switch

**C:** Flow adjustment

NB: Pumps contain batteries which need to be charged before use.

All pumps should be capable of providing a smooth airflow and maintaining the set flow rate during the period of sampling (188). The flow rate of the pump should be measured by a working flow meter (calibrated against a primary standard with a sampling head in-line). The flow meter should be sufficiently sensitive to be capable of measuring the appropriate flow rates:

- within ± 10 % for flow rates ≤ 2 litres/minute;
- within ± 5 % for flow rates > 2 litres/minute.

If the flow rate varies by more than ± 10 % during sampling, the sample should be marked as invalid (189).

The following general requirements should be considered.

- For personal sampling, the pump should be lightweight and portable, and capable of being fitted to a belt or harness or carried in a pocket.
- In some Member States, it may also be common practice to use high-volume non-portable pumps with long flexible tubing to connect the pump to the worker's breathing zone, particularly when monitoring short-term tasks, as these pumps allow larger volumes of air to be sampled (190). In such cases, care should be taken to ensure that the tubing does not cause any further hazards (such as a trip hazard).
- The pump should be safe for use in the working environment, including (where relevant) in potentially explosive environments or when high temperatures are encountered.
- The pump battery should have sufficient power to operate within the specified flow limits for the duration of the measurement.
- Static sampling pumps powered by mains electricity should be used with appropriate safety precautions (such as portable appliance testing). Static sampling pumps should have the facility to enable the sampling head to be positioned 1–2 metres above ground level (e.g. by using tubing and a stand to position the sampling head at the required height) (191).

(188) HSE (2021), Asbestos: *The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.

(189) ISO (2019), 'ISO 14966:2019 – Ambient air – Determination of numerical concentration of inorganic fibrous particles – Scanning electron microscopy method', https://www.iso.org/standard/75583.html.

(190) TNO (2021), 'Annex: Information on the measurement method(s) for asbestos and difficulties measuring asbestos in relation to a low occupational exposure limit value (OELV) or in a dusty (work) environment in view of lowering the European OELV for asbestos', R12180, https://perosh.eu/wp-content/uploads/2022/06/Memorandum-Measuring-Methods-Asbestos_TNO-R12180-Nov-2021.pdf.

(191) HSE (2021), Asbestos: *The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.

- The pump needs to be able to be suitably decontaminated. If it cannot be wiped clean (i.e. it is incompatible with water), an alternative decontamination procedure should be identified.

#### 6.6.6.1 Direct-reading instruments

Direct-reading instruments allow exposure to be monitored in (near) real time, without requiring samples to be taken and analysed in a laboratory. They provide information about variations in the exposure with respect to time, location and worker. These instruments can be an excellent tool to provide continuous monitoring of air and can therefore be used as an early indicator of exposure.

However, direct-reading instruments currently have several limitations:

- particulate direct-reading instruments lack specificity (i.e. they cannot confirm asbestos, only the presence of particulates);
- they often have high LOD (i.e. the lowest concentration that can be measured);
- there are concerns that they may not detect thin fibres;
- although portable, they are typically large in size, often making them difficult to manoeuvre and unsuitable for use as personal monitors.

## 6.7 Sample analysis

Analysis of samples must be performed by laboratories equipped for fibre counting, see Annex 6 for further discussion on laboratory requirements ([192]).

EN ISO/IEC 17025:2017 is an international standard that sets out general requirements for the competence, impartiality and consistent operation of laboratories. This standard emphasises the need for laboratories to prioritise quality practices and demonstrate their competence. Accreditation to the standard plays an important role in supporting the provision of accurate and reliable results. This accreditation is not specific to asbestos, but requires laboratories to demonstrate that they operate competently and generate valid results, thereby promoting confidence in their analytical practices and reporting. EN ISO/IEC 17025:2017 accreditation covers organisation, quality systems, control of records, personnel, test facility conditions, test and calibration methods, method validation, equipment, handling of test and calibration items and reporting results.

Some Member States may have different accreditation requirements. For example, in Spain the accreditation programme is carried out by the National Institute for Occupational Safety and Health. It is therefore important to check the relevant Member State scheme.

The responsibility to ensure that analysis is conducted by suitably competent laboratories, whether following EN ISO/IEC 17025:2017 or other relevant standards or accreditation programs, rests, as far as OSH is concerned, with the employer. In some Member States (such as Spain), the national competent authorities provide a list of accredited laboratories.

### 6.7.1 Analytical methodologies for the assessment of asbestos in samples

To measure asbestos fibres in the air, fibres that fall within the applicable fibre definition (see Section 6.2) are taken into consideration ([193]).

As of 21 December 2029 at the latest ([194]), fibre counting must be carried out by EM or an alternative method that provides equivalent or greater accuracy ([195]).

([192]) Directive 2009/148/EC, Article 7(4).
([193]) Directive 2009/148/EC, Article 7(7).
([194]) End of the transposition period set for this provision by Article 2(2) of Directive (EU) 2023/2668 amending Directive 2009/148/EC, ELI: http://data.europa.eu/eli/dir/2023/2668/oj.
([195]) Directive 2009/148/EC, Article 7(6).

The three commonly used analytical techniques are PCM, SEM and TEM ([196]): the latter two techniques are shown in Figure 6-7. The PCM method cannot distinguish between asbestos and non-asbestos fibres and therefore cannot identify fibre type. Unlike light microscopy, EM can produce higher-magnification images, revealing fine details of a sample's surface and internal structure.

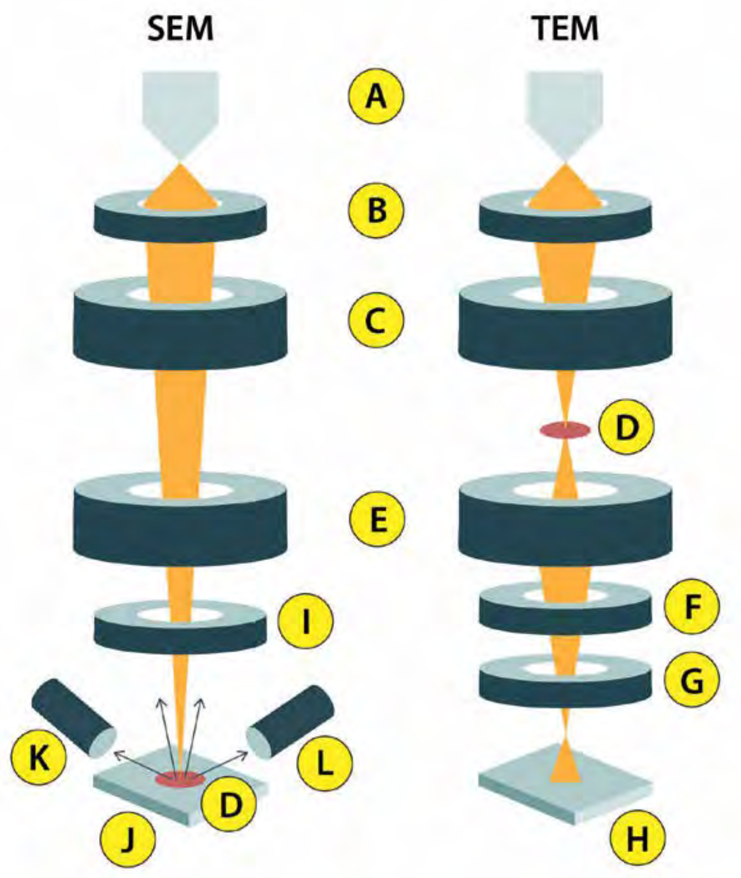
Both SEM and TEM use electrons to create images of samples. The 'column' of all electron microscopes contains a series of components that are responsible for the core functions:

- an electron source to create the electron beam;
- condenser lenses to focus and direct the beam onto the sample;
- an objective lens to form the image in TEM or create the focused probe for scanning in SEM;
- a sample chamber to hold the sample and determine the size of the sample being analysed;
- detectors to capture signals from which the images are generated.

SEM uses a specific set of coils to scan the beam in a raster-like pattern and creates images of a sample's surface using secondary and backscattered electrons. TEM detects electrons that pass through the sample, revealing internal structures such as crystal arrangement and morphology ([197]). SEM typically uses EDXA to determine the elemental composition of fibres. TEM combines EDXA and SAED to give information on both elemental composition and crystal structure, allowing more definitive fibre identification.

**Figure 6-7: Basic elements of scanning electron microscopy and transmission electron microscopy**

**A:** Electron source
**B:** Anode
**C:** Condenser lenses
**D:** Sample
**E:** Objective lenses
**F:** Intermediate lens
**G:** Projector lens
**H:** Fluorescent screen
**I:** Backscattered electron detector
**J:** Stage
**K:** X-ray detector
**L:** Secondary electron detector




NB: Figure and individual components not to scale.

([196]) Franken, R., Tromp, P., Ervik, T. K., Staff, J., Jensen, K. A. et al. (2025), 'European harmonization of asbestos exposure assessment: comparing PCM, SEM, and TEM to derive conversion factors', *Annals of Work Exposures and Health*, Vol. 69, Issue 6, pp. 575–591, https://doi.org/10.1093/annweh/wxaf023.

([197]) Nanoscience Instruments (n.d.), 'What's the difference between SEM & TEM?', https://www.nanoscience.com/blogs/whats-the-difference-between-sem-and-tem/.

A comparison of the methods is presented in Table 6-1.

**Table 6-1: Comparison of analytical methodologies for the assessment of asbestos in samples**

| Parameter | PCM | SEM (EDXA) | TEM (SAED & EDXA) |
|---|---|---|---|
| **Method** | WHO 1997 ([a]) | ISO 14966:2019 ([b]) (direct method)<br>No indirect method but adaptations can be made to ISO 14966:2019 to include additional sample preparation | ISO 10312:2019 ([c]) (direct method)<br>ISO 13794:2019 ([d]) (indirect method) |
| **Can distinguish asbestos fibres from non-asbestos fibres** | No | Width > 0.2 µm: yes<br>Width < 0.2 µm: no | Yes |
| **Sample preparation** | Simple | Direct: simple<br>Indirect: more complex | Direct: simple<br>Indirect: more complex |
| **Magnification** | 400–600x | Regular SEM: 2 000x<br>HR-SEM: 10 000x | 10 000–40 000x |
| **Counting rules** (*) | > 5 µm length and < 3 µm width; aspect ratio 3 : 1 | > 5 µm length and < 3 µm width; aspect ratio 3 : 1 | Aspect ratio 5 : 1, minimum length 0.5 µm ([c])<br>Aspect ratio 3 : 1, minimum length 0.5 µm ([e]) |
| **Lower limit of visibility (resolution) (fibre width, µm)** (**) | 0.2 | Regular SEM: approx. 0.2<br>HR-SEM: approx. 0.1 | Approx. 0.01 |

(*) Counting rules based on the methods outlined. Other counting rules may exist for specific methods used by Member States.

(**) These are approximate values. The true values are dependent on various factors and should be determined before use.

*Sources:* TNO (2021), 'Annex: Information on the measurement method(s) for asbestos and difficulties measuring asbestos in relation to a OELV or in a dusty (work) environment in view of lowering the European OELV for asbestos', R12180, https://perosh.eu/wp-content/uploads/2022/06/Memorandum-Measuring-Methods-Asbestos_TNO-R12180-Nov-2021.pdf; Franken, R., Tromp, P., Kringlen Ervik, T., Staff, J., Alstrup Jensen K. et al. (2025), 'European harmonization of asbestos exposure assessment: comparing PCM, SEM, and TEM to derive conversion factors', *Annals of Work Exposures and Health*, Vol. 69, Issue 6, pp. 575–591, https://doi.org/10.1093/annweh/wxaf023.

([a]) World Health Organization (1997), 'Determination of airborne fibre concentrations: a recommended method, by phase-contrast optical microscopy (membrane filter method)', https://iris.who.int/handle/10665/41904.

([b]) ISO (2019), 'ISO 14966:2019 – Ambient air – Determination of numerical concentration of inorganic fibrous particles – Scanning electron microscopy method', https://www.iso.org/standard/75583.html.

([c]) ISO (2019), 'ISO 10312:2019 – Ambient air – Determination of asbestos fibres – Direct transfer transmission electron microscopy method', https://www.iso.org/standard/75577.html; ISO (2019), 'ISO 13794:2019 – Ambient air – Determination of asbestos fibres – Indirect-transfer transmission electron microscopy method', https://www.iso.org/standard/75576.html.

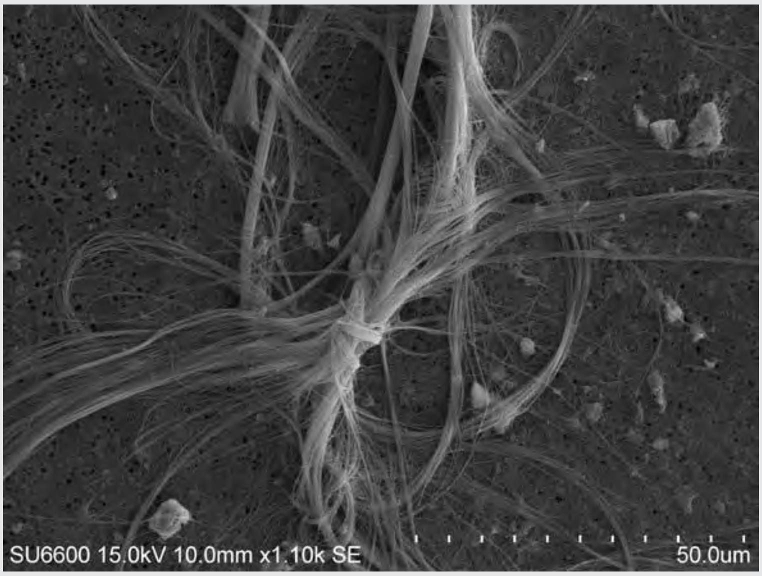
([d]) ISO (2019), 'ISO 13794:2019 – Ambient air – Determination of asbestos fibres – Indirect-transfer transmission electron microscopy method', https://www.iso.org/standard/75576.html.

([e]) AFNOR (2017), 'NF X43-269:2017 – Air quality – Workplace atmospheres – Sampling on membrane filters for the determination of the fibre number concentration by microscopic techniques: phase contrast optical microscopy, scanning electron microscopy analysis and transmission electron microscopy analysis – Counting by phase contrast optical', https://www.boutique.afnor.org/en-gb/standard/nf-x43269/air-quality-workplace-atmospheres-sampling-on-membrane-filters-for-the-dete/fa187994/1696; AFNOR (2021), 'NF X43-050:2021 – Air quality – Determination of the asbestos fiber concentration by transmission electron microscopy – Indirect method', https://www.boutique.afnor.org/en-gb/standard/nf-x43050/air-quality-determination-of-the-asbestos-fiber-concentration-by-transmissi/fa189583/263903.

**Figure 6-8: Image of a PCM being used by a laboratory analyst**

This image is not available for reuse, see inside front cover.

**Figure 6-9: Images using SEM**




Chrysotile

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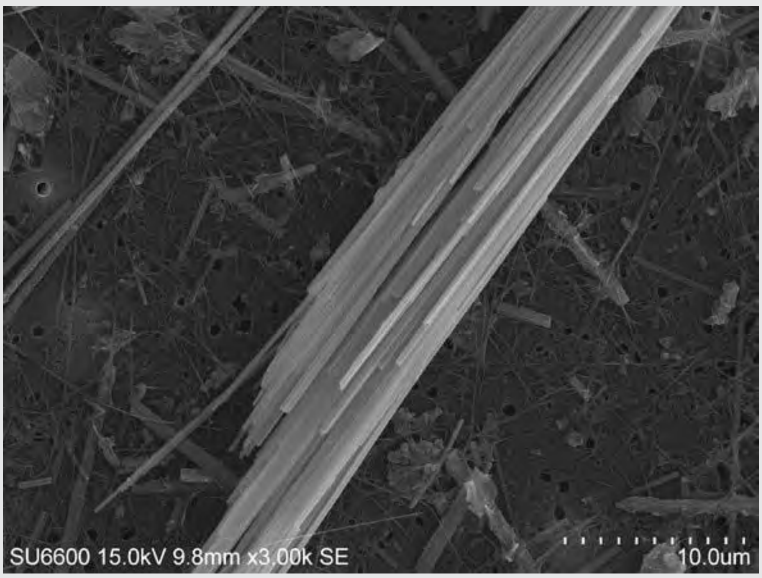


Amosite

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**Figure 6-10: Search and detection of fibres, including fine fibres by AI, before analysis (chemistry and diffraction) by a qualified technician**

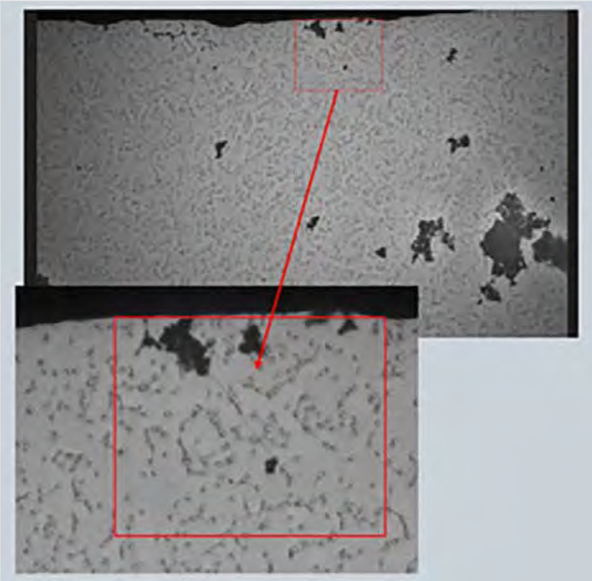

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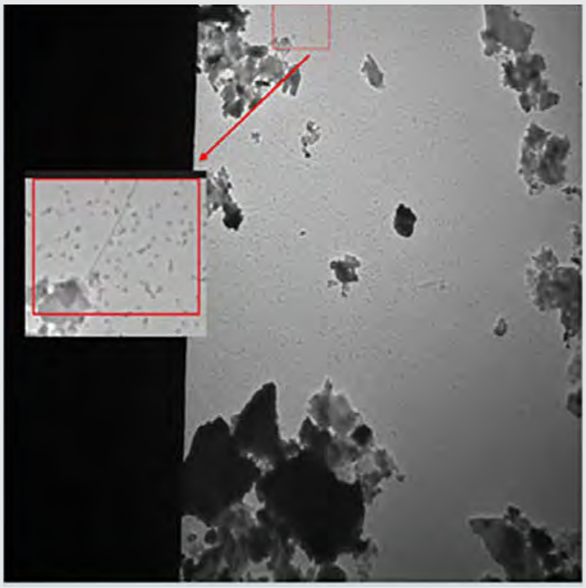
**Figure 6-11: Search and detection of fibres including fine fibres by AI, before analysis (chemistry and diffraction) by a qualified technician**



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The analytical technique is determined by the transposition of the AWD in each Member State. Please refer to national legislation for further details about the applicable rules and practices in each Member State. Additional standards are provided in Annex 5.

The protocols defined for each analytical method (e.g. WHO 1997 ([198]), ISO 14966:2019, ISO 10312:2019 and ISO 13794:2019) are designed to limit the impact of filter contamination and the misidentification of non-asbestos materials. Any additional sample treatment (such as when following indirect methods or using half samples) can increase the risk of contamination. Measures taken to minimise this risk should be documented in the reporting.

Background or blank filter results should not be subtracted from collected filter results. Any contamination observed in blank filters should be investigated, and the batch-to-batch consistency of membrane filters monitored ([199]).

Types of blank filters include the following.

- **Sampling media blanks.** Used to verify the quality of the filter batch. These are obtained from a box of unused filters, being mounted and counted before sampling to check that the batch is satisfactory; the initial procedure is to select at least four blank filters from each manufacturer's batch (or a minimum of 1 % from larger batches) before the filters are used ([200]).
- **Field blanks.** Used to assess contamination on site. These should be activity-specific, with at least one blank collected per day of sampling an activity. Field blanks are typically only analysed if actual samples have > 20 fibres counted ([201]).
- **Laboratory blanks.** Used to assess laboratory contamination. At least one blank should be analysed per batch of samples. The frequency of laboratory blank analysis should be defined in the laboratory's internal QC measures.

([198]) WHO (1997), 'Determination of airborne fibre concentrations: A recommended method, by phase-contrast optical microscopy (membrane filter method)', https://iris.who.int/handle/10665/41904.
([199]) HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.
([200]) HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.
([201]) HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.

## 6.7.2 Analytical sensitivity

### 6.7.2.1 Limit of detection

The LOD is the lowest concentration that can be measured with 90 % certainty (based on Poisson distribution) with standard microscope settings for fibre counting (202). The LOD is determined by the measurement technique and analytical method used, each of which has technical limitations.

Only fibres with a breadth greater than 0.2 µm are visible when using either:

- PCM at 500x magnification;
- standard SEM, scanning at 2 000x magnification and measuring fibre width at 10 000x magnification.

Therefore, if measurements are intended to meet the 0.01 fibres/cm³ 8-hour TWA OEL option (see Section 6.2.2), these methods will no longer be suitable from 21 December 2029, and the stricter OEL (0.002 fibres/cm³ as an 8-hour TWA) will need to be followed.

Thin fibres (i.e. those < 0.2 µm in breadth) can be detected using high-resolution SEM (HR-SEM) and TEM methods (at a minimum of 10 000x magnification). These techniques offer lower detection limits but require more time and experience to perform. Higher magnification also reduces the field of view, meaning that fewer fibres are captured per image and a larger field of view would require analysis to cover the same filter area. This increases analysis time and the potential for human error. As a result, greater uncertainty may exist when extrapolating fibre counts to the full filter surface. Nevertheless, including thin fibres in the analysis of air samples is of great importance, as analytical methods that cannot detect them underestimate asbestos concentrations compared to those that can (203).

Under the specifications of ISO 14966:2019, EDXA is suitable for use on fibres > 0.2 µm in width, meaning EDXA alone may not reliably identify thin fibres. TEM's use of both EDXA and SAED provides greater confidence in fibre identification than SEM, even on fibres < 0.2 µm in width.

As mentioned in Section 6.7.1, the PCM method cannot distinguish between asbestos and non-asbestos fibres and therefore cannot identify fibre type. This significantly limits its accuracy compared to EM methods. Future advancements may include combining PCM with other techniques (such as fluorescence) to enhance fibre identification capability.

In some Member States, PCM may continue to be used in a complementary role to measurements required with the EM method, particularly on building/demolition sites, for purposes such as to check fibre levels frequently or to obtain faster warnings (see Section 6.6.4 about unexpected significant increases in fibre concentrations). However, EM methods (or other methods capable of providing equivalent or more accurate results) should be used to verify the presence of asbestos (including thin fibres) and to demonstrate compliance with the applicable OEL.

In any case, the methodology adopted to count fibres is decided at the national level, in accordance with the transposition of the AWD made in each Member State.

### 6.7.2.2 Limit of quantification

The LOQ refers to the lowest concentration of asbestos fibres that can be measured with certainty using the standard methodology (204). Methods with a lower LOQ are considered more sensitive, as they allow the detection of lower fibre concentrations with greater reliability.

(202) TNO (2021), 'Annex: Information on the measurement method(s) for asbestos and difficulties measuring asbestos in relation to a low occupational exposure limit value (OELV) or in a dusty (work) environment in view of lowering the European OELV for asbestos', R12180, https://perosh.eu/wp-content/uploads/2022/06/Memorandum-Measuring-Methods-Asbestos_TNO-R12180-Nov-2021.pdf.

(203) Eypert-Blaison, C., Romero-Hariot, A., Clerc, F. and Vincent, R. (2018), 'Assessment of occupational exposure to asbestos fibers: Contribution of analytical transmission electron microscopy analysis and comparison with phase-contrast microscopy', *Journal of Occupational and Environmental Hygiene*, Vol. 15, Issue 3, pp. 263–274, https://pubmed.ncbi.nlm.nih.gov/29194016/.

(204) European Food Safety Authority (n.d.), 'LOQ', https://www.efsa.europa.eu/en/glossary/loq.

In the context of air sampling for asbestos, the sensitivity of a method, and therefore its LOQ, depends on several factors:

- the filter deposit area, typically a set value as 25–50 mm filters used;
- the air volume sampled (correlated to both flow rate and sampling duration);
- the analysed surface of the filter.

The latter two points can be adjusted to improve sensitivity where needed. For considerations on air volume, see Section 6.6.1.3

To increase the sensitivity of the EM methods, a greater amount of filter surface can be analysed. However, this increases the time required for analysis. Future advancements aim to address this constraint through automated EM analysis, which would increase the number of fields examined and improve the efficiency of these methods. The use of automated, AI-assisted microscopy and EDXA analysis will enable laboratories to evaluate a larger part, or even the entirety, of the filter with a much lower effort compared with that of a human analyst ([205]).

**Box 6-8: Example of TEM, AI-assisted microscopy and EDXA analysis**

**Introduction**

Quantifying asbestos fibres in air samples traditionally requires extensive manual screening of numerous fields / grid openings to detect and identify the fibres. The integration of AI significantly reduces the amount of technician time required. However, any AI solution needs to be properly validated.

**Overview**

An AI solution was first introduced in France and subsequently expanded to laboratories in other European countries. It was designed to reduce technician effort and increase the accuracy of the analysis. The AI application aimed to focus the technician's work on EM on high value-added tasks, specifically the identification of fibres. To achieve this, the AI solution is paired with EM control software to scan the fields /grid openings and present only the detected fibres to the technician.

The solution has been validated by four different EN ISO/IEC 17025:2017 accredited bodies in multiple countries.

**Achievements and impact**

The key impacts achieved include the reduction in the difficulty of EM routine analysis and increase in the number of fibres identified as asbestos (or interferent) by technicians per hour. Key success factors for AI implementation are:

- effective communication within the laboratory;
- quality-driven AI construction;
- integration of the AI development team into laboratory analysts' workflow.

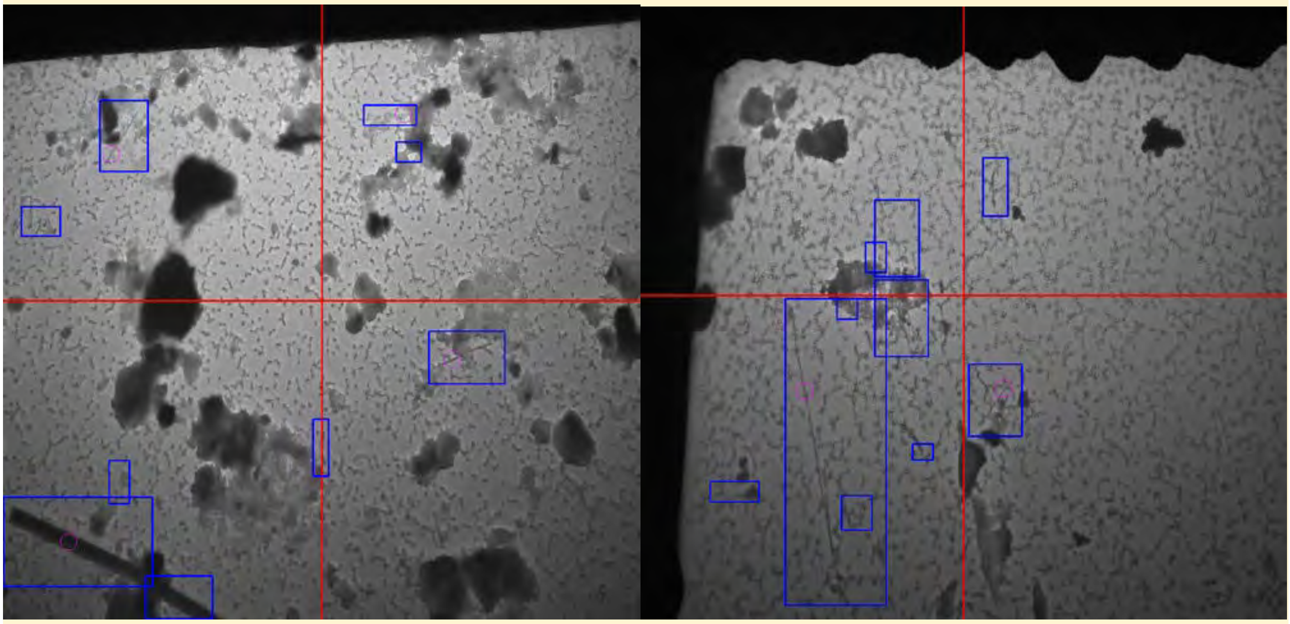
**Transferability and lessons learnt**

AI-supported EM analysis can help ensure that human analysts can detect all fibres in the analysed fields / grid openings, including the thin fibres. These AI solutions are transferable to any asbestos laboratory, provided they meet certain requirements (e.g. EN ISO/IEC 17025:2017). Successful transferability of the AI solution across multiple EM units in an analytical park is feasible only if the equipment specifications were designed during the early stages of AI development and if all equipment adheres to those specifications (e.g. EM model, camera/detector performance, screen dimensions).

([205]) TNO (2021), 'Annex: Information on the measurement method(s) for asbestos and difficulties measuring asbestos in relation to a low occupational exposure limit value (OELV) or in a dusty (work) environment in view of lowering the European OELV for asbestos', R12180, https://perosh.eu/wp-content/uploads/2022/06/Memorandum-Measuring-Methods-Asbestos_TNO-R12180-Nov-2021.pdf.

**Box 6-8: Example of TEM, AI-assisted microscopy and EDXA analysis**

**Figure 6-12: Left: AI-assisted amphibole and serpentine fibre detection. Right: AI-aided detection of fine fibres and clumps**



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## 6.8 Reporting

The report detailing air monitoring results should contain ([206]):

- contextual information such as ([207]):
  - details of the appraiser and institution who took the measurements, including reference to any qualifications and/or accreditation held by the appraiser and institution that took and analysed the measurements, see Annex 6 for further discussion on accreditation requirements,
  - purpose of the assessment,
  - name and address of premises,
  - details of workplace factors and working conditions (including all control measures in place and their use),
  - date and time of sampling,
  - measuring procedure,
  - equipment used, including serial numbers,
  - volume of air passed through the filter,
  - unique identifier of the sample,
  - calibration of the pump – equipment used and results,
  - starting and final sampling time,
  - workplace or site of sampling;
- any observations made during monitoring;
- details of analytical methods followed (including the analysed surface area of the filter);
- details of standard method followed (including any deviations);
- details of any sample treatment methods;
- LOD and LOQ;

([206]) The information listed here is based on requirements from the standards previously mentioned and suggested improvements from the authors of this guide.

([207]) CEN, EN 689:2018+AC:2019.

- Filter sample results:
  - raw data, i.e. a table outlining the fibres counted with their respective lengths and widths,
  - upper and lower 95 % confidence limits, using protocols such as those described in their relevant ISO methods ([208]),
  - comparison to the relevant OEL (see Section 6.2.2) using the upper 95 % confidence limit around the nominal value, as a conservative approach compared to the use of the nominal value itself;
- details of QA ([209]), including blank filter results.

# 6.9 Calculating exposure levels

Qualified personnel who conduct the air sampling will calculate the personal exposure level based on the analytical result. This is done by considering the number of fibres counted for fibre classification (see Section 6.2), the number of image fields examined and the sampled air volume per image field (accounting for the effective diameter of the filter used). The result is expressed as a numerical mean fibre concentration in fibres/m$^3$, either of a particular fibre type, all asbestos fibres or all inorganic fibres.

For EM methods, the result should also include the upper and lower 95 % confidence interval to provide an assessment of the uncertainty of the result. This value can then be compared to one of the two OEL options outlined in Section 6.2.2.

If an RPD has been applied, this should be considered when calculating worker exposure. Assuming that an RPD is worn and maintained as recommended (see Section 8.2.6), assigned protection factors (APFs) can be used to estimate the likely personal exposure. For example, selecting RPDs with an APF of 10 would reduce personal exposure to one tenth of the air monitoring result, see Section 8.2.6.

# 6.10 Interpreting monitoring results and taking corrective action

## 6.10.1 Evaluating compliance with the occupational exposure limit

Tests should be conducted to assess compliance with the OEL.

For example, the EN 689:2018+AC:2019 standard describes both a preliminary and a statistical test to evaluate compliance with an OEL. The preliminary test only provides a 'Compliance' result if all results in a SEG are below:

- 10 % of OEL if 3 valid measurements are included;
- 15 % of OEL for 4 valid measurements;
- 20 % of OEL for 5 valid measurements.

For the statistical test, the process for determining compliance is more complex. A 'Compliance' result is achieved when there is at least ≥ 70 % confidence that fewer than 5 % of the measurements in the SEG exceed the OEL.

These tests should be followed as defined in the standard ([210]) or by other suitable protocols, and the results should be clearly described.

([208]) ISO, 'ISO 14966:2019 (SEM direct method)', 'ISO 10312:2019 (TEM direct method)' or 'ISO 13794:2019 (TEM indirect method)'.
([209]) CEN, EN 689:2018+AC:2019.
([210]) CEN, EN 689:2018+AC:2019.

## 6.10.2 Understanding monitoring data

Understanding what to do with monitoring data will depend on the purpose of sampling, see Section 6.3.

**Table 6-2: Purpose of sampling and understanding air monitoring results**

| Purpose of sampling | Understanding air monitoring results |
|---|---|
| **Evaluation of the exposure of workers** | If the OEL is exceeded, work must stop immediately and the reasons for the limit value being exceeded must be identified. Appropriate corrective action must be taken as soon as possible ([a]). Once control measures are implemented, a new exposure assessment must be conducted to ensure compliance with the OEL ([b]). |
| **Design and improvement of work procedures** | Workers' exposure to asbestos must be as low as technically possible ([c]), therefore if fibres are detected (even if below OEL), further improvement of work procedures may be required. |
| **Control of the effectiveness of preventive measures to avoid the dispersion of fibres** | Workers' exposure to asbestos must be as low as technically possible ([c]), therefore if fibres are detected (even if below OEL), further improvement of preventative measures may be required. |
| **Verification of the correct selection of RPDs** | Monitoring results can be used to select the most suitable protection factor for RPDs (note: APFs should be used rather than nominal ones), see Section 8.2.6. If deemed suitable based on the initial risk assessment (see Section 4.1), air monitoring data from literature or national databases can be used for decision-making. |
| **Verification of decontamination (clearance testing)** | Air measurements should be used, in combination with other measures, to determine whether it is safe for workers to re-enter areas where asbestos removal/repair has been completed, see Section 8.2.4.3. The concentration of asbestos fibres in the air should be adequately low and, in any case, below the relevant limit value. |
| **Support current and future risk assessments** | Monitoring results provides useful input for risk assessments and allows decisions to be made about suitable control measures to be implemented. If deemed suitable based on the initial risk assessment, air monitoring data from literature or national databases can be used for decision-making. |

*Sources:*

([a]) Directive 2009/148/EC, Article 10(1).

([b]) Directive 2009/148/EC, Article 10(2) and EN 689:2018+AC:2019.

([c]) Directive 2009/148/EC, Article 6.

## 6.10.3 Corrective action

### Box 6-9: Corrective action following exceedance of the OEL

**Article 10(1) and (2) of Directive 2009/148/EC (AWD):**

1. Where the relevant limit value as laid down in Article 8 is exceeded, or if there is reason to believe that materials containing asbestos which are not identified prior to the work have been disturbed so as to generate dust, work shall stop immediately.

Work shall not be continued in the affected area until adequate measures have been taken for the protection of the workers concerned.

Where the relevant limit value as laid down in Article 8 is exceeded, the reasons for the limit value being exceeded shall be identified and appropriate measures to remedy the situation shall be taken as soon as possible.

2. In order to check the effectiveness of the measures mentioned in the first subparagraph of paragraph 1, a further determination of the asbestos-in-air concentrations shall be carried out immediately.

If exposure exceeds the limit value, work must stop immediately and not be continued in the affected area until adequate measures have been taken for the protection of the workers concerned [211].

The reasons for the limit value being exceeded must be identified [212]. For information on incident management, see Section 11.

# 6.11 Records and communication

**Box 6-10: Keeping records of personal exposure**

**Article 19 of Directive 2009/148/EC (AWD):**

2. The employer shall enter the information on the workers engaged in the activities referred to in Article 3(1) in a register. That information shall indicate the nature and duration of the activity and the exposure to which they have been subjected. The doctor and/or the authority responsible for medical surveillance shall have access to this register. Workers shall have access to the results in the register which relate to them personally. The workers and/or their representatives shall have access to anonymous, collective information in the register.

3. The register referred to in paragraph 2 and the medical records referred to in the fourth subparagraph of Article 18(2) shall be kept for at least 40 years following the end of exposure, in accordance with national laws and/or practice.

4. The documents referred to in paragraph 3 shall be made available to the responsible authority in cases where the undertaking ceases trading, in accordance with national laws and/or practice.

Employers must keep a register of workers that are or may be exposed in the course of their work to dust arising from asbestos or MCAs. This register must indicate the exposure to which they have been subjected [213].

The full air monitoring report, including details of any subsequent remedial action, should be kept on file and used for further risk assessment review. Details of worker personal exposure results should be discussed with the worker after the exposure levels and their interpretation have been obtained. This information should be provided in writing to the worker upon termination of employment.

The air monitoring results and an explanation of their significance must be accessible to workers and/or their representatives [214]. If results exceed the limit value, the workers concerned and their representatives must be informed as quickly as possible and consulted on the measures to be taken or, in emergencies, informed of the measures which have been taken [215].

In some Member States, it is a requirement for exposure assessment data to be sent to the labour authority.

The results of the exposure monitoring should be used to review and update the risk assessment, see Section 4.1.

[211] Directive 2009/148/EC, Article 10(1).
[212] Directive 2009/148/EC, Article 10(2).
[213] Directive 2009/148/EC, Article 19.
[214] Directive 2009/148/EC, Article 17(2)(a).
[215] Directive 2009/148/EC, Article 17(2)(b).

# 7 Passive exposure

## 7.1 Introduction

**Box 7-1: Passive exposure to asbestos**

**Recital 5 of Directive (EU) 2023/2668:**

… passive exposure, where workers who work either in the vicinity of someone working with materials containing asbestos, or in premises where materials containing asbestos are degrading in building structures, are exposed to asbestos,

[…]

Both passive and secondary exposure can have significant impacts on health.

[…]

Avoiding exposure to asbestos, in whatever form, therefore remains an imperative. With regard to the passive exposure of workers to asbestos, Council Directive 89/391/EEC and Directive 2009/148/EC require employers to be in possession of an assessment of all the risks to the safety and health of workers at work by identifying potential hazards, including those stemming from passive exposure to asbestos, and to put in place the necessary preventive and protective measures to protect the safety and health of workers, with the risk avoidance principle always being the primary basis for any measures to be implemented.

[…]

The above definition of workers subject to passive exposure includes those who work either in the vicinity of someone working with materials containing asbestos (MCAs), or in buildings, civil engineering sites, ships, trains, aircraft, vehicles, mines or quarries where MCAs are degrading ([216]). A first indication could be that the building was constructed before the year asbestos was banned in the relevant Member State, see Section 5.2.1.

Examples of situations where passive exposure may occur include, but are not limited to:

- failure to correctly cordon off an asbestos contaminated area, resulting in fibre release from 'dirty' zones and exposing any worker positioned in the adjacent 'clean' zones;
- degrading MCAs (see Annex 4 for examples) that are inadequately encapsulated or enclosed within a building structure, resulting in fibre release (such as in schools, office buildings, archives and hospitals), impacting all workers within the affected area of the building;
- insufficient control measures during MCA removal or maintenance work conducted where MCAs are present, resulting in fibre release and exposure to workers nearby.

([216]) Directive (EU) 2023/2668, recital 5.

## Box 7-2: Example of passive exposure

Where: Tripode (administrative building, France)

**Introduction**

The Tripode building housed government offices and was found to have significant asbestos contamination. In the 1980s, samples of asbestos dust were taken within the building, and concerns were raised by workers. Measurements of the airborne concentration of asbestos fibres taken in various offices between 1980 and 1990 showed relatively constant contamination levels over time on the order of 15 000 fibres/m$^3$ (0.015 fibres/cm$^3$) ([a]). The administrative staff in the building was passively exposed to asbestos. The building was evacuated in 1992, accompanied by the development of health monitoring systems, along with national regulations to prevent further asbestos exposure. To date, more than 30 cases of occupational disease and death due to asbestos exposure have been recognised among the approximately 1 800 Tripode workers.

**Figure 7-1: Exterior and interior of the Tripode building (France)**

*Source:* Centre d'Histoire du Travail (Nantes).

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## Box 7-2: Example of passive exposure

### Overview

A collective precautionary approach was implemented, involving both employer representatives and trade unions. This initiative comprised several key measures aimed at enhancing occupational health protection in office environments. Efforts were made to raise awareness about dust exposure, particularly asbestos, by disseminating information and facilitating discussions within staff representative bodies (Comités d'hygiène et de sécurité). An epidemiological study was conducted to assess the health impacts of asbestos exposure among office workers. Trade unions provided coordinated support to encourage former workers to exercise their right to individual medical follow-up, reinforcing the commitment to long-term health monitoring and preventive care.

### Achievements and impact

The dissemination and discussion of information within staff representative bodies was a key factor in raising awareness about asbestos exposure and facilitated the evacuation of a hazardous building. While an epidemiological study effectively highlighted the health impacts of asbestos on office workers, such research requires extended time frames and is not part of a precautionary policy. Crucially, trade unions acted as vital intermediaries by helping to draw up and distribute a summary presenting the results of the study. Through this effort, the potential consequences of asbestos exposure were effectively communicated, ensuring that the information was both understandable and actionable for those directly affected.

### Transferability and lessons learnt

In this example, air samples were taken as early as 1980 but the building was not evacuated until 1992. At the time, the air monitoring results were interpreted in accordance with less stringent exposure limits than those in place today. However, workers expressed concern over the air sampling results and should have been consulted on the subsequent action.

Key lessons from the Tripode case have already been applied to other French public administration bodies. In particular, precautionary practices have been developed to manage occupational or secondary exposure risks following the storage of archives or objects in asbestos-contaminated buildings ([b]).

### Additional transferability and lessons

- Need for suitable risk assessments involving workers and their representatives.
- Relevance of a medical follow-up for exposed workers (including after retirement).
- Collection of air monitoring samples during times when the building is occupied by workers and in several parts of the building, with proper methods (including both air samples and technique of wipe sampling documents).
- Inform workers of the presence of MCAs and of air monitoring results.

*Sources:*

([a]) Koksal, M. (2023), 'Asbestos in the Tripode, a warning for Europe', *HesaMag*, Issue 27, pp. 41–43, https://www.etui.org/sites/default/files/2023-06/HM27_Asbestos%20in%20the%20Tripode%2C%20a%20warning%20for%20Europe_2023.pdf.

([b]) République Française, Ministre de la culture et de la communication (2015), 'Circulaire du 5 août 2015 relative aux préconisations pour la prise en compte du risque d'exposition à l'amiante dans les services d'archives' [Communication on the risk of asbestos exposure in archives], https://www.legifrance.gouv.fr/download/pdf/circ?id=39901.

## 7.2 Risk assessment

A suitable risk assessment must be prepared for any activity likely to involve a risk of exposure to dust arising from asbestos or MCAs, see Section 4.1 ([217]). Therefore, the risk assessment for all asbestos-related activities must consider the potential for passive exposure and ensure appropriate measures are in place to minimise this risk, see Box 8-1. The findings of the risk assessment should be provided to all relevant workers, as this is an important first step in preventing exposure, including passive exposure, see Section 4.1.5.

**Box 7-3: Example of an approach to screening and managing asbestos in public and private buildings to reduce active and passive exposure**

In the Flanders region of Belgium, private building owners are required to conduct an asbestos screening whenever a property is sold, and all buildings have to be screened by 2032. Between 2022 and 2024, over 280 000 asbestos certificates were issued and approximately 60 % of these buildings were found to contain asbestos.

The results of these asbestos certificates are collected by the regional Public Waste Agency (OVAM). For public buildings, additional requirements exist both for asbestos screening and removal.

The screening of public buildings identified widespread presence of asbestos in schools and identified a significant number requiring urgent asbestos removal. Approximately half of the 6 000 schools in Flanders were issued an asbestos certificate over a seven-year period. Of these, only one in five was assessed as containing no asbestos or only low-risk MCAs. More than half were deemed to need urgent asbestos removal.

*Sources:*

European Commission: Directorate-General for Environment, Akelyte, R., Chiabrando, F., Camboni, M., Ledda, C. et al., *Study on asbestos waste management practices and treatment technologies*, Publications Office of the European Union, Luxembourg, 2024, https://data.europa.eu/doi/10.2779/251640; OVAM (2024), '2 years asbestos certificates in figures', https://ovam.vlaanderen.be/nl/w/2-jaar-asbestattest-in-cijfers?p_l_back_url = %2Fzoeken %3Fq %3Dasbest; *Belga News Agency* (2024), 'Half of schools with asbestos certificate in need of urgent asbestos removal', https://www.belganewsagency.eu/half-of-schools-with-asbestos-certificate-in-need-of-urgent-asbestos-removal; *The Brussels Times* (2024), 'Urgent asbestos removal needed in half of all inspected Flemish school buildings', https://www.brusselstimes.com/1504484/urgent-asbestos-removal-needed-in-half-of-all-inspected-flemish-school-buildings.

Awareness points that interested parties (including workers' representatives and employers) may find useful when raising the issue of passive exposure in their company are provided in Annex 11.

([217]) Directive 2009/148/EC, Article 3(2).

## 7.3 Air monitoring

Air monitoring can be used as a tool to help ensure workers are not passively exposed to asbestos. This may involve regular air monitoring in buildings where MCAs are present (not only in areas where direct work with asbestos is taking place, but also in surrounding areas) or regular monitoring of workers' workstations (including those not directly involved with asbestos-related tasks).

Exposure to asbestos must be reduced to a minimum and, in any case, to as low a level as is technically possible below the relevant limit value ([218]). For example, the detection of short fibres during routine air monitoring in buildings containing MCAs may indicate degradation of MCAs. In such cases, an inspection of the building should be conducted to identify and remove the cause of the exposure.

As noted in Section 6.6.2.2, wipe sampling can supplement air monitoring by identifying asbestos in settled dust. Samples can be taken from surfaces not regularly cleaned to detect asbestos fibres. ISO 16000-27:2014 provides a method for determining the concentration of settled fibrous dust on surfaces, including asbestos, using SEM. This protocol can also be adapted for use with other analysis methods, such as TEM.

Wipe samples can help prioritise areas for air sampling and/or indicate when updates to the asbestos inventory are required (i.e. identification of MCAs or reassessment of their condition). Wipe sampling is further described in Section 6.6.2.2.

The requirements for air monitoring are described in Section 6. The results of air monitoring should be shared with workers or their representatives.

([218]) Directive 2009/148/EC, Article 6.

## 7.4 Control measures

The risk of passive exposure can increase when control measures in place to prevent spread of asbestos fibres in the vicinity of work with asbestos do not address all relevant workers, or if they are inadequate or improperly applied. While some sector-specific advice is available, such as for archives [219], it is important to consider the general following measures to prevent passive exposure.

- **Identification.** Correctly identify all asbestos and MCAs, along with the risk from any activity likely to involve an exposure to dust arising from asbestos or MCAs, see Sections 4 and 5. An asbestos inventory should be maintained for the building. This inventory should be regularly updated and made available to all relevant workers, including maintenance staff, contractors and emergency responders, and possibly other relevant stakeholders (such as other employers and national authorities) [220].
- **Inspection.** Ensure the condition of MCAs is inspected regularly and the risk assessment updated accordingly. Early detection of degrading MCAs is critical to reducing passive exposure, see Sections 4 and 5. If degrading MCAs are identified, evacuate the area until appropriate measures, such as removal or encapsulation, have been implemented, see Section 8.
- **Work practices.** Implement and enforce work practices that minimise the likelihood of disturbance of MCAs. This includes special procedures for maintenance activities near (suspected) MCAs, see Section 4.
- **Limiting access.** Areas containing (suspected) MCAs should have restricted access, see Section 8.2.4.2.
- **Removal.** During removal activities, ensure that the removal area is correctly enclosed and sealed off from adjacent 'clean' zones, see Section 8. After removal, ensure all areas and equipment are thoroughly cleaned and airborne fibre levels are as low as technically possible before re-entering the area, see Section 8.
- Organisational measures. Ensure appropriate signage to indicate the (potential) presence of asbestos and restrict access to these areas, see Section 8.2.4. Provide all relevant staff with the necessary information about the (potential) presence of asbestos (including temporary staff or those hired from external contractors and any emergency service workers), see Section 3.4.

[219] Ministère de la Culture (2017), 'Handbook on asbestos', https://francearchives.gouv.fr/file/067847bfbd8ac699a69f0af88d23bbde74d3768c/vademecum_amiante_19juin2017.pdf.

[220] Directive 2009/148/EC, Article 11, Article 13(2)(c) and Article 13(3).

## 7.5 Training

The requirements for training are described in Section 9.

Providing appropriate training to managers and health and safety representatives is important to prevent passive exposure. Training typically includes various topics, including good practices for identification of asbestos and implementing suitable control measures to prevent passive exposure. Training should also raise awareness of passive exposure and be appropriate in view of the risk assessment.

## 7.6 Health surveillance

The requirements for health surveillance, applicable to both direct and passive exposure, are detailed in Section 10.

## 7.7 Incident management

Procedures should be in place for responding to the unexpected discovery or accidental disturbance of MCAs, especially where such events may result in exposure levels exceeding the OEL. These procedures should be communicated to all relevant personnel, see Section 11.

## 7.8 Waste management

Ensure that waste containing asbestos (WCA) is managed safely and correctly in accordance with applicable procedures and regulations, see Section 12.


N TOEGANG ASBEST
ITERDIT AMIANTE

# 8 Control measures

## 8.1 Introduction

**Box 8-1: Control measures – all activities in which workers are or may be exposed to asbestos or materials containing asbestos**

**Article 6 of Directive 2009/148/EC (AWD):**

… the exposure of workers to dust arising from asbestos or materials containing asbestos at the place of work shall be reduced to a minimum and in any case to as low a level as is technically possible below the relevant limit value as laid down in Article 8, in particular through the following measures:

(a) the number of workers exposed or likely to be exposed to dust arising from asbestos or materials containing asbestos shall be limited to the lowest possible figure;

(b) work processes shall be designed so as not to produce asbestos dust or, if that proves to be impossible, to avoid the release of asbestos dust into the air by taking measures such as:

(i) asbestos dust suppression;

(ii) the suction of asbestos dust at source;

(iii) the continuous sedimentation of asbestos fibres suspended in the air;

(ba) workers shall be subject to an appropriate decontamination procedure;

(bb) for work carried out under confinement, adequate protection shall be ensured;

(c) all premises and equipment involved in the treatment of asbestos shall be capable of being regularly and effectively cleaned and maintained and subject to regular cleaning and maintenance;

(d) asbestos or dust-generating materials containing asbestos shall be stored and transported in suitable sealed packing;

(e) waste, other than waste arising from mining activities, shall be collected and removed from the place of work as soon as possible in suitable sealed packing with labels indicating that it contains asbestos and shall then be dealt with in accordance with Directive 2008/98/EC of the European Parliament and of the Council.

Control measures are designed to prevent or minimise the release of asbestos fibres into the air and reduce exposure to workers. They should be implemented and, if necessary, refined based on the findings of the asbestos risk assessment.

In accordance with Article 13 of the Occupational Safety and Health (OSH) Framework Directive 89/391/EEC, workers are required, in accordance with their training and the instructions given by their employer, to correctly use machinery, apparatuses, tools, dangerous substances, transport equipment and other means of production, and to make correct use of the PPE supplied to them and return it to its proper place after use.

This section focuses on control measures related to exposure arising from workers' activities. For control measures concerning passive exposure, see Section 7.

### 8.1.1 Key principles and requirements for implementing control measures

Workers' exposure to dust arising from asbestos or materials containing asbestos (MCAs) must be reduced to a minimum and, in any case, to as low a level as is technically possible below the relevant limit value (OEL) specified in Section 6.2.2 ([221]).

The control measures listed in Box 8-1 ([222]) apply to all activities where workers are or may be exposed to asbestos or MCAs (see Annex 4) as a result of their activity. Some Member States may also prohibit certain asbestos-related activities through national regulations.

The list of control measures in Box 8-1 is non-exhaustive, i.e. additional measures can be implemented. When doing so, the hierarchy of controls principle should be followed.

- **Elimination.** Eliminate hazardous materials such as asbestos through remediation ([223]).
- **Technical measures.** Apply engineering controls to physically isolate people from the hazard. Examples include enclosures, wetting techniques, and ventilation and filtration systems to reduce airborne asbestos fibre concentrations.
- **Organisational measures.** Introduce procedures and policies to reduce access and exposure, including training, scheduling work to limit exposure time, area demarcation and safe work practices.
- **PPE.** Provide equipment like respiratory protective devices (RPDs) and protective clothing when other controls cannot sufficiently reduce exposure.

This approach prioritises control methods from most to least preferable, underpinning effective minimisation of occupational exposure to asbestos.

Where it is envisaged that the exposure will exceed the OEL specified in Section 6.2.2 despite applying all possible technical preventive measures, the requirements in Box 8-2 must be followed ([224]). These requirements aim to protect not only workers, but also the surrounding environment and those within it.

**Box 8-2: Control measures – activities where it is envisaged that the OEL will be exceeded despite the use of technical measures**

**Article 12 of Directive 2009/148/EC (AWD):**

In the case of certain activities such as demolition, asbestos removal work, repairing and maintenance, in respect of which it is foreseeable that the relevant limit value as laid down in Article 8 will be exceeded despite the use of all possible technical preventive measures for limiting asbestos in air concentrations, the employer shall determine the measures intended to ensure protection of the workers while they are engaged in such activities, in particular the following:

(a) workers shall be issued with suitable personal protective equipment to be worn, which shall be appropriately handled and, in particular with regard to respiratory equipment, which shall be individually adjusted, including through fitting checks, in accordance with Council Directive 89/656/EEC;

(b) warning signs shall be put up indicating that it is foreseeable that the limit value laid down in Article 8 will be exceeded; and

(c) the spread of dust arising from asbestos or materials containing asbestos outside the premises or site of action shall be prevented, and for work performed under confinement, the enclosure shall be airtight and under mechanical extraction ventilation.

[...]

([221]) Directive 2009/148/EC, Article 6.
([222]) Directive 2009/148/EC, Article 6.
([223]) Directive 2009/148/EC, Article 3(2).
([224]) Directive 2009/148/EC, Article 12.

The list of measures in Box 8-2 is non-exhaustive, i.e. additional measures can be implemented. When implementing control measures, the hierarchy of controls principle should always be followed.

The choice and combination of control measures depends on the risks identified during the asbestos risk assessment, see Section 4.1. The specific control measures selected should be documented.

# 8.2 Control measures strategy

Based on the risk assessment, appropriate control measures should be selected and implemented ([225]). The following control measures are described: elimination, technical measures, organisational measures and the use of PPE. The selected techniques should aim to ([226]):

- minimise workers' exposure to asbestos fibres during (follow-up) activities;
- reduce fibre emissions in the worksite environment to the lowest possible level;
- reduce the number of exposed workers;
- lower the physical strain on employees to an acceptable level, considering the demanding conditions and constraints of these worksites.

This subsection contains general information on control measures for asbestos. Control measures for specific situations are described in Sections 13 to 17.

## 8.2.1 Elimination

Eliminating the risk of exposure may be possible by creating an asbestos-free workplace before starting other activities, such as (partial) demolition. In some instances, removal may be the most appropriate control measure to prevent both direct and passive exposure. Examples include:

- asbestos insulation on pipes;
- areas with asbestos-contaminated dust;
- loose insulation containing asbestos fibres;
- cracked or damaged fibreboard containing asbestos.

Remediation techniques are further addressed under technical measures, see Section 8.2.2.

If it is not possible to remove asbestos, or if it would cause a greater risk to workers than if the asbestos is left in place, other control measures need to be considered and implemented.

## 8.2.2 Technical measures

A range of technical measures can help prevent the generation of asbestos dust or limit its release into the air. Technical measures include the use of asbestos dust suppression approaches ([227]) such as:

- low-intensity tools, for example manual (wet) scraping, chiselling orblast cleaning at lower pressure levels, with or without water additives ([228]) – using manual tools rather than power tools, where possible;

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([225]) SUVA (n.d.), 'Asbestos fibres are life-threatening – protect yourself from them!', https://www.suva.ch/de-ch/praevention/nach-gefahren/gefaehrliche-materialien-strahlungen-und-situationen/asbest, see the documents in the 'Downloads and orders' section..

([226]) INRS (2012), 'Removal or encapsulation of materials containing asbestos – Prevention guide', ED6091, https://www.inrs.fr/media.html?refINRS=ED %206091.

([227]) German Social Accident Insurance (DGUV) (2021), 'DGUV Information 201-012: Emissionsarme Verfahren nach TRGS 519 für Tätigkeiten an asbesthaltigen Materialien', https://publikationen.dguv.de/widgets/pdf/download/article/422https:/www.dguv.de/ifa/praxishilfen/praxishilfen-gefahrstoffe/asbestsanierung/aktuelle-ergaenzungen/index.jsp?query=webcode+d646056; Intstitut für Arbeitsschutz der Deutschen Gestetzlichen Unfallversicherung (IFA) (n.d.), 'Current supplements to DGUV information 201-012 (formerly: BGI 664) "Asbestos removal"', https://www.dguv.de/ifa/praxishilfen/praxishilfen-gefahrstoffe/asbestsanierung/aktuelle-ergaenzungen/index.jsp.

([228]) INRS (2012), 'Removal or encapsulation of materials containing asbestos – Prevention guide', ED6091, https://www.inrs.fr/media.html?refINRS=ED %206091.

- wetting, for example using foams, water sprinklers or systems with water additives ([229]) – the waste water should be filtered, see Section 8.2.3;
- collection or suction of asbestos-containing dust at source, for example mechanised scraping with debris collection or tools with integrated extraction systems;
- filter installations, for example in cabins with positive pressure to avoid dust from entering, with doors and windows kept closed during operation;
- use of equipment that can be easily decontaminated;
- encapsulation, for example sealing or coating with a protective barrier or fixative, or gel cutting of asbestos-cement pipes;
- automation ([230]), for example robots equipped with high-precision cutting tools, vacuum systems and real-time monitoring sensors (e.g. robotic extraction ([231])).

**Box 8-3: Example of the use of robotic systems in asbestos removal**

The Bots2ReC project ('Robots to Re-Construction') is an EU-funded initiative aimed at developing and validating a robotic system for the automated, safe and efficient removal of asbestos from buildings. The project addresses the significant health and safety risks and inefficiencies associated with manual asbestos removal by introducing autonomous and semi-autonomous robotic solutions specifically designed for real-world construction and demolition environments. The project's goal is to protect workers and improve the economic and environmental sustainability of building rehabilitation.

The system consists of multiple mobile robots on a mobile platform with a central process control system. The system is equipped with one or more robot arms with abrasive tools for asbestos removal. These robots also use suction systems to safely capture and contain hazardous asbestos dust. The robots are fitted with optical and radar sensors, allowing them to perceive their environment, navigate within complex and dusty building interiors and monitor the progress of asbestos removal tasks in real time.

Operators interact through a user interface that displays a virtual map of the worksite, enabling them to assign tasks to robots, supervise operations and intervene remotely if needed. The system autonomously plans and coordinates the robots' movements and task allocation. By automating the asbestos removal process, robots may significantly reduce human presence and exposure to hazardous materials, and increase the speed and cost-effectiveness of asbestos remediation.

The project has produced and tested operational prototypes in environments closely resembling real-world scenarios, demonstrating the feasibility and benefits of robotic asbestos removal, and bringing together multiple European partners to combine expertise in robotics, construction and process control.

*Sources:* Eurocat (n.d.), 'Bots2Rec – Robots to Re-Construction', https://eurecat.org/en/portfolio-items/bots2rec/; Deteret, T., Charaf Eddine, S., Faroux, J-C., Haschke, T., Becchi, F. et al. (2017), 'Bots2ReC: Introducing mobile robotic units on construction sites for asbestos rehabilitation', *Construction Robotics*, Volume 1, pp. 29–37, http://publications.rwth-aachen.de/record/707255/files/707255.pdf; Community Research and Development Information Service (CORDIS) (n.d.), Horizon 2020, 'Robots to Re-Construction, Bots2ReC', https://cordis.europa.eu/project/id/687593/reporting.

The chosen work method should be justified by the risk assessment and clearly detailed in the plan of work, see Section 4.2.

Filter installations in equipment such as cranes, shovels, trucks, extraction systems and vacuum cleaners should be proven effective for asbestos fibres. H-Class filters ([232]) should be used. The systems and filters used should be tested and inspected periodically in accordance with the supplier's procedures and regulations.

New techniques for removing asbestos and MCAs may be developed and introduced, such as

([229]) INRS (2012), 'Removal or encapsulation of materials containing asbestos – Prevention guide', ED6091, https://www.inrs.fr/media.html?refINRS=ED %206091.

([230]) European Commission (n.d.), 'Robots to re-construction', Horizon2020, https://cordis.europa.eu/project/id/687593.

([231]) Burkhard, C., Tobias, H. and Mathia, H. (2021), *Robots to Re-construction – The roadmap to robotized asbestos removal*, Boston-Delft, http://dx.doi.org/10.1561/9781680837155.

([232]) British Standards Institution, 'EN 1822-1:2019 – High efficiency air filters (EPA, HEPA and ULPA) – Classification, performance testing, marking', https://knowledge.bsigroup.com/products/high-efficiency-air-filters-epa-hepa-and-ulpa-classification-performance-testing-marking.

covers, sealants, sprays and foams. It is strongly recommended to validate new methods, techniques, pieces of equipment or machines independently before introduction (e.g. see the Validation and Innovation Point Asbestos in the Netherlands ([233])).

Where removal is not possible or it would cause a greater risk to workers than if the asbestos is left in place and the asbestos is at risk of damage from work activities, containment and decontamination are the recommended control measures, see Section 8.2.2.1 and Section 8.2.2.2 respectively.

**Figure 8-1: Example of wetting a building containing asbestos**

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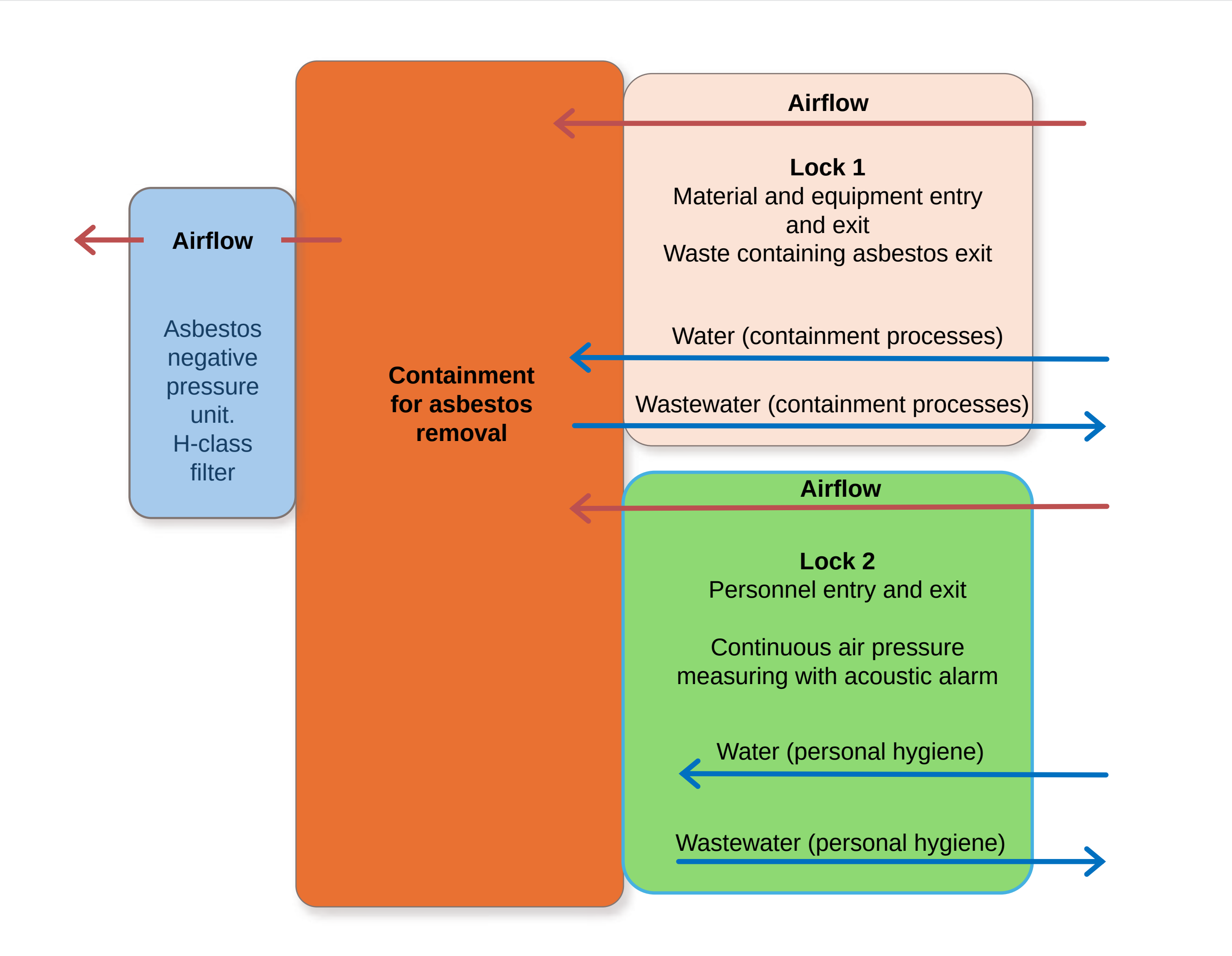
### 8.2.2.1 Containment

Containment is a combination of a technical and organisational control measure. It refers to the creation of a physical barrier around the location with asbestos to prevent its spread and to control access to the contained area. This isolates areas and makes them off-limits to unauthorised workers and the public.

([233]) Validatie – en Innovatiepunt Asbest (VIP) (n.d.), 'The Validation and Innovation Point Asbestos', https://www.vipasbest.nl/en.

**Figure 8-2: Schematic containment system set-up**




*Source:* adapted from TNO, https://publications.tno.nl/publication/34638746/nZg8Vq/TNO-2021-R10986.pdf?utm_source=perplexity.

A containment system should be installed with suitable equipment and locks, tools and waste. It should be under negative pressure to prevent the release of dust, which is monitored continuously. Asbestos negative pressure machines (H-Class filtered air compressors) should be used ([234]).

For short-duration tasks (approximately one hour), including cleaning, where significant asbestos exposure is not expected, the work could be carried out in a one-person enclosure system (such as a boot tent) ([235]). This needs to be justified in the risk assessment.

Containment systems should undergo a structural integrity check before work commences. The result of this check should be documented. Smoke tests are recommended to check for leaks and 'dead zones' where airflow is inadequate. Smoke should clear within 15 minutes in all parts of the confined space when the extractors are activated. In some Member States, smoke tests are mandatory and subject to specific requirements (Belgium ([236]) and France ([237])).

A glove box (also referred to as a sleeve bag, glove bag, incubator bag or glove tarpaulin) is a specific containment device used for small-scale asbestos

([234]) TNO (n.d.), 'Dust-free working', https://stofvrijwerken.tno.nl/wp-content/uploads/sites/8/2022/04/Infoblad_ODM-maart_2022.pdf.

([235]) HSE (n.d.), 'Building and dismantling a mini-enclosure', https://www.hse.gov.uk/pubns/guidance/em3.pdf.

([236]) Federal Public Justice Service (2008), 'Ministry of the Brussels-Capital Region', https://www.ejustice.just.fgov.be/eli/besluit/2008/04/10/2008031254/staatsblad.

([237]) INRS (2012), 'Removal or encapsulation of materials containing asbestos – Prevention guide', ED6091, https://www.inrs.fr/media.html?refINRS=ED %206091.

removal, for example on pipes and similar structures where electrical equipment needs to remain operational ([238]). It consists of an impervious plastic enclosure with a built-in glove-like appendage, allowing workers to handle and remove MCAs without direct contact.

**Figure 8-3: Examples of glove boxes**

These images are not available for reuse, see inside front cover.

Although a glove box can be an effective control measure for small-scale asbestos removal work, they should be used in conjunction with other safety measures, including appropriate PPE and nearby decontamination facilities. The plastic film is sensitive to tearing or punching and can therefore release asbestos dust, particularly during removal of the bag and while using tools. In some Member States, such as Belgium, France and the Netherlands, the use of glove bags as the sole control method is discouraged or heavily restricted.

Workers involved in demolition or asbestos removal work must receive training on the use of technological equipment and machines to contain the release and spread of asbestos fibres ([239]).

### 8.2.2.2 Decontamination

#### *8.2.2.2.1 Decontamination of workers*

Decontamination is crucial to prevent the spread of asbestos fibres out of the site where asbestos work is performed and to minimise the risk of secondary exposure to others. Workers should undergo an appropriate decontamination procedure after asbestos-related activities when exiting the contaminated (dirty) area ([240]), such as from within a containment system. Decontamination is also important for firefighters and other emergency responders after potential asbestos exposure, and following incidental asbestos exposure as stated in the corresponding sections.

For effective decontamination, a dedicated procedure and the use of an airlock system, with three chambers at a minimum, ensures that asbestos dust is contained within the work area. Strict procedures include removing clothes and PPE, showering and cleaning. The three-chamber airlock involves three

([238]) INRS (2012), 'Removal or encapsulation of materials containing asbestos – Prevention guide', ED6091, https://www.inrs.fr/media.html?refINRS=ED %206091.

([239]) Directive 2009/148/EC, Annex Ia(6).

([240]) Directive 2009/148/EC, Article 6.

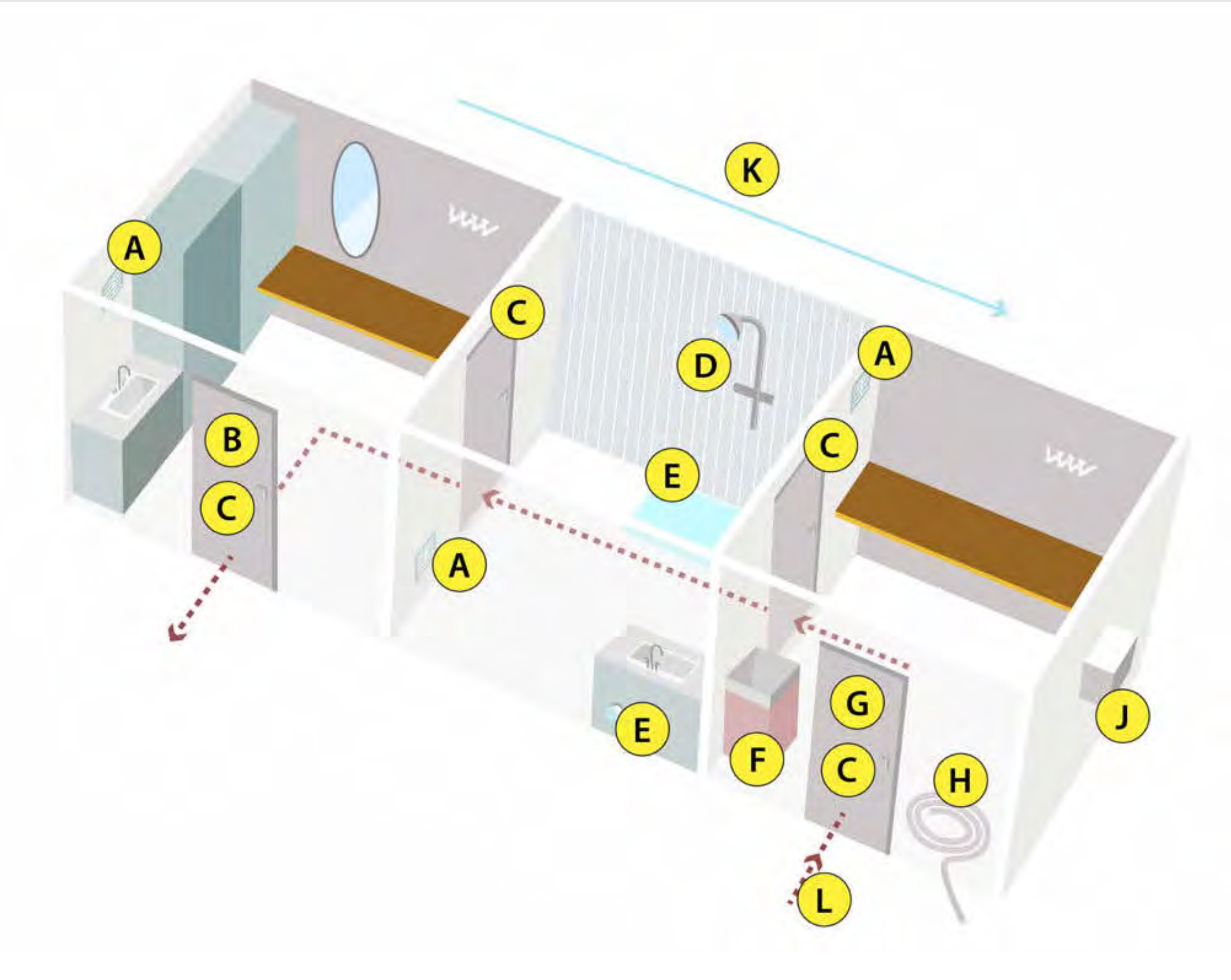
sequential steps in separate chambers to ensure adequate decontamination. Some Member States (such as France) impose additional requirements, for example the use of a five-compartment airlock, with two separate showers (one for decontamination and one for hygiene).

A distinction can be made between:

- direct decontamination, using facilities that are physically attached to the work area, see Section 8.2.2.2.2;
- indirect decontamination, where physical connection is not applicable, see Section 8.2.2.2.3.

#### *8.2.2.2.2 Direct decontamination*

**Figure 8-4: Example of a three-chamber airlock system**




**A:** Grill with self-closing flap
**B:** Clean end
**C:** Well-sealed self-closing door
**D:** Shower
**E:** Waste water
**F:** Waste bin
**G:** Dirty end
**H:** Vacuum cleaner hose
**J:** Extract ventilation unit
**K:** Airflow movement
**L:** Movement of people through unit

Mobile and modular hygiene or decontamination units (DCU) can be used. The DCU should preferably be directly connected to the enclosure. Convenient, mobile, ready-made DCUs are commercially available and often include water treatment systems. A modular unit is not recommended and should only be used where space does not permit a mobile unit, and where its use eliminates the need for transit procedures. There are prefabricated sections that can be assembled on-site, offering more flexibility in layout and size.

Constructing a modular decontamination chamber can involve using a wooden frame covered with thick, transparent plastic sheeting [241]. All openings should be sealed with double layers of plastic to prevent dust spread. The chamber should ideally be at least 0.8 metres wide and 1.9 metres high, with space for changing clothes, showering and adequate ventilation. At the same time, the size of decontamination area should be minimised to reduce the need for air purification and cleaning.

Showering time with an adequate warm water supply (8 litres/minute, 38 °C) should be a minimum of 90 seconds. Some Member States, such as France, may require longer durations. Single-use materials should be disposed of, and reusable ones thoroughly cleaned. Post-ventilation cleaning and decontamination of the DCU itself is to be ensured, along with a final assessment before dismantling. Member States may have specific requirements for wastewater treatment.

When using a three-chamber lock, the following procedure applies [242]. Before starting the work, check that the DCU and the water management systems are functioning properly.

**Figure 8-5: Example of a decontamination unit set-up**


This image is not available for reuse, see inside front cover.

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([241]) Stichting Ascert (2023), 'Sci Eisen aan arbeidsmiddelen', https://www.ascert.nl/images/img-1688135324-649ee69c8c092.pdf; HSE (2006), 'Asbestos: The licensed contractor's guide', https://www.hse.gov.uk/pubns/priced/hsg247.pdf.

([242]) Stichting Ascert (2022), 'SCi-Directe decontaminatieprocedure', https://www.ascert.nl/images/img-1648142466-623ca88256b33.pdf.

**Working area:**

- visible dust should be vacuumed from the suit, footwear and PPE in the work area by using an H-Class vacuum cleaner ([243]);
- remove footwear, either leaving it in the work area or packing it in an airtight bag.

**Dirty end chamber:**

- PPE, packed footwear, suits and the outside of the RPD should be once again thoroughly vacuumed in the first chamber of the airlock. A vacuum cleaner nozzle should be fitted with a brush;
- fully undress while keeping the RPD on;
- place contaminated clothing in a designated waste containing asbestos (WCA) bag; disposable items such as suits and underwear should be disposed of as WCA.

**Shower chamber:**

- the second chamber should contain a shower; an extra shower (for the purpose of having decontamination and hygiene separate) is recommended;
- shower with the RPD still on for thorough cleaning;
- wipe the packed footwear thoroughly with wet wipes.

**Clean end chamber:**

- remove the RPD in the third chamber of the airlock;
- dry yourself (optionally in the shower chamber), dry the RPD and get dressed;
- store packed footwear and RPD in accordance with proper protocol;
- exit the chamber.

Figure 8-6: Example of cleaning using a vacuum cleaner

This image is not available for reuse, see inside front cover.

([243]) CEN, EN 1822-1:2019.

Waste, tools and materials should be double-bagged in strong plastic bags (0.095 mm thick) that are sealed airtight (e.g. with a gooseneck type closure (244)) and properly labelled. In some Member States, such as France, separate decontamination chambers are required for staff and waste and equipment (baglock), which is also highly recommended, see Figure 8-2. Waste should be disposed of in line with local hazardous waste regulations. Waste disposal should be carried out when the work area is cleaned.

If waste, tools or materials need to be removed while work is in progress, they should be packed similarly and cleaned in the airlock.

Personal decontamination, including hand and fingernail washing, should be performed every time workers leave the asbestos work area and after completing asbestos-related tasks.

The DCU should be cleaned daily using an H-Class vacuum cleaner, in line with manufacturer instructions. Workers cleaning the unit should wear appropriate PPE.

**Figure 8-7: Image of a WCA bag tied with a gooseneck closure**

This image is not available for reuse, see inside front cover.

#### *8.2.2.2.3 Indirect decontamination*

When the DCU is not physically connected to the work area, or when asbestos work takes place in the open air, an indirect decontamination procedure should be implemented. In such cases, a sluice with at least two compartments (referred to as a transit sluice, consisting of a dirty area and a clean area) is placed at the work area, and a transit route is used.

A 'transit' procedure should be in place and include the following steps (245).

- Preliminary decontamination in the workplace or the dirty chamber of the transit sluice. The transit sluice may consist of a dirty and a clean compartment airlock system. In the work area or dirty compartment, visible dust should be vacuumed from the suit, footwear and RPD by using an H-Class vacuum cleaner. Keep the RPD on. Then remove the footwear, clean with wet wipes and either leave behind or pack in an airtight container and transport as appropriate.
- Disposable items such as suits and underwear should be disposed of as WCA.
- In the clean compartment of the sluice, the transport shoes and transport coverall should be put on, where applicable, over reusable suits.
- The worker should then follow the designated and segregated outdoors transit route to the DCU.
- Decontamination should be completed starting in the dirty chamber of the DCU.

(244) Règles de l'Art Amiante (2023), 'Recouvrement De Peinture/Enduit: Ratissage D'enduit [Intérieur]', https://www.reglesdelartamiante.fr/fiche/recouvrement-de-peinture-enduit-ratissage-denduit-interieur/.

(245) Stichting Ascert (2022), 'SCi-Indirecte decontaminatieprocedure', https://www.ascert.nl/images/img-1648142466-623ca88256b33.pdf.

**Figure 8-8: Example of vacuum cleaning of a worker with an RPD and suit in a mobile decontamination unit**

This image is not available for reuse, see inside front cover.

#### *8.2.2.2.4 Cleaning the worksite after asbestos work*

After completing the asbestos work and removing the waste, the area (containment) is maintained under negative pressure (– 5 pascals as a minimum, as required in some Member States). When under negative pressure, the inside undergoes a thorough cleaning process, as outlined in a French guide ([246]).

- Visual inspection: inspect all surfaces, including hard-to-reach areas (e.g. corners, flanges, supports), to confirm no MCA residue remains.
- Vacuuming: vacuum all surfaces and equipment using H-Class vacuum cleaners. This includes hidden areas where dust may have settled.
- Treat uncleaned reusable equipment as waste: identify, package and remove it in transport crates for cleaning at a later stage.
- Inspection of plastic film/sheeting/cover: inspect protective plastic for tears or delamination (separation of the plastic into layers) and repair as needed.
- Washing: clean walls, equipment and plastic films with water or wet cleaning methods. Filter the washing water before discharge. Apply a surfactant to plastic films to prevent airborne fibres during removal.
- Plastic film/sheeting/cover removal (first layer): remove the first layer of plastic before drying. Fold it with the contaminated side facing inward and dispose of as WCA. If torn, clean and repair the second layer before removal.
- Final inspection: inspect treated surfaces. Any MCA residues or inadequate encapsulation should be rectified.
- Air monitoring: perform air sampling and fibre analysis to detect residual asbestos contamination. Take corrective action if needed (e.g. further cleaning). Some Member States require air monitoring before dismantling containment or before reoccupying the premises. Requirements may include accredited inspection bodies and simulation of occupancy using fans or blowers. In Belgium, France and the Netherlands, for example, this testing needs to be carried out by an independent, certified or accredited laboratory.
- Plastic layer removal (final layer): remove the last plastic layer gradually while maintaining a slight vacuum. Vacuum or damp-wipe exposed surfaces during removal if wet cleaning could cause damage.
- Equipment maintenance: replace filters in vacuum cleaners and negative pressure extractors in accordance with manufacturer instructions, using trained personnel. Pack and label used filters as WCA for transport or storage.
- Rented equipment decontamination: fully decontaminate rented equipment and remove polluted consumables (such as filters) before return, unless otherwise stated in the rental contract. Record decontamination of the rented equipment in the plan of work, see Section 4.2.

([246]) INRS (2012), 'Removal or encapsulation of materials containing asbestos – Prevention guide', ED6091, https://www.inrs.fr/media.html?refINRS=ED %206091.

### 8.2.3 Waste water

Waste water from containment, laundering asbestos-contaminated clothes and reusable PPE, and asbestos decontamination activities (wash-down and run-off) should be filtered before discharge into a sewer. Alternatively, this waste water should be contained and disposed of appropriately, to prevent it from entering sewers and water courses, or soaking into the ground where it would eventually reach underground freshwater aquifers. There should be regular (weekly) measurements of suspended matter in waste water. Member States may have specific requirements for wastewater treatment.

### 8.2.4 Organisational measures

#### 8.2.4.1 Segregation and warning signs

**Box 8-4: Control measures – segregation and warning signs**

**Article 12 of Directive 2009/148/EC (AWD):**

In the case of certain activities such as demolition, asbestos removal work, repairing and maintenance, in respect of which it is foreseeable that the relevant limit value as laid down in Article 8 will be exceeded despite the use of all possible technical preventive measures for limiting asbestos in air concentrations, the employer shall determine the measures intended to ensure protection of the workers while they are engaged in such activities, in particular the following:

[...]

(b) warning signs shall be put up indicating that it is foreseeable that the limit value laid down in Article 8 will be exceeded; and

[...]

Article 16 of Directive 2009/148/EC (AWD):

1. In the case of all activities referred to in Article 3(1), and subject to Article 3(3), appropriate measures shall be taken to ensure that:

(a) the places in which the above activities take place:

(i) are clearly demarcated and indicated by warning signs;

(ii) are not accessible to workers other than those who by reason of their work or duties are required to enter them;

(iii) constitute areas where there should be no smoking;

(b) areas are set aside where workers can eat and drink without risking contamination by asbestos dust;

[...]

(d) separate storage places are provided for working or protective clothing and for street clothes;

(e) workers are provided with appropriate and adequate washing and toilet facilities, including showers in the case of dusty operations;

[...]

Areas where asbestos-related activities take place must not be accessible to workers other than those required to enter them for their work or duties ([247]), subject to any potential derogations implemented by the Member States for sporadic and low-intensity exposure ([248]).

The asbestos work area must be demarcated to restrict access by unauthorised personnel and the public ([249]). The segregation distance should be determined based on the asbestos risk assessment. Warning signs and demarcation must be used ([250]), see Annex 12. The signs must comply with national legislation transposing Directive 92/58/EEC on the minimum requirements for the provision of safety and/or health signs at work ([251]). They should be placed at all entry points, see Annex 12. Signs should be placed at all the main entry points to restrict entry. They should be weatherproof, constructed of lightweight material and securely fastened. The signs should also be of sufficient size and design so that they are easily visible and clearly legible from the distance at which workers or third parties may first encounter the hazard zone.

The following control measures should be applied:

- demarcation can include the use of barrier tape;
- doors should be closed;
- appropriately labelled heavy-duty plastic WCA disposal bags should be available;
- if possible, heavy-duty plastic sheeting should be used, secured with adhesive (cloth or duct) tape, to cover any surface within the asbestos work area that could become contaminated;
- adequate lighting should be provided.

Access to the working/removal area and/or containment should be restricted to:

- trained asbestos workers and supervisors;
- competent personnel responsible for final inspection before clearance.

In addition, the following should be observed:

- disconnect the work area from the building's general ventilation systems to prevent contamination (if applicable); this can be done, for instance, by sealing or blocking the inlet and exhaust ventilation grids;
- use special measures for windy environments, such as negative pressure enclosures or side covers;
- if drilling a roof from outside, segregate the area beneath;
- if there is access to other sides of the asbestos cement, these should also be segregated;
- work should follow a sequence that minimises the potential for recontamination, for example progressing from top to bottom;
- remove waste materials promptly to prevent accumulation and reduce the risk of secondary contamination.

The areas in which activities with asbestos take place must be non-smoking ([252]).

#### 8.2.4.2 Limitation of number of workers

The number of workers exposed or likely to be exposed to dust arising from asbestos or MCAs must be limited to the lowest possible number ([253]). This should be specified in the plan of work, see Section 4.2.

A permit-to-work system may be implemented as a practical way of restricting access to authorised personnel only.

([247]) Directive 2009/148/EC, Article 16(1)(a)(ii).

([248]) Directive 2009/148/EC, Article 16 and Article 3(3).

([249]) Directive 2009/148/EC, Article 16(1)(a)(ii).

([250]) Directive 2009/148/EC, Article 16(1)(a)(i).

([251]) Directive 92/58/EEC; see also Non-binding Guidelines Regarding Directive 92/58/EEC – Safety and/or health signs at work, Publications Office of the European Union, Luxembourg, 2022, https://data.europa.eu/doi/10.2767/686887.

([252]) Directive 2009/148/EC, Article 16(1)(a)(iii).

([253]) Directive 2009/148/EC, Article 6(a).

### 8.2.4.3 Final inspection

In accordance with Article 13(2)(c) of Directive 2009/148/EC ([254]), the plan of work – which must be drawn up before demolition work or work on removing asbestos and/or MCAs from buildings, structures, plants or installations or from ships (see Section 13 and Section 14) begins – must specify that when the demolition or asbestos removal work has been completed, the absence of risks of exposure to asbestos at the place of work should be verified before other activities resume ([255]). In any case, for all asbestos activities, a final inspection is strongly recommended. The final inspection should be carried out by a competent person.

The final inspection should include the following ([256]).

- A visual inspection to confirm that all asbestos and/or MCAs that were supposed to be removed have been removed, before and after removing the enclosure, as dust may have fallen off the enclosure or sheeting. If necessary, gel or adhesive tape samples could be taken.
- Verification that protective measures have been taken to prevent recontamination of the location.
- Confirmation that MCA waste has been disposed of outside of the location/containment or properly packed and decontaminated inside.
- Confirmation that the tools and equipment used have been disposed of outside of the location/containment or properly packed and decontaminated inside.
- A visual check that no asbestos dust, waste or loose MCA fragments remain in the area or containment, and the area or containment is thoroughly cleaned before reuse or dismantling. Airborne fibre concentrations should be well below the OEL specified in Section 6.2.2, and, if necessary, verified through air sampling as indicated in the risk assessment. Member States may have specific requirements for fibre concentrations and clearance testing, for instance to disturb dust during sampling to simulate the re-occupation of the work area.

In some Member States, the final inspection must be performed by an independent and accredited inspection body or a person holding a personal certification, see Annex 6. The final inspection should be documented before site clearance.

To verify the absence of the risk of asbestos exposure at the workplace, a final clearance report should be prepared, documenting the removal process, cleaning procedures, visual inspection results and air testing results. This report should be kept and shared as part of the asbestos management records. Where an asbestos register or asbestos management plan (AMP) exists, it should be updated to reflect the removal of the MCAs.

**Box 8-5: Example of release of an asbestos containment**

Once the asbestos removal is complete, the containment (sealed work area) needs to be decontaminated and formally assessed prior to its dismantling. In the Netherlands, this process is strictly regulated and follows a set protocol, based on the NEN 2990:2020+C1:2020 standard. Below is an overview of the process.

**Remediation and preparation for the final assessment**

- After asbestos removal, the containment (sealed work area) is thoroughly cleaned by the certified asbestos remediation company.
- The certified asbestos remediation company reports via the National Asbestos Monitoring System (LAVS) when the remediation is complete and the final assessment can take place. LAVS is a web application used to track and register asbestos removal by various parties, such as clients, asbestos surveyors, asbestos removal companies, final inspection companies and inspectors, ensuring that all stakeholders have access to the relevant information. Asbestos surveyors and asbestos removal companies are obliged to register their activities in LAVS.

([254]) Directive 2009/148/EC, Article 13(2)(c).
([255]) Directive 2009/148/EC, Article 13.
([256]) HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.

## Box 8-5: Example of release of an asbestos containment

**Independent final assessment**

An accredited and independent inspection agency performs the final assessment, which consists of the following.

- Document review: asbestos inventory report, work plan and remediation report.
- Visual inspection: the inspector checks for any asbestos residues, suspicious materials or dust in the containment.
- Air sampling: air-sampling pumps with filters are placed at strategic points in the containment. The collected samples are analysed (using SEM) in a laboratory for the presence of asbestos fibres.
- Measurements and inspections are performed in accordance with the current version of the NEN 2990:2020+C1:2020 standard. For example, the fully protected laboratory technician should actively circulate the air in the room while performing measurements. This causes any fibres that may have settled on surfaces to become airborne, ensuring they are included in the air monitoring.

**Assessment and reporting**

The inspector evaluates the results.

- Approved: no asbestos detected, fibre concentration below the standard; the containment is released.
- Approved after additional cleaning: minor residues are removed immediately, after which the containment is released.
- Rejected: asbestos or excessive fibre concentration detected; the area must be cleaned again, followed by a new final assessment.
- The findings are documented in a report, including photos and floor plans, which is handed over to the client.

**Release**

Only after a positive final assessment ('approved') may the containment be released and re-entered without protective measures.

**Important points**

- The final assessment should be independent and cannot be performed by the asbestos remediation company itself.
- The entire procedure is designed to ensure that the space is safe for users after remediation and meets legal requirements.

*Sources:* NEN 2990:2020+C1:2020 nl. – Air – Visual inspection and clearance sampling for control of asbestos abatement works;
*LAVS*, https://iplo.nl/thema/asbest/lavs/.

### 8.2.5 Personal protective equipment

The use of PPE, including RPDs, must meet the requirements of national legislation and relevant EU directives ([257]). The main requirements under the directives relating to the use of PPE, including RPDs, are shown in Box 8-6.

**Box 8-6: PPE including RPD**

**Article 3 of Directive 89/656/EEC (PPED):**

Personal protective equipment shall be used when the risks cannot be avoided or sufficiently limited by technical means of collective protection or by measures, methods or procedures of work organisation.

**Article 4(1) to (3) and (7) of Directive 89/656/EEC (PPED):**

1. Personal protective equipment must comply with the relevant Community provisions on design and manufacture with respect to safety and health.

All personal protective equipment must:

(a) be appropriate for the risks involved, without itself leading to any increased risk;

(b) correspond to existing conditions at the workplace;

(c) take account of ergonomic requirements and the worker's state of health;

(d) fit the wearer correctly after any necessary adjustment.

2. Where the presence of more than one risk makes it necessary for a worker to wear simultaneously more than one item of personal protective equipment, such equipment must be compatible and continue to be effective against the risk or risks in question.

3. The conditions of use of personal protective equipment, in particular the period for which it is worn, shall be determined on the basis of the seriousness of the risk, the frequency of exposure to the risk, the characteristics of the workstation of each worker and the performance of the personal protective equipment.

[...]

7. The employer shall first inform the worker of the risks against which the wearing of the personal protective equipment protects him.

[...]

When buying PPE, employers need to make sure that the products comply with Regulation (EU) 2016/425. The essential health and safety requirements that apply to the design and manufacture of PPE are set out in Annex II to Regulation (EU) 2016/425. If PPE complies with harmonised standards published in the *Official Journal of the European Union*, it is presumed to meet the requirements of Annex II to the extent that they are covered by those standards ([258]).

PPE that protects against substances and mixtures hazardous to health belongs to PPE category III ([259]). This means that RPDs for protection against asbestos must comply with the essential requirements in Section 3.10.1 of Annex II ([260]).

Conformity assessment of category III PPE requires the involvement of a notified body ([261]). PPE or its packaging and documentation must bear a CE (Conformité Européenne) mark which, for

([257]) Directive 2009/148/EC; Directive 89/656/EEC.
([258]) Regulation (EU) 2016/425, Articles 5 and 14.
([259]) Regulation (EU) 2016/425, Annex I.
([260]) Regulation (EU) 2016/425, Annex II.
([261]) Regulation (EU) 2016/425, Article 8(2), Article 19 and Annexes V, VII and VIII.

category III PPE, must be followed by the four-digit identification number of the notified body involved in production control ([262]).

PPE must be supplied with instructions and information in a language easily understood by the users, and either a copy of the EU declaration of conformity or the internet address at which it can be accessed ([263]).

Before selecting PPE, employers are required to assess the requirements that the PPE must fulfil, to make sure that it satisfies the requirements ([264]). This assessment should include:

- an analysis and assessment of risks that cannot be avoided by other means;
- a determination of the characteristics PPE should have to protect effectively against these risks, considering any risks introduced by the PPE;
- a comparison of the PPE available with the determined characteristics.

This assessment must be reviewed if any changes are made to any of its elements ([265]).

## 8.2.6 Respiratory protection devices

**Box 8-7: Control measures – PPE**

**Article 10(3) of Directive 2009/148/EC (AWD):**

3. Where exposure cannot be reduced by other means and where compliance with the limit value makes necessary the wearing of individual respiratory protective equipment, this shall not be permanent and shall be kept to the strict minimum necessary for each worker. During periods of work which require the use of such equipment, provision shall be made for regular breaks appropriate to the physical and climatological conditions and, where relevant, in consultation with the workers and/or their representatives within the undertaking or establishment, in accordance with national law and practice.

**Article 12 of Directive 2009/148/EC (AWD):**

In the case of certain activities such as demolition, asbestos removal work, repairing and maintenance, in respect of which it is foreseeable that the relevant limit value as laid down in Article 8 will be exceeded despite the use of all possible technical preventive measures for limiting asbestos in air concentrations, the employer shall determine the measures intended to ensure protection of the workers while they are engaged in such activities, in particular the following:

(a) workers shall be issued with suitable personal protective equipment to be worn, which shall be appropriately handled and, in particular with regard to respiratory equipment, which shall be individually adjusted, including through fitting checks, in accordance with Council Directive 89/656/EEC

[...]

**Article 16 of Directive 2009/148/EC (AWD):**

1. In the case of all activities referred to in Article 3(1), and subject to Article 3(3), appropriate measures shall be taken to ensure that:

[...]

(c) workers are provided with appropriate working or protective clothing; this working or protective clothing remains within the undertaking; it may, however, be laundered in establishments outside the undertaking which are equipped for this sort of work if the undertaking does not carry out the cleaning itself; in that event the clothing shall be transported in closed containers;

[...]

(f) protective equipment is placed in a well-defined place and checked and cleaned after each use, and appropriate measures are taken to repair or replace defective equipment before further use.

([262]) Regulation (EU) 2016/425, Article 17.

([263]) Regulation (EU) 2016/425, Articles 8(7), 8(8) and 10(4) and point 1.4 of Annex II.

([264]) Directive 89/656/EEC, Article 4.

([265]) Directive 89/656/EEC, Article 4(2).

The selection of appropriate RPDs should be based on the risk assessment. The choice depends not only on the expected exposure duration, but also on the (expected) concentration of airborne fibres and the APF of RPDs.

At a minimum, the following RPDs should be used, unless stricter national requirements apply.

- An FFP3 mask with appropriate APF. Guidance on RPDs is available in Dutch- and French-language documents (266). There may be national requirements, including limits on maximum exposure times and restrictions on use for certain tasks, such as asbestos removal or encapsulation.
- For short-duration exposure, for instance during inspections, disposable RPDs or half-mask RPDs fitted with P3 filters are generally suitable.
- For longer exposure periods, for instance removal work, powered or supplied air RPDs should be used. These include:
  - powered air purifying respirators (PAPR), which filter contaminants in the air and use a battery-operated blower to provide the user with clean air through a tight-fitting RPD, a loose-fitting hood or a helmet;
  - supplied air respirators that deliver breathing air from a clean source through a tight-fitting RPD, a loose-fitting hood or a helmet;
  - the operation of the battery and the air supply should be continuously monitored, for example using an alarm system.

Some Member States may have stricter national requirements.

RPD use should be limited to a maximum amount of time per day (267). The number of breaks and wearing time should consider the working conditions and be further adjusted in situations involving high temperatures and physical strain. This should be addressed in the risk assessment. Some Member States include specific limitations in their national asbestos legislation (268).

After showering and removing the reusable RPD in the DCU, it should be inspected for contamination. If it is reusable, it should be stored in a clean container. Disposable respirators should be discarded in an asbestos-labelled waste bag and disposed of as WCA.

**Box 8-8: Examples of RPDs and correct use**

The selection of RPDs depends on the following items.

- Asbestos fibre concentration: air monitoring determines the minimum required protection factor.
- Task factors: work intensity, duration, mobility and communication needs.
- RPD types: PAPRs are preferred over other masks. PAPRs with loose-fitting RPDs (TH class) offer higher protection, require no fit testing or shaving, and present a lower failure risk. Filtering facepiece (FFP) masks rely heavily on user behaviour (e.g. correct donning and seal checks) and may leak. When using FFP, select the right size (small/medium/large) based on the user's body dimensions.
- Decontamination: choose RPDs with smooth surfaces for easy cleaning; avoid designs with hard-to-clean edges.

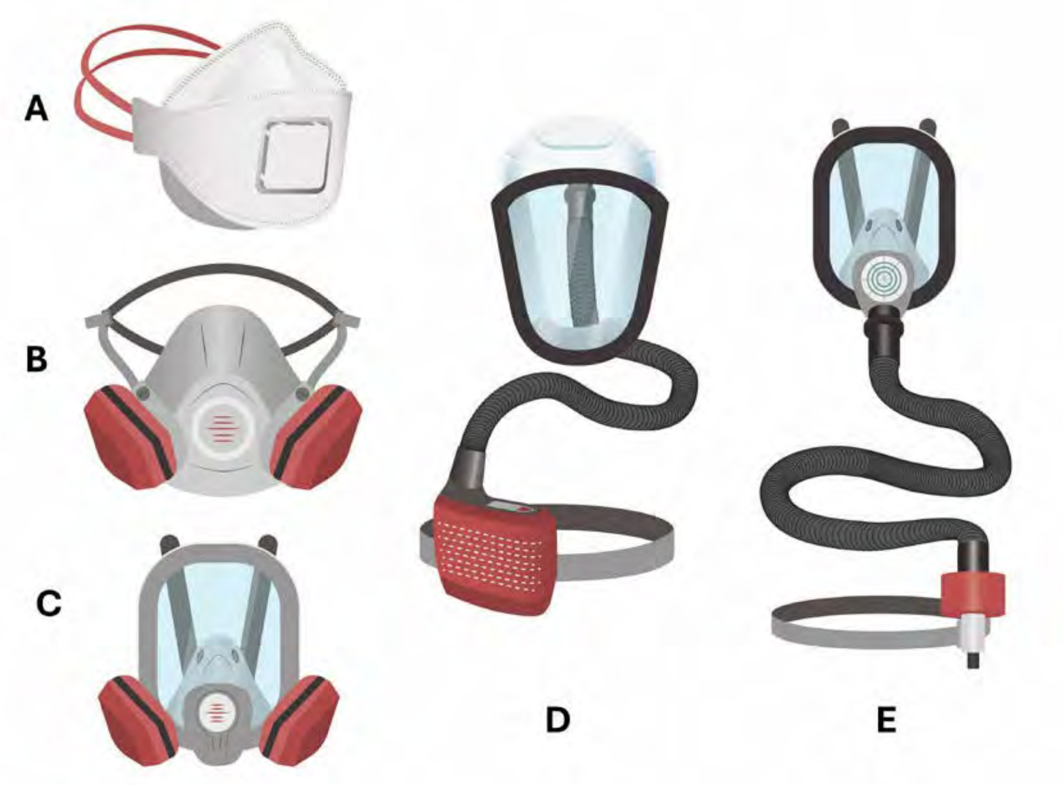
(266) Netherlands Association for Occupational Hygiene (NVvA) (2024), *Respiratory Protective Equipment Guideline: Practical information on the selection and use of respiratory protective equipment when working with hazardous substances*, https://arbeidshygiene.nl/wp-content/uploads/2024/04/nvva_richtlijn_ademhalen_digitaal.pdf; INRS (2020), 'Les appareils de protection résipratoire, choix et utilisation', INRS Guide ED6106, https://www.inrs.fr/dam/inrs/CataloguePapier/ED/TI-ED-6106.pdf.

(267) Netherlands Association for Occupational Hygiene (NVvA) (2024), 'Respiratory Protective Equipment Guideline: Practical information on the selection and use of respiratory protective equipment when working with hazardous substances', https://arbeidshygiene.nl/wpcontent/uploads/2024/04/nvva_richtlijn_ademhalen_digitaal.pdf; INRS (2020), 'Les appareils de protection résipratoire, choix et utilisation', INRS Guide ED6106, https://www.inrs.fr/dam/inrs/CataloguePapier/ED/TI-ED-6106.pdf.

(268) Under Royal Decree 396/2006 in Spain, which establishes the minimum health and safety provisions applicable to work with a risk of exposure to asbestos. See: Spanish Official State Gazette Agency (2006), Royal Decree 396/2006 of 31 March, which establishes the minimum health and safety provisions applicable to work with a risk of exposure to asbestos, https://www.boe.es/eli/es/rd/2006/03/31/396/con.

**Box 8-8: Examples of RPDs and correct use**

Figure 8-9: Examples of respiratory protective devices




**A:** Filtering half-mask with valve (FFP3)

**B:** Half-mask with two P3 side filters

**C:** Full-face mask with two P3 side filters

**D:** PAPR P3 filter

**E:** Full-face mask with positive-pressure demand valve, connected to an air supply system

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**Protection factors**

The APF is the expected workplace protection level, which may differ between Member States. A simulated workplace protection factor (SWPF) is derived from controlled tests mimicking real tasks for specific situations. SWPFs only apply to the tested devices. For example, an asbestos-specific SWPF study in the Netherlands showed that independent systems provide approximately 10 times higher protection than dependent systems. Use the 5th percentile SWPF with safety factors for reliability.

EN standards (*) aim to harmonise protection factors across Europe, considering the type of work, the physical workload and the nature of the hazardous substance to determine the correct choice of RPDs.

RPDs only offer sufficient protection when used correctly. Conditions for proper RPDs functioning include:

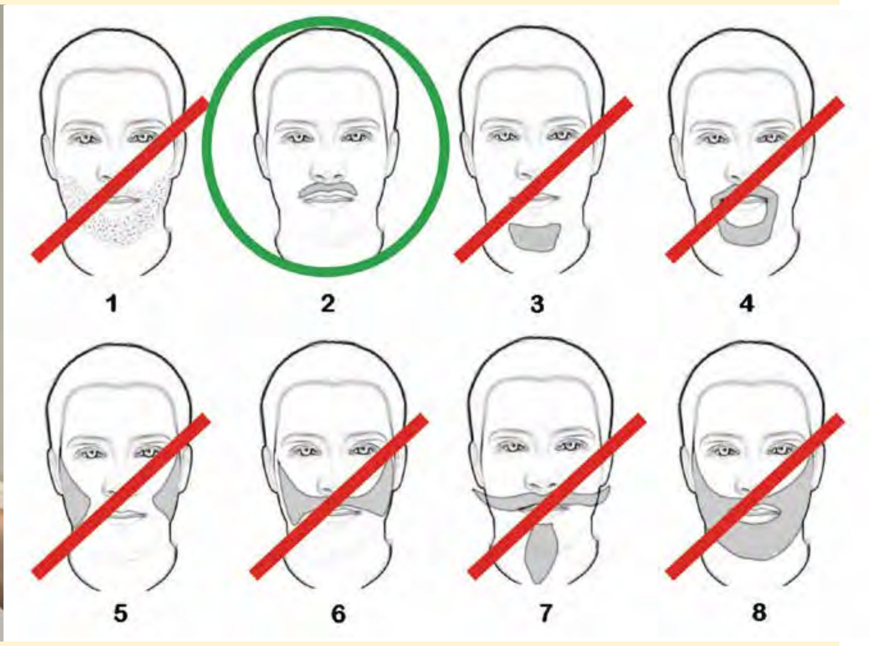
- a proper fit with an effective seal;
- cleanliness and regular maintenance, including routine cleaning and disinfection, and timely filter replacement;
- correct use in accordance with the manufacturer's instructions, including training on proper donning, adjustment, fit testing and appropriate storage;

**Box 8-8: Examples of RPDs and correct use**

- a clean-shaven face, last shaved at least eight hours prior to work, with no obstructive facial hair or jewellery that could compromise the seal when using tight-fitting respirators; facial hair can increase leakage by 20–1 000 times;
- wearing comfort, as a comfortable mask is more likely to be worn consistently and correctly;
- the user must be physically capable of wearing the RPD, especially in systems with increased breathing resistance;
- avoid over-tightening masks, which may cause leaks;
- decontaminate RPDs and clean interiors to prevent mould;
- to ensure a proper seal, use two fingers on each side of the nose bridge and press the mask firmly.

**Figure 8-10: Ensuring a proper seal**

**Figure 8-11: Requirements for a proper filtering facepiece fit: clean-shaven face, no obstructive facial hair or jewellery**

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Always prioritise loose-fitting PAPRs for high-risk tasks like asbestos removal. If an FFP mask is used, the seal is critical. There are options on the market with a valve to reduce heat and moisture build-up, which can otherwise decrease filter efficiency and increase breathing resistance. Some models also feature a soft, cushioned lining for lasting comfort and a better fit.

(*) EN 12941:2023; EN 529:2005.

*Sources:* NVvA (2024), 'Guideline Respiratory Protective Equipment – Practical information on the selection and use of respiratory protective equipment when working with hazardous substances', https://arbeidshygiene.nl/wp-content/uploads/2024/04/nvva_richtlijn_ademhalen_digitaal.pdf; CEN (2023), 'EN 12941:2023 – Respiratory protective devices – Powered filtering devices incorporating a loose fitting respiratory interface – Requirements, testing, marking', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:62407,6062&cs=117A27EA6C5DA223B58A0C24FFF017562; CEN (2005), 'EN 529:2005 – Respiratory protective devices – Recommendations for selection, use, care and maintenance – Guidance document', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:2011,6062&cs=1526CB848B2B255A71EDA60BE224C8424; TNO (2017), 'Research into protection factors for respiratory protective equipment used in the asbestos industry', https://repository.tno.nl/SingleDoc?find=UID %2041b09a66-5a3f-4ca7-ab4d-b9d3d8b6988f; INRS (2020), 'Les appareils de protection respiratoire: Choix et utilisation', ED 6106, 4/2020, https://www.inrs.fr/media.html?refINRS=ED%206106.

#### 8.2.6.1 Fit of respiratory protection devices

Facepieces (masks or half-masks) should fit securely to the face to ensure optimal protection. Improperly fitted facepieces, particularly filtering devices, can provide significantly reduced protection. Users should ensure that hair, beards, spectacle arms or other objects (such as the hood of a garment) do not interfere with the face seal. The size of the facepiece should be appropriately chosen to fit the wearer. Workers need to be physically fit to wear RPDs.

To verify fit and tightness, a face fit test is recommended, in accordance with the manufacturer's instructions ([269]). In some Member States, a face fit test is a requirement. A negative pressure test may be done as a basic method, but more advanced techniques, such as quantitative testing using particle counters, provides a more accurate assessment by measuring the particles' concentration inside and outside the facepiece. These tests should be performed by a competent person.

Workers should receive regular training and instruction on the correct use and maintenance of RPDs. A visual leak- and seal-check should be performed every time a worker puts on the RPD (pre-use check).

There are ongoing developments in 3D-printed prototypes of custom-fit RPDs that conform to the user's facial features and adapt to facial movements during use. Some designs also integrate a pressure-sensing network that continuously monitors the fit and alerts the user if it is compromised. These innovations are promising and should be closely followed.

**Box 8-9: Face fit testing for RPDs**

Face fit testing is essential to ensure the effectiveness of tight-fitting RPDs, such as FFP masks, half-masks and full-face masks. Without a proper fit, inward leakage can occur, compromising protection against hazardous substances like asbestos. Face fit testing verifies that the mask seals correctly to the wearer's face, accounting for individual facial features and correct donning. This process is critical because even certified RPDs fail if they do not fit the user properly, leading to potential exposure.

Face fit testing is not a guarantee of continuous protection, but validates that the mask can provide its APF when worn correctly. The test result is either a pass or fail. It identifies poorly fitting masks early, ensuring users are matched with suitable RPDs.

Face fit testing is required annually or after significant physical changes (e.g. weight change greater than nine kilograms or dental surgery). It should be performed by a competent, trained person in accordance with certified protocols. Additionally, a pre-use check should always be carried out on-site to verify a proper seal and absence of any leaks.

**Figure 8-12: Examples of face-fit testing for full face mask and filtering facepiece**

From left to right:

- face fit testing for FFP (FFP no longer usable after testing);
- face fit testing for full face mask.

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([269]) ISO, ISO 16975-3:2017; HSE (2019), 'Guidance on respiratory protective equipment (RPE) fit testing', INDG479, https://www.hse.gov.uk/pubns/indg479.htm.

**Box 8-9: Face fit testing for RPDs**

To ensure an effective face fit testing protocol, consider the following:

**Figure 8-13: Pre-use check for leakages for an FFP3 mask**

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- perform a visual check to confirm that the mask is properly positioned;
- use quantitative methods (e.g. ambient particle counting test) over qualitative (smell/taste) tests;
- conduct testing on-site with user's own RPD, following certified protocols, including several practical exercises such as like bending over, turning the head side to side and speaking aloud (see Yellow Safety Sign in the Netherlands, Fit2Fit in the UK);
- ensure that there is no smoking 60 minutes before an ambient particle counting test to avoid false results;
- perform seal checks before use (e.g. covering filters and inhaling to test for a vacuum).

Keep face fit testing results readily accessible on site. Pre-use check for leakages for an FFP3 mask include:

- cover the FFP3 mask with both hands, inhale gently and verify that a vacuum is formed, indicating the absence of leaks, see Figure 8-13;
- block the inlet of the full-face mask with one hand, inhale gently and verify that a vacuum is formed, indicating the absence of leaks.

Loose-fitting RPDs, such as PAPRs, eliminate the need for face fit testing, as they rely on airflow rather than facial seals.

Face fit testing is vital for tight-fitting RPDs but avoidable with loose-fitting PAPRs, which offer superior protection and usability. Always combine face fit testing with robust RPD programmes, manufacturer guidelines and task-specific test data to ensure adequate protection.

*Sources:* NVvA (2024), 'Guideline Respiratory Protective Equipment – Practical information on the selection and use of respiratory protective equipment when working with hazardous substances', https://arbeidshygiene.nl/wp-content/uploads/nvva_guidance-respiratory-protection-def.pdf; CEN (2023), 'EN 12941:2023 – Respiratory protective devices – Powered filtering devices incorporating a loose fitting respiratory interface – Requirements, testing, marking', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:62407,6062&cs=117A27EA6C5DA223B58A0C24FFF017562; CEN (2005), 'EN 529:2005 – Respiratory protective devices – Recommendations for selection, use, care and maintenance – Guidance document', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:2011,6062&cs=1526CB848B2B255A71EDA60BE224C8424; INRS (2020), 'Les appareils de protection respiratoire: Choix et utilisation', ED 6106, 4/2020, https://www.inrs.fr/media.html?refINRS=ED%206106; HSE (2019), 'Guidance on respiratory protective equipment (RPE) fit testing', INDG 479, https://www.hse.gov.uk/pubns/indg479.htm; ISO (2017), 'ISO 16975-3:2017. Respiratory protective devices – Selection, use and maintenance – Part 3: Fit-testing procedures', https://www.iso.org/standard/64513.html; OSHA 1910.134. Personal Protective Equipment. Respiratory Protection, https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134; Fit2Fit (n.d.), 'Fit2Fit Accreditation', https://www.fit2fit.org/; Stichting Safety Sign (n.d.), 'Certified face fit tester, yellow safety signs for certified companies', https://safetysign.nl/erkenningsregelingen/erkend-face-fittester/.

### 8.2.6.2 Maintenance and storage of respiratory protective devices

Only clean and functional RPDs in good hygienic condition should be used. This requires maintenance, repair and replacements as necessary. The effectiveness of RPDs should be reviewed periodically in accordance with the supplier's guidance (e.g. at least annually) (270). All reusable RPDs should be cleaned immediately after use (271). Filters should be changed regularly in accordance with manufacturer's instructions and disposed of as WCA.

- Maintenance and storage of RPDs should follow the manufacturer's instructions. After use in a contaminated environment, the following measures should be followed: RPDs should be used until

(270) Committee on Hazardous Substances (AGS) (2015), 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html (under revision at the time of writing).

(271) In accordance with Article 4(6) of Directive 89/656/EEC, employers must ensure the good working order of the PPE they provide and its satisfactory hygienic condition by means of the necessary maintenance, repair and replacements; FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

contaminated disposable coveralls and clothing have been vacuum cleaned (with an H-Class vacuum cleaner) and/or removed and bagged for disposal, and personal washing has been completed.

- RPDs should be cleaned thoroughly during showering.
- Filters should be disposed of as WCA.
- Face pieces should be cleaned and disinfected.
- When not in use, RPDs should be properly stored in a clean container.
- The external surface of the container should be wet wiped to remove any adhering dust before removal from the asbestos work area.

## 8.2.7 Personal protective equipment other than respiratory protective devices

In addition to RPDs, the following PPE should generally be used. Additional PPE may be required to protect against other workplace hazards, such as the need for head protection (e.g. wearing hard hats) or fall protection equipment.

### 8.2.7.1 Coveralls and underwear

Disposable coveralls rated type 5, category 3 (EN ISO 13982–1:2004 ([272]), EN ISO 13982-1:2004/A1:2010 ([273])), with fitted hoods (worn over the straps of RPDs) and cuffs, should be worn to minimise contamination. To ensure an effective seal, adhesive tape should be used between the mask's face seal and the disposable suit. Disposable underwear should be worn underneath.

The following precautions should be observed for removal and disposal of coveralls and underwear as WCA:

- turn disposable coveralls and underwear inside-out when removing them to entrap any remaining contamination;
- place them into appropriately labelled WCA disposal bags, or wrap in a double layer of heavy-duty plastic, clean with wet disposable tissues, and seal using adhesive (cloth or duct) tape;
- dispose of as WCA, see Section 12;
- reusable clothing should remain on the premises and be laundered by a specialised facility.

### 8.2.7.2 Gloves

Unless the risk assessment indicates otherwise, disposable nitrile gloves should be worn. If latex gloves are used, low-protein (powder-free) gloves should be provided to minimise potential irritation or allergic reactions. Gaps between gloves and overalls should be sealed, for example by taping.

As with coveralls and underwear, the gloves should be disposed of in the same manner as WCA after use.

**Figure 8-14: Example of gloves secured with tape**

This image is not available for reuse, see inside front cover.

### 8.2.7.3 Footwear

Suitable footwear should be selected based on the risk assessment and consider any additional hazards in the workplace.

([272]) CEN, 'EN ISO 13982-1:2004 – Protective clothing for use against solid particulates – Part 1: Performance requirements for chemical protective clothing providing protection to the full body against airborne solid particulates (type 5 clothing)', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:6683,6143&cs=15A8BF7EF354DB21F830F9026254F0C8D.

([273]) CEN, 'EN ISO 13982-1:2004/A1:2010 – Protective clothing for use against solid particulates – Part 1: Performance requirements for chemical protective clothing providing protection to the full body against airborne solid particulates (type 5 clothing) – Amendment 1 (ISO 13982-1:2004/Amd 1:2010)', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:32023,6143&cs=1CB3BA7430812E43ADF351967333CB762

High rubber safety boots are recommended, as they are easy to clean. Footwear should not have laces, to limit asbestos fibre adhesion. Seal gaps between boots and overalls, for example by securing them with tape.

Footwear should be cleaned with an H-Class vacuum cleaner and, after removal, with wet wipes.

Shoe covers can be used indoors but may reduce grip and traction and increase safety risks (e.g. tripping). Therefore, disposable non-slipping shoe covers are preferable and should be disposed of as WCA after use.

**Figure 8-15: Example of footwear used at a demolition project**

This image is not available for reuse, see inside front cover.

### 8.2.7.4 Eye and face protection

When using disposable RPDs or half-mask RPDs, wear safety goggles, spectacles or a face shield that is compatible with the respirator or mask to protect the eyes from airborne fibres and debris.

After use, clean the eye protection thoroughly with water (under the shower) or wipe with wet wipes and store properly in a clean container when not in use.

## 8.3 Secondary exposure

**Box 8-10: Secondary exposure to asbestos**

**Recital 5 of Directive (EU) 2023/2668:**

… secondary exposure, where people are exposed to asbestos fibres brought home by occupationally exposed individuals mostly from their clothing or hair …

secondary exposure can have significant impacts on health …

Avoiding exposure to asbestos, in whatever form, therefore remains an imperative. …

With regard to secondary exposure to asbestos or materials containing asbestos, the OSH requirements provided for in this Directive are important means by which to avoid such exposure.

Secondary exposure occurs when individuals are exposed to asbestos fibres that have transferred to another location on the body (such as hair), clothes or belongings of directly exposed individuals. As far as occupational exposure is concerned, secondary exposure, occupational or not, can occur where fibres are transferred outside the workplace of first exposure ([274]).

Secondary exposure typically results from a failure of the control measures set out in Section 8.2, particularly ineffective decontamination procedures, see Section 8.2.2.2.

Examples of measures to prevent secondary exposure include:

- follow correct protocols for decontamination (including decontamination of workers and reusable equipment and PPE, if used) following asbestos removal and/or handling;
- implement and follow all proper hygiene recommendations (such as correct removal of disposable PPE, provision of designated work clothing and a laundry service to prevent contaminated items from being taken home).

([274]) Directive (EU) 2023/2668, recital 5.

# 9 Training

## 9.1 Introduction

**Box 9-1: Training requirement**

**Article 14 of Directive 2009/148/EC (AWD):**

1. Employers shall provide appropriate training for all workers who are, or are likely to be, exposed to dust from asbestos or materials containing asbestos. Such training must be provided at regular intervals and at no cost to the workers.

2. The content of the training shall be easily understandable for workers. It shall enable them to acquire the necessary knowledge and skills in terms of prevention and safety in accordance with the national law and practice applicable where the work takes place.

3. The minimum requirements with regard to the content, duration and frequency of the training provided pursuant to this Article and the documentation relating thereto are set out in Annex Ia.

Employers must ensure that all workers who are, or are likely to be, exposed to dust from asbestos or materials containing asbestos (MCAs) receive appropriate training ([275]). This includes passive exposure (see Section 7), where one of its primary objectives should be to raise awareness of asbestos.

Training must cover health risks associated with asbestos, balancing the need to inform without unnecessarily alarming people ([276]). While it is essential that all workers understand the risks of asbestos exposure, unnecessary fear can result in both employers and workers making poor decisions. The mere knowledge of asbestos presence can provoke anxiety that may lead to unsafe or irrational responses about remedial action when it is found.

Throughout this guide, 'competence' and 'competent worker' (with respect to working with asbestos) refer to someone who has received adequate information, instruction and training for the task at hand, and who can demonstrate an adequate and current understanding of asbestos risks, control measures, safe procedures and relevant OSH legal obligations.

Training should develop the specific skills needed to minimise the risk of workers being exposed to asbestos. It should include both theoretical and practical elements. However, attending a training course alone does equate to competence. Competence is developed over time by applying skills in real-life work, supported by skills learnt during face-to-face training, e-learning, practical hands-on training outside the work environment, simulation, on-the-job learning, instruction and assessment.

Newly trained workers, particularly those new to asbestos-related work, should apply their skills as soon as possible in the field. Employers, supervisors and managers play an important role in coaching less experienced staff by reinforcing safe working practices and correcting poor habits. Where recurring problems occur, retraining may be required, tailored to address specific performance gaps. Employers may also use logbooks to track and document the types of work that the worker has been carrying out and the proficiency level achieved.

Long-standing workers should also receive regular competency checks and refresher training, see Section 9.4.5

([275]) Directive 2009/148/EC, Article 14.
([276]) Directive 2009/148/EC, Annex Ia(5)(b).

### Box 9-2: Minimum requirements for training

**Annex Ia of Directive 2009/148/EC (AWD):**

Workers who are, or who are likely to be, exposed to dust from asbestos or materials containing asbestos shall receive mandatory training, encompassing at least the following minimum requirements:

(1) The training shall be provided at the start of an employment relationship and whenever additional training needs are identified.

(2) The length of the training shall be adequate in relation to the tasks of the workers concerned.

(3) The training shall be provided by an instructor whose qualification is recognised in accordance with national law and practice.

(4) Every worker who has attended training in a satisfactory manner shall receive a training certificate indicating all of the following:

(a) the date of the training;

(b) the duration of the training;

(c) the content of the training;

(d) the language of the training;

(e) the name, qualification, and contact details of the instructor, or the institution providing the training, or both.

(5) Workers who are, or are likely to be, exposed to dust from asbestos or materials containing asbestos shall receive theoretical and practical training concerning at least the following:

(a) the applicable law of the Member State in which the work is carried out;

(b) the properties of asbestos and its effects on health, including the synergistic effect of smoking;

(c) the types of product or material likely to contain asbestos;

(d) the operations that could result in exposure to asbestos and the importance of preventive controls to minimise such exposure;

(e) safe working practices, controls and protective equipment;

(f) the appropriate role, choice, selection, limitations and proper use of protective equipment, with particular regard to respiratory equipment;

(g) emergency procedures;

(h) decontamination procedures;

(i) waste disposal;

(j) medical surveillance requirements.

The training shall be adapted as closely as possible to the characteristics of the profession of the workers and the specific tasks and working methods of that profession.

(6) Workers who engage in demolition or asbestos removal work shall be required to receive training in addition to the training provided for pursuant to point (5) regarding the use of technological equipment and machines to contain the release and spread of asbestos fibres during work processes, in accordance with this Directive.

## 9.2 Who is responsible for delivering training?

The employer is responsible for ensuring that workers who are, or are likely to be, exposed to dust from asbestos or MCAs are adequately trained (277). The training must be adequate to safeguard the workers' health and safety in the context of their specific duties, and workers must follow the training and instructions given by their employer (278).

Workers need to be told to attend the training available (see Section 9.4.4) and should complete it; records should be kept, see Section 9.6. Workers' representatives with a specific role in protecting the safety and health of workers should be informed of the training provided and must be entitled to appropriate training (279).

The employer may assign training responsibility to qualified internal personnel, in accordance with national law and practice, or may hire external providers. In either case, the training must be delivered by an instructor whose qualifications are recognised under national law and practice (280), and who should have the following competencies:

- knowledge, skills and experience to assess the training needs for all relevant roles and develop the training programme;
- an understanding of asbestos, work environments, typical tasks, how and when exposure can happen, and relevant health and safety regulations;
- an appropriate authority and seniority level.

Where applicable, external training courses offered by professional bodies should be accredited by the relevant authority.

Workers and/or their representatives must be consulted and allowed to take part in discussions on the planning and organisation of training (281).

## 9.3 Scope

### 9.3.1 Scope of the training

The aim of asbestos training is to ensure workers acquire the knowledge and skills necessary to prevent and manage risks associated with (potential) asbestos exposure, in accordance with the national law and practice applicable where the work takes place (282).

The training must address all aspects set out in Annex Ia to Directive 2009/148/EC (see Box 9-2), including, where relevant:

- the risks associated with asbestos exposure;
- safe work practices for handling and removal or sealing of MCAs;
- OSH aspects of handling potential waste containing asbestos (WCA);
- response procedures for incidents such as uncontrolled release of asbestos dust into the workplace.

Training must be updated to reflect new or changed risks, including the introduction of new work equipment technologies or a change in equipment. Appropriate training must be provided whenever such changes occur (283).

Workers must receive appropriate training at the start of their employment (284), particularly those whose roles are listed in Section 1.3. Workers involved in

(277) Directive 2009/148/EC, Articles 12(1) and 14(1).
(278) Directive 89/391/EEC, Article 13(1).
(279) Directive 89/391/EEC, Article 12(3).
(280) Directive 2009/148/EC, Annex Ia(3).
(281) Directive 89/391/EEC, Article 11.
(282) Directive 2009/148/EC, Article 14(2).
(283) Directive 89/391/EEC, Article 12(1).
(284) Directive 2009/148/EC, Annex Ia(1) and Directive 89/391/EEC, Article 12(1).

asbestos-related work should undergo a competency assessment after initial training and at regular intervals thereafter, such as annually.

Asbestos training must be provided at no cost to the workers or their representatives ([285]). It must be delivered during working hours. Training for workers' representatives must also take place during working hours or in accordance with national practice, either within or outside the undertaking and/or establishment ([286]).

### 9.3.2 Which workers need training (roles)

All workers who are, or are likely to be, exposed to dust from asbestos or MCAs must receive appropriate training ([287]), as determined by the risk assessment, see Section 4.1. The training must be specific to the worker's role, tasks and workstation ([288]).

Employers must ensure that workers from outside undertakings and/or establishments engaged in work in the employer's undertaking and/or establishment have in fact received appropriate instructions regarding health and safety risks during their activities in the employer's undertaking and/or establishment ([289]). Particular attention should be paid to the roles outlined in Section 1.3.1.

### 9.3.3 What is required?

The training needs of workers should be assessed by role and should typically consider:

- workers' roles and tasks;
- level of risks identified in the risk assessment, see Section 4.1;
- activities carried out in the workplace;
- existing training provided and any evaluation of it;
- the workers' prior experience, educational level and language skills;
- the most effective delivery methods (which may vary depending on factors such as the organisation size, geographical spread, workforce characteristics or type of worker).

Based on the identified training needs, a structured training programme should be developed, covering all relevant roles, activities and workplaces or workstations where asbestos exposure may occur. The training content will differ according to the type of work, for example the training required for asbestos removal workers differs significantly from that needed by electricians.

Workers should be encouraged to view training as an ongoing process, and attend in-house or external courses, workshops, seminars and conferences according to their evolving needs.

([285]) Directive 2009/148/EC, Article 14(1) and Directive 89/391/EEC, Article 12(4).
([286]) Directive 89/391/EEC, Article 12(4).
([287]) Directive 89/391/EEC, Article 14(1).
([288]) Directive 89/391/EEC, Article 12(1).
([289]) Directive 89/391/EEC, Article 12(2).

# 9.4 Methods

## 9.4.1 How is it achieved?

Training should be delivered through a structured programme comprising core and role-specific modules, enabling workers with different roles and exposure risk to receive appropriate instruction, including practical training.

A compulsory core module should be completed by all workers who are, or are likely to be, exposed to dust from asbestos or MCAs. Additional training tailored to the worker's role, tasks and workstation should be added as required.

Training must be easily understood and delivered in a format, language and manner accessible to all workers ([290]). Written materials should be provided. Where workers may have limited proficiency in the language of the training or low literacy levels, training should be adapted accordingly to ensure comprehension.

The length of the training must be adequate in relation to the tasks of the workers concerned ([291]). It should reflect the difficulty of the subject matter, the needs of the worker and the ability of the worker to understand and concentrate.

## 9.4.2 Core training

Core theoretical and practical training, see Box 9-2, must include instruction on ([292]):

- applicable law of the Member State in which the work is carried out;
- the properties of asbestos and its effects on health, including latency periods and the synergistic effect of smoking, see Section 1.1.2;
- types of products or material likely to contain asbestos, see Section 5.2.1;
- operations that could result in exposure to asbestos and the importance of preventive controls to minimise such exposure, see Section 8;
- safe working practices, controls and protective equipment, see Section 3 and Section 8;
- the appropriate role, choice, selection, limitations and proper use of protective equipment regarding respiratory protective devices (RPDs), see Section 8;
- incident procedures, see Section 11;
- decontamination procedures, see Section 8.2.2.2;
- waste disposal, see Section 12;
- health (medical) surveillance requirements, see Section 10.

For workers engaged in demolition or asbestos removal, the core training must also cover the use of technological equipment and machines to contain the release and spread of asbestos fibres during work processes ([293]).

Additional core training may be required depending on the exposure scenario, including:

- buildings, see Section 13.8;
- ships, trains, aircraft, vehicles and machinery, see Section 14.8;
- mining and quarrying, see Section 15.7;
- civil engineering, see Section 16.8;
- emergency services, see Section 17.7.

([290]) Directive 2009/148/EC, Article 14(2).
([291]) Directive 2009/148/EC, Annex Ia(2).
([292]) Directive 2009/148/EC, Annex Ia(5).
([293]) Directive 2009/148/EC, Annex Ia(6).

### 9.4.3 Additional training

Additional asbestos training should be tailored to the worker's role, activities and workplace. Training needs will vary by qualification and job responsibility. For example, a site operator (such as a roofer or electrician) is not expected to demonstrate the same competencies as an asbestos removal specialist, asbestos surveyor or technical supervisor. The latter would be expected to undertake tasks such as risk assessment, manage large-scale asbestos removal projects, inspect buildings for asbestos, interpret air monitoring test reports or prepare documents related to licences and permits.

Some roles, such as an OSH specialist, should demonstrate relevant previous education and training upon which to develop their role.

The specific requirements for additional training should be based on the risk assessment (see Section 4.1), the recommended reading for the role (see Table 1-5) and the following possible in-depth elements, which go beyond what is required for the core training, as applicable:

- understanding requirements and procedures for notifications or licences required for the task by Member State legislation, see Section 4.3;
- identification of asbestos, see Section 5:
  - potential MCAs and the history of imported MCAs, see Section 5.2.1,
  - MCA friability, previous treatments and the conditions under which fibre release may occur, see Section 5.2.1;
- air monitoring, including understanding the results, see Section 6;
- risk assessment process and asbestos management plan (AMP), see Section 4.1 and Section 4.5 respectively;
- understanding the task-specific risk assessment and plan of work, see Section 4.1 and Section 4.2 respectively;
- rights of workers for an individual risk assessment when the worker's exposure risk is not covered by broader exposure groups, see Section 4;
- role-specific responsibilities in managing asbestos;
- hazard identification in the workplace;
- selection, correct use, limitations, proper use (such as putting on and taking off, and face fit test), maintenance, storage and disposal (see Section 8) of:
  - RPDs, including fitting and testing,
  - other dust/fibre controls such as suppression, vacuums, enclosures and negative pressure equipment,
  - PPE, including cleaning and decontamination;
- hygiene requirements and facilities:
  - correct use and maintenance of work equipment, including recording, reporting and correcting defects in equipment,
  - improving irregular or unsafe work methods;
- risks of secondary exposure for others (e.g. co-workers, families and the general public) due to incorrect use of control measures when handling contaminated equipment and clothing, see Section 8.3;
- understanding the need for individual and anonymised health records;
- detailed procedures for controlling asbestos exposure during maintenance, renovation or demolition;
- awareness of other workplace risks (e.g. working at height, electric shocks, noise, vibration, slips, fire) alongside asbestos;
- site clean-up and clearance procedures before reoccupation, see Section 8.2.2.2;
- scenario-specific emergency procedures, including response to accidental MCAs disturbance (see Annex 4) and evacuation procedures;
- relevant legislation covering:
  - waste management,
  - inland transport of dangerous goods,
  - emergency services, see Section 11 and Section 17,
  - other relevant occupational health and safety legislation,
  - other relevant role-specific legislation.

If there is passive exposure (see Section 7), training for managers and health and safety representatives can be an effective means of protection. This training should include good practices to identify asbestos and the most effective control measures.

## 9.4.4 Format of training

Training can be delivered through a variety of methods, including:

- face-to-face training;
- e-learning;
- practical hands-on training outside the work environment;
- simulated work scenarios;
- on-the-job learning;
- one-to-one instruction;
- practical assessment of knowledge and skills.

The format should comply with national regulations and guidance. For example, in Ireland, basic asbestos safety awareness training is defined as a one-day course with a maximum of 12 participants per session ([294]).

## 9.4.5 How often?

Training must be provided at the following times for activities that may lead to asbestos exposure ([295]).

- New staff: at the start of employment before any asbestos exposure. This should apply to all roles at risk of being exposed to asbestos.
- Staff changing roles: immediately upon taking up a new role involving potential exposure.
- Before the introduction of new work equipment, technologies or changes in work processes are implemented.
- When training needs or competency gaps are identified.
- At regular intervals, as necessary.

Workers returning after a prolonged absence should be retrained immediately if their role involves risk of asbestos exposure.

Training frequency should comply with national legislation and be in line with the requirements of the risk assessment.

([294]) Health and Safety Authority (HSA) (2013), 'Asbestos containing materials (ACM) in workplaces – Practical guidelines for ACM management and abatement', https://www.hsa.ie/eng/publications_and_forms/publications/chemical_and_hazardous_substances/asbestos_guidelines2023.pdf.

([295]) Directive 2009/148/EC, Article 14 and Annex Ia(1); Directive 89/391/EEC, Article 12(1).

## 9.5 Evaluate and revise

The quality of the training programme should be regularly evaluated, considering the following:

- workers' feedback on the training and the trainers;
- trainers' feedback on the workers;
- whether the workers are competent at the end of training;
- whether the workers maintain competence over time (competence should be checked at least annually);
- whether the workers are applying the training in their work;
- workers' representatives' views on the training provided;
- whether training has reduced exposure levels, as verified by air monitoring (see Section 6), both before and after the training.

Worker assessments could include their ability to:

- define basic concepts and asbestos-specific terminology;
- complete theoretical tests or practical demonstrations, including incident response;
- demonstrate how they apply the acquired skills and knowledge in the workplace.

The evaluation should also consider reasons to revise the training, including:

- new or changed administration processes for asbestos;
- any other changes to working practices relating to asbestos exposure.

Training evaluation should take place annually and be revised as necessary based on the findings above.

## 9.6 Record-keeping

Each worker who satisfactorily completes asbestos training must receive a certificate indicating [296]:

- worker's name;
- date of the training;
- duration of the training;
- content of the training;
- language in which the training was delivered;
- name, qualifications and contact details of the instructor and/or the institution providing the training.

Employers should keep records both for each training course and for each worker who completes training. These records should include the information held on the training certificate, as well as the following:

- trainer's signature confirming they provided the training course;
- names of all attendees of the course;
- signatures of attendees confirming completion of the course;
- feedback from workers on the training course;
- training course evaluations;
- assessment and certificate of competencies.

Employers should retain training course records, and each worker's training records should be kept in their personnel file until retirement. Workers should be provided with copies of their certificates and training records.

Record-keeping needs to comply with national legislation or guidance, which varies between Member States.

[296] Directive 2009/148/EC, Annex Ia(4).

# 10 Health surveillance

## 10.1 Introduction

### 10.1.1 Scope and objectives

**Box 10-1: Health surveillance**

**Article 18(2) to (4) of Directive 2009/148/EC (AWD):**

2. An assessment of each worker's state of health must be available prior to the beginning of exposure to dust arising from asbestos or materials containing asbestos at the place of work.

[...]

A new assessment must be available at least once every three years for as long as exposure continues.

[...]

3. Following the clinical surveillance referred to in the second subparagraph of paragraph 2, the doctor or authority responsible for the medical surveillance of the workers shall, in accordance with national laws, advise on any individual protective or preventive measures to be taken or determine such measures.

Those measures may include, where appropriate, the withdrawal of the worker concerned from all exposure to asbestos.

4. ... the doctor or authority responsible for the medical surveillance of workers may indicate that medical surveillance must continue after the end of exposure for as long as they consider it necessary to safeguard the health of the person concerned.

[...]

A health assessment must be carried out for all workers exposed to dust arising from asbestos or materials containing asbestos (MCAs) (see Annex 4) at the workplace, both before and at intervals thereafter for as long as exposure continues ([297]). Where a doctor or authority responsible for health surveillance considers it necessary, health surveillance must continue after exposure ends, in accordance with national legislation and/or practice ([298]).

Health surveillance before, during and after exposure to asbestos is essential for assessing the potential health effects of asbestos exposure. It also serves to verify the effectiveness of control measures. The objectives of health surveillance include:

- identifying vulnerable workers, including those for whom exposure restrictions may be necessary;

([297]) Directive 2009/148/EC, Article 18.
([298]) Directive 2009/148/EC, Article 18.

- detecting ill-health effects in workers at an early stage, which may improve chances for effective treatment and/or prevent worsening of ill-health;
- providing data to support employers in evaluating health risks;
- offering workers an opportunity to raise health concerns or ask questions;
- highlighting possible deficiencies in workplace control measures and providing feedback on the asbestos risk assessment and risk management;
- reinforcing worker training and awareness (e.g. on the use of protective equipment and on health risks);
- collecting information related to past professional or domestic exposure to asbestos.

Health surveillance must be appropriate to the health and safety risks workers face ([299]). This means it may need to consider not only asbestos fibres, but also other risks identified and assessed in the risk assessment.

Given that Member States are responsible for establishing the arrangements for carrying out health surveillance, employers must ensure they are familiar with applicable national legislation and/or guidance to establish the extent of their responsibilities for health surveillance. Health surveillance must always comply with other EU and national legislation and/ or practices, including on the protection of personal data ([300]).

Employers also need to consider protective or preventative recommendations made by a doctor or health surveillance authority.

It is the responsibility of the worker to follow the prescribed working procedures and use of control measures correctly, including appropriate use of PPE, such as respiratory protective devices (RPDs) ([301]).

## 10.1.2 Asbestos-related occupational diseases

**Box 10-2: An indicative list of diseases that can be caused by exposure to asbestos**

**Annex I(1) of Directive 2009/148/EC (AWD):**

1. Current knowledge indicates that exposure to free asbestos fibres can give rise to at least the following diseases:

- asbestosis,
- mesothelioma,
- lung carcinoma,
- gastro-intestinal carcinoma,
- carcinoma of the larynx,
- carcinoma of the ovary,
- non-malignant pleural diseases.

Member States must maintain a register of all medically diagnosed cases of asbestos-related occupational diseases ([302]). They may also establish their own lists of recognised occupational diseases caused by asbestos exposure.

Recognition of asbestos-related occupational diseases falls within the competence of Member States.

([299]) Directive 89/391/EEC, Article 14(1).
([300]) Regulation (EU) 2016/679 (GDPR), Article 9.
([301]) Directive 89/391/EEC, Article 13.
([302]) Directive 2009/148/EC, Article 21.

Annex 13 provides a summary of diagnostic criteria based on EU-guidance and the Helsinki Criteria for the diagnosis.

The following subsections outline the minimum legal requirements and practical examples in health surveillance.

### 10.1.3 Who should conduct health surveillance?

Health surveillance is a multidisciplinary activity involving several professional roles.

The starting point is the asbestos risk assessment, which should be conducted by a trained occupational hygienist and/or health and safety expert. This assessment should identify all workers at risk of work-related health problems due to asbestos exposure.

Health surveillance should be conducted by an occupational medical doctor or a medical doctor trained in the health risks associated with asbestos. The doctor and/or authority responsible for the health surveillance must be familiar with the exposure conditions or circumstances of each worker ([303]).

Prior to asbestos exposure, the health assessment must include a specific chest examination ([304]), carried out by a trained medical professional.

After exposure, examination should be conducted by a trained general physician or pulmonary specialist, subject to national provisions.

### 10.1.4 Training

Medical and health professionals should receive training on the health effects of asbestos exposure as part of their professional curriculum. Public healthcare providers, such as general practitioners or pulmonologists, should be aware of the potential consequences of asbestos and trained to ask referred persons or patients about their previous occupations, medical records and past exposure to asbestos, even after the exposure has ended (post-exposure medical surveillance).

### 10.1.5 Coordination between health surveillance and asbestos risk assessment

Medical and health professionals should consider the outcomes of the asbestos risk assessment when performing health surveillance. The results of health surveillance should inform updates to the asbestos risk assessment and the adoption of asbestos risk management measures. This feedback loop is useful, as all workers who are or may be exposed to dust arising from asbestos or MCAs must undergo health surveillance ([305]).

Health surveillance is therefore an important tool to complement asbestos risk assessments. The occupational hygienist and/or health and safety expert should be informed about the results of the health surveillance, while maintaining confidentiality of personal information.

The asbestos risk assessment should identify all workers exposed or likely to be exposed to asbestos, including those performing tasks with higher associated exposure. It must determine the nature and degree of exposure to dust arising from asbestos or MCAs ([306]). These findings can be used to adapt health surveillance programmes to individual worker situations.

Health surveillance cannot be treated as a substitute for conducting an asbestos risk assessment or using effective control measures.

([303]) Directive 2009/148/EC, Annex I, point 2.
([304]) Directive 2009/148/EC, Article 18(2).
([305]) Directive 2009/148/EC, Articles 3 and 18.
([306]) Directive 2009/148/EC, Article 3.

## 10.2 Groups that should undergo asbestos health surveillance

Health surveillance must be carried out for all workers who are or may potentially be exposed to asbestos in the workplace ([307]).

The following groups of workers may be included in the health surveillance process.

- Direct exposure: refers to workers directly involved in activities that expose or may expose them to asbestos fibres. This includes, but is not limited to, tasks such as demolition, construction, insulation work and asbestos removal.
- Passive exposure (see Section 7): refers to workers who are not directly handling asbestos but work in the vicinity of asbestos-related activities or in premises where MCAs are present and degrading. Inclusion in health surveillance should be based on the outcome of the risk assessment (such as whether they are exposed).

## 10.3 Key elements for prevention and effective health surveillance

Good practices for asbestos-related health surveillance could include ([308]):

- asbestos risk assessment, see Section 4.1;
- medical health examinations:
  - pre-exposure examination,
  - examination during exposure,
  - post-exposure medical examination;
- risk communication and raising awareness (see Section 3.5):
  - informing workers about asbestos risks, symptoms to watch for and the importance of regular medical check-ups,
  - reinforcing the need to follow instructions and use control measures such as PPE ([309]);
- specific training sessions (see Section 9):
  - tailored resources to the characteristics of workers (e.g. multilingual materials);
- data management (see Section 10.5): maintaining detailed records of medical evaluations, exposure levels and follow-up schedules.

Health surveillance requires multidisciplinary collaboration involving medical professionals (occupational medical doctors, pulmonologists, radiologists), occupational hygienists, and health and safety experts. Implementation practices vary by Member State.

## 10.4 Health surveillance requirements

### 10.4.1 Medical health examinations

Performing medical health surveillance should include:

- general occupational health surveillance, both pre-exposure and during exposure, should be conducted by an occupational medical doctor

([307]) Directive 2009/148/EC, Articles 3 and 18.

([308]) BG BAU (2012), BGV A4, 'Accident prevention regulations', https://www.bgbau.de/fileadmin/Medien-Objekte/Medien/DGUV-Vorschriften/6__BGV_A4_/BGV_A4_Arbeitsmedizinische_Vorsorge.pdf; Medical Examinations Research & Services (Netherlands) (n.d.), 'Asbestos – Medical examination and research', https://medischekeuringen.net/medische-keuring/werken-met-gevaarlijke-stoffen/asbest/.

([309]) Directive 2009/148/EC, Article 18(3).

or a medical doctor trained in the health risks associated with the specific work activities;

- specific lung examinations should be conducted by a trained medical professional (e.g. radiologist and pulmonologist);
- post-exposure examinations depend on national requirements but, for good practice, they should be conducted by a trained general physician or pulmonologist.

#### 10.4.1.1 Pre-exposure examination

**Box 10-3: Minimum requirements for health surveillance**

**Annex I(3) of Directive 2009/148/EC (AWD):**

3. Health examination of workers should be carried out in accordance with the principles and practices of occupational medicine. It should include at least the following measures:

- keeping records of a worker's medical and occupational history,
- a personal interview,
- a general clinical examination, with particular reference to the chest,
- lung function tests (respiratory flow volumes and rates).

The doctor and/or authority responsible for health surveillance should decide on further examinations, such as sputum cytology tests or a chest X-ray or a tomodensitometry, in the light of the latest occupational health knowledge available.

Pre-exposure examinations are a job-specific health check to determine whether the worker's health condition is sufficient to safely perform asbestos-related tasks, whether special, personalised measures are needed, and to establish a baseline prior to exposure ([310]).

Pre-exposure examination must include, at a minimum, the measures set out in Box 10-3.

Pre-exposure examinations could include ([311]):

- medical history;
- assessment of fitness for the job and the risks of asbestos exposure;
- basic health examination (e.g. height, weight, blood pressure and pulse);
- physical examination by a medical doctor, with regard to the job demands, including the use of personal protection (e.g. RPDs with breathing resistance);
- baseline check before asbestos exposure:
  - lung function tests (respiratory flow volumes and rates: forced expiratory volume in one second (FEV1) and forced vital capacity (FVC));
- advanced imaging where indicated, using up to date radiologic guidelines ([312]), considering:
  - workers' demographics and lifestyle,
  - medical and occupational history (including previous occupational asbestos exposure);
- cardiac film/electrocardiogram if indicated and from 40 years of age;
- advice and recommendations (lifestyle / anti-smoking advice, see Section 1.1.2 on co-exposure of asbestos and tobacco smoke);
- establishing and maintaining records of the worker's previous medical and occupational history.

([310]) Directive 2009/148/EC, Article 18(3).

([311]) NVAB (n.d.), 'Aanstellingskeuringen', https://nvab-online.nl/kennisbank/aanstellingskeuringen/; Medical Examinations Research & Services (Netherlands) (n.d.), 'Asbestos - Medical examination and research ', https://medischekeuringen.net/medische-keuring/werken-met-gevaarlijke-stoffen/asbest/.

([312]) Wolff, H., Vehmas, T., Oksa, P., Rantanen, J. and Vainio, H. (2015), 'Asbestos, asbestosis, and cancer, the Helsinki criteria for diagnosis and attribution 2014: Recommendations', *Scandinavian Journal of Work, Environment & Health*, consensus report, https://doi.org/10.5271/sjweh.3462.

#### 10.4.1.2 During exposure examination

Health surveillance during exposure is a periodic assessment of the worker's health to identify any changes that may be caused by, or have an effect on, asbestos-related work. The frequency and content of these examinations may vary by Member State. However, the minimum requirements in Directive 2009/148/EC must be followed: during-exposure examinations must include at least the measures in Box 11-3 ([313]) and must be carried out at least once every three years for as long as exposure continues ([314]).

More generally, a periodic examination during exposure should include ([315]):

- updated exposure evaluation;
- basic health examination;
- physical examination by a doctor, with respect to the job demands, including work using compressed breathing air;
- evaluation of the worker's well-being in the workplace – for example, access to hydration, use of fan-powered or compressed-airline respirator, need to modify working hours for RPD users;
- updated medical history, focusing on respiratory symptoms such as chronic cough or shortness of breath;
- lung function tests (respiratory flow volumes and rates: FEV1 and FVC);
- cardiac film/electrocardiogram if indicated and from 40 years of age;
- advanced imaging if indicated, for early detection of asbestos-related conditions such as mesothelioma;
- screening for ovarian, laryngeal and gastrointestinal cancers;
- advice on individual protective and preventive measures to be taken – if appropriate, a worker may be advised to withdraw from all asbestos exposure ([316]).

An individual record for each worker must be maintained ([317]).

#### 10.4.1.3 Post-exposure examination

**Box 10-4: Health surveillance after the end of exposure**

**Article 18(4) Directive 2009/148/EC (AWD):**

4. Information and advice must be given to workers regarding any assessment of their health which they may undergo following the end of exposure.

The doctor or authority responsible for the medical surveillance of workers may indicate that medical surveillance must continue after the end of exposure for as long as they consider it necessary to safeguard the health of the person concerned.

Such continuing surveillance shall be carried out in accordance with national laws and/or practice.

End-of-exposure medical examination: a final medical examination should be carried out with emphasis on the respiratory system. Workers with ongoing symptoms of conditions possibly related to asbestos exposure should be advised to seek further diagnostics from a medical specialist (e.g. a pulmonologist).

Post-exposure medical examination: when indicated by the doctor or authority responsible for the medical surveillance of workers, post-exposure monitoring

([313]) Directive 2009/148/EC, Annex I.

([314]) Directive 2009/148/EC, Article 18(2).

([315]) NVAB (n.d.), 'Aanstellingskeuringen', https://nvab-online.nl/kennisbank/aanstellingskeuringen/; Medical Examinations Research & Services (Netherlands) (n.d.), 'Asbestos - Medical examination and research ', https://medischekeuringen.net/medische-keuring/werken-met-gevaarlijke-stoffen/asbest/.

([316]) Directive 2009/148/EC, Article 18(3).

([317]) Directive 2009/148/EC, Article 18(2); Directive 2009/148/EC, Article 19.

should be continued, recognising the long latency of asbestos-related diseases such as mesothelioma and asbestosis.

Content of post-exposure medical examination.

- Monitoring should focus on early detection of diseases, particularly respiratory conditions, even decades after exposure. For relevant diagnostic tests, see Section 10.4.1.2.
- The register with the information on the workers engaged in activities in which they are or may be exposed in the course of their work to dust arising from asbestos or MCAs and the individual medical records must be retained for at least 40 years following the end of exposure, in accordance with national laws and/or practice ([318]), and be made available to the responsible authority in cases where the undertaking ceases trading, in accordance with national laws and/or practice ([319]). Workers should receive information on how and where to access these documents, see Section 10.5.
- Medical professionals involved in the post-employment medical examinations should also have access to, and be familiar with, previous health surveillance reports.

While existing sources suggest that follow-up for highly exposed workers should be continued for up to 30 years after the cessation of exposure ([320]), lifelong follow-up can be indicated by doctors or authorities responsible for medical surveillance to safeguard the health of the person, see Box 10-4.

**Box 10-5: Example of health monitoring programme after passive exposure: the Tripode building, France**

For background on the Tripode building, see Box 7-2.

Over 1 795 workers were passively exposed to asbestos in the Tripode building. Epidemiological studies revealed serious health consequences, with a mortality rate far exceeding official risk estimates. Tripode workers faced a reduction in average lifespan compared to unexposed peers, and 31 confirmed asbestos-related cancer deaths were recorded by 2022. Chronic respiratory conditions, including pleural abnormalities, were also significantly more prevalent.

A dedicated health monitoring programme was established for all individuals who had worked in the Tripode. This included:

- regular medical follow-up, including chest X-rays and respiratory function tests every five years;
- continued monitoring even after staff left the building or changed jobs, ensuring long-term surveillance;
- later, with support from the French Health Authority, access to advanced diagnostic tools such as CT scans was secured, improving early detection of asbestos-related diseases.

The programme also included legal advocacy for the recognition of occupational diseases and compensation for affected individuals. By 2009, automatic liability was established for recognised asbestos-related diseases.

The Tripode case highlights the importance of comprehensive, long-term health surveillance for all exposed individuals.

*Source:* Koksal, M. (2023), 'Asbestos in the Tripode, a warning for Europe', *HesaMag*, Issue 27, pp. 41–43, https://www.etui.org/sites/default/files/2023-06/HM27_Asbestos%20in%20the%20Tripode%2C%20a%20warning%20for%20Europe_2023.pdf.

Annex 14 provides an overview of post asbestos exposure programmes in six Member States. Box 10-6 presents the Amiantus programme in Poland, while Box 10-7 outlines the Tuscany programme in Italy.

([318]) Directive 2009/148/EC, Article 19(3).

([319]) Directive 2009/148/EC, Article 19(4).

([320]) Wolff, H., Vehmas, T., Oksa, P., Rantanen, J. and Vainio H. (2015), 'Asbestos, asbestosis, and cancer, the Helsinki criteria for diagnosis and attribution 2014: Recommendations', *Scandinavian Journal of Work, Environment & Health*, consensus report, https://doi.org/10.5271/sjweh.3462.

### Box 10-6: Example of asbestos health surveillance: the Amiantus programme in Poland

The Amiantus programme, launched in Poland in 2000, is a public health initiative addressing the long-term health consequences of occupational asbestos exposure. Established under the 1997 act banning asbestos-containing products, the programme provides lifelong medical surveillance for former workers of 28 asbestos-processing plants, prioritising early detection and management of asbestos-related diseases. This systematic monitoring forms a critical component of Poland's occupational medicine framework, combining clinical care with epidemiological research to mitigate the delayed effects of asbestos exposure.

**Objectives and implementation**

The programme's primary objective is to fulfil the legal rights of former asbestos workers to periodic health evaluations, mandated by legislation to counteract the persistent risks posed by asbestos's long latency period (averaging 40 years). Coordinated by the Nofer Institute of Occupational Medicine, the Amiantus programme operates through 13 regional occupational medicine centres, ensuring standardised diagnostic protocols aligned with the 1997 Helsinki Criteria. Periodic examinations include chest X-rays (using International Labour Organization (ILO) classification standards), spirometry, clinical evaluations and supplementary tests like CT scans when necessary. These measures aim to detect pathologies such as pleural plaques, parenchymal opacities and malignancies linked to asbestos exposure. Patients receive free medication related to asbestos-related diseases and are entitled to one free annual treatment in a sanatorium.

**Health surveillance**

The Amiantus programme is implemented in phases and offers various follow-up options based on medical results.

Phase 1 – Initial screening:

- occupational history
- medical exam
- chest X-ray (regular intervals, ILO standard)
- computed tomography
- spirometry
- blood gas test
- abdominal ultrasound, abdominal computed tomography (from January 2026).

Phase 2 – Advanced diagnostics:

- the scope of diagnostic imaging is determined by the examining doctor, considering the patient's health condition, the level of exposure to asbestos dust, the latency period and tobacco consumption;
- otolaryngology and pulmonology consultation when medically indicated;
- the examining physician may request additional tests or specialist consultations if deemed necessary.

Check-up frequency:

- fixed periodic examinations for all registered individuals (e.g. every two to three years);
- the frequency is determined by the physician, based on health condition, job position, level of exposure to asbestos dust, length of service and latency period.

Risk stratification:

- based on exposure history, individual risk and current health status.

## Box 10-6: Example of asbestos health surveillance: the Amiantus programme in Poland

**Education and training**

Regular training, medical conferences, consultations for doctors performing periodic medical examinations, epidemiological analyses and scientific publications help to strengthen medical knowledge and surveillance quality.

**Key findings and health outcomes**

From 2000 to 2019, the programme screened 8 329 individuals, identifying asbestos-related diseases in 25 % of participants. Asbestosis accounted for 90.5 % of diagnoses, followed by lung cancer (5.8 %) and pleural mesothelioma (3.7 %). Radiological abnormalities were prevalent, with pleural changes in 40 % of participants and pulmonary shadows in 65 %. The incidence of diagnosed pathologies rose from 8 % in 2000 to 25 % by 2019, reflecting both disease progression and enhanced detection capabilities. Workers from asbestos-cement plants showed the highest disease burden, correlating with longer exposure durations and advanced age.

**Epidemiological and systemic impact**

Beyond individual health monitoring, the Amiantus programme has generated robust epidemiological data, informing national policies and international research on asbestos-related morbidity. The Reference Centre for Asbestos Exposure and Health Risk Assessment oversaw centralised data collection and trend monitoring between 1970 and 2015, during which 4 983 asbestos-related occupational cases were reported in Poland, with over 60 % identified post-2000 due to improved surveillance. The programme also elevated diagnostic accuracy, reducing underreporting by training physicians to recognise asbestos-specific pathologies and adhere to standardised criteria.

**Challenges and legacy**

While the programme successfully targets former asbestos-processing workers, it excludes other high-risk groups, such as construction and shipyard workers, due to incomplete exposure records. Nevertheless, its integration into Poland's National Asbestos Abatement Programme (2009–2032) reflects a comprehensive approach to managing residual asbestos risks. The Amiantus model highlights the necessity of long-term surveillance in occupational health, particularly for carcinogens with extended latency. It has raised public awareness, supported early retirement schemes for affected workers and provided a template for asbestos management in other post-industrial nations.

In conclusion, the Amiantus programme shows that structured health surveillance can address the long-term consequences of industrial hazards. By combining legislative mandates, clinical precision and data-driven policymaking, Poland has set a precedent for addressing occupational diseases in populations with historic toxic exposures.

*Source:* Świątkowska B. (2020), 'The Amiantus Programme in Poland – 20 years of implementation', *Medycyna Pracy*, Vol. 71, Issue 5, pp. 595–601, https://pubmed.ncbi.nlm.nih.gov/32667289/.

### Box 10-7: Example of asbestos health surveillance: the Tuscany programme in Italy

The Tuscany programme for post-asbestos exposure health surveillance was initiated due to the recognised long latency period of asbestos-related diseases. This justified the need for ongoing health monitoring of former asbestos-exposed workers, even after their occupational exposure had ceased.

While Italian law (Decree No 81/2008) ([a]) mandated health surveillance for such individuals, it did not define the responsible parties, timeframe or clinical protocols. This resulted in inconsistent and uncoordinated initiatives across the region. To address these shortcomings, the Tuscan region hired a group of experts to develop a standardised, regional programme. The aim was to ensure equitable, high-quality health surveillance for all eligible former asbestos workers, replacing previously uncoordinated efforts of local health authorities and university hospitals. The programme is offered free of charge to residents under 80 years of age whose occupational asbestos exposure ceased within the previous 30 years.

The programme was launched by Deliberation of the Regional Administration of Tuscany No 396/2016 ([b]), and clinical activities began on 3 April 2017. It is supported by dedicated regional funding and in collaboration with public health services, social partners, unions and asbestos worker associations, to maximise participation and coverage.

**Objectives and implementation**

The Tuscany programme aims to monitor and protect the health of former asbestos-exposed individuals by facilitating early detection of asbestos-related diseases, preventing disease progression and improving long-term health outcomes. The programme is coordinated through a regional network of healthcare providers, occupational health services and public health authorities, ensuring systematic follow-up of at-risk populations.

**Health surveillance**

The Tuscany programme has two phases, with follow-up depending on clinical findings.

Phase 1 – Initial screening:

- occupational history
- physical examination
- chest X-ray (ILO standard)
- spirometry
- counselling for smoking cessation.

Phase 2 – Advanced diagnostics:

- conducted only for high-risk or abnormal Phase 1 cases;
- high-resolution CT scan (ICOERD);
- additional lung function tests, as needed;
- in some cases, experimental blood biomarkers like soluble mesothelin-related peptides and osteopontin.

Check-up frequency:

- phase 1 follow-up: every three to five years;
- phase 2 follow-up: annually.

Risk stratification:

- based on available exposure data (job-exposure matrix), for example in occupational cohorts.

### Box 10-7: Example of asbestos health surveillance: the Tuscany programme in Italy

Assessments focus on early identification of asbestosis, pleural plaques and malignant conditions like mesothelioma and lung cancer. Surveillance protocols are tailored to individual risk profiles based on exposure history, latency periods and clinical findings.

**Education and training**

The programme emphasises education and training for healthcare professionals, including pulmonologists, radiologists and occupational health specialists. Training sessions cover asbestos-related disease recognition, diagnostic techniques and patient management. Awareness campaigns also target exposed individuals to promote understanding of symptoms, health risks and the importance of regular medical follow-up.

**Key findings and health outcomes**

The Tuscany programme has enabled early identification of asbestos-related diseases in former workers. In the cohort followed by the University Hospital of Pisa, 20.2 % of subjects were diagnosed with benign asbestos-related lung diseases, such as pleural plaques and asbestosis, and 1.93 % with asbestos-related neoplastic diseases (malignancies).

Additionally, 36 % of participants presented with benign lung diseases not related to asbestos exposure, highlighting the importance of differential diagnosis.

**Epidemiological and systemic impact**

The surveillance programme in Tuscany monitors a substantial cohort of former asbestos workers, with an average age of 66 and an average exposure duration of nearly 18 years. Data are integrated into a central health registry integrated with public health systems, generating robust epidemiological insights. The programme has improved awareness of long-term asbestos health risks and informed regional and national public health policy. Systemically, it has strengthened occupational health infrastructure and fostered multidisciplinary collaboration. It serves as a model for similar initiatives across Italy and Europe.

**Challenges and legacy**

Challenges include ensuring long-term adherence to surveillance protocols, managing resource constraints and addressing psychological impacts on affected individuals. Nevertheless, the programme's legacy lies in its comprehensive, long-term approach to post-exposure health monitoring, raising awareness and shaping preventive occupational health strategies.

The Tuscany programme represents a proactive and integrated approach to safeguarding the health of asbestos-exposed populations. Through systematic monitoring, education and research, it improves early detection and patient outcomes and contributes to public health knowledge and policy development.

*Sources:* Italy, Bollettino Ufficiale della Regione Toscana (2024), Regional Government Decision No 193 of 26 February 2024, Approval of the new operational protocol for the health surveillance of workers exposed to asbestos, pursuant to Legislative Decree 81/2008, Article 259(4), and repeal of Regional Government Decision No 396/2016, https://olympus.uniurb.it/index.php?option=com_content&view=article&id=32683:tos193_24&catid=27&Itemid=137.

([a]) Italy, Gazzetta Ufficiale (2008), Legislative Decree No 81/2008, Implementation of Article 1 of Law No 123 of 3 August 2007, in on the protection of health and safety in the workplace work, https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2008-04-09;81!vig=2025-07-28.

([b]) Italy, Bollettino Ufficiale della Regione Toscana (2016), Regional Government Decision No 396 of 21 March 2016, Approval of the regional protocol for health surveillance of workers exposed to asbestos, https://olympus.uniurb.it/index.php?option=com_content&view=article&id=17385:tosc396_16&catid=27&Itemid=137.

#### 10.4.1.4 Use of biomarkers

Biomarkers can be used when there is a high likelihood of asbestos-related diseases. Biomarkers of asbestos exposure can help identify past exposure, assess risk and monitor disease progression. These include direct detection of asbestos fibres in the lungs, immune and inflammatory markers, oxidative stress indicators and genetic/molecular changes. However, the use of biomarkers in health surveillance after asbestos exposure is mostly still in a developmental stage, but is expected to become more common in the near future.

Furthermore, the use of biomarkers for disease monitoring related to asbestos exposure interpreted in combination with other clinical and diagnostic information is already more common in healthcare practice. This kind of medical surveillance is outside the scope of this guidance document and should follow current evidence-based medical guidelines in the Member States.

The following tests for health surveillance can be considered.

- Direct detection of asbestos in lung tissue ([321]):
  - asbestos bodies and fibres in bronchoalveolar lavage fluid (BALF),
  - amphibole and chrysotile fibre concentrations in BALF, which correlate strongly with occupational exposure, even decades after exposure ends,
  - asbestos bodies (iron-coated fibres), which are specific indicators of past exposure, particularly in railway and shipbuilding workers,
  - multi-marker approaches, such as combining BALF fibre analysis with serum cytokines (IL-6/IL-8) and oxidative stress markers, can improve diagnostic accuracy and are recommended for screening and monitoring purposes;
- Immune and inflammatory biomarkers:
  - interleukins (IL-6, IL-8): elevated serum levels in exposed workers, reflecting inflammatory response ([322]),
  - fibronectin: increased in BALF of exposed individuals with restricted lung function,
  - regulatory T cells (Tregs): elevated populations in exposed workers, suppressing antitumor immunity ([323]),
  - oxidative stress indicators 8-iso-prostaglandin F2α (8-iso-PGF2α): elevated in exhaled breath condensate of asbestos-exposed individuals, demonstrating persistent oxidative stress ([324]);
- Genetic and molecular biomarkers:
  - microRNAs (miRNAs): circulating miRNAs (such as miR-197-3p) show dysregulation in ex-exposed workers, offering non-invasive screening potential ([325]),
  - DNA damage markers: distinct patterns in lipid peroxidation and antioxidant pathways differentiate exposed populations ([326]); oxidative DNA lesions (such as 8-hydroxydeoxyguanosine) correlate with asbestos-induced free radical production,
  - an association exists between ovarian cancer and BRCA gene mutations – both BCRA mutations and asbestos exposure are independent risk factors, but some evidence suggests potential overlapping effects, such as shared defects in DNA repair pathways and amplified risks – women with BCRA mutations and known asbestos exposure should undergo regular pelvic examinations and imaging ([327]).

([321]) Paolucci, V., Romeo, R., Sisinni, A. G., Scancarello, G., Volterrani, L. et al. (2018), 'Asbestos exposure biomarkers in the follow-up of asbestos-exposed workers', *Industrial Health*, Vol. 56, Issue 3, pp. 249–254, https://pmc.ncbi.nlm.nih.gov/articles/PMC5985464/.

([322]) Mesaros C., Worth, A. J., Snyder, N. W., Christofidou-Solomudou, M., Vachani, A. et al. (2015), 'Bioanalytical techniques for detecting biomarkers of response to human asbestos exposure', *Bioanalysis*, Vol. 7, Issue 9, pp. 1157–1173, https://pmc.ncbi.nlm.nih.gov/articles/PMC4487641/.

([323]) Maeda, M., Matsuzaki, H., Yamamoto, S., Lee, S., Kumagai-Takei, N. et al. (2018), 'Aberrant expression of FoxP3 in a human T cell line possessing regulatory T celllike function and exposed continuously to asbestos fibers', *Spandidos Publications*, Oncology reports, https://www.spandidos-publications.com/10.3892/or.2018.6481.

([324]) Foddis, R., Bonotti, A., Landi, S., Fallahi, P., Guglielmi, G. et al. (2018), 'Biomarkers in the prevention and follow-up of workers exposed to asbestos', *Journal of Thoracic Disease*, Vol. 10, Issue 2, S360–S368, https://jtd.amegroups.org/article/view/17859/html.

([325]) Mukhopadhyay, D., Cocco, P., Orrù, S., Cherchi, R. and De Matteis S. (2025), 'The role of MicroRNAs as early biomarkers of asbestos-related lung cancer: A systematic review and meta-analysis', *Pulmonology*, Vol. 31, Issue 1, https://pubmed.ncbi.nlm.nih.gov/38402124/.

([326]) Mesaros, C., Weng, L. and Blair, I. (2017), 'Biomarkers of response to asbestos exposure', in: Testa, J. (ed), *Asbestos and Mesothelioma*, Springer, pp. 259–277, https://www.researchgate.net/publication/315913281_Biomarkers_of_Response_to_Asbestos_Exposure.

([327]) Luo, Y., Akatsuka, S., Motooka, Y., Kong, Y., Zheng, H. et al. (2022), 'BRCA1 haploinsufficiency impairs iron metabolism to promote chrysotile-induced mesothelioma via ferroptosis resistance', *Cancer Science*, Vol. 114, Issue 4, pp. 1423–1436, https://doi.org/10.1111/cas.15705.

### 10.4.2 Health surveillance requirements per group

Health surveillance for all groups must comply with the minimum requirements of Directive 2009/148/EC, see Box 10-2, Box 10-4 and Box 10-7. However, some variation between the groups may be warranted to reflect the differences in nature and degree of the workers' exposure to dust arising from asbestos or MCAs.

Workers with direct exposure should undergo health surveillance as follows:

- pre-exposure medical examination before the worker is exposed to asbestos;
- periodic medical examinations at least once every three years during exposure or more frequently depending on exposure levels and the findings of the asbestos risk assessment, in line with national legislation;
- post-exposure surveillance, which may be lifelong depending on individual health risks, symptoms and clinical findings.

Workers retrospectively identified as passively exposed must undergo a post-exposure medical check with regular periodic checks tailored to the level and duration of exposure, see Box 10-2, Box 10-3 and Box 10-4. The content and frequency of these checks may be reduced for low-risk exposures, provided that they remain compliant with Directive 2009/148/EC and the applicable national legislation.

## 10.5 Record-keeping

### 10.5.1 Exposure register (personal)

The employer must record information on workers who are or may be exposed to dust arising from asbestos or MCAs in a register ([328]). This information must indicate the nature and duration of the activity and the exposure to which the workers have been subjected ([329]). The doctor and/or authority responsible for medical surveillance must have access to this register. Workers must have access to the information relating to them personally, while workers and/or their representatives must have access to anonymous, collective information in the register ([330]).

All exposure records should include the following:

- employer's business name and address;
- site address, where appropriate;
- date of exposure assessment;
- type of work being done and, where relevant, its exact location;
- period of exposure;
- measured or estimated fibre concentration of exposure;
- fibre type, if known.

Any summary of results should contain sufficient detail on airborne fibre levels and the control measures adopted to allow for the estimation of individual average exposure by task type, as accurately as possible.

Both the register and the health surveillance records must be retained for at least 40 years following the end of exposure ([331]).

([328]) Directive 2009/148/EC, Article 19(2).
([329]) Directive 2009/148/EC, Article 19(2).
([330]) Directive 2009/148/EC, Article 19(2).
([331]) Directive 2009/148/EC, Article 19(3).

### 10.5.2 Medical record (personal)

**Box 10-8: Register of workers and exposures**

**Article 19 of Directive 2009/148/EC (AWD):**

2. The employer shall enter the information on the workers engaged in the activities referred to in Article 3(1) in a register. That information shall indicate the nature and duration of the activity and the exposure to which they have been subjected. The doctor and/or the authority responsible for medical surveillance shall have access to this register. Workers shall have access to the results in the register which relate to them personally. The workers and/or their representatives shall have access to anonymous, collective information in the register.

3. The register referred to in paragraph 2 and the medical records referred to in the fourth subparagraph of Article 18(2) shall be kept for at least 40 years following the end of exposure, in accordance with national laws and/or practice.

4. The documents referred to in paragraph 3 shall be made available to the responsible authority in cases where the undertaking ceases trading, in accordance with national laws and/or practice.

All health surveillance records must include ([332]):

- the worker's full name and date of birth;
- the name of the occupational health practitioner;
- the name and address of the employer (party commissioning the health surveillance);
- the date of the health surveillance;
- any test results or assessments that indicate whether the worker was exposed to a health risk;
- any findings suggesting the worker may have a disease, illness or injury related to their work;
- any recommendation that the person or organisation takes remedial measures, including fitness to continue the type of work that triggered the surveillance requirement.

Personal health records should be stored confidentially and remain accessible to the worker even after the end of their employment.

Due to the personal nature of the data, medical records are confidential and should be kept separate from the exposure register and handled in line with Regulation (EU) 2016/679.

Both the exposure register and the medical records must be kept for at least 40 years following the end of exposure ([333]).

### 10.5.3 National register

Member States must maintain a register of all cases of medically diagnosed asbestos-related occupational disease, see Section 10.1.2.

([332]) Royal Dutch Medical Association (KNMG) (2024), 'KNMG guidelines –Dealing with medical data', https://nvab-online.nl/app/uploads/2024/08/KNMG_Richtlijn_omgaan_met_medische_gegevens_2024.pdf.

([333]) Directive 2009/148/EC, Article 19(3).

### 10.5.4 Safeguarding of, medical records

Individual medical records must be retained for at least 40 years following the end of exposure ([334]). Due to the sensitive nature of personal health information, these records should be stored separately from the exposure register.

As good practice, safeguarding medical records supports:

- long-term health monitoring;
- research and Member-State-specific compensation procedures related to occupational diseases.

### 10.5.5 Storage and accessibility of health surveillance data

The custodian of each medical record should store it securely and ensure it remains accessible to former workers and medical professionals responsible for health surveillance ([335]).

Employers should store all health surveillance records separately from other human resources files and unrelated medical records.

([334]) Directive 2009/148/EC, Article 19(3).
([335]) Directive 2009/148/EC, Article 19(3).


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# 11 Incident management

## 11.1 Introduction

Employers should establish procedures to manage accidents, incidents or emergencies at the workplace that could result in asbestos exposure. However, the diversity of asbestos-related activities makes it challenging to apply a single, universal approach across all sites. Therefore, employers involved in asbestos-related activities of a significant duration should develop a site-specific incident plan. This ensures that, in the event of an incident, effective measures are in place to provide rapid care for affected workers, protect responders and minimise the spread of asbestos contamination beyond the controlled area [336].

**Box 11-1: Incident management for accidental OEL exceedance and unidentified material containing asbestos (MCA) disturbance**

**Article 10(1) and (2) of Directive 2009/148/EC (AWD):**

1. Where the relevant limit value as laid down in Article 8 is exceeded, or if there is reason to believe that materials containing asbestos which are not identified prior to the work have been disturbed so as to generate dust, work shall stop immediately.

Work shall not be continued in the affected area until adequate measures have been taken for the protection of the workers concerned.

Where the relevant limit value as laid down in Article 8 is exceeded, the reasons for the limit value being exceeded shall be identified and appropriate measures to remedy the situation shall be taken as soon as possible.

2. In order to check the effectiveness of the measures mentioned in the first subparagraph of paragraph 1, a further determination of the asbestos-in-air concentrations shall be carried out immediately.

[336] INRS (2012), 'Removal or encapsulation of materials containing asbestos – Prevention guide', ED6091, https://www.inrs.fr/media.html?refINRS=ED %206091.

The incident plan should be developed in collaboration with the occupational physician and external emergency services, to ensure comprehensive preparedness and coordination ([337]). The plan should consider a range of potential incidents, including ([338]):

- uncontrolled release of asbestos dust into the workplace;
- major and minor injuries or illnesses inside 'live' enclosures;
- fire inside or outside an enclosure;
- other hazardous releases inside or outside the enclosure, such as toxic gas or radioactive dust;
- detection of asbestos contamination outside the enclosure;
- failure of a power-assisted respiratory protective device (RPD) inside a 'live' enclosure;
- failure of a negative pressure unit;
- complete electrical power failure;
- loss of water supply to the hygiene unit;
- disturbance of previously unidentified MCA, see Annex 4;
- communication challenges, either within the work zone or between operators and external personnel ([339]).

Examples of measures to be taken before, during and after incidents are provided in Section 11.2, Section 11.3 and Section 11.4 respectively.

## 11.2 Preparation before an incident

Employers must take the necessary measures for first aid, firefighting and evacuation of workers, adapted to the nature of the activities and the size of the undertaking and/or establishment, and taking into account other people present, and arrange any necessary contacts with external services, particularly for first aid, emergency medical care, rescue work and firefighting ([340]). This can involve making arrangements with specialised asbestos removal companies (where the employer in question is not a specialised company) ([341]) and developing and sharing instructions with the fire brigade in advance of any work being undertaken.

Employers should ensure that all workers are familiar with incident procedures, understand their roles in the event of an incident and are able to respond effectively ([342]). Regular training sessions (see Section 9) and drills are essential to equip workers with the knowledge and confidence to respond promptly and appropriately.

Preparatory measures should include the following:

- analysing the possible incidents and plan the proper measures and procedures for each one;
- designating the workers required to implement the necessary measures, including for first aid, firefighting and the evacuation of workers;
- ensuring the availability of appropriate emergency equipment and facilities;
- implementing warning systems within the workplace to alert workers of incidents;
- making information on emergency arrangements involving asbestos available to relevant internal and external emergency services;
- establishing clear communication methods (see Section 3.5), including relays with external emergency services if needed;

([337]) INRS (2012), 'Removal or encapsulation of materials containing asbestos – Prevention guide', ED6091, https://www.inrs.fr/media.html?refINRS=ED %206091.

([338]) HSE (2006), 'Asbestos: The licensed contractor's guide', https://www.hse.gov.uk/pubns/priced/hsg247.pdf.

([339]) INRS (2012), 'Removal or encapsulation of materials containing asbestos – Prevention guide', ED6091, https://www.inrs.fr/media.html?refINRS=ED %206091.

([340]) Directive 89/391/EEC, Article 8(1).

([341]) If there is asbestos in the building, but it is not being removed, and maintenance causes an incident, the employer might want to have an arrangement with a specialist contractor who already knows the building. Alternatively, for removal works, the employer might want to have a second specialist company available in case of any issues with the primary specialist.

([342]) Directive 2009/148/EC, Annex Ia, point 5(g).

- developing and disseminating site-specific instructions, especially for evacuations involving containment breaches;
- displaying a site plan with clearly marked exits to guide workers during evacuation;
- providing all workers with a detailed explanation and training on incident procedures and necessary control measures, before work begins, and to new workers before they start;
- complying with all applicable national legal requirements (e.g. on fire safety).

## 11.3 Measures to be taken during an incident if occupational exposure limits are exceeded

If the OEL for asbestos specified in Section 6.2.2 is exceeded, or if there is reason to believe that MCAs not previously identified have been disturbed in a way that generates dust, work must stop immediately (343). For such incidents, and any other incidents involving asbestos, at least the following measures should be taken (344).

- Containing the area: restrict access to the affected area by sealing it off, placing appropriate warning signs and securing the perimeter.
- Inspecting and isolating the ventilation system, and blocking it if necessary.
- Arranging alternative routes or access points for remediation activities.
- Limiting access to essential personnel only, ensuring that any workers entering the area are equipped with adequate protection. Work should not resume until normal conditions have been restored and the causes of abnormal exposure addressed.
- Informing and consulting workers: the employer must promptly inform affected workers and/or their representatives if the OEL is exceeded (see Section 7.3), and must consult them on the proposed remedial measures or, in an emergency, inform them of the measures taken (345).
- Taking remedial measures that ensure that no further accidental releases of asbestos dust occurs and that worker exposure is prevented or minimised.
- Decontaminating the exposed workers.
- Cleaning and decontaminating the incident site.
- Immediately conducting air monitoring to verify the effectiveness of the remedial measures (346).
- Potential medical surveillance and healthcare follow-up.

(343) Directive 2009/148/EC, Article 10(1).

(344) Secrétariat général (France) (2023), 'Guide de prévention du risque amiante dans la gestion des bâtiments', https://www.solidairesfinances.fr/images/Doc/2023/2023_04_guide-amiante-sg.pdf.

(345) Directive 2009/148/EC, Article 17(2)(b).

(346) Directive 2009/148/EC, Article 10(2).

## 11.4 Measures to be taken after the incident

After the incident involving asbestos, the following procedures should be followed.

- Identifying causes: investigate the incident to determine the contributing factors. These may include non-adherence to the plan of work (see Section 4.2), such as deviations from the prescribed methods, use of inappropriate removal techniques or failure by workers handling MCAs to follow specified procedures, proper tool usage or safety protocols.
- Documentation: all incidents should be documented, including details on the causes, measures taken and outcomes. This information can be valuable for identifying preventative methods and may also be required by the relevant authorities ([347]).

**Box 11-2: Example of an incident registration form**

The incident registration form should typically include:

- date, time and location of the incident;
- description of the area where exposure occurred;
- list of individuals exposed or potentially exposed;
- exposure concentrations, if known;
- medical treatment provided;
- control measures applied during and after the incident;
- description of the measures in place before the incident occurred;
- identification of the causes of the incident (e.g. non-adherence to the plan of work, insufficient approaches in the plan of work, no plan of work);
- lessons learnt for improving protocols, equipment, training and worker instructions;
- any safety alerts issued to communicate findings.

The completed form should be retained with the risk assessment, and the data should be analysed to identify trends, see Section 4.1. If a worker has been contaminated, a copy of the form should be stored with the worker's exposure and medical records, see Section 10.5.1 and Section 10.5.2.

Record-keeping needs to comply with national legislation or guidance, which can vary considerably between Member States. Some Member States require all incidents to be reported to the relevant authority.

([347]) See Directive 89/391/EEC, Article 9(1)(c), (d) and Article 9(2).

## Box 11-3: Example of an approach to incident management – asbestos in blasting grit

**Incident overview**

In October 2017, a Dutch manufacturer of blast cleaning grit, made from aluminium silicate slag, identified chrysotile (white asbestos) contamination in its product. The affected grit, mainly derived from coal slag imported from a non-EU country, had been distributed to approximately 130 companies in the Netherlands and abroad between July and September 2017. Contamination was first discovered during plant maintenance, when fibrous material was found in the sieves. Laboratory analysis confirmed the presence of asbestos. The company promptly notified authorities and customers and initiated a large-scale product recall.

**Immediate (short-term) measures**

Upon confirmation of contamination, the company and authorities took urgent action.

- Product recall: customers (direct and indirect) were immediately notified and asked to stop using and return the grit. Approximately 5 981 tonnes of contaminated grit were retrieved and disposed of at licensed landfill sites.
- Market withdrawal: all contaminated stock at the company and external storage sites was quarantined and removed from the market. By March 2018, over 44 000 tonnes had been safely disposed of, with only minimal quantities pending final disposal.
- Regulatory notification and coordination: authorities including the Netherlands Labour Authority, Environmental Services and the Human Environment and Transport Inspectorate (ILT) were notified and coordinated the response. International customers were also informed.
- Workplace safety: affected companies were instructed to halt all use of the grit from the company, prevent further spread and follow strict protocols for the clean-up of contaminated sites. Workers involved in clean-up were advised to use PPE, such as P3-filter masks, and to keep the material moist to minimise dust and fibre release.

**Long-term measures**

To prevent recurrence, the following regulatory and operational controls were implemented.

- Supply chain controls on raw materials: the company discontinued the use of coal slag from this non-EU country. All raw materials and products from new suppliers are now tested for asbestos before use.
- Permit adjustments: environmental permits for the company and its storage partners were revised and updated to prohibit the acceptance of MCAs and require routine asbestos testing.
- Monitoring and oversight: the ILT and Environmental Services committed to ongoing monitoring of the sector, with increased vigilance for asbestos in imported materials.
- Sector guidance on waste handling: industry bodies clarified that under EU law, returning a non-compliant product to the supplier does not trigger waste regulations. However, all returned grit needs to be securely packaged and labelled as waste containing asbestos (WCA), in line with environmental and occupational safety laws.
- The Dutch National Institute for Public Health and the Environment (RIVM) was asked to prepare a proposal for the restriction on the use of intentionally contaminated products with asbestos within the REACH Regulation (ongoing).

**Exposure of workers**

- Exposure scenarios: exposure assessments were conducted for six worker profiles: the 'Ketelboy' (filling operator), blaster, confined-space attendant, cleaner, inspector and scaffold dismantler. The highest exposures were found for the Ketelboy (no RPD), with geometric mean exposures of 31 819 fibres/m$^3$ and a 90th percentile of 83 563 fibres/m$^3$ (8-hour TWA). Other roles had lower exposures, especially when RPDs were used.
- Clean-up activities: during clean-up, worst-case personal exposure measurements occasionally approached or exceeded the Dutch OEL of 2 000 fibres/m$^3$ (8-hour TWA), but with proper moistening, vacuuming cleaning (with HEPA filters) and ventilation, exposures could be kept well below this threshold.

**Box 11-3: Example of an approach to incident management – asbestos in blasting grit**

- Protective measures: the use of blast helmets or FFP3/P3 masks, combined with moistening and vacuuming, provided effective protection. Regular air monitoring and registration of exposed workers were recommended.

**Exposure of bystanders and residents**

- Environmental exposure: two scenarios were modelled.

  (a) Long-term, low-level exposure during two months of blasting in a tent near residences.

  (b) Short-term, high-level exposure during two days of open-air blasting (worst-case at 61 100 fibres/m$^3$ for two days). Even the results for scenario (b) showed that cumulative exposure was limited.

- Risk assessment: the calculated additional cancer risk for bystanders and residents was low: 0.06 extra cases per million (long-term scenario) and 0.12 per million (short-term scenario).

**Health risks**

- Risk quantification: for the highest modelled risk for workers (worst-case 'Ketelboy'), the estimated risk was one extra cancer case per 100 000 exposed individuals. Risks for other worker roles and bystanders were lower.

**Competent authorities**

The Netherlands Labour Authority and ILT drew key lessons from the case:

- involve the right expertise as soon as possible, including internal clients, project managers and communication and legal teams;
- conduct a stakeholder analysis to identify affected parties, those with influence and key information and coordination needs;
- clearly explain the approach taken from the outset, including the communication channels to be used;
- internally communicate the capacity demands of urgent responses; coordinate the activities that will be cancelled or postponed as a result;
- internal QC: do not compromise on the quality of advice and external communication due to external (time) pressure, to avoid the risk of damage to reputation.

**Conclusion**

The incident involved the unintentional distribution of asbestos-contaminated blast grit traced to coal slag from a non-EU country. Immediate measures, including product recall, market withdrawal and strict clean-up protocols, helped contain the risk. Long-term measures, such as supply chain control on raw materials, permit adjustments and enhanced monitoring, were implemented to prevent recurrence. Exposure assessments confirmed that, given the short duration and low concentrations, the additional health risk for both workers and bystanders was low. The incident underscores the importance of robust supply chain controls, rapid incident response and long-term health monitoring for potentially exposed individuals.

The case was presented at the 11th International Occupational Hygiene Association Scientific Conference in Washington DC.

**Box 11-3: Example of an approach to incident management – asbestos in blasting grit**

**Figure 11-1: Worker removing paint inside of a fuel storage tank using blasting grit**



*Sources:* Inspectorate Environment and Transport, Ministry of Infrastructure and Water Management (2018), 'Findings report: asbestos-containing blasting grit', https://www.ilent.nl/documenten/leefomgeving-en-wonen/stoffen-en-producten/asbest/rapporten/bevindingenrapport-asbesthoudend-straalgrit; RIVM (2024), 'Regulatory Management Option Analysis Conclusion Document: Asbestos', assessment of regulatory needs list – ECHA, https://echa.europa.eu/documents/10162/c93c5a10-2031-c36a-bba1-5c8fcdedd99e; TNO (2017), 'Status phase 1 – exposure workers, our reference used during cleanup', https://www.eerstekamer.nl/overig/20171031/onderzoek_tno_naar_blootstelling/document; TNO (2018), 'Assessment of asbestos exposure for workers (and residents) during and after application of asbestos-contaminated blasting grit', https://zoek.officielebekendmakingen.nl/blg-861107.pdf; RIVM (2018), 'Health risks to workers and residents due to exposure to asbestos-contaminated blasting grit', https://zoek.officielebekendmakingen.nl/blg-861106.pdf; Onos, T., Terwoert, J., Holtrop, A., van Balen, P. and Fransman, W. (2018), 'The low countries in turmoil. Sudden awareness of unknown exposure to carcinogenic substance', IOHA 2018, The Dutch session D2, 24 September 2018, preview available at https://publications.aiha.org/201808-ioha-2018-preview.


ACHTUNG
ENTHALT
ASBEST
VOORZICHTIG
BEVAT
ASBEST
Het inademen van
asbeststof
is schadelijk voor
de gezondheid
Houdt u aan de
veiligheides-
voorschriften
Suivre les consignes
de securite

# 12 Waste management

## 12.1 Introduction

Asbestos waste, also referred to as waste containing asbestos (WCA), includes asbestos, materials containing asbestos (MCAs) and any asbestos product (see Annex 4) that the holder discards, intends to discard or is legally required to discard ([348]). Because asbestos was widely used in construction materials, most WCA arises from building maintenance, renovation and demolition activities. Over 95 % of WCA consists of construction MCAs ([349]), around 2 % comes from insulation MCAs ([350]) and the remainder originates from other products, such as automotive components (e.g. brake pads and clutches), textiles and paper-based items ([351]). Waste resulting from mining activities is exempt from WFD ([352]) and AWD ([353]) requirements, see Section 15.10 and Box 15-5.

In accordance with the concentration limit for carcinogenic substances defined in Annex III to the WFD, waste is classified as hazardous if it contains asbestos ([354]) in concentrations ≥ 0.1 %. If there is any uncertainty about the presence of asbestos, even in trace amounts, the waste should be handled as hazardous as a precaution.

Hazardous waste poses greater risks to human health and the environment. Accordingly, the WFD sets stricter management requirements, including enhanced labelling, record-keeping, monitoring and control obligations, applicable from the point of generation through to final disposal or recovery, as stipulated by the directive.

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([348]) Directive 2008/98/EC, Article 3(1).

([349]) List of Waste (LOW) code 17 06 05* in the European Waste Catalogue.

([350]) LOW 17 06 01*.

([351]) European Commission: Directorate-General for Environment, Akelytė, R., Chiabrando, F., Camboni, M., Ledda, C. et al. (2024), *Study on asbestos waste management practices and treatment technologies*, Publications Office of the European Union, Luxembourg, https://data.europa.eu/doi/10.2779/251640.

([352]) Directive 2008/98/EC.

([353]) Directive 2009/148/EC, Article 6(e).

([354]) Which is classified as Carc. 1A.

**Box 12-1: Collection, transport and temporary storage of hazardous waste**

**Article 4(3)(c) of Directive 2009/148/EC (AWD):**

[...]

The notification shall include at least a brief description of:

[...]

(c) the activities and processes involved, including with regard to the protection and decontamination of workers, waste disposal and, where relevant, air exchange when working under confinement;

[...]

**Article 6(e) of Directive 2009/148/EC (AWD):**

For all activities referred to in Article 3(1), the exposure of workers to dust arising from asbestos or materials containing asbestos at the place of work shall be reduced to a minimum and in any case to as low a level as is technically possible below the relevant limit value as laid down in Article 8, in particular through the following measures:

[...]

(e) waste, other than waste arising from mining activities, shall be collected and removed from the place of work as soon as possible in suitable sealed packing with labels indicating that it contains asbestos and shall then be dealt with in accordance with Directive 2008/98/EC of the European Parliament and of the Council (1).

Annex Ia(5)(i) of Directive 2009/148/EC (AWD):

Workers who are, or who are likely to be, exposed to dust from asbestos or materials containing asbestos shall receive mandatory training, encompassing at least the following minimum requirements:

[...]

(i) waste disposal;

[...]

**Article 17 of Directive 2008/98/EC (WFD):**

Member States shall take the necessary action to ensure that the production, collection and transportation of hazardous waste, as well as its storage and treatment, are carried out in conditions providing protection for the environment and human health in order to meet the provisions of Article 13, including action to ensure traceability from production to final destination and control of hazardous waste in order to meet the requirements of Articles 35 and 36.

**Article 18(1) of Directive 2008/98/EC (WFD):**

1. Member States shall take the necessary measures to ensure that hazardous waste is not mixed, either with other categories of hazardous waste or with other waste, substances or materials. Mixing shall include the dilution of hazardous substances.

**Article 19 of Directive 2008/98/EC (WFD):**

1. Member States shall take the necessary measures to ensure that, in the course of collection, transport and temporary storage, hazardous waste is packaged and labelled in accordance with the international and Community standards in force.

The WFD prohibits the mixing of hazardous waste with other hazardous or non-hazardous waste streams. Section 12.2.3 summarises the key requirements for separating and labelling hazardous waste, including WCA. In addition, Council Directive 1999/31/EC on the landfill of waste ([355]) lays down stricter conditions for the disposal of hazardous waste in dedicated landfill sites. In combination with Council Decision 2003/33/EC, which lays down detailed waste acceptance criteria, they provide specific rules for the disposal of asbestos waste, including its allowable placement in hazardous or, under certain conditions, non-hazardous landfills, subject to management measures, including to prevent fibre release.

In the context of this guide, WCA management, which includes collection, transport, recovery and disposal, is addressed primarily from an occupational health and safety perspective. The relevant provisions of EU OSH legislation (see Section 2) apply where WCA handling poses risks to workers' health and safety. While this guide focuses on OSH aspects of WCA, it is important to note that WCA management also raises broader environmental protection concerns. In particular, Directive 87/217/EEC on the prevention and reduction of environmental pollution by asbestos establishes requirements to minimise emissions to air, water and soil. Member States and operators need to ensure that WCA management complies with both OSH and environmental legislation. For a more detailed overview of environmental and operational aspects of WCA management across the EU, the Commission's 2024 *Study on asbestos waste management practices and treatment technologies* ([356]) provides a valuable reference point.

Employers must conduct a risk assessment ([357]) (see Section 4.1) and implement control measures to reduce worker exposure to asbestos and MCAs to a minimum and, in any case, to as low a level as is technically possible below the relevant limit value ([358]) (OEL) specified in Section 6.6.2 by implementing measures such as prioritising elimination and engineering controls before relying on PPE. Required measures include that WCA, other than waste arising from mining activities, should be collected and removed from the place of work as soon as possible in suitable sealed packing with labels indicating that it contains asbestos ([359]). It must then be managed in accordance with the WFD ([360]).

([355]) Directive 1999/31/EC.

([356]) European Commission: Directorate-General for Environment, Akelytė, R., Chiabrando, F., Camboni, M., Ledda, C. et al. (2024), *Study on asbestos waste management practices and treatment technologies*, Publications Office of the European Union, Luxembourg, https://data.europa.eu/doi/10.2779/251640.

([357]) Directive 2009/148/EC, Article 3(2).

([358]) Directive 2009/148/EC, Article 6.

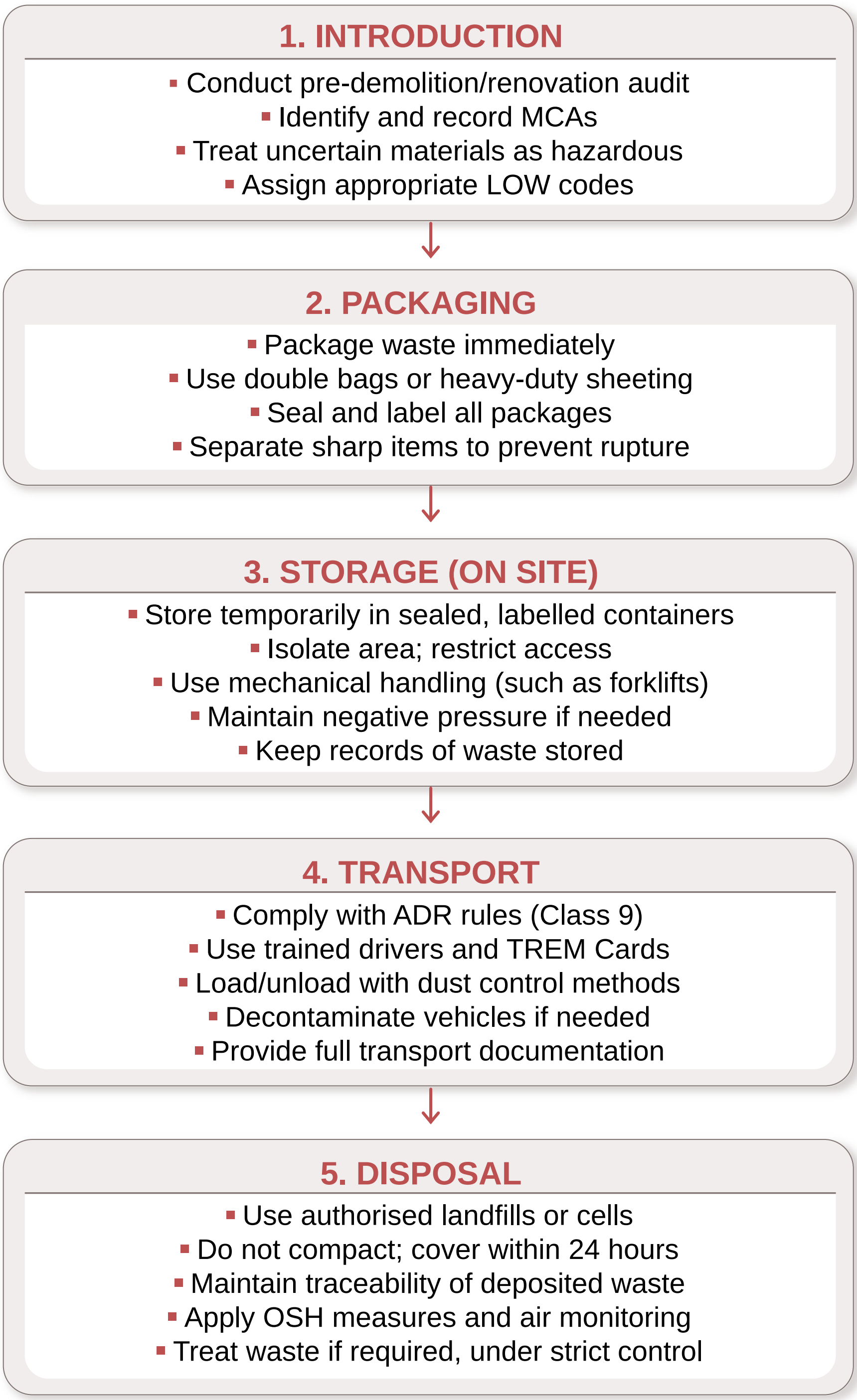
([359]) Directive 2009/148/EC, Article 6(e).

([360]) Directive 2008/98/EC.

## 12.2 Waste management and organisation

The flowchart below outlines the key stages in the WCA management process, from initial identification through to final disposal. It highlights essential safety and compliance requirements at each step.

**Figure 12-1: WCA management process**



### 12.2.1 Identification of waste containing asbestos

The first step to allow correct management of WCA is identification. In the case of demolition, maintenance or renovation work in premises built before the entry into force of the Member State's asbestos ban (see Section 5.3), presumed MCAs must be identified before work begins ([361]).

For further guidance on asbestos risk assessment and asbestos identification, see Section 4 and Section 5 respectively. Examples of MCAs and their typical locations are provided in Section 5.2.1 and Annex 4.

If there is any doubt about whether a material or building contains asbestos, the applicable provisions of the AWD must be followed ([362]).

**Box 12-2: Further reading on the identification and management of WCA in buildings**

For additional information on asbestos waste management in buildings, see the following.

- The 2024 updated edition of the EU construction & demolition waste management protocol *including guidelines for pre-demolition and pre-renovation audits of construction works* ([a]). This document sets out non-binding recommendations and includes examples of best practices, technologies and tools for the management of construction and demolition waste (CDW), including WCA.
- The European Commission *Study on asbestos waste management practices and treatment technologies* ([b]), which remains the most recent and comprehensive EU-level review of asbestos waste practices. It provides a comparative analysis of legal frameworks, collection systems, transport, storage, disposal and emerging treatment technologies across all Member States. The study includes practical examples and country-specific approaches that can support the implementation of safe and compliant WCA management strategies.
- The UK Asbestos Training Association (UKATA) website, which includes a photo gallery showing examples of MCAs in domestic and non-domestic products ([c]).
- Section 13 of this guide, 'Buildings'.

*Sources:*

([a]) European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Oberender, A., Fruergaard Astrup, T., Frydkjær Witte, S., Camboni, M. et al. (2024), *EU construction & demolition waste management protocol including guidelines for pre-demolition and pre-renovation audits of construction works*, Publications Office of the European Union, Luxembourg, https://data.europa.eu/doi/10.2873/77980.

([b]) European Commission: Directorate-General for Environment, Akelytė, R., Chiabrando, F., Camboni, M., Ledda, C. et al. (2024), *Study on asbestos waste management practices and treatment technologies*, Publications Office of the European Union, Luxembourg, https://data.europa.eu/doi/10.2779/251640.

([c]) UKATA (n.d.), Asbestos Gallery, 'Typical examples of asbestos containing materials', https://www.ukata.org.uk/library/about-asbestos/asbestos-gallery/.

Identification of MCAs in non-CDW streams requires tailored strategies, due to the diverse nature of such materials. Waste handlers should be trained to recognise potential MCA and follow strict handling and segregation protocols to minimise contamination risks, see Section 12.3. Definitive detection may require laboratory analysis.

([361]) Directive 2009/148/EC, Article 11.
([362]) Directive 2009/148/EC, Article 11.

To ensure correct handling and disposal, WCA must first be classified as hazardous or non-hazardous in accordance with Annex III to the WFD ([363]). Once classified, WCA must then be identified using the appropriate code(s) from the European List of Waste (LOW). The LOW includes several codes explicitly covering WCA, see Annex 15 ([364]). In some cases, other LOW codes may be applied to WCA ([365]), even if they do not explicitly refer to asbestos, based on the origin and composition of the waste, see Annex 15 for examples.

## 12.2.2 Pre-renovation, pre-maintenance and pre-demolition audits, and site-specific waste management plans

Pre-renovation, pre-maintenance and pre-demolition audits allow the identification of the nature and quantities of asbestos and presumed MCAs, along with other building materials. These audits help optimise waste management planning, such as determining the required number and type of containers, deciding between on-site and off-site sorting, and selecting appropriate packaging methods.

An audit typically comprises two key components.

- **Inventory of materials and construction products.** This should result in the comprehensive identification of all asbestos and MCAs expected to be generated by the planned work, including details on their quantity, condition, exact location and method of installation (e.g. glued, screwed, embedded).
- **Resource management recommendations.** These provide practical information, advice and guidance on the separation of asbestos and MCAs at the source and on safe handling practices for WCA. These recommendations may include:
  - legal requirements to be followed;
  - safe removal techniques and pollution control measures;
  - health and safety precautions for the deconstruction and waste management phase;
  - on-site separation, removal, handling, transport and storage conditions;
  - identification of local companies/solutions for asbestos and WCA management;
  - limitations of the field materials assessment, such as the need for further testing to decide on the management of materials or elements.

The audit results should inform the risk assessment that must be carried out to determine the nature and extent of workers' potential exposure to dust from asbestos and MCAs and guide the development of handling procedures ([366]).

There are currently no harmonised EU thresholds that require audits or the development of site-specific waste management plans. For national thresholds, see Annex 16. A WCA management plan should be required only once the presence of MCAs has been confirmed through visual inspection, documentation review or sampling, or where their presence can be presumed with a high degree of likelihood based on the building's age, materials or use. This ensures that planning efforts and resources are not unnecessarily expended in cases where asbestos is not present or suspected. However, once MCAs have been identified or presumed, the plan should be developed prior to any work, in accordance with the waste hierarchy and applicable safety requirements.

Site-specific waste management plans differ from demolition plans, which focus on the practical execution of demolition work. A site-specific waste management plan sets out how waste generated during a project, such as construction, deconstruction, demolition or maintenance, will be managed in compliance with legal requirements, prioritising

([363]) Directive 2008/98/EC, Annex III.

([364]) European Commission (2018), Commission notice on technical guidance on the classification of waste, C/2018/1447, OJ C 124, 9.4.2018, pp. 1–134, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2018_124_R_0001.

([365]) Most of the codes listed were identified by the Italian National Institute for Insurance against Accidents at Work (INAIL), which has collected information on the LOW codes with which WCA is identified and accepted in landfills currently operating in Italy. INAIL (2021), *Guidelines for classifying and managing asbestos-containing waste*, https://www.inail.it/portale/it/inail-comunica/pubblicazioni/catalogo-generale/catalogo-generale-dettaglio.2021.12.guidelines-for-classifying-and-managing-asbestos-containing-waste.html.

([366]) Directive 2009/148/EC, Article 3(2).

health and safety. For projects involving WCA, the plan addresses its specific hazards and regulatory obligations.

The plan should:

- describe its purpose, scope, and relevance to the project, along with an overview of the legal and regulatory framework;
- include a detailed inventory and classification of all expected waste types and quantities, highlighting hazardous waste such as WCA, and indicating the appropriate LOW codes;
- contain a dedicated section focusing on asbestos management, covering the identification of MCAs and the methods for their safe removal, handling and containment;
- outline procedures for waste handling, emphasising the segregation of different waste types and specifying packaging and labelling standards for WCA, following national and international guidelines;
- provide detailed instructions on the transportation and disposal of WCA, ensuring the use of sealed containers, licensed carriers and authorised disposal facilities while maintaining strict chain-of-custody documentation;
- assign roles and responsibilities to various parties involved in waste management, such as site managers, contractors and waste removal and waste transport companies;
- specify the training requirements for personnel handling asbestos and WCA;
- include a monitoring and reporting framework to ensure compliance with the plan and maintain accurate records, especially concerning asbestos and WCA removal, transport and disposal;
- set out emergency response procedures for accidental releases of asbestos fibres, including contact information for relevant emergency services and regulatory authorities.

The plan should provide clear information on:

- locations of asbestos and MCAs identified in risk assessments;
- estimated/potential quantities of asbestos and WCA to be generated;
- methods for safe removal;
- authorised disposal sites;
- worker safety measures, including training, use of PPE and decontamination protocols.

## 12.2.3 Removal, separation, collection, storage and transport of asbestos and waste containing asbestos

### 12.2.3.1 Collection and removal

Asbestos and MCAs should be removed selectively before demolition work is carried out. Removal work must be carried out by authorised personnel/contractors possessing a permit ([367]), see Section 4.4. For guidance on control measures for removal, see Section 8. WCA must be collected and removed from the worksite as soon as possible ([368]), and must not be mixed with other waste, substances or materials ([369]).

### 12.2.3.2 Storage

- WCA must be stored on-site only temporarily ([370]), pending collection by an authorised waste management operator. The collection and interim storage procedures should be clearly described in the work plan. Waste should be removed from the work area and sealed and cleaned without delay, to minimise any risk of fibre release or damage to the site.
- Asbestos and dust-generating WCA should be stored in sealed, secure containers, skips

([367]) Directive 2009/148/EC, Article 15.
([368]) Directive 2009/148/EC, Article 6(e).
([369]) Directive 2008/98/EC, Article 19(1).
([370]) Directive 2009/148/EC, Article 6(e).

or packaging to prevent fibre release prior to transport to an appropriate site.

- To prevent packaging breaking and releasing asbestos dust or fibres, mechanical equipment such as forklifts should be used when unloading containers at the storage area.
- Containers designated for WCA should contain a sealable inner plastic bag, or the waste should be encapsulated by wrapping it in plastic before placing it in the container, to prevent asbestos fibres from spreading when the waste is tipped at a waste facility.
- Containers or skips are preferrable but, if unavailable, asbestos and WCA should be double-bagged.

Personnel responsible for storage should observe the following:

- wear appropriate PPE, including protective clothing, gloves, safety goggles and a respiratory protective device (RPD) (at a minimum, FFP3 or half-face mask with P3 filter, see Section 8);
- keep WCA separate from other materials, especially non-hazardous waste, to avoid cross-contamination and facilitate safe handling and disposal;
- clearly designate the temporary asbestos storage area, ensuring it is distinct from other waste storage zones and from cleaning and maintenance areas;
- position containers so they do not obstruct walkways or impede access for staff depositing waste;
- maintain the storage area in line with occupational health and safety regulations;
- ensure that the area is accessible to waste collection and removal vehicles ([371]).

All packages must be clearly labelled with the appropriate LOW codes and must indicate they contain asbestos ([372]). Containers should be covered and locked when not in use to prevent unauthorised access.

**Box 12-3: Example of storage facilities**

Temporary WCA storage solutions vary in scale and complexity depending on the volume and friability of the material. However, effective systems share common features: physical containment, restricted access, proper labelling and ventilation, and compliance with OSH standards.

In Italy, for high-risk situations or large construction sites where friable asbestos is removed, dedicated temporary storage facilities (WCA sheds) are set up with static-dynamic confinement. These are sealed structures equipped with air extraction and filtration systems that maintain negative pressure to prevent airborne fibre release. Access is limited to authorised personnel through airlock systems with decontamination facilities. These storage areas are clearly marked, locked when not in use and regularly inspected to ensure containment integrity.

In France, national legislation requires temporary storage areas to meet specific OSH and environmental criteria. At large sites, interim storage of WCA in a form or state that can easily release asbestos fibres into the air requires double confinement: first, in packaging (double-bagging or shrink-wrapping with asbestos warning markings) and second, in designated lockable containers or enclosures. The use of FFP3 masks is limited to 15 minutes unless supplemented with half-masks equipped with P3 filters.

In Cyprus, WCA is stored in sealed ISO containers and stored in designated areas with restricted access, pending transfer to a central disposal site or export.

In Spain, WCA may be temporarily stored for a maximum of six months. All waste must be sealed and labelled, and any storage site must be clearly separated from other operations.

([371]) Spanish National Security and Hygiene at Work Institute (INSHT) (2016), 'Residuos con amianto: desde el productor al gestor', NIPO 272-16-018-4, https://www.insst.es/documents/94886/789635/Residuos+con+amianto.pdf/fa1f94f6-2fb1-47dd-baee-5809b1418ca7?t=1605802865165.

([372]) Directive 2009/148/EC, Article 6(e).

**Box 12-3: Example of storage facilities**

**Common operational requirements and safety measures for WCA storage facilities across the EU**

- Waste must be collected and removed immediately upon generation ([373]) to prevent accumulation.
- Storage areas should be well ventilated (with HEPA filtration if indoors), clearly marked with hazard signage and subject to daily visual inspections.
- Packaging typically involves a double-bagging system (such as a red inner bag with an asbestos hazard label, clear ADR-compliant outer bag) or wrapping large items in 1 000-gauge plastic sheeting.
- Containers or skips should be sealable and resistant to rupture or puncture, especially when transporting large or sharp items such as asbestos-cement sheets or pipe lagging.
- WCA waste should be kept separate from other materials to avoid cross-contamination, with access restricted to trained personnel.
- Workers handling or monitoring storage areas should wear PPE appropriate to the level of risk: this includes protective suits, gloves, safety goggles and RPDs (FFP3 or half-mask with P3 filter).
- Mechanical equipment (such as forklifts) should be used to move waste within the storage area to prevent damage to packaging.

### 12.2.3.3 Packaging procedure

WCA must be collected, packaged and removed immediately upon generation ([374]), avoiding any accumulation of unpackaged waste. Avoid breaking or fragmenting asbestos materials. Intact items (such as boards or pipes) should be removed whole wherever possible to prevent breaking or fragmentation of MCAs. Keep WCA separate from other types of waste to avoid contamination and facilitate appropriate treatment ([375]). Unless derogated under Article 3(3) of the AWD by the relevant Member State, areas, rooms or enclosures used to store WCA must be clearly marked with a suitable warning sign ([376]), see Annex 12.

Use sealed containers or hermetically sealed plastic packaging with adequate mechanical strength to avoid rupture and fibre release. Ensure that packaging materials are compatible with the contents and chemically stable. One practical solution is to use a red inner bag bearing a clear asbestos hazard warning, see Figure A12-3 in Annex 12. The bag is then placed inside a clear ADR-compliant labelled outer bag for transport ([377]), see Section 12.2.3.4. This dual-layer system minimises the risk of fibre release.

Do not overfill bags: this allows for proper sealing and avoids forcing out contaminated air. Sharp or pointed items (such as screws, nails) should be packaged separately to avoid puncturing the packaging.

Items that are too large for bags should be double-wrapped in polyethylene sheeting and sealed with adhesive tape. For large intact items (such as asbestos-cement slabs), place them on pallets, wrap in plastic sheeting (minimum 1 000-gauge thickness), and seal securely. A UN asbestos bag ('big bag') can also be used ([378]). Each package should be labelled with asbestos hazard warnings and any applicable ADR transport labels ([379]).

Wear appropriate PPE during the entire packaging process.

([373]) Directive 2009/148/EC, Article 6(e).

([374]) Directive 2009/148/EC, Article 6(e).

([375]) INSHT (2016), 'Residuos con amianto: desde el productor al gestor', NIPO 272-16-018-4, https://www.insst.es/documents/94886/789635/Residuos+con+amianto.pdf/fa1f94f6-2fb1-47dd-baee-5809b1418ca7?t=1605802865165.

([376]) Directive 2009/148/EC, Article 16.

([377]) United Nations Economic Commission for Europe (UNECE) (2023), 'ADR 2023 – Agreement concerning the International Carriage of Dangerous Goods by Road', https://unece.org/transport/standards/transport/dangerous-goods/adr-2023-agreement-concerning-international-carriage.

([378]) Asbestos Removal Contractors Association (ARCA) (2023), 'Packaging and transporting asbestos-cement sheets for disposal', *ARCA News*, Issue 120, https://www.arca.org.uk/media/ghmbvic1/arca-transportpack-cement-sheets-webflyer-06_23.pdf.

([379]) For some minimum requirements regarding the signs/labels to be used, see Directive 92/58/EEC, Annexes II and III.

Wetting is an effective measure to suppress the release of airborne asbestos fibres during handling but may not always be suitable. In such cases, alternative dust-suppression measures and careful containment should be applied. Waste water should be filtered before discharge, see Section 8.2.3. Potentially unsuitable situations include:

- unstable friable materials may deteriorate further if wetter;
- electrical components or water-sensitive materials may be damaged;
- in cold environments, wetting may cause freezing, increasing packaging failure risks during handling or transport.

It is useful to designate waste collection areas within the premises for the temporary WCA storage before it is transported off-site. These areas should be clearly marked and restricted to authorised personnel.

All materials used for cleaning after asbestos removal, including disposable PPE, should be treated as WCA: sealed in a container or bag and labelled before being removed.

Non-disposable PPE should be either:

- cleaned on-site if facilities are appropriate;
- laundered at a facility equipped to handle asbestos-contaminated materials.

If reusable protective clothing is used (e.g. in licensable work), it should be vacuumed, cleaned with a wet cloth and stored in a designated area, such as in the airlock.

Contaminated protective clothing or materials should never be brought home. Contaminated towels should either be thoroughly washed after each shift or disposed of as WCA.

Asbestos and WCA can be stored temporarily before collection by an authorised waste manager but should be removed from the work area as soon as possible (380). Temporary storage and collection procedures should follow the site-specific waste management plan. Some Member States limit the maximum temporary storage period. For example, Spain allows a maximum of six months from the start of the deposit of waste at the storage site (381).

Sealed containers used for storing contaminated PPE should be labelled and decontaminated before leaving the asbestos area.

Records of all asbestos and WCA generated should be maintained, including quantity, source and disposal method, and kept for the period specified by national regulations.

#### 12.2.3.4 Transport

Asbestos and WCA transported outside buildings must comply with the ADR (382) and other applicable legislation. Packaging used for transport must bear a hazard class label with a class number (Class 9) (383), see Figure A12-4 in Annex 12. Unbonded or fibrous asbestos, such as thermal insulation material or asbestos insulation board, is classified under ADR Class 9 (miscellaneous dangerous goods).

Drivers transporting asbestos must hold a certificate proving they have completed the required training and passed an examination (384). All personnel involved in handling asbestos, including drivers of smaller loads, must receive dangerous goods awareness training (385).

Asbestos and WCA must be loaded and unloaded in a manner that prevents dust release and limits worker exposure (386), using advanced mechanisation,

(380) Directive 2009/148/EC, Article 6(e).

(381) INSHT (2016), 'Residuos con amianto: desde el productor al gestor, NIPO 272-16-018-4, https://www.insst.es/documents/94886/789635/Residuos+con+amianto.pdf/fa1f94f6-2fb1-47dd-baee-5809b1418ca7?t=1605802865165.

(382) However, in accordance with Chapter 3.3 of the ADR, point 168: 'Asbestos which is immersed or fixed in a natural or artificial binder (such as cement, plastics, asphalt, resins or mineral ore) in such a way that no escape of hazardous quantities of respirable asbestos fibres can occur during carriage is not subject to the requirements of ADR. Manufactured articles containing asbestos and not meeting this provision are nevertheless not subject to the requirements of ADR when packed so that no escape of hazardous quantities of respirable asbestos fibres can occur during carriage', https://unece.org/transport/standards/transport/dangerous-goods/adr-2023-agreement-concerning-international-carriage.

(383) UNECE (2023), 'ADR 2023 – Agreement concerning the International Carriage of Dangerous Goods by Road', Vol. 2, Chapter 5.2, https://unece.org/transport/standards/transport/dangerous-goods/adr-2023-agreement-concerning-international-carriage.

(384) UNECE (2023), 'ADR 2023 – Agreement concerning the International Carriage of Dangerous Goods by Road', Vol. 2, Chapter 8.2.1.1, https://unece.org/transport/standards/transport/dangerous-goods/adr-2023-agreement-concerning-international-carriage.

(385) UNECE (2023), 'ADR 2023 – Agreement concerning the International Carriage of Dangerous Goods by Road', Vol. 1, Chapter 1.3, https://unece.org/transport/standards/transport/dangerous-goods/adr-2023-agreement-concerning-international-carriage.

(386) Directive 2009/148/EC, Article 6.

automation and remote control of technological processes and operations where possible ([387]).

If a vehicle's cabins or passenger area may have been contaminated, it should be cleaned. This includes ([388]):

- vacuuming the surfaces using an H-Class vacuum cleaner fitted with HEPA filters;
- wet-wiping surfaces with disposable cloths and soap;
- cleaning the windows with disposable cloths and glass cleaner.

Transported asbestos and WCA must be accompanied by a transport document provided by the waste holder (consignor) ([389]). An example is shown in Table 12-1.

**Table 12-1: Example of a transport document for WCA**

| ADR transport document | | |
|---|---|---|
| Waste consignor: Demolition company ABC<br>Address: ABC street 2, ZIP ABCtown<br>Date: dd/mm/yyyy | | |
| **Dangerous goods description** | **No of packages/type** | **Total quantity** |
| WASTE, UN2590, ASBESTOS, CHRYSOTILE, 9, PGIII, (E) | 100 × 20 kg bags | 2 000 kg |
| Consignee: Disposal facility XYZ<br>Address: XYZ street 4, ZIP XYZville | | |

The carrier (transport company) must provide the vehicle crew with written instructions (transport emergency card or TREM Card) in a language they understand ([390]). The TREM Card sets emergency procedures, the hazard characteristics of the WCA relevant to the risk assessment, required safety equipment to be carried on the vehicle and other relevant guidance. The vehicle crew must be familiar with the TREM Card before starting the journey ([391]).

## 12.2.4 Treatment and disposal

As of 2025, almost all asbestos and WCA in the EU is disposed of in landfills. However, inertisation technologies are available and the role of treatment is expected to increase ([392]). While treatment technologies vary, all associated working places must comply with the AWD ([393]). In particular, employers must implement control measures, including dust suppression techniques, to reduce worker exposure to asbestos and MCAs to a minimum and, in any case, to as low a level as is technically possible below the relevant limit value ([394]) (OEL) specified in Section 6.2.2.

([387]) UNDP (2023), 'Asbestos waste management protocol', https://www.undp.org/sites/g/files/zskgke326/files/2024-08/UNDP-AsbestosWasteManagementProtocol-v5NovemberEN_v01.pdf.

([388]) INSHT (2016), 'Residuos con amianto: desde el productor al gestor', NIPO 272-16-018-4, https://www.insst.es/documents/94886/789635/Residuos+con+amianto.pdf/fa1f94f6-2fb1-47dd-baee-5809b1418ca7?t=1605802865165.

([389]) ADR (2017), Annex B, Chapter 8.1 'General requirements concerning transport units and equipment on board', Section C8.1.2, https://adrbook.com/en/2017/ADR/8.1; ADR (2017), Annex B, Chapter 5.4 'Documentation', 5.4.1.1, https://adrbook.com/en/2017/ADR/5.4.1.1.

([390]) Instructions are available in writing from UNECE (2025), 'Linguistic versions (ADR, instructions in writing)', https://unece.org/linguistic-versions-adr-instructions-writing.

([391]) Instructions are available in writing from UNECE (2025), 'Linguistic versions (ADR, instructions in writing)', https://unece.org/linguistic-versions-adr-instructions-writing.

([392]) WCA treatment technologies include: thermal processes (melting of WCA at temperatures ranging between 650 and 1 600 °C); chemical processes (dissolution of WCA in acid -hydrofluoric, hydrochloric, sulphuric acids -or base -sodium, potassium hydroxides -at temperatures ranging from room to 200 °C); thermochemical processes (shredding and mixing WCA with fluxing agent and then heating for demineralisation at temperatures ranging from 1 200 to 1 250 °C for about 20 minutes); and mechanochemical processes (chemical and physical-chemical transformations produced by the effect of mechanical energy with or without addition of acids/bases). For more information, see European Commission: Directorate-General for Environment, Akelytė, R., Chiabrando, F., Camboni, M., Ledda, C. et al. (2024), *Study on asbestos waste management practices and treatment technologies*, Publications Office of the European Union, Luxembourg, https://data.europa.eu/doi/10.2779/251640.

([393]) Directive 2009/148/EC, Article 6.

([394]) Directive 2009/148/EC, Article 6.

Asbestos treatment or disposal activities should only take place if the following conditions are met:

- the employer complies with all relevant safety requirements, in line with the latest technical standards;
- suitable safety equipment is available;
- all personnel are adequately trained;
- a competent worker is designated to carry out activities related to the protection and prevention of occupational risks, or, if no such worker is available, the employer should appoint qualified external services or persons ([395]).

Disposal of asbestos and WCA must comply with Directive 1999/31/EC and Council Decision 2003/33/EC. Asbestos and WCA should be disposed of in landfills for hazardous waste. In some cases, if the material is stable and has leaching behaviour equivalent to non-hazardous waste, it may be permitted in landfills for non-hazardous waste. However, such waste must not be deposited in cells designated for biodegradable non-hazardous waste ([396]). Some Member States apply stricter rules and prohibit WCA in non-hazardous landfills altogether.

Disposal operations must be designed to avoid the release of dust ([397]). Appropriate technical and organisational control measures, including PPE, should be applied as defined in the site-specific risk assessment, see Section 8.

**Box 12-4: Example of the importance of protecting workers at municipal solid waste landfills (not specialised landfills for asbestos)**

In many Member States, municipal (non-hazardous) solid waste landfills may accept certain types of MCAs, particularly non-friable asbestos cement, under strict conditions. However, there is a risk that WCA, especially from small renovation projects or mixed waste loads, may arrive undeclared or incorrectly packaged. This can expose landfill workers and the environment to risk.

To ensure worker protection and legal compliance, the following high-level controls are recommended for both expected and unexpected WCA.

- **Visual screening and staff training.** Landfill staff must be trained to visually recognise common MCAs that may be mis-declared or incorrectly presented. Training should cover historical uses of asbestos in construction materials and the visual cues associated with different product types. If there is any doubt, the material must be treated as a potential MCA until proven otherwise. Examples of MCAs include:
  - corrugated or flat cement sheets;
  - asbestos pipe lagging or gaskets;
  - floor tiles, roofing felts or insulation board;
  - bags or packages marked with asbestos labels;
  - broken or unlabelled wrapped bundles with visible fibrous content.
- **Immediate response to suspected asbestos.** If suspected WCA is identified:
  - isolate the material and restrict access to the area;
  - stop any mechanical handling or compaction near the material;
  - notify the site manager or designated health and safety officer;
  - use wetting techniques to suppress dust if disturbance has occurred.

([395]) Directive 89/391/EEC, Article 7.
([396]) Directive 1999/31/EC, Article 6(c)(iii).
([397]) Directive 2009/148/EC, Article 6.

**Box 12-4: Example of the importance of protecting workers at municipal solid waste landfills (not specialised landfills for asbestos)**

- **Safe handling and PPE.** Workers handling suspected WCA should wear suitable PPE and RPDs, including Type 5 disposable coveralls, gloves and a half-mask with P3 filters. PPE must be disposed of as WCA after use if contamination is suspected.
- **Segregated deposition and containment.** If WCA is confirmed, it should be packaged (into UN-approved bags or wrapped in heavy-duty plastic sheeting), clearly labelled and stored in a designated asbestos area or transferred to a permitted facility. The WCA must not be compacted or mixed with other waste streams.
- **Worker awareness and communication.** Landfill staff must be made aware that WCA may occasionally be mislabelled. Briefings and visual aids (such as posters with photo examples) can help reinforce vigilance. A clear reporting protocol should be in place for suspected cases.
- **Documentation and prevention.** All incidents involving unexpected WCA must be recorded (including follow-up measures). Feedback should be shared with the original waste producer (if identifiable) and further action taken to prevent recurrence, for example through liaison with local authorities and contractors.

Within landfills, WCA should be placed in separate cells or separate disposal units. These should be covered within 24 hours with a layer of non-asbestos material (such as soil, clay, crushed construction waste) at least 20 cm thick to prevent fibre release ([398]), see Figure 12-3. If the cells or units are not wrapped in plastic sheeting, they should be moistened regularly to supress dust.

Compaction of landfilled WCA should be avoided, as should unnecessary vehicle traffic on the site. The final cover should be applied as soon as possible using suitable material free of sharp elements that could damage the packaging.

The operator should implement tracking and containment measures, including systems to trace and locate the landfilled WCA and restrict access to these areas.

Where WCA is contaminated with other hazardous substances, it should be landfilled in underground storage facilities.

Examples of methods in the Member States for the disposal of WCA are provided in Annex 15.

([398]) Secretariat of the Pacific Regional Environment Programme (SPREP) (2022), *Recommended procedures for the disposal and landfilling of asbestos containing wastes*, https://pacwasteplus.org/wp-content/uploads/2022/07/ACM-landfill-requirements-guidance_Final.pdf.

**Figure 12-2: Wetting of WCA to prevent dust**



**Figure 12-3: WCA disposed in sealed bags**

**Box 12-5: Examples of occupational health and safety measures at a landfill accepting WCA**

A landfill site that accepts WCA and asbestos-contaminated soil applies a comprehensive set of OSH measures to protect workers and reduce environmental risks. The landfill is managed by a company with over 30 years of experience managing multiple landfill sites for WCA, some of which are still active, while others have closed. The occupational health and safety measures described below are applied consistently across all sites.

**Systematic registration and controlled acceptance:** waste producers must pre-notify the landfill and submit documentation detailing the origin, composition, European Waste Code and the WCA's treatment history. Upon arrival, each load undergoes a two-stage visual inspection, first by the driver, then a trained acceptance officer. Loads with damaged packaging are rejected. Waste must be delivered in airtight packaging, typically in labelled big bags, including container depot bags (CDBs) up to 10 tonnes or double-wrapped plastic. Demolition waste increasingly arrives in sealed bags, as this minimises dust release and avoids the need for opening on site. All WCA and contaminated soil must be delivered moist to reduce fibre dispersion. Non-compliant deliveries may result in the transport contractor facing financial penalties or even being barred from delivering further waste to the site.

**Technical and procedural control measures:** to prevent the release and inhalation of asbestos fibres, the site applies the following layered controls.

- **Moisture control.** Waste is kept damp during transport and handling, using mist or foam systems to supress dust and fibre release.
- **Restricted active zone.** The area used for WCA deposition is kept as small as possible to limit potential fibre dispersion. While individual CDBs are deposited without the need for daily covering, the overall zone is managed to minimise exposure. Upon closure of the active zone, the area is sealed and covered with approximately two metres of soil, and future excavation is restricted.
- **Packaging integrity.** All WCAs must arrive in sealed, undamaged containers. Damaged packaging is not accepted and may lead to the load being rejected on arrival.
- **Vehicle cleaning.** Trucks are cleaned at on-site designated (some automated) washing stations (see Figure 12-4, and waste water is collected and treated to prevent environmental contamination.
- **Demarcation and access control.** WCA handling areas are marked with signs and access is restricted to authorised, trained personnel.

Figure 12-4: Vehicle cleaning

This image is not available for reuse, see inside front cover.

**Box 12-5: Examples of occupational health and safety measures at a landfill accepting WCA**

**Worker protection and decontamination:** personnel handling WCA are equipped with full PPE and RPDs, including FFP3 respiratory protection, disposal coverall (Tyvek), gloves and safety footwear. Where needed, RPDs, such as full-face respirators with P3 filters, are used. Vehicles and machinery operators are protected by sealed overpressure cabins with filtered air. After each shift, decontamination procedures include changing clothing, washing and cleaning equipment cleaning.

**Training, monitoring and oversight:** all personnel handling WCA receive mandatory training on hazard recognition, safety procedures and emergency response. Regular meetings reinforce good practice and update procedures. Workers are listed in a health surveillance register and undergo periodic medical examinations (at least once every three years) in line with Dutch OSH regulations. Air monitoring is carried out during operations to ensure that fibre concentrations remain below the Dutch OEL of 2 000 fibres/$m^3$. All incidents are logged, and evaluations are conducted at regular intervals to review and adapt measures as necessary.

**Special measures for asbestos-contaminated soil:** the site also accepts soil contaminated with asbestos, which is:

- delivered in bulk, in bags or sealed containers (CDBs), which are deposited without being opened;
- deposited immediately upon arrival in a dedicated trench or cell;
- covered with clean material to prevent airborne dispersion;
- marked and isolated from other activities.

If reuse or cleaning is not feasible (e.g. due to contamination levels or soil type), the soil is permanently contained at the site. The landfill is subject to regular inspections and reporting requirements by the regional environmental authority.

In some Member States, certain types of WCA are disposed of in underground facilities, such as former salt mines or purpose-built geological repositories. This method is used for waste that cannot be safely or sustainably managed in surface landfills, offering long-term isolation from the biosphere and a high level of environmental and human health protection. Underground disposal is mainly used for friable asbestos or WCA streams (e.g. industrial residues or filter dusts) that cannot meet the stability or packaging requirements for surface disposal, or in cases where the long-term integrity of surface landfill containment cannot be assured.

The underground disposal of WCA is subject to strict requirements under the Landfill Directive (Directive 1999/31/EC), Council Decision 2003/33/EC and national legislation. Common criteria include:

- waste must be stable, non-reactive and securely packaged;
- the facility must be located in a geologically stable formation (e.g. impermeable rock or salt dome);
- a natural geological barrier must be combined with engineered containment systems;
- the site must be protected against water ingress and have no connection to groundwater;
- strict site access control, environmental monitoring and traceability measures must be in place;
- mixing with incompatible or non-hazardous waste is prohibited;
- the facility must operate under a specific permit issued in accordance with EU and national laws.

## 12.3 Training

In addition to the general education and training requirements outlined in Section 9, workers handling WCA must receive tailored theoretical and practical training, including on WCA disposal ([399]).

Training must be provided in a form, manner and language that workers can easily understand ([400]). It should be adapted to the specific roles and tasks of each worker group ([401]), for example maintenance workers repairing water supply systems with asbestos-cement pipes, or municipal solid waste collectors, as the risk and procedures differ.

For workers involved in asbestos removal in buildings, see Section 13.8. For all other workers handling asbestos and WCA, training should include:

- required equipment for safe handling of asbestos and WCA;
- use and maintenance of collective protective equipment and PPE;
- identification and classification of asbestos and WCA;
- action to take when encountering suspected MCAs (such as in general building waste);
- correct procedures for bagging, wrapping and labelling asbestos and WCA;
- safe loading and unloading techniques for transport;
- emergency response in case of packaging failure;
- procedures for landfilling and WCA plan procedures;
- emergency procedures, including fire or other high-risk incidents.

([399]) Directive 2009/148/EC, Article 14 and Annex Ia point (5)(i).
([400]) Directive 2009/148/EC, Article 14(2).
([401]) Directive 2009/148/EC, Article 14(2).

# 13 Buildings

## 13.1 Scope

This section builds on Sections 3 to 9 by providing additional information relevant to occupational exposure during maintenance, renovation or demolition of buildings. Occupational exposure in the maintenance, renovation or demolition of civil engineering structures is addressed in Section 16.

## 13.2 Coordination

At construction sites where activities such as maintenance, renovation or demolition of buildings are undertaken (and which may involve asbestos-related work), one or more SHCs must be appointed if more than one contractor is present [402], see Section 3.2.2.

## 13.3 Risk assessment

A risk assessment must be undertaken for any activity likely to involve a risk of exposure to dust arising from asbestos or materials containing asbestos (MCAs) [403], see Section 4.1.

The removal of asbestos from buildings must be prioritised over other forms of asbestos handling in the risk assessment [404]. However, immediate removal may not always be feasible. In some cases, deferring removal until a later stage (such as during planned refurbishment) may reduce the overall risks of occupational exposure. Decisions about removal should consider the potential for exposure during maintenance, non-routine tasks and passive exposure, see Section 7.

The risk assessment should consider factors such as:

- type of MCAs (e.g. decorative textured coating versus sprayed asbestos coating);
- condition of MCAs (such as degraded or damaged);
- removal method (destructive versus non-destructive: for example, removal by scraping or steaming versus coatings applied to a plasterboard which can be removed whole);
- presence of hazardous substances other than asbestos (such as polycyclic aromatic hydrocarbons (PAHs), either intentionally added or present due to contamination during use).

An additional factor that should be considered is the friability of the MCAs.

Where MCAs (see Annex 4) are not removed, they should be managed consistently to minimise risks to workers during maintenance, renovation and demolition.

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(402) Directive 92/57/EEC; European Commission: Directorate-General for Employment, Social Affairs and Inclusion (2011), *Non-binding guide to good practice for understanding and implementing Directive 92/57/EEC on the implementation of minimum safety and health requirements at temporary or mobile construction sites*, Publications Office of the European Union, Luxembourg, https://op.europa.eu/en/publication-detail/-/publication/96b5fe83-ef7d-4628-9af0-e02b25810c1d.

(403) Directive 2009/148/EC, Article 3(2).

(404) Directive 2009/148/EC, Article 3(2).

The risk assessment should determine whether an enclosure or containment is required (see Section 8.2.2.1), along with the relevant organisational measures and specific removal techniques. National legislation should be consulted to determine whether containment is required for all removals of the relevant MCAs or only under certain conditions. For example, in Belgium and the Netherlands, some types of MCAs are always removed under containment. In France, containment may be required as soon as the process is likely to exceed a certain concentration ([405]). Other Member States may apply similar approaches.

If the risk assessment or relevant national legislation determines that enclosure or containment is required, the work area should be separated from the rest of the site, be put under negative pressure and have a minimum of 3–5 airlocks, see Section 8.2.2.2. All items of furniture, soft furnishings and other movable objects should be removed prior to setting up the containment area.

**Box 13-1: Highly friable MCAs**

Although some national guidance differentiates between friable and non-friable asbestos, this distinction is not universal. For example, France does not differentiate between friable and non-friable asbestos, as risk is a combination of factors, such as material, techniques and confinement. The following practices apply to all asbestos and MCAs but are particularly important to highly friable MCAs.

Highly friable MCAs include materials such as sprayed coatings, pipe insulation and insulating boards where asbestos fibres are loosely bound and easily released into the air when disturbed, see Section 5.2.1. Their presence significantly increases the potential risk to workers. Key practices include the following.

- **Condition assessment.** Regular, thorough inspections should be conducted to monitor the condition of MCAs. Any signs of damage, deterioration or disturbance should be immediately addressed to prevent passive exposure of workers.
- **Removal prioritised.** Encapsulation is a temporary solution if the materials are in good condition, but removal remains the safest long-term option.
- **Controlled work environment.** Establish strict containment and control measures for work on MCAs, including:
  - enclosures/containment;
  - negative air pressure systems;
  - decontamination procedures;
  - PPE;
  - regular air monitoring during and after any work;
  - proper waste management in line with local regulations.

For further information on control measures, air monitoring and waste management, see Section 8, Section 6 and Section 12 respectively.

([405]) Article 4 of the Order of 8 April 2013 on the technical rules, preventive measures and collective protection to be implemented by companies during operations involving a risk of exposure to asbestos, https://www.legifrance.gouv.fr/loda/id/JORFTEXT000027324535/.

### 13.3.1 Notification

In accordance with national regulations and practices, a notification must be submitted to the competent authority of the Member State before starting any activity likely to involve a risk of exposure to asbestos dust (406), unless the Member State concerned has derogated such activities from the notification requirement, as provided for under Article 3(3) of the AWD (407), see Section 4.3.

### 13.3.2 Plan of work

Proper planning is crucial for the safe removal or management of asbestos in buildings. A plan of work (see Section 4.2) must be prepared before starting any demolition or asbestos removal work involving buildings, structures, plants or installations (408). A plan of work should be based on a risk assessment tailored to the specific situation and activities to be undertaken. At the request of the competent authority, this plan must also be provided to them prior to the start of work (409).

When preparing the workplace, employers should:

- segregate the asbestos work area to restrict unauthorised access;
- install, as necessary, prohibition and/or warning signs at all entry points, see Annex 12;
- allow only trained asbestos removal workers and supervisors into the designated area;
- cover surfaces in the asbestos work area with heavy-duty plastic sheeting to prevent contamination;
- establish clear decontamination procedures;
- ensure adequate lighting;
- avoid working in windy environments where asbestos fibres could be redistributed.

When roof removal is planned, the risk assessment should also consider the possibility of contamination beneath the roofing material.

### 13.3.3 Permits

A permit must be obtained from the competent authority of the Member State before starting any demolition or asbestos removal work, see Section 4.4.

## 13.4 Identifying asbestos

Before work begins, the type of MCAs should be identified, as removal methods vary depending on the type, such as coatings, flooring or cement-based materials, and other relevant factors. These distinctions are often reflected in national legal requirements. The identification of asbestos (see Section 5) should always be carried out by a qualified specialist.

Examples of common locations where asbestos can be found in residential and commercial or industrial buildings are shown in Figure 13-1 and Figure 13-2. These figures are provided for illustrative purposes and are non-exhaustive; for example, MCAs may also be found in production equipment, which is not shown in Figure 13-2.

(406) Directive 2009/148/EC, Article 4.
(407) Directive 2009/148/EC, Article 4.
(408) Directive 2009/148/EC, Article 13(1).
(409) Directive 2009/148/EC, Article 13(3).

Visual inspection, documentation review and information on the building's age, materials or use may not be sufficient to determine the presence of asbestos. Many coating materials used historically may appear similar and some MCAs may be concealed, for example painted over and therefore not visible. Where asbestos is suspected or presumed, material samples should be collected and tested in a laboratory. In the case of vinyl floor tiles, the adhesives may also need to be tested.

**Figure 13-1: Residential building – where asbestos might be found (non-exhaustive)**

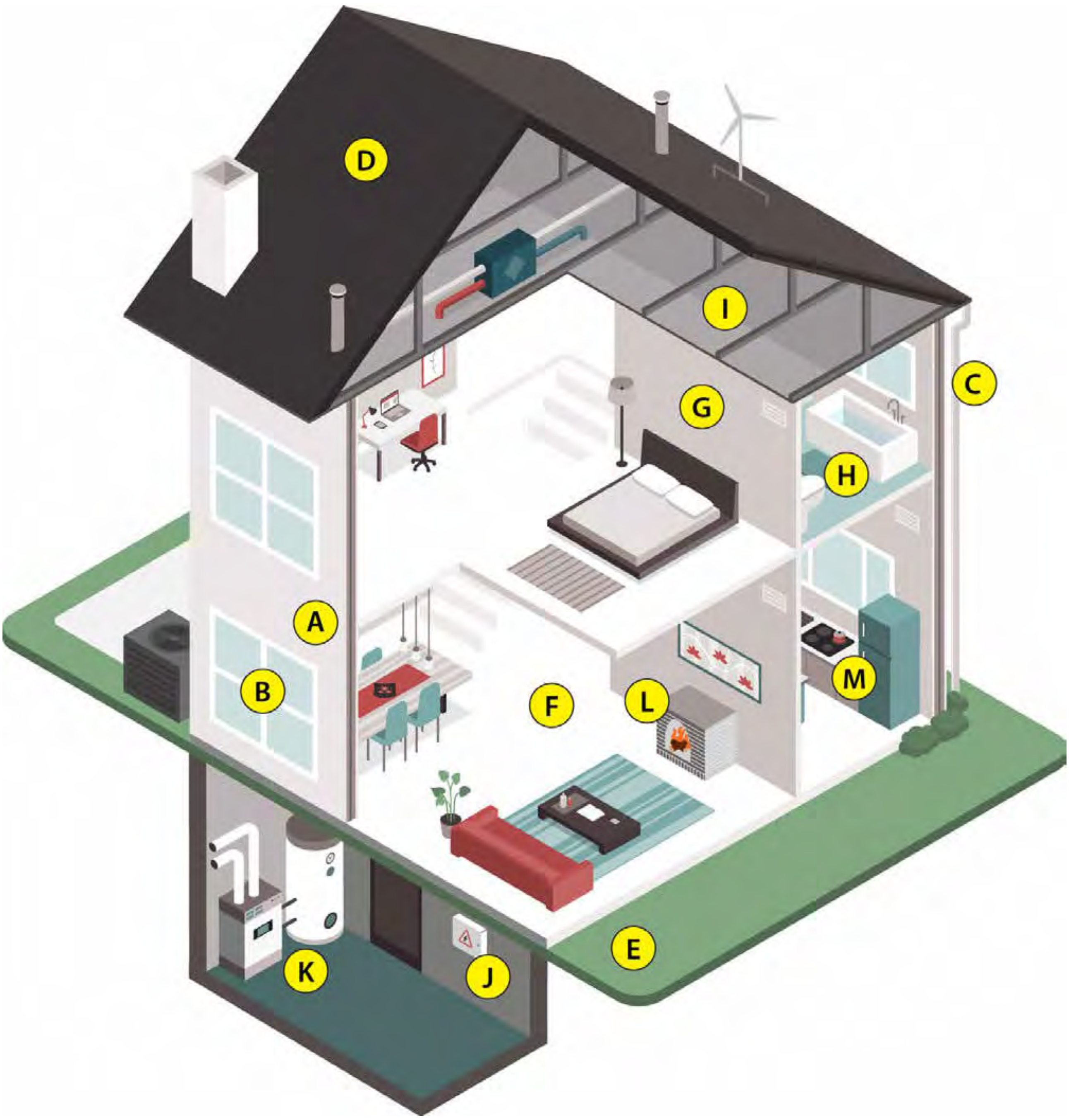


**Figure 13-1: Residential building – where asbestos might be found (non-exhaustive)**

**A: Exterior walls**

Cladding board
Soffits
Fascia boards
Infill panels
Render, pebbledash

**B: Exterior windows**

Window panel
Window putty
Panel beneath windows
Window flashing
Window boxes

**C: Guttering and drainage**

Gutters
Downpipes
Underground pipes
Stormwater and sewage pipes
Stormwater trap

**D: Roofing**

Eaves and gable ends
Roof ridge capping
Corrugated roof sheeting
Roof panels
Roofing tiles
Roof flashing
Roof felt
Chimneys and flues
Skylights
Asbestos slate and other products
Asphalt products
Roofing membranes
Roof underlay

**E: Around building**

Asphalt
Hardcore
Cement
Road paving
Water tank
Fence panels
Wall capping

**F: Flooring**

Vinyl flooring and floor tiles
Backing to vinyl flooring
Adhesive for vinyl tiles
Carpet underlay

**G: Internal walls, ceilings and doors**

Partition wall
Compressed sheeting
Panels
Wall cladding
Mouldings
Wall gaskets and linings
Spray coatings on ceilings, walls, beams and columns
Textured decorative coating
Textured paint
Interior window panel
Fire doors
Door gaskets
Ceiling tiles
Recessed lighting
Mastic sealant for joints

**H: Bathroom**

Wet area lining substrate
Bath panel
Splashback panels
Toilet seat and cistern
Toilet ventilation (soil) pipes

**I: Insulation**

Loose fill or vermiculite insulation
Batt or blanket insulation
Boilers Insulation

**J: Electrical installation**

Fuse box / electrical meter board
Fireproof wiring insulation
Socket outlets
Low-voltage knife cartridges

**K: Boilers and heating systems**

Boiler lagging
Around heaters
Around warm air heating systems
Panels lining airing cupboards

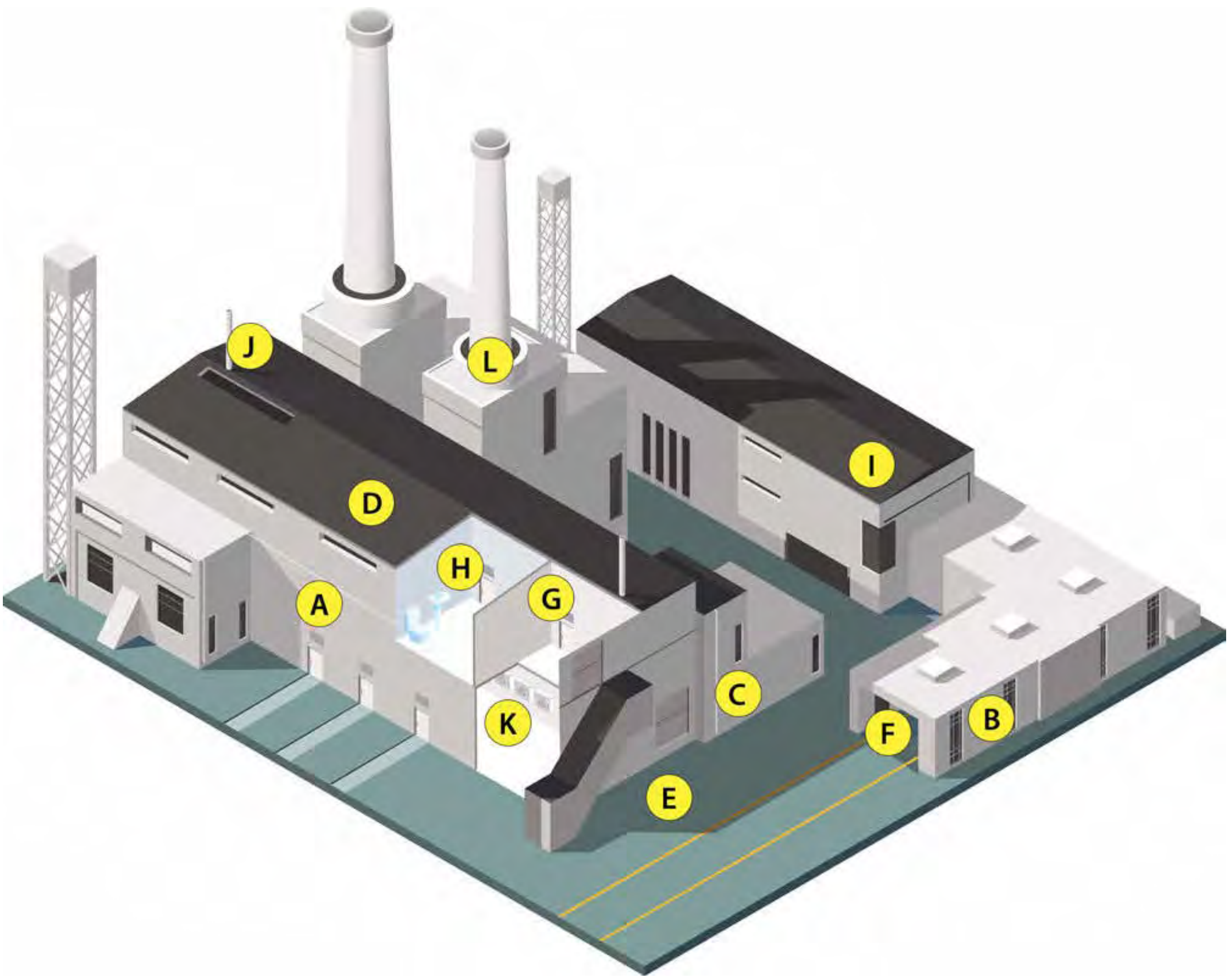
**L: Fireplaces**

Around fireplaces
Fireplace flues
Fireplace logs
Fire blankets

**M: Kitchen**

Refrigerators and freezers
Extraction hoods
Wood burning stoves
Clothes dryers

Figure 13-2: Commercial/industrial building – where asbestos might be found (non-exhaustive)




**A: Exterior walls**

Cladding board

Soffits

Fascia boards

Infill panels

Render, pebbledash

Bitumen damp proof course

Mastic expansion joints

**B: Exterior windows**

Window panel

Window putty

Panel beneath windows

Window flashing

Window moulding and louvre blades

**C: Guttering and drainage**

Gutters

Downpipes

Underground pipes

Flues & stench pipes

Stormwater and sewage pipes

Stormwater trap

**Figure 13-2: Commercial/industrial building – where asbestos might be found (non-exhaustive)**

**D: Roofing**

Eaves and gable ends

Roof ridge capping

Corrugated roof sheeting

Roof panels

Internal roof lining

Roof sheeting

Roofing tiles

Roof flashing

Roof felt

Chimneys and flues

Roof ventilator

Skylights

Asbestos slate and other products

Asphalt products

Roofing membranes

Roof underlay

**E: Around building**

Asphalt

Hardcore

Cement

Road paving

Water tank

Fence panels

Wall capping

**F: Flooring**

Vinyl flooring and floor tiles

Backing to vinyl flooring

Adhesive for vinyl tiles

Compressed sheet flooring

**G: Internal walls, ceilings and doors**

Partition wall

Compressed sheeting

Panels

Wall cladding

Mouldings

Wall gaskets and linings

Spray coatings on ceilings, walls, beams and columns

Interior window panel

Fire doors

Door gaskets

Ceiling tiles

Mastic sealant for joints

**H: Bathroom**

Wet area lining substrate

Splashback panels

Toilet seat and cistern

Toilet ventilation (soil) pipes

**I: Insulation**

Loose fill or vermiculite insulation

Batt or blanket insulation

Boilers Insulation

**J: Ventilation**

Vent pipes and ventilators

Surface ductwork

Exhaust and ventilation ducts

Duct linings

Fire damper

**K: Electrical installation**

Fuse box / electrical meter board

Fuse backing panels

Fireproof wiring insulation

Socket outlets

Low-voltage knife cartridges

Moulded telecommunications pit

**L: Boilers and heating systems**

Boiler lagging

Pipe insulation and lagging

Gaskets to pipes

Around heaters

Around warm air heating systems

Heat exchanger

**Not shown**

Fire blankets

Waste chutes

Elevator brakes

Drive belts and conveyor belts

# 13.5 Air monitoring

See Section 6 for general requirements and procedures related to air monitoring. No additional specifications apply for air monitoring in buildings.

# 13.6 Control measures

## 13.6.1 Control measures for buildings

In addition to the control measures described in Section 8, the following considerations are specific to work involving buildings:

- if other parts of the same building or nearby buildings remain in use during asbestos-related work, additional control measures may be needed to protect occupants and workers;
- building ventilation systems may require sealing, disabling or modification to prevent the spread of fibres;
- waste removal routes should be carefully planned to avoid contamination of clean areas and minimise the risk of fibre dispersal;
- access for emergency services should be considered when designing containment areas and planning workflows.

## 13.6.2 Removal techniques and procedures

The removal of MCAs from buildings should be carried out using techniques and procedures that minimise the release of asbestos fibres into the air. The most appropriate methods will depend on the type of MCAs, their condition and their location.

General principles for asbestos removal should include:

- use of negative pressure containment when required by the risk assessment and/or national legislation;
- working in small, manageable sections;
- avoiding contact between MCAs and containment walls;
- wetting the MCAs to reduce dust generation or using other dust suppression or containment techniques, see Section 13.6.2, Section 13.6.2.2 and Section 13.6.2.3 for material specific methods;
- filtering waste water created by wetting techniques, see Section 8.2.3;
- preferably using manual tools; if power tools are necessary, they should be low-speed / low-power models with extraction systems;
- immediate double-bagging or wrapping of removed MCAs.

The sections that follow highlight elements to consider for specific types of MCAs.

### 13.6.2.1 Removal of asbestos-cement roofing sheets ([410])

Asbestos-cement products, commonly found in roofing sheets, wall cladding, pipes and guttering, typically contain 10–15 % asbestos fibres bound in a cement matrix. When weathered, damaged or disturbed, these materials can disintegrate. This is particularly true for roofing materials that have been exposed to the elements for decades, where the surface may have degraded, allowing fibres to become more easily released.

This section focuses on examples of techniques for the removal of asbestos-cement roofing and sheets. The removal of asbestos-cement pipes is not covered here. This section provides examples of potentially relevant techniques; the choice of the specific technical, organisational measures and PPE should be based on the risk assessment for the site in question.

Asbestos cement may be found together with other MCAs, for example roof sheets may be coated with sprayed asbestos. In such cases, additional precautions may be necessary to address the combined risk posed by the different materials.

A key consideration for determining the appropriate removal approach and risk control measures is the condition of the asbestos cement, specifically whether it is degraded or non-degraded:

- degraded asbestos cement is brittle, increasing the risk of fibre release;
- non-degraded asbestos cement retains its integrity, with fibres bound in the matrix, thus reducing the likelihood of fibre release.

The risk assessment should consider the condition of the MCAs and assess how likely the chosen removal technique is to cause mechanical damage (and consequently the release of fibres). Based on this evaluation, appropriate risk reduction measures should be identified. These may include:

- containment,
- wet or dry removal methods,
- specific types of PPE.

#### *13.6.2.1.1 Technical measures*

Examples of equipment that may be needed include:

- wetting agents,
- spraying equipment,
- hand tools to loosen the fastening of asbestos-cement sheets,
- an H-Class vacuum cleaner,
- waste bags,
- adhesive tape,
- thick plastic foil.

Non-destructive removal techniques that allow MCAs to be removed whole, without mechanical damage or breaking, should be prioritised. Damaged areas should be identified and stabilised or covered before removal. Where whole-piece removal is not possible, the material should be wetted and carried out under containment, particularly if it needs to be broken into smaller parts for removal. Care should be taken with overlapping sections of roofing sheets, which should also be dampened.

The fastening system (such as systems attaching roofing sheets) should be loosened or unscrewed using the least dust-generating method available. Where possible, hand tools (such as bolt cutters) should be used in preference over power tools to reduce the likelihood of dust generation.

Demolition of asbestos roofing sheets should be carried out in a way that minimises dust spreading, for example in a containment.

Depending on the risk assessment, water and, if applicable, a suitable binding agent, should be used.

MCAs removed whole should be carefully lowered to the ground to avoid breakage; bulk material/rubble chutes should not be used. Loose debris should not be swept; instead, it should be collected using vacuum cleaners (equipped with HEPA filters) or by wet methods that do not raise dust. Sub-structures beneath removed asbestos roofing should be cleaned by vacuuming or wet wiping.

([410]) Health and Safety Authority (HSA) (2013), *Asbestos-containing Materials (ACMs) in Workplaces – Practical guidelines on ACM management and abatement*, https://www.hsa.ie/eng/Publications_and_Forms/Publications/Chemical_and_Hazardous_Substances/Asbestos_Guidelines.pdf; HSE (2017), 'Introduction to asbestos essentials', https://www.hse.gov.uk/pubns/guidance/a0.pdf; Senior Labour Inspectors Committee (SLIC) (2006), 'A practical guide on best practice to prevent or minimise asbestos risks', https://www.ilo.org/publications/practical-guide-best-practice-prevent-or-minimise-asbestos-risks; Committee on Hazardous Substances (AGS) (2025), 'TRGS 519 – Asbestos – Demolition, renovation or maintenance work', https://www.baua.de/DE/Angebote/Regelwerk/TRGS/pdf/TRGS-519.pdf?__blob=publicationFile.

Where remote demolition techniques are used (such as when MCAs are disintegrating or the structure is unsafe), continuous spraying should be ensured. Enclosures, tents or other containment systems may be used. Remote demolition of asbestos roofing sheets should be carried out in a way that minimises dust generation, for example by directing debris inwards, into the interior of the building.

Where possible, all surfaces should be vacuumed or wet cleaned after completion of work. Multiple air changes should be performed before the space is declared safe for access without PPE, see Section 8.2.4.3.

Attention should be paid to other, non-asbestos occupational risks, such as working at height. Asbestos roofing sheets are not load-bearing and may fail under body weight. Workers should use load-spreading boards and catwalks (411).

Removed MCAs should be double-bagged or wrapped for transport as soon as possible. Asbestos-cement waste should not be bulldozed into piles, swept or thrown into lorries.

Waste water should be filtered prior to discharge, see Section 8.2.3.

#### *13.6.2.1.2 Organisational measures and personal protective equipment*

See Section 8.2.4 for general guidance on organisational measures.

Examples of potentially suitable PPE include (but always depend on the removal technique and the findings of the risk assessment):

- disposable coveralls (at a minimum Category 3 Type 5/6), see Section 8.2.7.1;
- respiratory protective devices (RPDs) (at a minimum, FFP3 or half-face mask with P3 filter, see Section 8.2.6);
- eye protection (e.g. goggles), see Section 8.2.7.4;
- boots without laces, footwear that can be decontaminated or overshoes, see Section 8.2.7.3;
- disposable underwear, see Section 8.2.7.1;
- gloves (e.g. nitrile), see Section 8.2.7.2.

Additional PPE may be necessary to protect against non-asbestos hazards, for example hard hats.

Considering the results of the risk assessment, the following steps should be followed upon completion of the work:

- decontamination of workers, see Section 8.2.2.2;
- cleaning of the building, see Section 8.2.2.2.4;
- final inspection, see Section 8.2.4.3.

### 13.6.2.2 Removal of asbestos-containing coatings (412)

The removal of asbestos-containing coatings is particularly challenging, as they often require destructive techniques that can generate significant amounts of dust, and therefore strict control measures are essential. The removal process typically involves scraping or other mechanical methods that, unless accompanied by dust control measures, can readily release asbestos fibres into the air. This section covers both textured and sprayed coatings, but it should be remembered that removal approaches for each of these MCAs differ.

(411) AGS (2025), 'TRGS 519 – Asbestos – Demolition, renovation or maintenance work', https://www.baua.de/DE/Angebote/Regelwerk/TRGS/pdf/TRGS-519.pdf?__blob=publicationFile.

(412) German Social Accident Insurance (DGUV) (2022), 'BT 53 Entfernen asbesthaltiger Wand- und Deckenbeschichtungen von Betonuntergründen mittels Strahlverfahren – GSA Streahlverfahren', https://www.dguv.de/medien/ifa/de/pra/asbest/bt-53.pdf; Irish Environmental Protection Agency (EPA) (2023), 'Best practice guidance for handling asbestos', https://www.epa.ie/publications/monitoring–assessment/waste/hazardous-waste/best-practice-guidance-for-handling-asbestos.php; HSA (2013), *Asbestos-containing Materials (ACMs) in Workplaces – Practical guidelines on ACM management and Abatement*, https://www.hsa.ie/eng/Publications_and_Forms/Publications/Chemical_and_Hazardous_Substances/Asbestos_Guidelines.pdf; HSE (2017), 'Introduction to asbestos essentials', https://www.hse.gov.uk/pubns/guidance/a0.pdf; HSE (2006), 'Asbestos: The licensed contractor's guide', https://www.hse.gov.uk/pubns/priced/hsg247.pdf; Steaming or dampening possible, see HSE (2017), 'Removing textured coating from a small area, for example 1 m$^2$', https://www.hse.gov.uk/pubns/guidance/a28.pdf; NFDC (2019), 'NNLW asbestos guidance notes', DRG103:2019; Senior Labour Inspectors Committee (SLIC) (2006), 'A practical guide on best practice to prevent or minimise asbestos risks', https://www.ilo.org/publications/practical-guide-best-practice-prevent-or-minimise-asbestos-risks; AGS (2025), 'TRGS 519 – Asbestos – Demolition, renovation or maintenance work', https://www.baua.de/DE/Angebote/Regelwerk/TRGS/pdf/TRGS-519.pdf?__blob=publicationFile.

Two types of asbestos-containing coatings were commonly used:

- textured decorating coatings and paints applied to walls and ceilings;
- sprayed coatings applied to ceilings, walls, beams, columns and objects (such as boilers).

When removing any sprayed asbestos or decorative coatings that involves scraping or other mechanical removal, containment should be set up.

#### *13.6.2.2.1 Technical measures*

Examples of equipment that may be needed include:

- plastic sheeting,
- wetting agent,
- spraying equipment or injection suppression equipment,
- hand tools (such as scrapers),
- an H-Class vacuum cleaner,
- waste bags,
- adhesive tape,
- thick plastic foil.

The process should begin by removing furniture, carpets, curtains and other items from the room. If containment is not used and non-work items cannot be removed from the work area, they should be covered with plastic sheeting and sealed with adhesive tape, and an airlock with at least three stages and decontamination facilities should be set up. The floor should be covered with plastic sheeting to prevent contamination.

Unless the coating can be removed using a non-destructive technique (such as removing the entire plasterboard), dust suppression techniques should be used. These include:

- wet removal,
- controlled dry removal,
- other techniques.

Wet removal is generally preferred. However, the decision should be based on an assessment of both the potential for asbestos dust generation and any additional hazards, such as electricity, other chemical substances and working at height, all of which may make wet stripping unsuitable in certain circumstances.

Uncontrolled dry removal or partial wetting should not be used, due to the high potential for dust generation.

Waste water should be filtered prior to discharge, see Section 8.2.3. For general control measures, see Section 8.

#### 13.6.2.2.1.1 Wet stripping

Wet removal techniques for asbestos-containing coatings include the following.

- Airless sprays, suitable for thin or porous materials. 'Airless' refers to the absence of gas or compressed air as a propellant, enabling low-pressure wet spraying. This method may not be suitable for sprayed asbestos coatings.
- Injection suppression, which involves injecting fluid to wet thick or impermeable materials internally.

Depending on the risk assessment, water and, if applicable, a suitable binding agent, should be used. The coating should be uniformly wetted, avoiding dry patches, and kept wet throughout the removal process. Correctly wetted asbestos should have a dough- or paste-like consistency. Over-wetting should be avoided, as it can result in a slurry-like consistency.

When using injection suppression systems:

- injection should take place at low pressure (3.5 bar);
- the system should rely as much as possible on gravity to distribute the fluid;
- if the surface is hard or non-porous, it may be necessary to drill holes or make cuts to ensure that injection suppression reaches all parts of material that is being removed;
- drilling should be accompanied by dust suppression techniques (wetting or extraction at the source).

Once the MCA is wetted, removal can be done, preferably by scraping using hand tools. If power tools have to be used, for example to remove strongly bound residuals, they should be run in a low-power mode, and preferably in combination with extraction at the source and other control measures.

Waste water should be filtered prior to discharge, see Section 8.2.3.

##### 13.6.2.2.1.2 Controlled dry removal

Controlled dry removal involves the use of dust extraction systems during the dry removal process to limit fibre release. This includes techniques such as shadow vacuuming, where dust is extracted at the point of generation.

The use of power tools should be avoided where possible. Manual tools should be used for scraping. Where power tools are necessary, such as for removing strongly bound residuals, they should be:

- used at low power;
- connected to an H-Class extraction system, whenever technically possible.

Other removal techniques not mentioned in this guide could also be applied to achieve a comparable result.

#### *13.6.2.2.2 Organisational measures and personal protective equipment*

Work should be carried out in a sequence that minimises recontamination, for example progressing from top to bottom, or from the ceiling to the walls.

See Section 8.2.4 for general guidance on organisational measures.

At a minimum, the following PPE should be used during removal:

- disposable coveralls (at a minimum Category 3 Type 5/6), see Section 8.2.7.1;
- RPDs (at a minimum, FFP3 or half-face mask with P3 filter, see Section 8.2.6);
- eye protection (e.g. goggles), see Section 8.2.7.4;
- boots without laces, footwear that can be decontaminated or overshoes, see Section 8.2.7.3;
- disposable underwear, see Section 8.2.7.1;
- gloves (e.g. nitrile), see Section 8.2.7.2.

Additional PPE may be required for non-asbestos hazards, such as a hard hat. In some situations, further PPE may be advisable.

Upon completion of asbestos removal work, the following steps should be followed:

- decontamination of workers, see Section 8.2.2.2;
- cleaning of the building, see Section 8.2.2.2.4;
- final inspection, see Section 8.2.4.3.

### 13.6.2.3 Removal of vinyl floor tiles and adhesives (413)

Vinyl floor tiles and associated adhesives containing asbestos were widely used in buildings from the 1950s to the 1980s. Vinyl asbestos tiles are flooring materials in which asbestos fibres are bound in a vinyl matrix and affixed to the subfloor using adhesive.

These materials can degrade over time. If disturbed during renovation or removal, both the tiles and the adhesives can release asbestos fibres. This is particularly true when the materials are strongly adhered or when the adhesive is removed (which should be done to prevent future exposure risks during renovation work).

#### *13.6.2.3.1 Technical measures*

Examples of equipment that may be needed include:

- plastic sheeting,
- sprayer with water mixed with detergent or surfactant,
- putty knife,
- scissors,
- knife,
- wet wipes / damp cloth,
- adhesive tape,
- H-Class vacuum cleaner,
- waste bags.

Before starting work, furniture, carpets, curtains and other items should be removed from the room. Fixtures that cannot be removed, such as heaters

(413) Estonian Health Development Institute (2011), 'Methods for low-risk asbestos work in demolition, renovation, and maintenance activities – Guide', https://www.tallinn.ee/et/media/298612; Safe Work Australia (2020), 'How to safely remove asbestos – Code of Practice', https://www.safeworkaustralia.gov.au/sites/default/files/2020-07/model_code_of_practice_how_to_safely_remove_asbestos.pdf; WorkSafe Victoria (2019), 'Compliance code: Removing asbestos in workplaces', 2nd edition, https://content-v2.api.worksafe.vic.gov.au/sites/default/files/2020-02/ISBN-Compliance-code-removing-asbestos-workplaces-2019-12.pdf; Deutsche Gesetzliche Unfallversicherung (DGUV) (2023) 'BT 11 Ausbau von asbesthaltigen Vinylplatten', https://www.dguv.de/medien/ifa/de/pra/asbest/bt_11.pdf.

and built-in furniture, should be covered with plastic sheeting and sealed with adhesive tape.

The floor should be moistened in sections. Tiles should be removed manually using a putty knife while ensuring they remain as intact as possible. Depending on the risk assessment, water and, if applicable, a suitable binding agent, should be sprayed underneath the tiles during removal.

Electric scrapers should not be used. Removed tiles should be placed in a plastic bag with a thickness of over 0.2 mm and then placed in a labelled cardboard box. After tile removal, any remaining floor covering residues or adhesives should be scraped off with a putty knife. Loose fragments and dust should be cleaned using an H-Class vacuum cleaner. Tools should be wiped with a damp cloth, which should then be disposed of as waste containing asbestos (WCA), see Section 8.2.2.2.2.

After the surface dries, the floor should be vacuumed and all other surfaces should be wiped with a damp cloth. A fixative should be applied to bind any residual fibres on the floor.

#### *13.6.2.3.2 Organisational measures and personal protective equipment*

No specific organisational measures are required beyond the general guidance provided in Section 8.2.4.

At a minimum, the following PPE should be used:

- disposable coveralls (at a minimum Category 3 Type 5/6), see Section 8.2.7.1;
- RPDs (at a minimum, FFP3 or half face mask with P3 filter, see Section 8.2.6);
- eye protection (e.g. goggles), see Section 8.2.7.4
- boots without laces, footwear that can be decontaminated or overshoes, see Section 8.2.7.3;
- disposable underwear, see Section 8.2.7.1;
- gloves (e.g. nitrile), see Section 8.2.7.2.

Other PPE may need to be worn for non-asbestos hazards (e.g. hard hat, ear protection). Additional PPE may also be advisable in some situations.

After completing asbestos removal work, the following steps should be taken:

- decontamination of workers, see Section 8.2.2.2;
- cleaning of the building, see Section 8.2.2.2.4;
- final inspection, see Section 8.2.4.3.

### 13.6.2.4 Removal in crawl spaces

Removing asbestos in crawl spaces presents several challenges, primarily due to the confined nature of these spaces. Crawl spaces often have limited entry points, such as small manholes, which restrict worker access and complicate evacuation in emergencies. Floors may be unsealed (e.g. soil), making it difficult to apply conventional cleaning methods, such as vacuuming, and complicating the maintenance of negative pressure environments.

Examples of MCAs often found in crawl spaces include pipe joints and ventilation ducts. In these cases, the first step is to assess whether asbestos removal is necessary. In some cases, particularly where demolition is not planned, alternative approaches such as targeted containment, improved ventilation and air monitoring may be more appropriate.

Common approaches to managing these challenges include:

- implementing shorter working shifts to prevent fatigue in the constrained conditions;
- ensuring emergency exits are sufficient in number and dimensions, in accordance with national legislation;
- creating additional or more convenient access points/manholes (e.g. through floors or foundation walls when existing manholes are insufficient or too small) – this is more feasible in demolition activities;
- instead of vacuuming, using plastic sheeting to cover the floor during asbestos removal, then carefully collecting and disposing of the sheeting as WCA to contain contamination;
- installing airlocks at access points and manholes to prevent further contamination.

**Figure 13-3: Work in crawl spaces**

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### 13.6.2.5 Removal in roofs

Asbestos removal from roofs presents distinct challenges, due to exposure to wind and weather conditions that can disperse asbestos fibres. The 'tent-in-tent' method is typically employed for asbestos removal from roofs to prevent contamination of surrounding areas, particularly in urban environments.

This method involves two primary containment layers.

- External covering: a weatherproof outer layer that provides weather protection and creates a structural framework for the internal containment system. The external covering shields the work area and complies with general safety requirements for roof renovations by preventing wet and slippery conditions.
- Internal asbestos containment tent: installed underneath the external covering, this layer can be either:
  - a mobile unit, repositioned as work progresses;
  - a fixed enclosure customised to match the roof's angles and inclination, typically 1.2–1.8 metres in height.

Scaffolding around the building should be equipped with side barriers to prevent falls. These barriers should be made airtight using plastic sheeting, extending to the edges to create a hermetically sealed perimeter.

During high wind conditions, scaffolding companies may need to remove the external plastic side coverings to prevent structural damage to the enclosure. To mitigate this risk, some systems use an innovative pulley-based hoisting system that allows the internal asbestos tent to be quickly lowered while maintaining its seal. This ensures containment is preserved, but work should pause until weather conditions improve.

Some systems support modular suspension structures for the internal tent, allowing it to be suspended from the external covering. These suspension systems use lightweight aluminium components that can be assembled without tools and adjusted to various heights and angles. They connect to scaffolding pipes from the external covering and include brackets for securing roof battens, to which containment materials can be attached. The scaffolding company needs to approve the additional weight of these systems.

**Figure 13-4: Suspension system inside an asbestos tent**

In rural or isolated areas, full-tent containment may not be necessary. Thorough wetting of materials may be sufficient to minimise fibre release, depending on the risk assessment and national requirements.

In all cases, horizontal surfaces should either be thoroughly cleaned after work is completed or protected in advance with plastic sheeting, which should be carefully removed and disposed of once work is completed.

#### 13.6.2.6 Removal in large indoor spaces

Managing asbestos in large indoor spaces, such as schools or hangars, presents specific challenges, including the inability for standard negative pressure equipment to effectively manage the large volume of air in these environments. At the same time, there is potential for contamination to spread to adjacent areas.

A potential approach involves dividing the work area into smaller sections or workspaces. Each section is individually enclosed and controlled using negative pressure equipment capable of effectively managing that zone. Work proceeds sequentially through the sections, with complete decontamination before transitions to the next sections. The interfaces between the sections need special attention in that no MCAs remain or are overlooked.

This phased approach ensures effective containment and decontamination.

## 13.7 Passive exposure

Passive exposure may occur in the vicinity of active asbestos-related work or in premises where MCAs are degrading in building structures ([414]), see Section 7. This section addresses how to manage such risks where MCAs are present in building structures.

Situations where risk to passive exposure may be present include:

- buildings with known or suspected MCAs in seemingly good condition;
- the period before scheduled removal of MCAs;
- buildings where complete removal is not immediately feasible;
- routine maintenance in buildings where MCAs are present.

Measures such as encapsulation can significantly reduce the risk of passive exposure but are not a permanent solution. The ultimate objective should always be the safe removal of all MCAs when feasible. The asbestos management plan (AMP) should be reviewed regularly to determine when safe removal can be undertaken.

([414]) Directive (EU) 2023/2668, recital 5.

## 13.8 Training

In addition to the general training requirements outlined in Section 9, specific training considerations apply to workers involved in the maintenance, renovation or demolition of buildings. These include:

- identifying suspected MCAs when discovered unexpectedly during building maintenance;
- understanding the asbestos inventory and its importance;
- procedures for working around MCAs managed *in situ*;
- recognising and reporting signs of degrading MCAs;
- applying special precautions for maintenance and renovation activities in buildings with known or suspected MCAs.

Additional training must be provided to workers who engage in demolition or asbestos removal work, including on the use of technological equipment and machinery designed to control fibre release and spread ([415]).

## 13.9 Health surveillance

For health surveillance requirements, see Section 10.

## 13.10 Incident management

For incident management procedures, see Section 11.

## 13.11 Waste management

WCA should be removed as soon as possible from the work area.

In addition to the general information provided in Section 12, the following apply to buildings.

- **Waste collection areas.** Designate specific areas within the building for the temporary storage of WCA before it is transported off-site. These areas should be clearly marked, and access should be restricted to authorised personnel only.
- **Transport within buildings.** WCA should be transported in sealed containers on wheel-driven carts. These carts should be cleaned regularly to avoid external contamination.
- **Disposal of cleaning materials.** All materials used for cleaning after asbestos removal, including disposable PPE, should be treated as WCA and disposed of accordingly.

For further details, see Section 12.

([415]) Directive 2009/148/EC, Annex Ia(6).


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# 14 Ships, trains, aircraft, vehicles and machinery

## 14.1 Scope

This section builds on Sections 3 to 12 by providing additional information relevant to occupational activities that relate to ships, trains, aircraft, vehicles and machinery.

### 14.1.1 Ships

The use of materials containing asbestos (MCAs) in ships was widespread in the past, see Section 14.4 and Annex 4. Although the use of MCAs was gradually restricted both within and outside the EU (see national bans in Section 5.3), MCAs can still be found on many ships, submarines and offshore vessels such as oil rigs.

In addition to EU-level restrictions (including Regulation (EU) No 1257/2013), since July 2002 the International Convention for the Safety of Life at Sea (SOLAS) ([416]), adopted by the International Maritime Organization (IMO), only permitted the use of MCAs in specific ship components, including:

- vanes used in rotary vane compressors and rotary vane vacuum pumps;
- watertight joints and linings used for the circulation of fluids when, at high temperature (in excess of 350 °C) or pressure (in excess of $7 \times 10^6$ pascals), there is a risk of fire, corrosion or toxicity;
- supple and flexible thermal insulation assemblies used for temperatures above 1 000 °C.

A full international prohibition on the use of MCAs in ships entered into force on 1 January 2011 through an amendment to SOLAS (Resolution MSC.282(86) 2009) ([417]). This prohibition includes MCAs purchased prior to 1 January 2011 ([418]).

However, ships built before 2011 may still contain asbestos in some components. Considering that the typical lifespan of a ship is approximately 30 years ([419]), workers may still be exposed to MCAs.

([416]) International Maritime Organisation (n.d.), 'Asbestos on board ships', https://www.imo.org/en/OurWork/Safety/Pages/Asbestos.aspx.

([417]) International Maritime Organisation (n.d.), Resolution MSC, 282(86); Annex, Part A-1, 'Structure of ship', https://www.imo.org/en/OurWork/Safety/Pages/Asbestos.aspx.

([418]) International Maritime Organisation (n.d.), IMO 'MSC.1/Circ.1379 Unified Interpretation of SOLAS Regulation II-1/3-5', https://www.imo.org/en/OurWork/Safety/Pages/Asbestos.aspx.

([419]) Du, Z., Zhang, S., Zhou, Q., Yuen, K. F. and Wong, Y. D. (2018), 'Hazardous materials analysis and disposal procedures during ship recycling', *Resources, Conservation and Recycling*, Vol. 131, pp. 158–171, https://doi.org/10.1016/j.resconrec.2018.01.006; Mikelis, N. E. (2008), 'A statistical overview of ship recycling', *WMU Journal of Maritime Affairs*, Vol. 7, pp. 227–239, https://doi.org/10.1007/BF03195133.

In addition, MCAs may be present in ships regardless of their construction date due to construction or maintenance carried out in countries with less stringent asbestos regulations ([420]). For example, components such as gaskets may be replaced during servicing outside the EU with components that contain MCAs in countries where such use is still permitted.

### 14.1.2 Trains

The use of asbestos in the railway industry was widespread, see Section 14.4 and Annex 4. MCAs were used for specific components such as gaskets for the insulation of boilers and carriages ([421]). Additionally, asbestos could be found in signal boxes, depots, outbuildings and other electrical equipment along railway lines ([422]). Although asbestos has largely been replaced by other materials such as fibreglass ([423]), the long lifespan of most trains means that individual components may still contain MCAs, posing a risk to workers ([424]). There is also a risk of MCAs being introduced during maintenance performed outside the EU, where regulations may be less stringent.

### 14.1.3 Aircraft

MCAs were commonly used in aircraft components such as brakes, where the chrysotile asbestos content ranged from 16 % to 23 % by weight, used as an aggregate in phenolic binders ([425]). Other components with MCAs included engine parts, electrical insulation, composite materials ([426]), blankets, brakes, cockpit heating systems, heat shields for engines, torque valves, gaskets, wiring and insulation, and cargo bays booths, see Section 14.4 and Annex 4. Aircraft serviced outside the EU or in countries with more lenient asbestos regulations may still contain MCAs.

### 14.1.4 Vehicles

Vehicles that may contain MCAs include cars, motorcycles, buses, trucks, agricultural vehicles, tractors, cranes, excavators and other special-purpose vehicles ([427]). In the past, asbestos was widely used in vehicle construction, meaning older vehicles (such as classic, vintage, heritage and historic models) may still contain MCAs. This is also the case for vehicles manufactured in countries where asbestos is not banned, posing a risk during maintenance ([428]). Historically, asbestos was used in

([420]) Brandweer (2018), 'Fire department response in the event of asbestos incidents', https://nipv.nl/wp-content/uploads/2022/04/201811-BRWNL-Brancherichtlijn-en-publicatie-Brandweeroptreden-bij-asbestincidenten-1.pdf.

([421]) Battista, G., Belli, S., Comba, P., Fiumalbi, C., Grignoli, M. et al. (1999), 'Mortality due to asbestos-related causes among railway carriage construction and repair workers', *Occupational Medicine*, Vol. 49, pp. 536–539, https://doi.org/10.1093/occmed/49.8.536; Maltoni, C., Pinto, C. and Mobiglia, A. (1991), 'Mesotheliomas due to asbestos used in railroads in Italy', *Annals of the New York Academy of Sciences*, Vol. 623, pp. 347–367, https://pubmed.ncbi.nlm.nih.gov/1809148/.

([422]) Office of Rail and Road (2014), 'ORR position paper on asbestos in the rail industry', https://www.orr.gov.uk/media/15531.

([423]) Maltoni, C., Pinto, C. and Mobiglia, A. (1991), 'Mesotheliomas due to asbestos used in railroads in Italy', *Annals of the New York Academy of Sciences*, Vol. 623, pp. 347–367, https://pubmed.ncbi.nlm.nih.gov/1809148/.

([424]) Office of Rail and Road (2024), '2023 REACH asbestos survey – Stakeholder survey report', https://www.orr.gov.uk/sites/default/files/2024-07/2023-reach-asbestos-survey-stakeholder-report.pdf.

([425]) Blake, C. L., Johnson, G. T. and Harbison, R. D. (2009), 'Airborne asbestos exposure during light aircraft brake replacement', *Regulatory Toxicology and Pharmacology*, Vol. 54, pp. 242–246, https://doi.org/10.1016/j.yrtph.2009.04.007.

([426]) Costa, G., Merletti, F. and, Segnan, N. (1989), 'A mortality cohort study in a north Italian aircraft factory', *Occupational and Environmental Medicine*, Vol. 46, Issue 10, pp. 738–743, https://pubmed.ncbi.nlm.nih.gov/2818961/.

([427]) Australian Government, Asbestos Safety and Eradication Agency (n.d.), 'Asbestos awareness for the automotive industry and historic vehicle enthusiasts', https://www.asbestossafety.gov.au/sites/default/files/documents/2021-09/Asbestos%20awareness%20for%20the%20automotive%20industry%20and%20historic%20vehicle%20enthusiasts_0.pdf.

([428]) Brandweer (2018), 'Fire department response in the event of asbestos incidents', https://nipv.nl/wp-content/uploads/2022/04/201811-BRWNL-Brancherichtlijn-en-publicatie-Brandweeroptreden-bij-asbestincidenten-1.pdf; Australian Government, Asbestos Safety and Eradication Agency (n.d.), 'Asbestos awareness for the automotive industry and historic vehicle enthusiasts', https://www.asbestossafety.gov.au/sites/default/files/documents/2021-09/Asbestos %20awareness %20for %20the %20automotive %20industry %20and %20historic %20vehicle %20enthusiasts_0.pdf.

many areas of vehicle construction, including brake pads and linings, clutch plates and housings, seals, gaskets, pipe wrap insulation (lagging), exhaust system insulation (flat and rope), firewalls and plastic MCAs (such as seat bases and battery holders). It was also used in bituminous coatings for underbodies and soundproofing in areas such as the interior floor pan, rear parcel shelf, boot, under the bonnet and wheel arches ([429]), see Section 14.4 and Annex 4.

### 14.1.5 Machinery

Asbestos was commonly used in machinery components for many years due to its resistance to high friction, pressure and heat ([430]), see Section 14.4 and Annex 4.

## 14.2 Coordination

Where asbestos-related work is carried out during the maintenance, renovation or demolition of ships, trains, aircraft and vehicles, a coordinator (similar to the SHC in the construction sector) could be appointed for any site on which more than one contractor is present, see Section 3.2.2.

## 14.3 Risk assessment

A risk assessment must be conducted for any activity likely to involve a risk of exposure to dust arising from asbestos or MCAs ([431]), see Section 4.1.

The removal of asbestos must be prioritised over other forms of asbestos handling in the risk assessment ([432]). However, removal may not always be feasible, or deferring removal to a later stage, such as during scheduled refurbishment, may reduce overall occupational exposure risks. Removal decisions should consider the potential for exposure during maintenance activities, non-routine tasks and passive exposure, see Section 7.

The risk assessment should determine whether containment is required (see Section 8.2.2.1) and identify the relevant organisational measures and removal techniques.

### 14.3.1 Notification

A notification must be submitted to the responsible authority of the Member State prior to commencing any activity likely to involve a risk of exposure to asbestos dust, unless the Member State concerned has derogated such activities from the notification requirement as provided for by Article 3(3) of the AWD ([433]), see Section 4.3.

([429]) Brandweer (2018), 'Fire department response in the event of asbestos incidents', https://nipv.nl/wp-content/uploads/2022/04/201811-BRWNL-Brancherichtlijn-en-publicatie-Brandweeroptreden-bij-asbestincidenten-1.pdf; Australian Government, Asbestos Safety and Eradication Agency (n.d.), 'Asbestos awareness for the automotive industry and historic vehicle enthusiasts', https://www.asbestossafety.gov.au/sites/default/files/documents/2021-09/Asbestos%20awareness%20for%20the%20automotive%20industry%20and%20historic%20vehicle%20enthusiasts_0.pdf.

([430]) University of Manchester (2017), 'Safety services guidance - Asbestos in equipment', https://documents.manchester.ac.uk/display.aspx?DocID=23182.

([431]) Directive 2009/148/EC, Article 3(2) .

([432]) Directive 2009/148/EC, Article 3(2).

([433]) Directive 2009/148/EC, Article 4.

### 14.3.2 Plan of work

A plan of work must be drawn up before starting any activity involving the removal of asbestos and/or MCAs from structures, plants, installations or ships ([434]), see Section 4.2. A plan of work should be based on a risk assessment tailored to the specific situation and activities to be undertaken.

## 14.4 Identifying asbestos

For general principles of asbestos and MCA identification, see Section 5.

Where a material or component is suspected of containing asbestos, it should be treated as an MCA until proven otherwise. A qualified individual should confirm whether the material is an MCA and, where relevant, identify the type of asbestos present.

Products containing MCAs may enter the EU in products manufactured in countries where the use of asbestos is not fully prohibited. Even in some jurisdictions with formal bans, limited uses may still be permitted. When purchasing products online, the country of origin and the materials used in the product should be verified. Generic material descriptions such as 'mineral fibres' or 'other materials' should be treated with caution ([435]).

The identification of asbestos should be carried out by a specialist. Non-invasive techniques, such as visual inspection and manufacturer declarations, may need to be combined with sampling and laboratory analysis.

### 14.4.1 Ships

MCAs (see Annex 4) were used in ships ([436]) and may still be present in components such as bulkhead, deck and pipe insulation, primarily in crew accommodation areas and engine rooms. However, asbestos fibres or dust can also be found in other parts of the ship, including ([437]):

- behind partition walls adjacent to bulkheads;
- cavities between partition walls;
- spaces between ceilings and upper decks;
- areas between floating floors and decks, and within escape trunks.

These void spaces are not designed for regular access, often lack ventilation and may contain friable MCAs. Vibrations experienced on ships can cause these MCAs to release fibres into the air, posing health risks to workers ([438]).

([434]) Directive 2009/148/EC, Article 13.

([435]) Australian Government, Asbestos Safety and Eradication Agency (n.d.), 'Asbestos awareness for the automotive industry and historic vehicle enthusiasts', https://www.asbestossafety.gov.au/sites/default/files/documents/2021-09/Asbestos%20awareness%20for%20the%20automotive%20industry%20and%20historic%20vehicle%20enthusiasts_0.pdf.

([436]) Wu, W., Lin, Y., Li, C., Tsai, P., Yang, C. et al. (2015), 'Cancer attributable to asbestos exposure in shipbreaking workers: A matched-cohort study', *PLoS One*, Vol. 10, Issue 7, pp. 1–12, https://doi.org/10.1371/journal.pone.0133128.

([437]) Fraguela-Formoso, J. Á., Fernández-Soto, J. L., Fariñas-Alvariño, P. and Carral-Couce, L. (2016), 'Seguridad marítima: Asbestos en la industria marítima', *DYNA*, Vol. 83, Issue 198, pp. 205–212, https://doi.org/10.15446/dyna.v83n198.50065.

([438]) Singh, R., Cherrie, J. W., Rao, B. and Asolekar, S. R. (2020), 'Assessment of the future mesothelioma disease burden from past exposure to asbestos in ship recycling yards in India', *International Journal of Hygiene and Environmental Health*, Vol. 225, 113478, https://doi.org/10.1016/j.ijheh.2020.113478.

Figure 14-1: Ships – where asbestos might be found (non-exhaustive)


**A: Cabin**

Heating, ventilation and air-conditioning (HVAC) system

Adhesives

Floor and wall coverings

**B: Common areas**

Levelling compounds

Wall coverings

Insulations

Spaces between ceilings, floating floors and decks

**C: Hull**

Spray coatings

Flocking

Bituminous paint and tar

**D: Ballast tanks**

Ballast in ballast tanks

**E: Bulkheads**

Backside of partition walls adjacent to bulkheads

Cavities between partition walls

**F: Engine, pump and boiler rooms**

Control panels

Incinerator

Pipe insulation

Electric materials

Heat exchanger

Rotary vane compressor

Rotary vane vacuum pumps

Watertight joints and linings

Thermal insulation

Coating/painting inside or outside ducts

Asbestos removal on ships can be supported by the Inventory of Hazardous Materials (IHM), as outlined in the Hong Kong Convention. Ships registered in Member States that are parties to the convention must carry an IHM on board, prepared in accordance with the IMO Resolution MEPC.379(80) – 2023 Guidelines for the Development of the Inventory of Hazardous Materials. ([439]) This document can support the planning and execution of asbestos removal and management on board.

In addition, national approaches, such as the French Standardisation Association (AFNOR) standard NF X46-101:2019, can provide procedures for surveying asbestos in ships, boats and other floating structures ([440]).

Asbestos may be present in ships regardless of their construction date due to the potential incorporation of MCAs during maintenance performed in countries with less stringent asbestos regulations. Therefore, the IHM should be kept updated. Any change, replacement or significant repair of the structure, equipment, systems, fittings, arrangements or materials that impact the IHM requires a material assessment ([441]). In addition, assessments of hazardous materials must be carried out at intervals not exceeding five years, and a final materials assessment must be carried out prior to recycling ([442]).

There is a possibility that ships, trains, aircraft, vehicles or machinery that have undergone maintenance outside the EU may have MCAs such as gaskets incorporated into them. Therefore, whenever they undergo maintenance in a country where asbestos is not banned or where it is possible that MCAs may be used despite a ban, it should be checked that no MCAs have been introduced. In the case of ships, the responsible parties should conduct a new partial material assessment to confirm that no MCAs have been introduced ([443]).

When a ship reaches the end of its operational life, it can be sent to a shipbreaking yard for dismantling. Shipbreaking poses significant health risks due to the presence of hazardous materials, including asbestos ([444]). To mitigate these risks, Regulation (EU) No 1257/2013, as amended by Regulation (EU) 2024/1157, sets out ship recycling rules in line with the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships ([445]). Under this framework, all EU commercial vessels must carry an IHM prepared in accordance with IMO guidelines.

([439]) IMO Resolution MEPC.379(80) – 2023 Guidelines for the Development of the Inventory of Hazardous Materials, https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/RES.MEPC.379(80)%20IHM.pdf

([440]) AFNOR (2019), 'NF X46-101:2019 – Asbestos survey – Survey of asbestos-containing materials and products in ships, boats and other constructions – Mission and methodology', https://www.boutique.afnor.org/en-gb/standard/nf-x46101/asbestos-survey-survey-of-asbestos-containing-materials-and-products-in-shi/fa194766/1770.

([441]) Regulation (EU) No 1257/2013 of the European Parliament and of the Council of 20 November 2013 on ship recycling and amending Regulation (EC) No 1013/2006 and Directive 2009/16/EC (OJ L 330, 10.12.2013, pp. 1–20, ELI: http://data.europa.eu/eli/reg/2013/1257/oj), Article 8(6).

([442]) Regulation (EU) No 1257/2013, Articles 8(5) and 8(7); Maritime and Port Authority of Singapore (2012), 'Shipping circular to shipowners No. 19 of 2012', see 'Resolution MEPC.222(64) – 2012 guidelines for the survey and certification of ships under the Hong Kong Convention', https://www.mpa.gov.sg/docs/mpalibraries/circulars-and-notices/shipping-circulars/-sc_no_19_of_2012.pdf?sfvrsn=8403fca4_0.

([443]) Regulation (EU) No 1257/2013, Article 8(6).

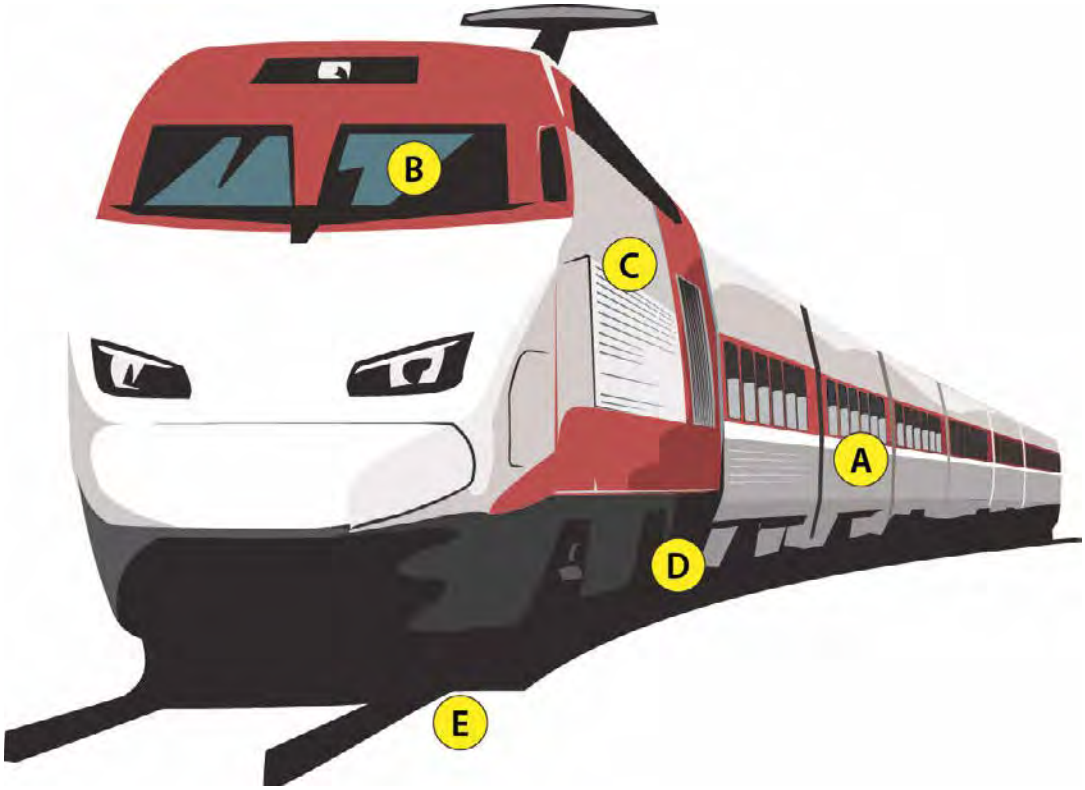
([444]) Du, Z., Zhang, S., Zhou, Q., Yuen, K. F. and Wong, Y. D. (2018), 'Hazardous materials analysis and disposal procedures during ship recycling', *Resources, Conservation and Recycling*, Vol. 131, pp. 158–171, https://doi.org/10.1016/j.resconrec.2018.01.006.

([445]) IMO (n.d.), The Hong Kong International Convention For The Safe And Environmentally Sound Recycling Of Shipshttps://www.imo.org/en/About/Conventions/Pages/The-Hong-Kong-International-Convention-for-the-Safe-and-Environmentally-Sound-Recycling-of-Ships.aspx.

## 14.4.2 Trains

A comprehensive guide to procedures for assessing the presence of asbestos in railway rolling stock is provided in the French standard NF F01-020:2019, published by AFNOR in 2019 ([446]).

**Figure 14-2: Trains – where asbestos might be found (non-exhaustive)**




**A: Carriage**

Floor

Window joints

Interior walls

Painting

Bituminous surface

Thermal insulation

Electrical insulation

Acoustic insulation

Anti-vibration coating

HVAC system (e.g. seals)

Gaskets

**B: Driver's cab**

Fire insulation of switchgear and circuit boards

Electric insulation

Acoustic insulation

Anti-vibration coating

HVAC system

**C: Engine**

Thermal insulation

Electrical insulation

Belts and conveyors

Seals (wiper motor friction ring)

**D: Break and clutch system**

Brake pads

Brake clutch discs

Brake cylinders

Brake control (seals)

**E: Railway track**

Ballast

**Not shown**

Thermal insulation of boilers and pipes

Exhaust

([446]) AFNOR (2019), 'NF F01-020:2019 – Railway application – Asbestos detection – Identification of MCAs and products in railway rolling stock', https://www.boutique.afnor.org/fr-fr/norme/nf-f01020/applications-ferroviaires-reperage-amiante-identification-des-materiaux-et-/fa194582/1814.

An example of an asbestos identification and removal plan in the transport sector is provided below.

**Box 14-1: Example of an asbestos removal plan at a major European train operator**

This train operator has a 10-year plan to remove or remediate asbestos in MCAs from rolling stock, fixed installations and civil infrastructure, due to be completed in 2028. This box focuses primarily on the identification and removal of asbestos from rolling stock. Around 13 900 rolling stock components were found to contain asbestos, including valves, washers, insulation and other hard-to-reach equipment.

All removal of MCAs is carried out by specialist asbestos contractors and protocols are in place to manage the risk of exposure during removal. To date, approximately 70 000 individual rolling stock MCAs have been removed, representing 70 % of the identified MCAs, and approximately 270 000 rolling stock components have been traced.

External contractors operate a continuous air monitoring programme across cabs, maintenance spaces and sealed systems. Any deviation triggers immediate corrective action. The results are archived in a central registry. Over 5 000 air quality measurements have been taken to date, and no airborne fibres have been detected.

The plan has three phases.

- **Characterisation.** Systematic inspection and analysis to identify MCAs. This is supported by external laboratories and specialist companies.
- **Management.** A control plan is developed for each MCA identified, and its safe removal is planned in accordance with safety regulations and with minimal disruption on the service provided.
- **Removal.** MCAs are removed from three main areas, namely rolling stock, fixed installations and infrastructure. Each phase is continually updated to reflect operational realities and new findings.

**Characterisation**

The train operator contacted all original train and component manufacturers, including assemblers and hundreds of subsystem suppliers (such as electrical, pneumatic, braking systems) asking them to provide certification of the asbestos content of their products. When a manufacturer formally certified that a component was asbestos-free, the train operator excluded the component from further testing. However, where manufacturers failed to provide documentation, expressed uncertainty or gave inconclusive responses, these components were classified as 'suspected' and underwent laboratory testing.

Many manufacturers were unaware that their components contained asbestos. Sometimes asbestos was added to equipment on an ad hoc basis, such as during maintenance, meaning that if asbestos is found in a component, it might be in all components of this type or only the one. Many manufacturers had incomplete archives, had changed ownership or no longer existed, especially for equipment manufactured before the national asbestos ban. In addition, spare parts coming from countries outside the EU sometimes still contain asbestos, even though they may be marked asbestos free. The train operator spent about five years gathering this information. As a result, a significant proportion of the 1 200–1 300 potentially affected train cars required direct inspection. Thousands of components across the train fleet were inspected, many of which were fully dismantled or rendered inoperable.

In some cases, removal of components with identified MCAs is not possible, due to the absence of viable replacements. If the asbestos is shown to be confined or could be encapsulated, and the risk assessment establishes that the risk of exposure is removed, the component can continue to be used.

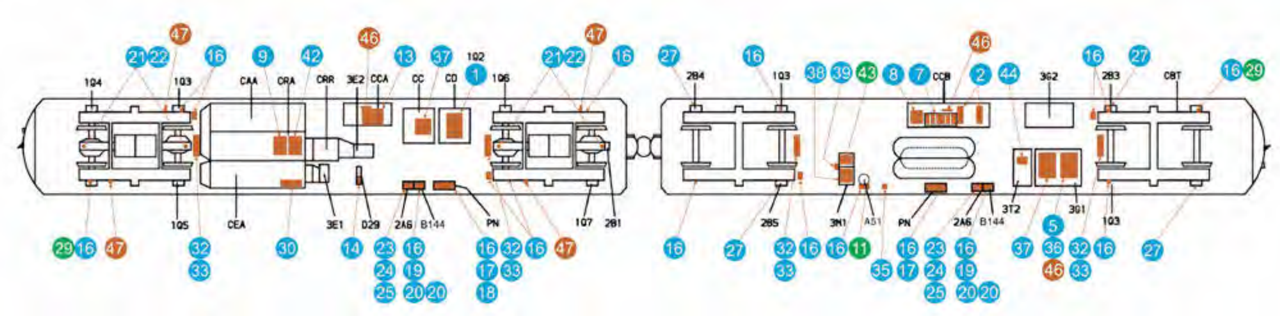
Some components were tested in the laboratory, others in the maintenance areas under containment. Every analysed component was assigned a category:

- no asbestos found;
- MCA removed;
- identified and controlled MCA (as shown by the risk assessment): MCA either embedded deep within a unit and inaccessible under normal conditions or encapsulated to prevent the release of fibres;
- unconfined MCA, accessible under normal conditions.

Every unit, sub-assembly and component was recorded in a central database, including those containing no asbestos.

**Box 14-1: Example of an asbestos removal plan at a major European train operator**

**Figure 14-3: Train with location of MCAs: green = MCA removed; blue = MCA encapsulated or confined, prior to removal; orange = MCA to be removed**

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**Management**

Staff are trained to visually identify suspect MCAs. A formal procedure was implemented, so that:

- all workers know how to identify MCAs, what to do if they find them and who they should tell: this is supported by training;
- any worker observing a suspicious part can halt work immediately;
- a third-party asbestos contractor is brought in to advise and remove MCAs as necessary;
- samples are taken;
- workbenches and the areas around them are thoroughly decontaminated.

Once an MCA is identified, a control plan is developed covering the risk assessment, inspections, describing how the MCA should be removed or encapsulated, environmental measurements and audits. The train could be an operational train, removed from operation for removal or a non-operational train (mothballed for spare parts). There are four occasions when removal takes place:

- scheduled long-term maintenance, usually at approximately every 600 000–720 000 km or approximately every three to seven years, depending on the line where the train operates;
- corrective maintenance, when there is a fault or accident;
- scheduled short-term maintenance;
- recovering spare parts that are MCAs from mothballed trains.

**Removal**

All MCA removal is carried out by contractors certified by the national register of asbestos removal specialists. A requirement of certification is that these contractors provide health surveillance for current and former workers.

Where possible, affected components are removed during scheduled maintenance and transported to the train operator's removal premises. Inside containment units, contractors perform the removal and decontamination. There are five containment units at the removal premises, all of which have three chambers. The containment units include:

- three small containment units for miscellaneous MCAs;
- one large containment unit for bulky MCAs;
- one large containment unit with a pit for bogies.

**Box 14-1: Example of an asbestos removal plan at a major European train operator**

Figure 14-4: Large containment unit with a pit for bogies



Where removal involves large or integrated components, for example certain pneumatic valves or fuse boxes, which cannot be taken to the removal premises, removal is carried out using custom containment tents with filtered air supply systems and strict personal protection equipment (PPE) protocols.

All containment units operate under strict negative pressure and regular air monitoring takes place within them.

The serial number and component's unique identifier are recorded in the central database, allowing full traceability of each item's decontamination history, usage cycle and reinstallation. On the MCA, the serial number and unique identifier are marked on the MCA in four ways, to ensure that the information always remains with the component:

- etching the component;
- label attached to component;
- radio-frequency identification chip attached to component;
- QR code attached to component, enabling a worker to find the serial number and unique identifier directly.

Removal of MCAs is key for waste management as trains cannot be recycled within the circular economy if they still contain MCAs. Managing the removal of bituminous paint containing asbestos is particularly difficult.

**Results to date**

The component database holds:

- component level inventory for each train (detailing every component that has been flagged, tested or remediated);
- location data (e.g. cab, undercarriage, electrical compartment) and confined or unconfined status;
- date and method of remediation (removal, encapsulation or replacement);
- certifications and laboratory reports issued by the removal contractors;
- colour-coded mapping of progress (completed, in progress or planned).

**Rolling stock maintenance manager's comments**

'An unexpected benefit of the database is that we can now analyse trends such as component failures.'

### 14.4.3 Aircraft

Examples of locations where asbestos can be found on an aircraft are shown in Figure 14-5.

An example of a comprehensive guide to procedures for assessing the presence of asbestos in aircraft is provided in the French standard NF L 80-001:2020, published by AFNOR in 2020 ([447]).

**Figure 14-5: Aircraft – where asbestos might be found (non-exhaustive)**


**A: Fuselage**

Insulation and composite materials

**B: Air conditioning**

Moulded piping

Fitted pipework

Insulating sleeve

Solenoid valve seal

**C: Cockpit**

Insulation of cockpit door

Composite materials (handles, push buttons)

Pilot stick

**D: Brake system**

Brake pads

Brake friction linings

**E: Engine**

Rear bearing seal

Braided joints

Fuel system joints

Gaskets

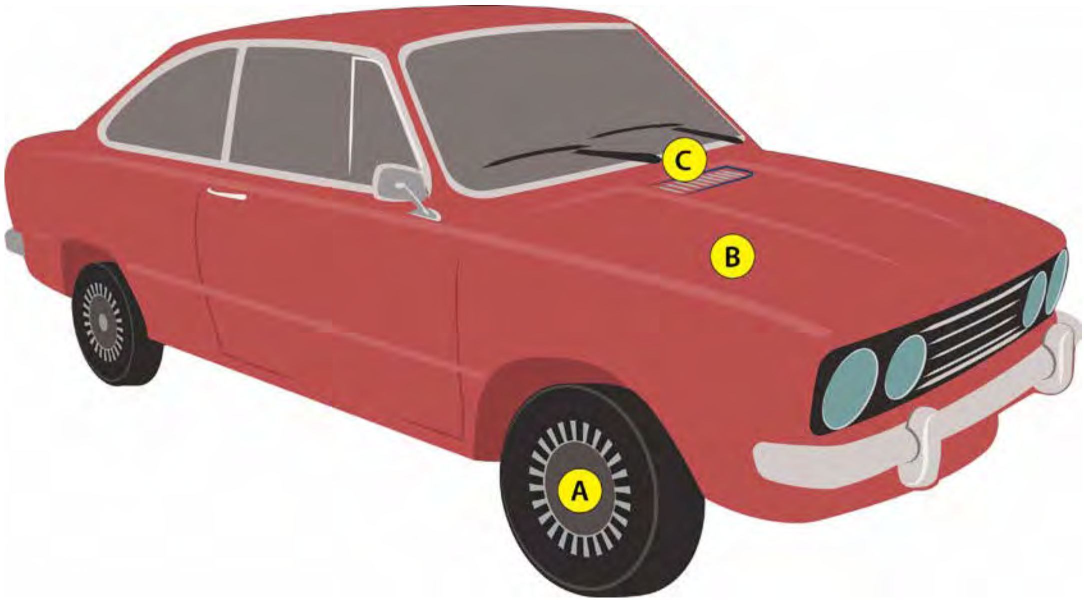
Throttle friction device

([447]) AFNOR (2020), 'NF L80-001:2020 – Aerospace series – Pre-work asbestos detection in aircraft mission and methodology', https://www.boutique.afnor.org/fr-fr/norme/nf-l80001/serie-aerospatiale-reperage-avant-travaux-de-lamiante-dans-les-aeronefs-mis/fa196834/1842.

### 14.4.4 Vehicles

Examples of locations where asbestos can be found in a car are provided in Figure 14-6.

**Figure 14-6: Vehicles – where asbestos might be found (non-exhaustive)**




**A: Brake and clutch systems**

Brake pads

Brake linings

Brake and clutch plates

Brake shoes

Brake housing

Brake clutch discs

**B: Engine**

Gaskets

Transmission plates

Transmission housing

**C: Ventilation**

Fan/ventilator

HVAC system

**Not shown**

Interior floor pan

Rear parcel shelf

Wheel arches

Seals

Gaskets

Pipe wrap insulation (lagging)

Exhaust system insulation (flat and rope)

Acoustic insulation

Underseals

Wheel arches

Rear parcel shelf

Bonnet liner

Firewalls

Plastic asbestos parts (such as seat bases and battery holders)

### 14.4.5 Machinery

In France, if machinery or equipment manufactured outside the country before 1 January 1997 is suspected of containing asbestos, this justifies conducting an asbestos identification operation, even if the building housing the equipment was constructed after France's asbestos ban came into effect on that date ([448]).

A comprehensive guide to procedures for assessing the presence of asbestos in various machinery is provided in the French standard NF X46-100:2019, published by AFNOR in 2019 ([449]).

## 14.5 Air monitoring

No additional details are required for air monitoring, therefore refer to the details provided in Section 6.

## 14.6 Control measures

Employers must ensure that worker exposure to dust arising from asbestos or MCAs is reduced to a minimum and, in any case, to as low a level as is technically possible below the relevant limit value ([450]) (OEL) specified in Section 6.2.2 ([451]).

This should be achieved through organisational and technical measures and, if these are not enough to avoid or sufficiently limit the risks, individual protective measures.

**Box 14-2: Examples of measures to reduce asbestos exposure in train dismantling**

**Background and context**

Some end-of-life trains contain MCAs and require dismantling by methods that prevent or minimise workers' exposure to asbestos. The examples presented reflect a synthesis of approaches used across multiple facilities, identified through literature review and stakeholder consultation.

**Risk assessment**

- Identification of MCAs should not be based solely on generic information for a given class of rolling stock. A survey should be undertaken for each individual carriage to account for the potential addition or removal of MCAs during its service life.
- Removal techniques should be tailored to each MCA. Examples of MCAs in train carriages include bituminous coatings, glass wool and slats, radiators with asbestos insulation, seals in toilet door frames and underbody asbestos coatings. Each may necessitate a specific removal approach.

([448]( French Regional Directorate for the Economy, Employment, Labor, and Solidarity (2024), 'Les fondamentaux de la prévention du risque d'exposition à l'amiante dans les immeubles bâtis', https://pays-de-la-loire.dreets.gouv.fr/Les-fondamentaux-de-la-prevention-du-risque-d-exposition-a-l-amiante-dans-les.

([449]) AFNOR (2019), 'NF X46-100:2019 – Asbestos identification – Identification of materials and products containing asbestos in installations, structures or equipment involved in the performance or implementation of an activity – Mission and methodology', https://www.boutique.afnor.org/fr-fr/norme/nf-x46100/reperage-amiante-reperage-des-materiaux-et-produits-contenant-de-lamiante-d/fa193507/1815.

([450]) Directive 2009/148/EC, Article 6.

([451]) Directive 2009/148/EC, Article 6.

### Box 14-2: Examples of measures to reduce asbestos exposure in train dismantling

**Control measures (technical, organisational, personal)**

- Train dismantling facilities are typically organised into a series of zones through which rolling stock is processed. For example, the following five-zone configuration can be used.
  - **Reception and initial depollution area.** This is the first zone where trains are received and undergo preliminary depollution activities, such as the removal of oils and other fluids.
  - **Green stripping area.** Non-hazardous components, such as furniture, upholstery and interior fittings, are removed. This phase may require fewer OSH controls and facilitates access to hazardous materials, including MCAs, for subsequent removal.
  - **Red stripping area.** Components containing asbestos that can be removed intact, without the need for significant destructive methods, are handled in this zone. Where destructive techniques are used, these require corresponding control measures.
  - **Destructive MCA removal area.** Destructive removal (e.g. abrasive blasting) takes place under fully contained, airtight conditions, together with appropriate PPE. Decontamination of personnel and equipment is undertaken after each operation. Removal techniques can be manual or robotised.
  - **Final dismantling area.** Once MCAs have been removed, trains proceed to the final stage, where the remaining structure undergoes final dismantling for the disposal or recycling of parts and materials.
- Each work zone can be subdivided into multiple work areas. For example, within the containment zone, isolated cells through which trains move for the removal of specific MCAs or components are used. These cells are sealed from one another to prevent contamination and are connected through sectional doors. Extractor fans are used to maintain negative pressure within each cell.
- The control measures used should be tailored to each removal activity. Destructive techniques, such as abrasive or water blasting, necessitate the highest level of control measures, including negative pressure containment, the use of highly effective PPE/RPDs, a high rate of air exchange with air outlet filtration and thorough personnel and equipment decontamination
- A one-way system facilitates workers moving from changing areas into the sealed dismantling zones and finally into the decontamination zone. Boots and helmets should remain in the controlled areas and disposable clothing should be worn.
- Dismantling operators typically aim for maximum recycling of materials and reuse of components. These parts should be removed in Zones 1 or 2, prior to accessing MCAs, or in Zone 5, once MCAs have been fully removed.

**Monitoring**

- Regular air measurements are taken in all areas. Air measurements can include an environmental measurement alongside measurements taken in the extractor outlet, changing room, recovery zone, personnel airlock and ambient zone. Air measurements can also be taken in the work area after completion of decontamination of each vehicle/carriage.
- Key zone parameters are continuously monitored, including negative pressure (airflow), the quality of breathable air and the operational condition of industrial compressors. Compliance with OSH procedures may also be overseen via a live camera feed covering the entire site.

**Waste management**

- All asbestos contaminated waste is labelled and disposed of as waste containing asbestos (WCA).
- Waste water contaminated with asbestos is filtered prior to being discharged off-site. Regular (weekly) measurements of suspended matter in waste water are also conducted.

An example of a train carriage following the green stripping stage (e.g. the removal of non-hazardous components), prepared for asbestos decontamination, is shown in Figure 14-7.

An example of an air extraction system used to maintain a high rate of air exchange during the removal of asbestos coatings through abrasive blasting is shown in Figure 14-8.

Figure 14-7: Train carriage following the removal of non-hazardous components, awaiting asbestos removal at a train dismantling facility in France



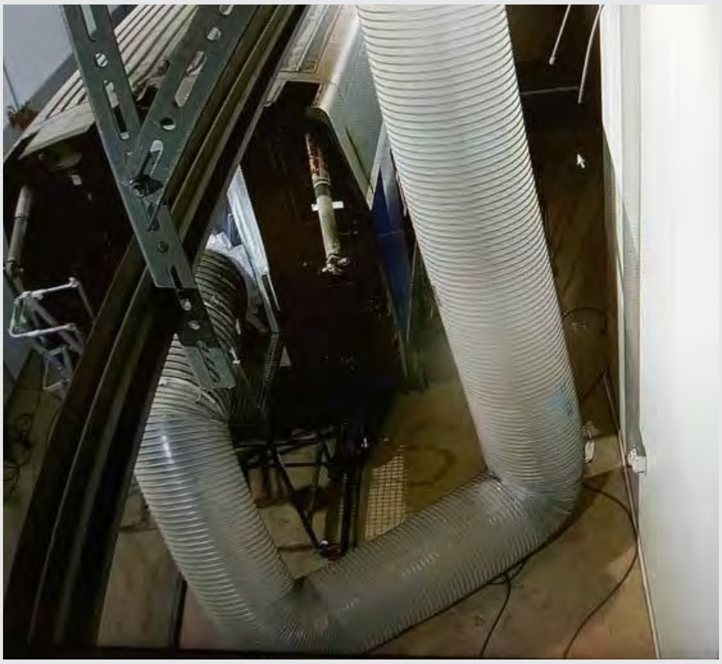


Figure 14-8: Air extraction system used during the removal of asbestos coatings by abrasive blasting from a train carriage at a train dismantling facility in France

## 14.6.1 Removal techniques and procedures

The most appropriate method for removing MCAs depends on several factors, including:

- condition and past use of the part (likelihood of wear and fibre release);
- location and accessibility (ease of removal without significant destructive techniques);
- size of the part (e.g. smaller parts in vehicle engines versus larger parts in ship engines).

### 14.6.1.1 Technical measures

For an overview of control measures, see Section 8.

If the risk assessment determines that an enclosure is needed, this should separate the work area from the rest of the site, maintain negative pressure and include three to five airlocks. All items that could be contaminated should be removed prior to setting up the containment area.

Examples of equipment that may be required include:

- marking materials to delineate the work area (such as tape, prohibition signs);
- plastic sheeting and adhesive tape;
- wetting agent (e.g. brake cleaner, water mixed with washing liquid) and application equipment;
- rust solvents or rust-removal oils, and applicators (such as brushes, sprayers);
- hand tools for disassembly and removal (such as scrapers, seal removal corkscrews, specialised tools);
- H-Class vacuum cleaner;
- cleaning cloths, wipes and other cleaning tools;
- waste bags or containers appropriate for WCA, for the disposal of removed parts, debris and used cleaning materials, see Section 8.2.2.2.2.

Non-destructive removal techniques should be used whenever possible. Destructive techniques that generate dust, such as drilling, should be avoided. Waste water should be filtered prior to discharge, see Section 8.2.3.

An example of a wastewater filtration system is shown in Figure 14-9.

**Figure 14-9: Filters to remove asbestos fibres from waste water at a train dismantling facility in France**



#### 14.6.1.2 Organisational measures and procedures

Before starting removal, put on the required PPE and delineate the work area to prevent unauthorised access. Prepare the site by removing objects that can be contaminated from the work area or cover them with plastic sheeting. Cover the floor with sheets and position the waste bags or containers within easy reach.

The following PPE should be considered, based on the removal technique and risk assessment:

- disposable coveralls (at a minimum Category 3 Type 5/6), see Section 8.2.7.1;
- respiratory protective devices (RPDs) (at a minimum, FFP3 or half-face mask with P3 filter, see Section 8.2.6);
- eye protection (e.g. goggles), see Section 8.2.7.4;
- boots without laces, footwear that can be decontaminated or overshoes, see Section 8.2.7.3;
- disposable underwear, see Section 8.2.7.1;
- gloves (solvent-resistant), see Section 8.2.7.2.

For further guidance on PPE, see Section 8.2.5.

Additional PPE, such as a hard hat, may be required for non-asbestos hazards.

During removal, work should be carried out in a sequence that minimises the risk of recontamination.

After removal work is completed, the following steps should be followed:

- decontamination of workers, see Section 8.2.2.2;

- cleaning of the part of the train, aircraft, ship, vehicle, machinery or premises in which removal was carried out, see Section 8.2.2.2.4;
- final inspection of the part of the train, aircraft, ship, vehicle, machinery or premises in which removal was carried out, see Section 8.2.4.3.

H-Class vacuum cleaners used in contaminated areas ('black zones') may only be reused if strict measures are in place to prevent contamination, such as ensuring that bypass cooling does not contaminate the engine.

## 14.7 Passive exposure

Passive exposure may occur:

- in the vicinity of someone working with MCAs;
- where MCAs are degrading on ships, trains, aircraft, vehicles and machinery, see Section 7.

In ships, it has been observed that asbestos fibres can remain airborne for an extended period after MCAs have been disturbed, posing a risk after the work is finished ([452]). Similar risks exist in other environments.

Disturbed asbestos fibres can be transported to areas away from the work zone. For example, in shipyards, exposure levels in these areas may approach those of the active removal zone, posing a significant risk of passive exposure ([453]). This has the potential to cause significant adverse health effects ([454]) as these workers may assume they are in asbestos-free environments and be unprotected.

## 14.8 Training

While no specific training requirements apply specifically to workers on ships, trains, aircraft, vehicles and machinery beyond those outlined in Section 9, such workers should still be aware of the following:

- historical context of MCA use in their sector;
- appearance and likely locations of MCAs in ships, trains, aircraft, vehicles and machinery (supported with photographs);
- action to take if suspected MCAs are identified.

([452]) Du, Z., Zhang, S., Zhou, Q., Yuen, K. F. and Wong, Y. D. (2018), 'Hazardous materials analysis and disposal procedures during ship recycling', *Resources, Conservation and Recycling*, Vol. 131, pp. 158–171, https://doi.org/10.1016/j.resconrec.2018.01.006.

([453]) Singh, R., Cherrie, J. W., Rao, B. and Asolekar, S. R. (2020), 'Assessment of the future mesothelioma disease burden from past exposure to asbestos in ship recycling yards in India', *International Journal of Hygiene and Environmental Health*, Vol. 225, 113478, https://doi.org/10.1016/j.ijheh.2020.113478.

([454]) Singh, R., Cherrie, J. W., Rao, B. and Asolekar, S. R. (2020), 'Assessment of the future mesothelioma disease burden from past exposure to asbestos in ship recycling yards in India', *International Journal of Hygiene and Environmental Health*, Vol. 225, 113478, https://doi.org/10.1016/j.ijheh.2020.113478.

## 14.9 Health surveillance

For guidance on health surveillance, see Section 10.

## 14.10 Incident management

For guidance on incident management, see Section 11.

## 14.11 Waste management

WCA should be removed from the work area as soon as possible.

In addition to the guidance in Section 12, the following points should be considered:

- **Designated WCA collection areas.** Designate specific areas for the temporary storage of WCA before it is transported off-site. These areas should be clearly marked and access should be restricted to authorised personnel only.
- **On-site transport.** Use sealed containers on wheel-driven carts. These carts should be cleaned regularly to remove any potential external contamination.
- **Disposal of cleaning materials.** All disposable materials used during cleaning (such as wipes, cloths, disposable PPE) should be treated as WCA and disposed of accordingly.

For information about waste management, see Section 12.


106

# 15 Mining and quarrying

## 15.1 Scope

Although asbestos is no longer mined intentionally in the EU, worker exposure to airborne asbestos fibres may occur during the extraction of other minerals that naturally contain asbestos (NOA). This section deals with preventing worker exposure to asbestos dust from NOA (see Section 5.2.2) during mining and quarrying activities, see Annex 10.

The level of risk depends on whether the NOA-containing rock is disturbed. In some cases, NOA may be present in the rock without posing a significant risk to workers if not disturbed. In others, even small deposits of NOA can result in fibre release when the material is handled mechanically and releases dust.

This section complements Sections 3 to 9 by providing additional guidance specific to mining and quarrying operations.

For examples of minerals potentially containing NOA, see Section 15.3.3.1

This guidance applies to activities in which workers are, or may be, exposed to dust from the six fibrous silicates falling within the scope of the AWD, as defined in Section 1.2.1. It also includes exposure to these fibrous silicates where they occur naturally. In mining and quarrying, workers may be exposed to fibrous silicates beyond the six asbestos types in Article 2 of the AWD, including but not limited to erionite ([455]), riebeckite, winchite, richterite or fluoro-edenite, in addition to other substances. These substances may still meet the criteria for classification as hazardous, even if not regulated under the AWD, see Section 1.2.1.

## 15.2 Coordination

Where asbestos-related work is carried out, a coordinator (similar to the SHC in the construction sector) could be appointed for any site on which more than one contractor is present, see Section 3.2.2.

([455]) ECHA (2022), 'Substance infocard – erionite', https://echa.europa.eu/substance-information/-/substanceinfo/100.149.232; ECHA (2022), 'Substance infocard – Erionite', https://echa.europa.eu/substance-information/-/substanceinfo/100.171.103.

# 15.3 Risk assessment

## 15.3.1 Purpose of asbestos risk assessment

An asbestos risk assessment must be undertaken for any mining or quarrying work where there is potential risk of worker exposure to dust arising from asbestos or materials containing asbestos (MCAs), see Section 4.1 ([456]). The purpose is to assess the workers' exposure to asbestos dust and determine appropriate preventive and control measures ([457]). This includes consideration of particularly sensitive risk groups or workers at particular risk, such as migrant workers ([458]), older workers and temporary workers.

The asbestos risk assessment should prioritise the removal of asbestos or MCAs over other handling methods, considering the potential level of dust exposure from different activities ([459]). For example, asbestos-rich material can be extracted through blasting with dust suppression techniques and deposited into a confined area within the pit or quarry to reduce exposure.

The risk assessment:

- must determine the nature and degree of the workers' exposure ([460]);
- must be revised where there is reason to believe that it is incorrect or there is a material change in the work ([461]);
- should consider the geological evaluation, geological sampling and exposure assessment, see Figure 15-1;
- should consider the challenges of determining the geological composition of the relevant minerals prior to commencing mining and quarrying activities;
- should consider the type of activity (underground work versus open cast mining or quarrying) and its implications for worker protection and containment measures to prevent secondary exposure.

While asbestos-related risks are a key concern, the assessment must also consider other occupational risks associated with mining and quarrying ([462]). These include, for example, exposure to carcinogens, mutagens and reprotoxic substances ([463]), along with other hazardous chemical substances ([464]). Specific OSH requirements also exist for workers in mineral-extracting industries, both on the surface and underground ([465]), including those involving drilling ([466]).

Further advice on non-asbestos risks in the mining and quarrying sector is provided in EU-OSHA's Online Interactive Risk Assessment tools for the mining and quarrying sector ([467]).

([456]) Directive 2009/148/EC, Article 3(2).

([457]) Directive 2009/148/EC, Article 3(2) and Article 6; Directive 2004/37/EC, Article 5; Directive 89/391/EEC, Articles 6 and 9.

([458]) Migrant workers may experience language barriers, poor OSH induction and coverage and may fear losing work or facing deportation for reporting unsafe working conditions.

([459]) Directive 2009/148/EC, Article 3(2); 'A whole section of the ore body may need to be segregated and excluded from mining activity, or require excavation and removal to a safe disposal site away from the ore body if possible. Alternatively, if the occurrence is minor, the suspect material may be carefully collected and removed for disposal, but the site must be recorded and remain flagged as an indicator of the need for caution.' (The Vermiculite Association (TVA) (2018), 'Best practices – Asbestos detection and control protocol: Vermiculite mining and milling', p. 9, https://www.vermiculite.org/wp-content/uploads/2018/06/TVA-Best-Practices-Procedural-Guide.pdf).

([460]) Directive 2009/148/EC, Article 3(2).

([461]) Directive 2009/148/EC, Article 3(5); Directive 89/391/EEC, Article 6.

([462]) See Directive 89/391/EEC, Articles 5, 6 and 9.

([463]) Directive 2004/37/EC, Article 3(2).

([464]) Directive 98/24/EC, Article 4.

([465]) Directive 92/104/EEC.

([466]) Directive 92/91/EEC.

([467]) EU-OSHA (2024), 'Ensuring safety in mining and quarrying: introducing OiRA tools', https://osha.europa.eu/en/oshnews/ensuring-safety-mining-and-quarrying-introducing-oira-tools.

## 15.3.2 Responsibility for asbestos risk assessment

As outlined in Section 5.4, the employer is responsible for ensuring the occupational health and safety of workers and must carry out the asbestos risk assessment ([468]).

Workplaces in the minerals extracting industry are subject to specific legislation aimed at protecting workers in both drilling operations ([469]) and surface and underground mineral-extraction industries ([470]).

Where applicable, national legislation may also set out specific health and safety conditions for the issuance of mining or quarrying permits.

## 15.3.3 Conducting a risk assessment for naturally occurring asbestos

Risk assessment of NOA in any new mine or quarry should follow a three-step process, see Figure 15-1. Repeating a risk assessment involves updating one or more of these steps, as required.

These three steps are explained in sections 15.3.3.1, 15.3.3.2 and 15.3.3.3, but more detailed guidance on risk assessment of NOA can be found in the following.

- Bureau de recherches géologiques et minières (BRGM) (2021), *Asbestos in the Natural Environment: Elements of understanding and help with identification and characterisation – Final report*, BRGM/RP-70343-EM, September 2021, https://infoterre.brgm.fr/rapports/RP-70343-FR.pdf.
- AGS (2015), 'TRGS 517 Tätigkeiten mit potenziell asbesthaltigen mineralischen Rohstoffen und daraus hergestellten Gemischen und Erzeugnissen' [TRGS 517 – Activities with mineral raw materials potentially containing asbestos and mixtures and products made from them], https://www.baua.de/de/Themen-von-A-Z/Gefahrstoffe/TRGS/TRGS-517.html, under revision at the time of writing.

Even after completing all three steps, it cannot be definitively determined that NOA is absent, only that no asbestos has been detected. For this reason, specific criteria and the frequency for repeating the risk assessment should be determined for each mine or quarry.

([468]) Directive 89/391/EEC, Articles 5, 6 and 9.
([469]) Directive 92/91/EEC, Article 2(a).
([470]) Directive 92/104/EEC, Article 2(a).

**Figure 15-1: Flow chart of the three steps in risk assessment for a mine or quarry**

| | |
|---|---|
| **Part 1:** Materials assessment – geological evaluation | ▪ Asbestos history<br>▪ Occurrence of potentially asbestos- and fibre-containing rock types<br>▪ General state of metamorphism<br>▪ Abundance of shear zones and metamorphosed sills/dykes |

↓

| | |
|---|---|
| **Part 2:** Materials assessment – geological sampling | Are there fibrous minerals in the mine or quarry area?<br>▪ Fibrous mineral assessment (plus thin sections of the samples)<br>▪ Thin sections from the drill cores |

↓

| | |
|---|---|
| **Part 3:** Exposure assessment | Does the dust released during mining or quarrying contain asbestos fibres or other mineral fibres?<br>▪ Investigation of the crushed rock (drilling and mud samples, other possible samples of crushed rock)<br>▪ Air sampling of the crushing pilot |

*Source:* Adapted from Finnish Institute of Occupational Health (FIOH) (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

**Box 15-1: Examples of Member State sources of guidance for risk assessment for mining and quarrying**

AGS (2015), 'TRGS 517 Tätigkeiten mit potenziell asbesthaltigen mineralischen Rohstoffen und daraus hergestellten Gemischen und Erzeugnissen' [TRGS 517 – Activities with mineral raw materials potentially containing asbestos and mixtures and products made from them], https://www.baua.de/de/Themen-von-A-Z/Gefahrstoffe/TRGS/TRGS-517.html, under revision at the time of writing.

FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://www.ttl.fi/sites/default/files/2022-03/Asbestos%20risk%20management%20guidelines%20for%20mines%20FIOH%202019.pdf.

IMA Europe (2024), 'IMA-Europe guideline for asbestos mitigation in mining and quarrying', Brussels 2024, https://ima-europe.eu/eu-policy/health-and-safety/asbestos/.

INAIL (2021), 'Amianto naturale e ambienti di lavoro: Indicazioni operative per la prevenzione' [Natural asbestos and workplaces: Operational indications for prevention], https://www.inail.it/portale/it/inail-comunica/pubblicazioni/catalogo-generale/catalogo-generale-dettaglio.2021.05.amianto-naturale-e-ambienti-di-lavoro.html.

INRS (2020), 'Travaux en terrain amiantifère. Opérations de génie civil de bâtiment et de travaux publics, Guide de prevention' [Work in asbestos-containing terrain. Civil engineering operations for buildings and public works. Guide for prevention], https://www.inrs.fr/media.html?refINRS=ED%206142.

MIRO (2008), 'Hilfestellung zur Gefährdungsbeurteilung im Rahmen der TRGS 517' [Assistance with Risk Assessment for TRGS 517 'Activities with potentially asbestos-containing mineral raw materials and preparations and products made from them'], Bundesverband Mineralische Rohstoffe (German Quarry Federation), available from: Walter Nelles at nelles@bv-miro.org or https://www.bv-miro.org/.

**Box 15-2: Example of a German quarry following TRGS 517**

Germany has a large number of producers of aggregates sourced from natural stone. They operate quarries that supply a wide range of crushed rocks, some of which are identified under TRGS 517 as potentially containing NOA.

This box provides examples of asbestos-related OSH practices at a German quarry, based on a site visit in 2025. The quarry has been in operation since before the adoption of TRGS 517 but was assessed for compliance after its adoption.

The production of natural stone products involves activities with the potential for dust generation, such as:

- blasting
- rock-breaking at blast location
- loading onto trucks and transportation to the crusher(s)
- crushing
- loading of aggregates onto customer trucks.

Measures are in place to control worker exposure to dust during these activities, as shown below.

- Pre-extraction assessment: comprehensive geological surveys were conducted to identify the mineral composition and the potential for NOA in the deposit. The assessment identified asbestos presence in the rock.
- Analytical surveillance: sampling and laboratory analyses are carried out on the quarried material to ensure compliance with the fibre concentration limits set by TRGS 517.
- Worker enclosures: excavator, dump truck and reloader cabins are enclosed under positive pressure and air intake is filtered. Cabins are regularly cleaned with a vacuum cleaner. Workers spend almost all of their working time in cabins.

**Box 15-2: Example of a German quarry following TRGS 517**

- Technical measures: the crushers are equipped with dust extraction. Other activities rely on tools that minimise dust release, such as drilling with dust extraction.
- Air monitoring: measurements of asbestos concentration in the air were taken for five key dust-generating activities carried out on the site, such as excavation, reloader use, dumper truck use and in the control room.
- Worker safety: personnel are trained on asbestos hazards.
- Regulatory reporting: the quarry maintains records of material composition and reports any findings or incidents to the relevant occupational safety and environmental authorities.

#### 15.3.3.1 Geological evaluation (part 1 of risk assessment)

For a new quarry or mine, the employer should undertake a geological evaluation of the site and planned extraction area. This should include a review of relevant geological literature and maps at a scale of 1 : 50 000 or more detailed ([471]). The evaluation should assess the potential presence of asbestos by examining, for example:

- the geological history and known occurrences of asbestos in the area;
- the metamorphic ([472]) state of the rocks, which influences the likelihood of fibrous mineral formation (including asbestos presence);
- abundance of shear zones, sills and dykes.

The following rock types may indicate the possible presence of asbestos ([473]):

- ultrabasite or peridotite (e.g. dunite, lherzolite, harzburgite);
- basic effusives (e.g. basalt, spilite, basanite, tephrite, phonolite);
- basic intrusives (e.g. gabbro, norite, diabase);
- metamorphic and metasomatically influenced rocks (e.g. metasomatic talc occurrences, green schist, chlorite and amphibole schist or bedrock such as nephrite, serpentinite and amphibolite);
- sedimentary rocks with a high percentage of clasts made up of asbestos-bearing rocks ([474]).

A good understanding of the geological circumstances that promote the formation of these fibrous minerals can help identify potential asbestos risks and interpret the results of laboratory analysis more effectively ([475]). The services of professional geologists ([476]) should be employed to undertake geological evaluations and use insights gained to inform the lab analysis.

For additional guidance on identifying NOA, see the sources listed in Box 15-3.

([471]) CEN, 'EN ISO 22475-1:2021 – Geotechnical investigation and testing – Sampling methods and groundwater measurements Part 1: Technical principles for the sampling of soil, rock and groundwater (ISO 22475-1:2021)', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:62418,404517&cs=10D5157F10EC2FE0146A8C8D55A1A08B6.

([472]) A change to the bedrock caused by temperature, pressure and compressive and tractive forces. See: FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

([473]) AGS (2015), 'TGRS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

([474]) Barale, L., d'Atri, A., Petriglieri, J., Piana, F. and Turci, F. (2023), 'Naturally occurring asbestos (NOA) in sedimentary rocks: State of the art and perspectives', EGU General Assembly, Vienna, Austria,

[2]023, EU23-17589, https://meetingorganizer.copernicus.org/EGU23/EGU23-17589.html?pdf.

([475]) Misseri, M. (2023), 'Nucleation of naturally occurring calcic amphibole asbestos', *Environmental Research*, Vol. 230, 114940, https://doi.org/10.1016/j.envres.2022.114940.

([476]) In some Member States, for example Italy, this is a legal requirement (Annex 4 of Italian Ministerial Decree 14.5.1996, https://www.gazzettaufficiale.it/eli/id/1996/10/25/096A6000/sg).

**Box 15-3: Examples of Member State sources listing the types of rocks potentially contaminated with asbestos**

AFNOR (2021), 'Appendix A of the French national standard NF P 94-001:2021 on Environmental asbestos survey – Geological investigation of in-place soils and rocks – Mission and methodology'. This can be purchased from https://www.boutique.afnor.org/.

AGS (2015), Annex 1 to the German 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/DE/Angebote/Regelwerk/TRGS/TRGS-517, under revision at the time of writing.

INAIL (2021), Amianto naturale e ambienti di lavoro: Indicazioni operative per la prevenzione [Natural asbestos and workplaces: Operational indications for prevention], https://www.inail.it/portale/it/inail-comunica/pubblicazioni/catalogo-generale/catalogo-generale-dettaglio.2021.05.amianto-naturale-e-ambienti-di-lavoro.html. This guidance lists rocks which can contain NOA in Section 3 and a discussion of the regional geology of Italy in Section 4.

Italy, Gazzetta Ufficiale (1996), Ministerial Decree of 14/05/1996, Regulations and technical methodologies for remediation interventions, including those to render asbestos harmless, provided for by Article 5, paragraph 1, letter (f) of Law No 257 of 27 March 1992, containing: 'Rules relating to the cessation of the use of asbestos'; The decree https://www.gazzettaufficiale.it/eli/id/1996/10/25/096A6000/sg regulates the exploitation of ophiolites. Annex 4 to the decree lists rock types which may contain NOA and requires that the presence of asbestos be investigated if the following specific rocks are present: serpentinite, prasinite, eclogite, amphibolite, actinolite schist, chlorite schist, talc schist, serpentine schist, ophicalcite.

Ministère de la transition écologique, Géosciences pour une Terre durable (BRGM) (2021), appendix to 'L'amiante dans l'environnement naturel: Compréhension des éléments et assistance à l'identification et à la caractérisation' [Asbestos in the natural environment: Understanding elements and assistance for identification and characterisation], https://infoterre.brgm.fr/rapports/RP-70343-FR.pdf. The document shows the 'typical' types of asbestos occurrences in mainland France.

#### 15.3.3.2 Geological sampling and analysis (part 2 of risk assessment)

Following geological evaluation, geological sampling and analysis should be carried out. This may involve ([477]):

- a conventional geological bedrock survey;
- core sampling and determination of sample composition;
- analysis of thin sections of rocks under a PLM ([478]);
- EM to identify the finest fibres.

Since NOA often occurs in localised veins and shear zones rather than being evenly distributed, representative sampling methods should be applied. Sampling may itself present a risk of exposure to airborne asbestos fibres, particularly when drilling or cutting rock.

There are currently no harmonised European standards for geological sampling of NOA. Practices vary between and within Member States. For example, sampling frequency ranges from 500-metre intervals to lithology-dependent continuous sampling (Italy ([479])). In terms of composite compared with point sampling, EN 932-1:1996 ([480]) principles underpin many practices across Europe ([481]), while

([477]) FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1, unless otherwise stated.

([478]) AFNOR (2021), 'NF P94-001:2021 – Environmental asbestos survey – Geological investigation of in-situ soils and rocks – Mission and methodology', https://www.boutique.afnor.org/en-gb/standard/nf-p94001/environmental-asbestos-survey-geological-investigation-of-inplace-soils-and/fa197187/278771.

([479]) Italian Government: Ministry of Infrastructure and Transport (n.d.), 'Things to know about asbestos', https://terzovalico.mit.gov.it/ambiente/cose-da-sapere-amianto/; ARPA FVG (2012), 'Terre E Rocce Da Scavo D.M. 161/2012 – Allegati, Considerazioni Tecniche E Criticita', https://ordineingegneri.ts.it/wp-content/uploads/sem_terrerocce_brandolin_0.pdf.

([480]) CEN, 'EN 932-1:1996 – Tests for general properties of aggregates – Part 1: Methods for sampling', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:5698,6136&cs=1BA4E302A9580CDED7B77FAC2615CA978.

([481]) Defra (2012), 'Process Guidance Note 3/08(12) – Statutory guidance for quarry processes', https://assets.publishing.service.gov.uk/media/5a80214140f0b62302691b16/quarry-processes-process-guidance-note-3-08_12_.pdf.

guidance in Germany emphasises incremental sampling for homogenisation ([482]). Detection thresholds also differ, for example 0.008 % in Germany ([483]) compared with a 1 000 mg/kg limit in Italy ([484]). Environmental sampling protocols have been standardised across the Nordic countries through the Nordtest NT ENVIR 008 certification scheme ([485]). Despite the lack of harmonisation across Europe, the following aspects can be considered in sampling protocols:

- applying representative sampling principles from EN 932-1:1996;
- following the approaches in the ISO 22262-1:2012 and ISO 22262-2:2014 for asbestos identification and quantification;
- consulting national guidance documents, where available ([486]);
- ensuring sampling is conducted by trained personnel, see Section 9.

If asbestos is identified in a gangue ([487]) area, mining or quarrying in that area should be avoided where possible ([488]). For example, the direction of exploitation may be adjusted to exclude asbestos-rich zones. Even when no asbestos is suspected, samples should be taken from the ore body and tested for the possible presence of asbestos minerals ([489]). One method is to take samples at one-metre intervals from a horizontal channel at mid-height of the working face.

At existing sites, the working area should be visually examined before and during mining and quarrying operations ([490]). Where suspected asbestos minerals are observed, samples should be collected immediately. However, visual examination alone cannot rule out the presence of NOA ([491]).

The bedrock being mined or quarried should be monitored continuously ([492]). All routine geological surveys should check for asbestos and other fibrous minerals ([493]). The product stream should be sampled regularly ([494]). Procedures for the quantification of asbestos mass fractions less than 5 % by weight and quantitative determination of asbestos in vermiculite, other industrial minerals and commercial products that incorporate these minerals are described in ISO 22262-2:2014 and in the analytical techniques ([495]).

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([482]) AGS (2015), 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

([483]) AGS (2015), 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

([484]) ARPA FVG (2012), 'Terre E Rocce Da Scavo D.M. 161/2012 – Allegati, Considerazioni Tecniche E Criticita', https://ordineingegneri.ts.it/wp-content/uploads/sem_terrerocce_brandolin_0.pdf.

([485]) Nordic Innovation Centre (Norden) (2008), 'Nordtest sampler certification scheme handbook version 2-1', https://www.nordtest.info/wp/2015/04/14/nordtest-sampler-certification-scheme-handbook-version-2-1-nt-envir-008/.

([486]) Several countries have developed national guidelines for sampling NOA, including: the United Kingdom (HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf); Italy (Decree 161/2012: Regolamento recante la disciplina dell'utilizzazione delle terre e rocce da scavo [Regulation on the use of land and excavated rocks], 12G0182, https://www.bosettiegatti.eu/info/norme/statali/2012_0161.htm); Germany (AGS (2015), 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/DE/Angebote/Regelwerk/TRGS/TRGS-517); France (AFNOR (2021), 'NF P91-001 – Repérage amiante environnemental – Etude géologique des sols et des roches en place – Mission et méthodologie' [Environmental asbestos detection – Geological study of soils and in-situ rocks – Mission and methodology], https://www.boutique.afnor.org/fr-fr/norme/nf-p94001/reperage-amiante-environnemental-etude-geologique-des-sols-et-des-roches-en/fa197187/278771); Spain (regional guidelines in Andalusia and Murcia).

([487]) Gangue usually means the worthless substances in a vein, see Shaw, M. (2013), 'Gangue minerals and pigment earths', https://www.namho.org/research/GANGUE_and_PIGMENTS_Assessment_20130205.pdf.

([488]) This may not always be possible; for example when mining or quarrying high-value minerals or when tunnelling when the route cannot be changed.

([489]) TVA (2018), 'Best practices – Asbestos detection and control protocol: Vermiculite mining and milling', https://www.vermiculite.org/wp-content/uploads/2018/06/TVA-Best-Practices-Procedural-Guide.pdf.

([490]) FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

([491]) TRGS 517, Annex I, paragraph 6 states that (machine translated by Google translate) 'Asbestos or asbestos minerals (fibrous and non-fibrous) may be present in the rock in two different forms: asbestos/asbestos minerals in fissures; asbestos/asbestos minerals in 'compact' undisturbed rock.' Paragraph 7 states 'The first form of occurrence is easily recognised during quarry inspections. The asbestos minerals contained in the rock itself can usually only be identified through petrographic examinations. Asbestos fibres of the second type often 'emerge' from nonfibrous asbestos minerals when the rock is subjected to mechanical stress (processing).' See AGS (2015), 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

([492]) TVA (2018), 'Best practices – Asbestos detection and control protocol: Vermiculite mining and milling', https://www.vermiculite.org/wp-content/uploads/2018/06/TVA-Best-Practices-Procedural-Guide.pdf.

([493]) FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

([494]) TVA (2018), 'Best practices – Asbestos detection and control protocol: Vermiculite mining and milling', https://www.vermiculite.org/wp-content/uploads/2018/06/TVA-Best-Practices-Procedural-Guide.pdf.

([495]) Industrial Minerals Association Europe, Belgium IMA (2024), IMA-Europe *Determination of Asbestos in Industrial Minerals: Review of state-of-the-art technologies and their statistical evaluation*, Section IV, 'How do you take a sample? Product sampling at mine and plant', https://acrobat.adobe.com/id/urn:aaid:sc:EU:0194e4e1-bdab-486f-9bf0-22a669bfcb4d.

CEN/TS 18020:2024 ([496]) provides specific guidance for asbestos assessment in construction products from quarrying operations.

Testing and verification (i.e. secondary testing) of representative product samples should be carried out ([497]). Replicate samples from each dispatched batch should be stored for future reference. Stockpiles of crude ore intended for blending prior to processing should be routinely inspected, sampled and tested for the presence of asbestos fibres as new material is added. Auditable records should be retained.

Laboratory methods for detecting asbestos fibres are described in Section 6.7.

#### 15.3.3.3 Exposure assessment (part 3 of risk assessment)

The asbestos risk assessment should consider all site-specific features and activities and include a sufficient basis for evaluating potential worker exposure. This includes the following aspects.

- **Air monitoring.** Depending on the results of the initial risk assessment, air monitoring must be carried out to ensure that worker exposure to asbestos and MCAs is reduced to a minimum and, in any case, to as low a level as is technically possible below the relevant limit value ([498]) (OEL) specified in Section 6.2.2 ([499]). See Section 15.4 for air monitoring methods specific to mining and quarrying.
- **Accounting for control measures.** Exposure estimates need to consider existing control measures, including the APFs provided by respiratory protective devices (RPDs). In some cases, vehicle operators may be protected inside sealed cabins with filtered air, certified to EN ISO air quality standards ([500]). See Section 8 for examples of possible control measures.
- **Routine and precautionary monitoring.** Regular air monitoring (both static and personal exposure monitoring) should be implemented to detect any accidental or unexpected asbestos exposure. This is particularly important given the limitations of geological evaluation and sampling, see Section 15.3.3.1 and Section 15.3.3.2 respectively. Even in the absence of detected asbestos, regular air monitoring should be used to detect asbestos during operations in mines and quarries as conditions can be variable; there can be large local and temporal variations in the presence of NOA, even in the same work task ([501]). The presence of NOA cannot necessarily be ruled out even with the help of measurements, so precautionary approaches should be included in risk management.
- **Monitoring during operations.** If fibrous minerals are detected in rock or mud samples, additional air and material sampling should be conducted during production activities (such as hole drilling; with air sampling of the crushing pilot ([502]), see Figure 15-1).
- **Indicators and analytical techniques.** In underground operations where asbestos is suspected, geological precursory indicators (also known as PLM indicator minerals) such as development subgrains ([503]) can be monitored. For example, samples of crushed rock could be taken from the conveyor of a tunnel boring machine every 30 to 100 cm for milling before analysis using EM. Analytical methods should favour near real-time detection using portable EM or similar equipment deployed close to the site.

([496]) CEN (2024), 'CEN/TS 18020:2024 – Construction products: Assessment of release of dangerous substances – Sampling and quantitative determination of asbestos in construction products, https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:72117,510793&cs=18A7B91C0B4AEBE6BA54BE53B484144BD.

([497]) TVA (2018), 'Best practices - Asbestos detection and control protocol: Vermiculite mining and milling', https://www.vermiculite.org/wp-content/uploads/2018/06/TVA-Best-Practices-Procedural-Guide.pdf.

([498]) Directive 2009/148/EC, Article 6.

([499]) Directive 2009/148/EC, Articles 6 and 7.

([500]) CEN (2022), 'EN ISO 23875:2022 – Mining – Air quality control systems for operator enclosures – Performance requirements and test methods, (ISO 23875:2021)', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:74586,6177&cs=1CAF952A1DCB696D662817D0A33228EBC.

([501]) According to the results of air monitoring from one mine.

([502]) FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

([503]) Misseri, M. (2021), 'Nucleation of naturally occurring calcic amphibole asbestos', *Environmental Research*, Vol. 230, 114940, https://www.sciencedirect.com/science/article/abs/pii/S0013935122022678.

### 15.3.4 Notification

Before work commences on any activity likely to involve a risk of exposure to asbestos dust, the employer must notify the Member State's competent authority ([504]), unless that Member State has exempted the activity from notification in accordance with Article 3(3) of the AWD, see Section 4.3.

### 15.3.5 Plan of work

A plan of work must be drawn up before starting any activity involving the removal of asbestos and/or MCAs from structures, plants or installations ([505]), see Section 4.2. A plan of work should be based on a risk assessment tailored to the specific situation and activities to be undertaken. Refer to national legisation to establish whether a plan of work (see Section 4.2) is required for mining and quarrying activities.

## 15.4 Air monitoring

Air monitoring should form part of a more extensive dust risk management programme or occupational hygiene assessment in a mine ([506]) or quarry. These environments are typically dusty, which can make sampling difficult, as filters can quickly become clogged with dust and hinder fibre detection.

Static (fixed) measurement points should be distributed across the production chain, from extraction to processing, to provide an overview of exposure risks. Sampling should be representative, and the person responsible should be appropriately qualified and competent to collect, interpret and assess results, see Section 6.7. The sampling report should describe the workplace conditions, including ventilation status and activities in the surrounding area.

Once asbestos fibre concentration levels are determined through static monitoring, personal exposure measurements should be taken in the breathing zones of workers, on a day representative of normal operations. The measurement period should include the peak or near-peak exposure periods. If the measurement period is shorter than eight hours, the TWA concentration over eight hours may be lower than the measured values.

Static air samples should also be used to assess the effectiveness of prevention measures, ventilation and local exhausts. These should be located centrally in each active work area with significant exposure risk. Comparing personal exposure results with static measurements can help evaluate exposure distribution. Personal exposure is typically higher than ambient levels, especially during high-exposure tasks.

The workplace may be divided into measurement compartments, which can be further broken down into measurement areas, grouping workers by similar exposure profiles, see Figure 15-2.

Where significant changes occur in the workplace, an assessment should be made to determine whether air monitoring should be repeated, see Section 6.

([504]) Directive 2009/148/EC, Article 4(3).
([505]) Directive 2009/148/EC, Article 13.
([506]) FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

**Figure 15-2: Division of mining or quarrying operations into measurement compartments and areas**


*Source:* adapted from FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

# 15.5 Control measures

## 15.5.1 Technical measures

Disturbance of NOA should be limited to the lowest possible amount, and extraction activities in areas with NOA should be avoided where possible ([507]). Fibrous material should be rejected in the mine or quarry pit to prevent fibres dispersal. In some cases, it may be possible to isolate a section of the ore body with NOA and exclude it from mining activity, or to remove and safely dispose of NOA off-site ([508]).

If mining or quarrying proceeds despite the presence of NOA, for example due to the presence of valuable minerals, preventive and protective measures must be applied ([509]), and the advice in this guide should

([507]) FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

([508]) TVA (2018), 'Best practices - Asbestos detection and control protocol: Vermiculite mining and milling', https://www.vermiculite.org/wp-content/uploads/2018/06/TVA-Best-Practices-Procedural-Guide.pdf.

([509]) Directive 2009/148/EC, Article 6.

be followed, see Section 8. Existing dust control measures and measures to reduce exposure to silica ([510]) may also help reduce asbestos exposure, but air monitoring for asbestos remains essential to ascertain worker exposure levels to NOA.

The choice of technical measures depends on the type of operation, such as blasting or drilling, and may be influenced by requirements set out in the operating licence issued by the national authority, such as requirements for dust control measures. Examples of control measures in mining and quarrying include the following.

- **Cleaning and maintenance.** Buildings and equipment should be designed for ease of cleaning, and cleaned with vacuums fitted with H-Class suction units ([511]).
- **Ventilation.** Permanent workstations in rooms (such as guidance and control stations) should be air conditioned and supplied with filtered air. Ventilation systems should operate under negative pressure ([512]) and filters should be replaced regularly.
- **Changing areas.** Changing areas should be kept clean.
- **Material containment.** Measures should be taken to prevent the spread of ore from stockpiles and in the plant ([513]). Material should be stored in closed silos (0–2 mm fraction) or at least in three-sided enclosed material boxes (> 2 mm fraction) ([514]).
- **Road surfaces and dust suppression.** Haul and loading roads should be sealed with a road surface, for example asphalt or concrete, and cleaned regularly (e.g. weekly) depending on the degree of contamination. Roadways should be moistened regularly as a dust suppression measure ([515]), although water use may be restricted in freezing conditions where ice presents a safety hazard.

Changing rooms should be designed to include a ‘dirty area’ (for washing and removal of clothing and shower rooms) and a ‘clean area’ (for storing and changing into clean clothes) ([516]). The number of equipment and footwear cleaning stations (see Figure 15-3) should be sufficient for the size of the workforce using them.

Decontamination practices may vary between sites depending on the operational needs and environment, see the example in Box 15-4. In continuous operations such as mining or mineral processing, full decontamination (such as showering) after every potential exposure to NOA may not be feasible. In such cases, enhanced cleaning of PPE using blowers can be used ([517]) (see Figure 15-4) and disposable outer coveralls are disposed of; showering and full removal of work clothes only occur at the end of the shift. Before moving into a ‘clean area’, work boots can be washed and then removed, and helmet and jacket can be removed for regular activities. DCUs may be centrally located rather than positioned at each exit point.

The employer should dispose of (potentially) asbestos-contaminated workwear and protective clothing or send these in closed containers to a specialised laundry facility ([518]).

([510]) Directive 2004/37/EC and European Network on Silica (n.d.), Good practice guide on workers health protection through the good handling and use of crystalline silica and products containing it, https://guide.nepsi.eu/.

([511]) DIN EN 60335-2-69:2012 – Safety of electrical appliances for household and similar purposes, Part 2 – 69: Special requirements for dust and water extraction, including power-operated brushes for industrial and commercial use (EN 60335-2-69:2002 + A1:2004 + A2:2007, modified) in TRGS 517.

([512]) AGS (2015), ‘TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same’, https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

([513]) TVA (2018), ‘Best practices - Asbestos detection and control protocol: Vermiculite mining and milling’, https://www.vermiculite.org/wp-content/uploads/2018/06/TVA-Best-Practices-Procedural-Guide.pdf.

([514]) AGS (2015), ‘TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same’, https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

([515]) AGS (2015), ‘TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same’, https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

([516]) FIOH (2019), ‘Asbestos risk management guidelines for mines’, Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

([517]) In several Member States (including Belgium, Germany, France and the Netherlands), using blowers is not permitted as a method of decontamination.

([518]) Directive 2009/148/ECC, Article 16; FIOH (2019), ‘Asbestos risk management guidelines for mines’, Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

**Figure 15-3: Footwear washing facilities inside a decontamination chamber**



**Figure 15-4: In a decontamination chamber, air jets can be used in an air lock to remove any remaining dust from PPE after vacuuming, by circulating air downwards**

#### 15.5.1.1 Mining machinery and vehicles

To reduce dust emission during loading operations, the free-fall height of material into transport vehicles should be minimised ([519]). Loading equipment should be fitted with dust extraction systems and/or a water sprinkler or jet ([520]). Where possible, aggregates should be moistened before loading onto trucks or trains (e.g. in non-humidity sensitive uses such as truck ballast), except for applications requiring dry material (such as asphalt production), where wetting is not appropriate for environmental reasons. Waste water should be filtered prior to discharge, see Section 8.2.3.

Vehicle cabins should be kept closed during operation, including in warm weather. Cabins should be supplied with filtered air and maintained under positive air pressure ([521]), see Figure 15-6. Air filters should be maintained regularly. If necessary, systems should be installed to allow workers to access drinking water without opening cabin doors ([522]). Supervisors should ensure that these control measures are implemented and followed.

**Figure 15-5: Height-adjustable truck-loading spout with dustproof skirt**

This image is not available for reuse, see inside front cover.

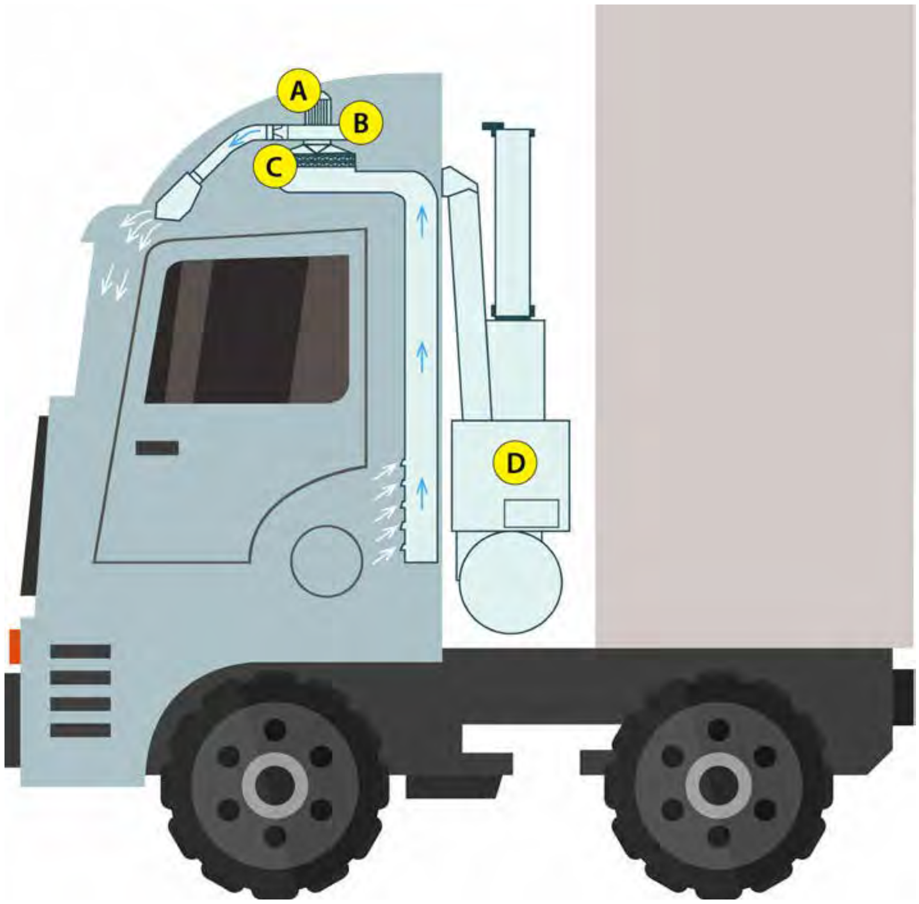
([519]) AGS (2015), 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

([520]) AGS (2015), 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', TRGS 517, https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

([521]) AGS (2015), 'Technical Rules for Hazardous Substances, Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html; FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

([522]) FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

Figure 15-6: Cross section of a mining vehicle cabin including a filtration system




**A: Engine** **B: Fan** **C: Absolute filter** **D: Diesel generator**

### 15.5.1.2 Extraction and processing

Drilling rigs should be equipped with extraction equipment to capture drilling dust at the source ([523]). Crushing and screening plants should be encapsulated wherever possible to minimise dust emission. If full encapsulation is not feasible, local exhaust ventilation and air filtration should be used to extract and clean exhaust air. Dust filters should be discharged into collection systems designed to capture and contain particulate matter. Deposited dusts should be permanently bound and collected in a dust-free manner.

For conveyor systems, potential dust control measures include encapsulation, local extraction systems, water sprinklers or jets and height-adjustable discharge points adjusted to the height of the dust spoil heap. The installation of aprons at drop-off areas can further reduce dust spread ([524]).

([523]) AGS (2015), 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

([524]) AGS (2015), 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

### Box 15-4: Case study of relevant practice: control measures at a mine and production plant working under a wide range of asbestos exposure levels

**Overview**

A mining company operating an ore mine and production plant implements a comprehensive asbestos management plan (AMP) to protect its workers from exposure to NOA, including chrysotile and tremolite. Both the ore and overburden contain NOA. Some production areas have detected asbestos fibres, and any area where the occurrence of NOA cannot be ruled out is classified as an 'asbestos area' in accordance with the precautionary principle. High worker protection is ensured during production, processing and maintenance work. Asbestos fibres are destroyed in a manufacturing process that operates at a very high temperature.

**Rationale for implementing asbestos management measures**

Exposure risk varies across the site and over time (verified with air monitoring). The company promotes a strong safety culture, with staff responsible for hazard reporting and rewarded for safe behaviour. Annual investments are made into asbestos management, equipment upgrades, automation and remote operations to reduce the risk to their workers as well as improve production efficiency.

**Notable technical measures**

- Continual construction of ventilation systems in underground mine production areas; maintained and controlled to improve air quality.
- Processing machinery enclosed in buildings where feasible.
- Modernising of conveyor belts to use metal casings or tunnels, which are more effective at containing dust than flaps.
- Structural improvements to old facilities, such as a covered and over-pressurised walkthrough tunnel through the asbestos area, to connect non-production areas while avoiding the asbestos area. Another example is a separate space between the control room and processing area to enable communication by phone and to restrict access to the control room.
- Remote or automated operation of some drilling operations (this reduces the working time in the asbestos area and trebles the efficiency of drilling).
- Airtight, positively pressurised vehicle cabins with filtered air so that workers do not need to wear an RPD inside the cabin. The aim is to control the indoor air quality of the cabins in accordance with EN ISO 23875:2022.
- Easy-to-clean vehicle interiors, for example seats with leather covers.
- Vehicles drive through a wash gate before entering the main levels of the underground mine.
- Remote monitoring of processes via cameras.
- Decontamination facilities equipped with traditional measures (e.g. shoe washing, vacuuming) and air jets in an air lock to blow and suck residual dust off of PPE.
- Shoe-washing equipment is installed directly onto mining vehicles, inside the decontamination facilities and at the entrance to non-production facilities (e.g. office blocks).

**Notable operational measures**

- Mandatory training for all workers entering asbestos areas, covering asbestos, environmental and safety procedures.
- Extracted rock is watered with sprinklers before loading.
- Asphalt roads are regularly washed.
- Mining vehicle cabins are cleaned daily.
- Process equipment is washed before entering the maintenance area or removed.
- Mandatory decontamination before leaving a production area with asbestos exposure risk.

**Box 15-4: Case study of relevant practice: control measures at a mine and production plant working under a wide range of asbestos exposure levels**

**Notable PPE measures**

- RPDs are mandatory in production areas, including half-masks (E140) and power-assisted air purifying respirators (TH3) depending on the level of exposure. The latter is preferable. There is also a time limit for the use of non-power assisted respirators.
- Some workers wear safety shoes with laces, which can collect dust and are harder to clean. These are being phased out, replaced by fully washable safety boots.
- Washable protective clothing is laundered off-site at a specialist laundry; taking PPE home is prohibited.

**Hazardous waste**

- Waste that may contain asbestos is treated appropriately as a hazardous waste. For example, filters from ventilation units or respirators and disposable overalls are collected, handled and removed as waste containing asbestos (WCA).
- Collected dust is recycled where possible or disposed of appropriately.

**Limitations**

- Use of water for dust control outdoors is restricted in winter due to the risk of ice forming.
- Shorter air sampling time (1–2 hours) is needed in high-dust areas, as filters quickly become clogged with dust.
- PPE can be hot in summer; lighter underlayers under the disposable coverall are used when fire-resistant PPE is not required.

**Solutions to challenges**

- Communication while wearing RPDs is improved through integrated radio or Bluetooth.
- Bearded workers use a power-assisted respirator with filters (turbohood type, TH3); tight-fitting respirators are fit-tested.
- Contaminated equipment is cleaned and serviced on-site.
- Dust generated during unloading into underground silos is controlled through water spraying and silo-level management (silo levels are kept as full as possible to minimise the height of the drop and the resulting dust).
- Ramp cleaning switched from sprinkling to washing with a specialised vehicle to reduce the slip hazard: dust accumulates on an asphalt-surfaced ramp leading to the underground mine. Sprinkler watering was tried, but the water mixed with the dust resulted in a slippery road and a different hazard. The solution now is a washing vehicle that regularly cleans the ramp.

**Planned improvements**

- Surveillance cameras with wipers will be installed in relevant dusty areas, to reduce the need for manual cleaning of cameras.
- Extending automation and remote operation.
- Tools used in asbestos areas will be kept on-site and treated as contaminated. This will save time as they will not require cleaning every time they are removed from the asbestos area.
- New washing facilities for process equipment and working machines.

**Box 15-4: Case study of relevant practice: control measures at a mine and production plant working under a wide range of asbestos exposure levels**

**Lessons learnt**

The health and safety team shared the following lessons learnt.

- 'Long-term planning, investment and continuous work is required for asbestos risk management. Specific conditions and processes may require customised solutions that are not available for purchase off the shelf.

  The good thing is that implemented measures have reduced other exposures as well, improved the level of cleanliness and increased workers' well-being. Asbestos training needs to be organised for different target groups considering the special requirements of the workplace.'
- 'It is essential to **comprehensively monitor asbestos exposure**, and to collect as detailed information about the circumstances as possible. We have learned that the risk of exposure cannot be ruled out according to the monitoring results; **the presence of asbestos is not constant in the materials handled and there may be temporal and spatial variation in the air concentrations.** We therefore regularly monitor exposure levels.'
- 'The changes in the safety culture and the implementation of measures take time and require commitment at all levels of the organisation. Cooperation is important (employer, workers and their representatives, health and safety, occupational healthcare, contractors) as well as sharing good practices with other mines. There has been considerable improvement, but there is still work to be done.'

## 15.5.2 Organisational measures

The number of workers exposed or likely to be exposed to asbestos dust must be limited to the lowest possible extent ([525]). Exposure areas must not be accessible to workers other than those who are required to enter them for their work or duties ([526]). These areas must be demarcated using warning signs ([527]) such as 'danger asbestos', 'use of RPDs and protective clothing' or 'smoking prohibited', see Section 8.2.4 and Annex 12.

Smoking is prohibited in exposure areas ([528]). Workers must be provided with areas set aside for eating and drinking without risking contamination by asbestos dust ([529]). Hygiene procedures should be followed before meals, coffee breaks and smoking ([530]).

Vehicle cabins should be regularly cleaned to remove dust ([531]); the frequency of cleaning will depend on the level of contamination.

Settled dust in areas used by workers (such as office premises and social facilities) should be sampled and analysed regularly to verify the effectiveness of dust control measures ([532]).

Underground work may require a specific risk assessment, for example if using a tunnel boring machine. In cases where there is a risk of rock falls, consideration should also need to be given to the risk of a mask restricting the worker's field of vision.

([525]) Directive 2009/148/EC, Article 6(a).

([526]) Directive 2009/148/EC, Article 16(1)(ii).

([527]) Directive 2009/148/EC, Article 16(1)(i).

([528]) Directive 2009/148/EC, Article 16 1(a)(iii).

([529]) Directive 2009/148/EC, Article 16(1)(b), subject to a potential derogation under Article 3(3) of Directive 2009/148/EC.

([530]) FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

([531]) AGS (2015), 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html.

([532]) TVA (2018), 'Best practices – Asbestos detection and control protocol: Vermiculite mining and milling', https://www.vermiculite.org/wp-content/uploads/2018/06/TVA-Best-Practices-Procedural-Guide.pdf.

### 15.5.3 Individual measures – PPE

The selection of PPE depends on the results of the risk assessment. Workers exposed to mining or quarrying dust ([533]) should be provided with appropriate RPDs. This can include, for example, FFP3 filter masks or respirators with a fan ([534]) with a P3 particle filter, see Figure 15-7. Alternatively, another RPD should be provided if the risk assessment concludes that another RPD is more appropriate. Where work clothes are worn under the disposable suit (e.g. for temperature control), these clothes should be managed appropriately to reduce the risk of contamination spreading to other areas.

Nitrile gloves may not be suitable in mining environments due to the presence of other hazards. Instead, non-flammable gloves can be used and cleaned using a vacuum cleaner. For further guidance, see Section 8.2.7.2.

**Figure 15-7: PPE for a mine worker, including an RPD**

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([533]) Some workers may be sitting inside sealed vehicles with filtered air, in which case an RPD is not needed as long as the worker protection systems (seals and filters) are working effectively to keep the air exposure levels below the OEL.

([534]) If necessary, with heating of the breathing air (TRGS 517).

## 15.6 Passive exposure

Passive exposure of workers may occur where NOAs are inadvertently disturbed, see Section 7.

## 15.7 Training

For workers in mining and quarrying, potential exposure to asbestos dust originates from NOA rather than MCAs (see Annex 4), but the training requirements in Section 9 are still applicable.

## 15.8 Health surveillance

For information about health surveillance, see Section 10.

## 15.9 Incident management

For information about incident management, see Section 11.

## 15.10 Waste management

**Box 15-5: Waste arising from mining activities**

**Article 6 of Directive 2009/148/EC (AWD):**

(e) Waste, other than waste arising from mining activities, shall be collected and removed from the place of work as soon as possible in suitable sealed packing with labels indicating that it contains asbestos and shall then be dealt with in accordance with Directive 2008/98/EC of the European Parliament and of thepCouncil.

General guidance on the collection, removal and transport of WCA is discussed in Section 12. However, waste arising from mining activities is exempt from certain waste requirements ([535]), see Box 15-5.

For extractive waste (waste from prospecting, extraction, treatment and storage of mineral resources and the working of quarries), operators must prepare a waste management plan for the minimisation, treatment, recovery and disposal of extractive waste, in line with the principle of sustainable development ([536]). In surface and underground mineral-extracting industries (excluding drilling), overburden dumps, spoil heaps and other tips must be designed, constructed, operated and maintained to protect worker health and safety ([537]).

Examples of other waste from mining or quarrying activities which may potentially be WCA:

- contaminated PPE (disposable, damaged or at end of life);

([535]) Directive 2009/148/EC, Article 6(e).
([536]) Directive 2006/21/EC, Article 5.
([537]) Directive 92/104/EEC, Annex, Part A, Paragraph 15.

- used air filters;
- HEPA filters from on-site vacuum cleaners and other materials used during cleaning that may be contaminated;
- extracted dust in a dust collection system;
- extracted material in a spoil heap, overburden dump, tip or landfill on site.

The following practices should be followed to manage possible WCA ([538]):

- dust prevention measures should be used during the waste collection, such as moistening, covering or storage in closed containers;
- waste must be prepared in accordance with national legislation;
- transportation of smaller volumes of WCA should be in suitable packaging;
- dumps and landfills on site should be protected by earthworks, windbreak planning, windbreak fences or regular moistening.

**Box 15-6: Examples of control measures for worker protection during environmental remediation of asbestos-rich soils from a former asbestos mine (Italy)**

Italy has a comprehensive legal framework for asbestos, covering health and safety, environmental protection and hazardous waste management ([a]). During the remediation of a former asbestos mine (chryosotile), a wide range of measures have been implemented. These include the protection of workers from airborne asbestos dust exposure, stabilisation of vast and steep mining tailings, and on-site storage and treatment of WCA and waste water in dedicated facilities.

Asbestos risk management measures: the remediation of the mine was necessary to reduce pollution of air, land and water in the surrounding area. The site was classified as a site of national interest ([b]) due to the extent of contamination. As a result, a publicly owned company was created and funded by the public authorities legally mandated to carry out the remediation works.

**Protection of remediation workers**

- Mandatory PPE for workers ([c]) and visitors accessing the site: disposable coverall, disposable FFP3 mask (P3 mask) or full-face mask with P3 filter, washable boots (or boot covers), gloves, specific undergarments or thermal wear; completion of a form to confirm compliance with procedures on site.
- Truck and lorry drivers have a patented filtration system for their cabins which removes 99.99 % of dust; PPE is worn by drivers as an additional protective layer when warranted by risk assessments (*) or in response to site-specific operating conditions, despite the presence of high-efficiency filtration.
- Personal air monitoring for workers (including drivers) to monitor exposure levels on site.
- Incident protocol: if site-specific OEL is exceeded, work stops immediately and measures are taken to reduce exposure levels in accordance with Istituto Superiore per la Prevenzione e la Sicurezza del Lavoro [National Institute for Occupational Safety and Prevention] (ISPESL) guidelines ([d]).
- DCU before workers and visitors can leave the site: wash boots, leave PPE behind.
- Static air monitoring on site (and in three nearby villages) to ensure air quality targets are met, with emergency procedures for exceedance.
- Meteorological monitoring to detect high wind speed conditions (**), which represent an increased risk of asbestos air exposure and are reported to the works management.
- If increased risk is assessed, the works management has the authority to immediately suspend all activities that may pose a risk to workers' health and safety or to environmental protection.
- General dust control measures on site: surfacing of roads and footpaths; spraying road surfaces and other surfaces; decontamination of vehicles before they leave the site by washing, vacuuming with HEPA filters and wiping down inside surfaces.

([538]) AGS (2015), 'TRGS 517 – Activities with potentially asbestos-containing minerals and mixtures and products manufactured from same', https://www.baua.de/EN/Service/Technical-rules/TRGS/TRGS-517.html, under revision at the time of writing.

**Box 15-6: Examples of control measures for worker protection during environmental remediation of asbestos-rich soils from a former asbestos mine (Italy)**

**Hazardous waste management**

A comprehensive on-site waste management system has been developed.

- A licensed temporary storage facility (D15) was established on-site to handle and store WCA. Only limited amounts of waste leave the site after being securely bagged (using big bags or flexible intermediate bulk containers), sealed and labelled for safe off-site disposal. This includes WCA, sludges, used PPE and small volumes of oils.
- Two former mining shafts have been repurposed for the underground disposal of WCA and permanently sealed, in accordance with EU and national landfill regulations.
- A dedicated hazardous waste landfill is currently under construction. The facility is fully equipped with a bottom barrier and will be provided with a surface capping system at the end of its active phase, as per EU and national landfill regulations, enabling the long-term disposal of WCA produced on-site.
- Leachate from the future landfill will be treated by the on-site wastewater treatment plant, which is licensed to accept liquid WCA. The plant is intended to operate indefinitely. Sludges from the wastewater treatment plant will also be disposed of in the on-site landfill.
- Run-off from the tailings slopes is collected in a lake and sedimentation basins at the base of the hill before discharge into local watercourses; waste water from remediation activities (such as waste water from vehicle decontamination) are treated by on-site wastewater treatment, ensuring compliance with environmental standards ([e]).
- Tailings covering 60 million $m^3$ and located on steep slopes (averaging 40 °) were partially removed using a tramway and airlift system. The remaining slopes were stabilised with wire mesh and timber supports. A biodegradable net was laid over the slopes, followed by the application of topsoil and fertiliser, and finally by planting vegetation to prevent erosion.

**Measurements of success**

Vegetation can abate the release of airborne fibres (50–65 %) as demonstrated by air samples collected (see Figures 15-9 and 15-10 for before and after vegetation photographs of Area A).

Airborne asbestos levels have markedly decreased from 10–100 fibres/litre (0.01–0.1 fibres/$cm^3$) in nearby villages before remediation activities commenced, to current levels of less than 1 fibres/litre (less than 0.001 fibres/$cm^3$, which is the limit) in the absence of work activities both at the site boundary and inside the site as measured by SEM.

**Success factors**

This remediation project was only possible due to recognition of its public value.

**Challenges/obstacles**

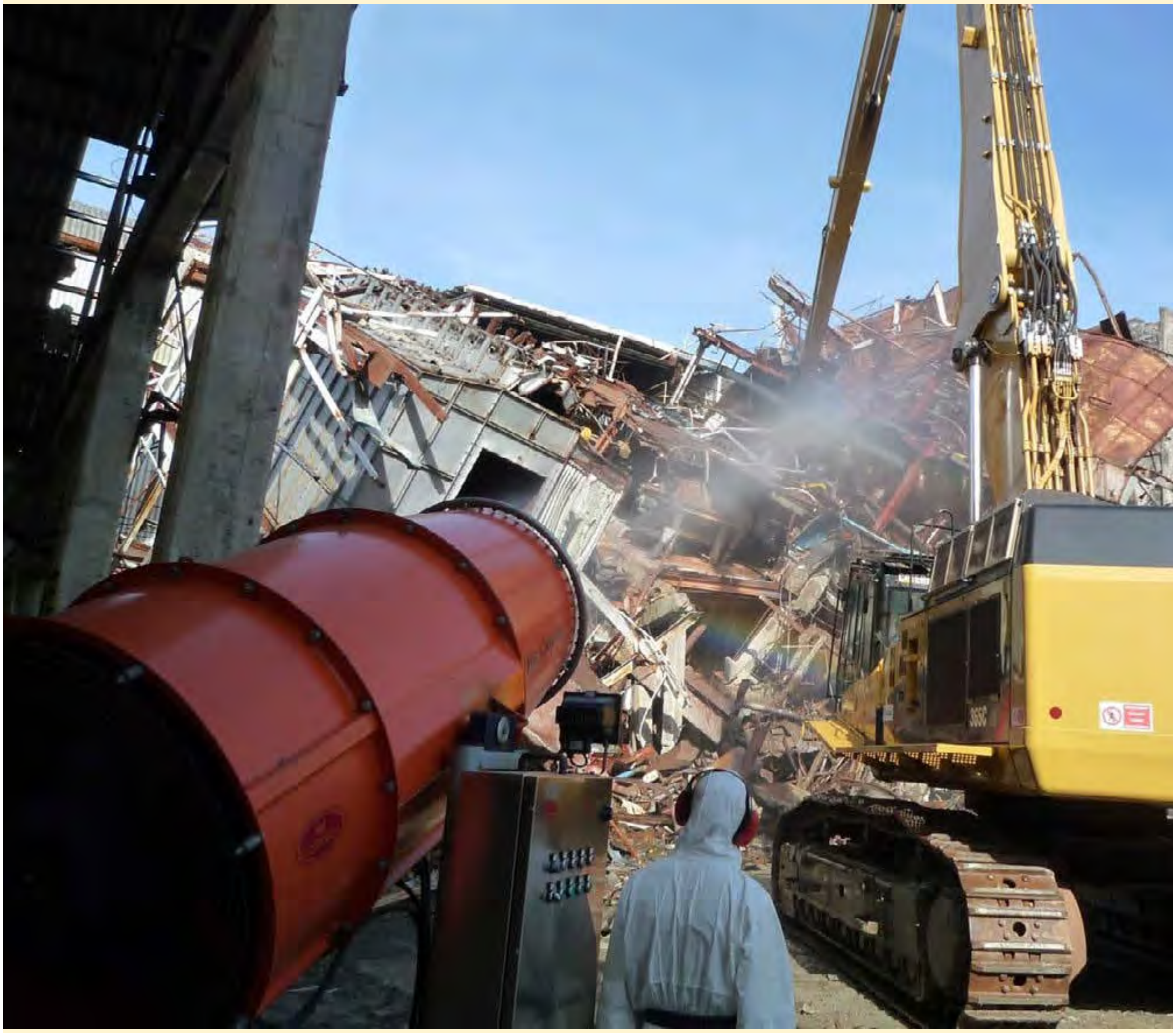
Heat stress affects workers in spring/summer due to wearing disposable coveralls, so specially designed cotton coveralls (***) were adopted and are washed in a washing machine on site using a special cleaning protocol. The use of cotton PPE and related decontamination procedures was proposed and formally approved by the local health and safety authority as part of the approved work plan for remediation activities. In Italy, for operations which do not involve handling MCAs, cotton PPE can be used as long as it is dedicated exclusively to these activities and subject to decontamination procedures ([f]). This can be worn by workers involved in low-dust tasks or support activities in peripheral zones of the remediation site, where exposure levels to airborne asbestos fibre concentrations are measurably low. Before exiting the remediation site, workers pass through a designated personal DCU, which includes thorough cleaning of footwear and full-body showering.

**Box 15-6: Examples of control measures for worker protection during environmental remediation of asbestos-rich soils from a former asbestos mine (Italy)**

For higher-risk operations, the use of disposable coveralls made of barrier material remains mandatory. For longer or higher-risk activities, workers are required to wear suits that include an integrated hood, sealed gloves and overshoes, to ensure complete protection.

The selected PPE therefore depends upon a risk assessment of the worker's potential exposure to airborne asbestos fibres. The production plant could not be encapsulated with polyethylene sheets due to the risk of collapse and height of the building, so it was demolished from the top down using a micronised cloud of water from a cannon for 'dynamic confinement' of asbestos dust.

**Figure 15-8: Nebulising cannon to dampen dust during demolition of a production plant**



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**Box 15-6: Examples of control measures for worker protection during environmental remediation of asbestos-rich soils from a former asbestos mine (Italy)**

**Figure 15-9: Area A before remediation**



**Figure 15-10: Area A after remediation: stabilised slopes covered in vegetation prevent the release of airborne dust**

## Box 15-6: Examples of control measures for worker protection during environmental remediation of asbestos-rich soils from a former asbestos mine (Italy)

### Lessons learnt

'It is important to take a pragmatic approach to remediation for an area of this scale where it was not practical to remove the asbestos contamination', said the Geologist General Manager, adding 'the main issue was airborne asbestos, so preventive measures such as stabilisation of slopes and vegetation were key to reduce asbestos fibres in the air.'

(*) For example, not all vehicles on site are currently fully compliant with EN ISO 23875:2022 and, due to the known presence of asbestos on site, a precautionary approach is adopted based upon risk assessment and occupational health protocols.

(**) Wind speeds of level seven or more on the Beaufort scale, corresponding to wind speeds of 51–62 km/h.

(***) Coveralls without any pockets or buttons which can collect dust.

*Sources:*

([a]) Italy, Gazzetta Ufficiale (1992), Law No 257/1992, Rules relating to the cessation of use of asbestos, https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:1992-03-27;257 (the law provides for the decontamination and remediation of contaminated sites and establishes worker protection measures); Italy, Gazzetta Ufficiale (2008), Legislative Decree No 81/2008, Implementation of Article 1 of Law No 123 of 3 August 2007, on the protection of health and safety in the workplace, https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2008-04-09;81!vig=2025-07-28 (chapter III includes updates on employer obligations for risk assessment, the work plan, training, provision of PPE, health surveillance and prior notification to the health and safety authority).

Italy, Gazzetta Ufficiale (1994), Ministerial Decree of 06/09/1994, Regulations and technical methodologies for the application of Article 6, paragraph 3, and Article 12, paragraph 2, of Law No 257 of 27 March 1992, concerning the cessation of the use of asbestos. (094A5917), https://www.gazzettaufficiale.it/eli/id/1994/09/20/094A5917/sg (the decree provides technical guidelines for asbestos removal, remediation and disposal procedures).

Italy, Gazzetta Ufficiale (1996), Ministerial Decree of 14/05/1996, Regulations and technical methodologies for remediation interventions, including those to render asbestos harmless, provided for by Article 5, paragraph 1, letter (f) of Law No 257 of 27 March 1992, containing 'Rules relating to the cessation of the use of asbestos', https://www.gazzettaufficiale.it/eli/id/1996/10/25/096A6000/sg# (the decree establishes the criteria for drafting the work plan for interventions involving asbestos).

Italy, Gazzetta Ufficiale (2006), Legislative Decree No 152/2006 approving the Code on the Environment, https://www.gazzettaufficiale.it/dettaglio/codici/materiaAmbientale (Part IV, Title V deals with the remediation of contaminated sites).

([b]) Italy, Gazzetta Ufficiale (1998), Law 426/1998, New interventions in the environmental field, https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:1998-12-09;426!vig=2025-07-28.

([c]) Italy, Gazzetta Ufficiale (2008), Legislative Decree No 81/2008, Implementation of Article 1 of Law No 123 of 3 August 2007, on the protection of health and safety in the workplace work, https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2008-04-09;81!vig=2025-07-28.

([d]) ISPESL (2010), 'Linee Guida Generali da adottare per la corretta gestione delle attività di bonifica da amianto nei Siti di Interesse Nazionale (SIN)' [General guidelines for the proper management of asbestos remediation activities in sites of national interest (SIN)], https://afevaemiliaromagna.org/wp-content/uploads/2021/12/20-19107_ispraall2.pdf.

([e]) Italian Environmental Quality Standard of 30 grammes/m³ of suspended solids in water (D.lgs 114/1995, art.2, c.1); See Italy, Gazzetta Ufficiale (1995), Legislative Decree No 114/1995, Implementation of Directive 87/217/EEC on the prevention and reduction of environmental pollution caused by asbestos, https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:1995-03-17;114!vig=. More stringent local environmental quality standards are indicated by the Regional Environmental protection Agency of 10 000 fibres/litre (10 000 000 fibres/m³).

([f]) See Annex 2, point 5.1 of Italy, Gazzetta Ufficiale (1994), Ministerial Decree of 06/09/1994, Regulations and technical methodologies for the application of Article 6, paragraph 3, and Article 12, paragraph 2, of Law No 257 of March 27, 1992, concerning the cessation of the use of asbestos. (094A5917), https://www.gazzettaufficiale.it/eli/id/1994/09/20/094A5917/sg.

# 16 Civil engineering

## 16.1 Scope

This section provides guidance tailored to occupational activities in civil engineering environments where exposure risks to asbestos or materials containing asbestos (MCAs) may arise. The objective is to prevent unintentional exposure to asbestos by workers or the public and to ensure that all legal and health and safety obligations are met throughout the project life cycle.

Examples of civil engineering works where exposure to asbestos or MCAs (see Annex 4) may occur include transport infrastructure (such as roads, railways, harbours and airports), civil engineering structures (such as bridges, tunnels, locks and dams) and networks (such as electricity and gas networks, water pipelines). These generally fall into the following categories:

- road construction, see Section 16.1.1;
- rail ballast, see Section 16.1.2;
- hardcore and made ground, see Section 16.1.3;
- civil-engineered structures and networks, see Section 16.1.4.

### 16.1.1 Road construction

Asbestos may be present in road [539] construction materials such as asphalt (see Figure 16-1), hardcore and cement. When road surfaces degrade or are cut, drilled or otherwise disturbed, asbestos fibres may be released into the air.

Asbestos was historically used to reinforce road paving in areas subject to heavy wear, enhancing durability. Asbestos (chrysotile and minerals of the tremolite group) was used as a filler in mixed asphalt for road surfaces [540].

**Figure 16-1: Asphalt containing asbestos**

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[539] The term ‘road’ refers to a thoroughfare, route or way on land that is specifically designed, constructed and maintained to allow the movement of people, goods and vehicles.

[540] Marrocchino, E., Telloli, C., Faccia, F., Rizzo, A. and Volpe, L. (2020), ‘Morphological and chemical analysis of tremolite related to natural asbestos in the road paving’, *Journal of International Geoscience*, Vol. 43, Issue 3, https://doi.org/10.18814/epiiugs/2020/0200s05.

### 16.1.2 Rail ballast

Rail ballast, the crushed stone or aggregate beneath railway tracks, may contain materials sourced from areas where naturally occurring asbestos (NOA) was present. Maintenance activities that disturb this ballast may release asbestos fibres, particularly if the ballast includes crushed NOA.

Rail ballast is made of crushed stone with good mechanical properties and a grain size of 30–60 mm. Common materials include basalts, porphyries orthogneisses and 'green rocks' (such as serpentinites, prasinites and amphibolites). These green rocks often contain asbestos minerals, such as chrysotile and amphibole asbestos ([541]).

The railway track ballast often originates from the crushing of serpentinite rocks, which may contain thin veins of chrysotile and tremolite fibres. Ballast can also become contaminated with asbestos from other sources, such as materials falling from trains, stations or trackside debris, particularly from older trains that used MCAs in components like brake pads and insulation ([542]), or from incidents (such as fires, water-related damage, structural failures, train derailments or collisions) ([543]).

Workers can be exposed to asbestos fibres during:

- application of fresh ballast on tracks;
- removal of used ballast;
- ballast-stirring operations (for adjusting the ballast bed of the railway track).

Fresh ballast should be asbestos-free, in accordance with the substitution-principle. It should also be free of silica, which is carcinogenic. Stirring of used ballast containing asbestos for adjusting the ballast bed of the railway track should be avoided. If unavoidable, dust suppression methods (spraying with water) should be applied. Machine cabins should be equipped with positive pressure systems and H-Class filtered air. Workers should use the correct PPE in accordance with the risk assessment, see Section 16.4. For risk assessment related specifically to NOA, see Section 15.3.3 and Section 5.5.2.

A more structured approach involves removing used ballast and replacing it with asbestos- and silica-free ballast. The same control measures should be applied during removal as during stirring used ballast.

### 16.1.3 Hardcore and made ground

Hardcore refers to coarse, dense aggregate material used in construction as a base layer for roads, pavements or foundations. It often consists of crushed stone, bricks, concrete or other rubble. Asbestos-contaminated demolition waste may unintentionally be included in hardcore, particularly when material from older buildings containing MCAs was recycled without thorough screening. This is now a concern where such material is excavated during current works. When hardcore containing asbestos is moved, compacted or broken up, asbestos fibres may become airborne.

In the past, some asbestos-processing companies made rejected products (such as broken asbestos-cement sheets) available to individuals, farmers and businesses for raising and paving driveways and yards. In some cases, this material was also used to pave roads, cycle tracks and footpaths.

Made ground, i.e. land that has been artificially raised using man-made deposits, may also contain MCAs.

([541]) Malinconico, S., Conestabile della Staffa, B., Guercio, A., Paglietti, F. and Rimoldi, B. (2020), 'Natural occurring asbestos (NOA) in Italy: Workers' potential exposure risks and prevention and protection measures', EGU General Assembly, Online, 4–8 May 2020, EGU2020-4918, https://doi.org/10.5194/egusphere-egu2020-4918.

([542]) European Parliament (2012), Parliamentary question E-008194/2012 to the Commission – 'Asbestos emergency – Rocks used as railway ballast show traces of the mineral, with a high risk of dispersal', https://www.europarl.europa.eu/doceo/document/E-7-2012-008194_EN.htm.

([543]) ProRail (2024), 'Rail renewal in Vroomshoop due to asbestos', https://www.prorail.nl/nieuws/volledige-spoorvernieuwing-in-vroomshoop-vanwege-asbest.

### 16.1.4 Civil-engineered structures and networks

Asbestos may be present in rock or soil excavated during the construction of roads, railways, airports, bridges, harbours, tunnels, locks, dams and pipelines ([544]).

#### 16.1.4.1 Gas and electricity networks

Legacy components in electricity and gas networks may contain asbestos. Workers may be exposed to asbestos during maintenance activities. Examples of components which may contain asbestos include ([545]):

- low-voltage knife cartridges (fuses);
- flange gaskets;
- metal house connection boxes;
- asbestos-cement gas pipes;
- asbestos-cement casing pipes for electrical cables;
- older end closures with cord containing asbestos;
- asbestos-containing sealant, originally used for fitting a main valve/pressure regulator/connection pipe/riser.

#### 16.1.4.2 Water and sewage pipelines

Water and sewage pipelines may have been constructed with asbestos-cement pipes.

## 16.2 Naturally occurring asbestos

NOA may be present in soil or rock, often as coloured veins. These may appear blue (crocidolite), brown (amosite), green (anthophyllite, tremolite and actinolite) or white (chrysotile, tremolite and actinolite), see Section 5.5.2 and Section 5.5.2.

The term NOA refers to the natural geologic occurrence of six regulated types of asbestos minerals, which may be disturbed through natural weathering or human activities. When disturbed, NOA can release asbestos fibres into the air, posing a risk of exposure.

Civil engineering activities that may expose workers to NOA include ([546]):

- remediation of NOA-contaminated sites, slope rearrangement and restoration of areas affected by hydrogeological instability;
- excavation for civil engineering works such as roads, railways, airports, harbours, bridges, tunnels, locks, dams and pipelines;
- excavation and urban development at various scales;
- removal and disposal/remediation of railway ballast.

([544]) AFNOR (2020), 'NF X46-102:2020 – Asbestos survey – Survey of materials and products containing asbestos in civil engineering structures, transportation infrastructures and diverse networks – Mission and methodology', https://www.boutique.afnor.org/en-gb/standard/nf-x46102/asbestos-survey-survey-of-materials-and-products-containing-asbestos-in-civ/fa197188/261225.

([545]) Guidance on the safe handling of asbestos-containing components in gas and electricity networks, for specific tasks, has been developed for the energy sector in the Netherlands, and is available in Dutch, see Network Companies (n.d.), 'Work instructions and attachments', https://netwerkbedrijven.dearbocatalogus.nl/werkinstructies-en-bijlagen.

([546]) Malinconico, S., Conestabile della Staffa, B., Guercio, A., Paglietti, F. and Rimoldi, B. (2020), 'Natural occurring asbestos (NOA) in Italy: Workers' potential exposure risks and prevention and protection measures', EGU General Assembly, Online, 4–8 May 2020, EGU2020-4918, https://doi.org/10.5194/egusphere-egu2020-4918.

# 16.3 Coordination

At construction sites where activities such as maintenance, renovation or demolition of civil engineering structures are carried out, which may involve asbestos-related activities, one or more SHCs must be appointed if more than one contractor is present on the construction site ([547]), see Section 3.2.2. These asbestos-related works may also form part of a larger construction project or site.

# 16.4 Risk assessment

A risk assessment must be carried out for any activity likely to involve a risk of exposure to dust arising from asbestos or MCAs ([548]), see Section 4.1. This includes all civil engineering works or contexts involving NOA, hardcore or made ground where asbestos could be present. The risk assessment will determine the nature and degree of worker exposure and the potential health risks, to support prevention, mitigation and management of risks. For risk assessment related specifically to NOA, see Section 15.3.3 and Section 5.5.2.

In addition, the document NF X46-102:2020 from AFNOR ([549]) provides detailed guidance on assessing the presence of asbestos in civil engineering structures and materials. It outlines methodologies for material assessment, procedures for conducting risk assessments, reporting requirements and protocols for traceability and mapping of MCAs in transport infrastructure, network structures (such as pipes and cables) and civil engineering structures (such as bridges and tunnels).

## 16.4.1 Identifying asbestos and ground assessment

Identification of asbestos and MCAs is addressed in Section 5. For detailed guidance on identifying NOA, see Section 5.2.2 and Section 5.5.2.

### 16.4.1.1 Ground assessment

Before any civil engineering work begins, the employer needs to establish whether there is risk of asbestos in the ground to be excavated. This ground assessment should be based on a construction stage plan and in accordance with Directive 92/57/EEC. There are three broad steps:

- assessing whether there is any indication of asbestos in the ground;
- if there is a risk of asbestos, sampling the ground;
- if the samples indicate the presence of asbestos, measuring the dust during construction.

The ground assessment typically starts with a desktop study, which may include ([550]):

- local knowledge from nearby sites, such as previous assessments, site history, local historic maps and records;
- information from owners or other sources about known asbestos contamination;
- potential presence and condition of MCAs in existing hardcore or made ground;

([547]) Directive 92/57/EEC; European Commission: Directorate-General for Employment, Social Affairs and Inclusion (2011), *Non-binding guide to good practice for understanding and implementing Directive 92/57/EEC on the implementation of minimum safety and health requirements at temporary or mobile construction sites*, Publications Office of the European Union, Luxembourg, https://op.europa.eu/en/publication-detail/-/publication/96b5fe83-ef7d-4628-9af0-e02b25810c1d.

([548]) Directive 2009/148/EC, Article 3(2).

([549]) AFNOR (2020), 'NF X46-102:2020 – Asbestos survey – Survey of materials and products containing asbestos in civil engineering structures, transportation infrastructures and diverse networks – Mission and methodology', https://www.boutique.afnor.org/en-gb/standard/nf-x46102/asbestos-survey-survey-of-materials-and-products-containing-asbestos-in-civ/fa197188/261225.

([550]) HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.

- potential presence and condition of NOA in existing rock or soil, through geological research and surveys;
- available data on asbestos use in past road construction, landfill or hardcore;
- available data on the use of NOA-containing ballast in rail tracks, including underground railways;
- available data on ballast contamination from fire or other incidents – fire-damaged ballast may contain degraded MCAs, which can become friable and release asbestos fibres during excavation;
- information on past industrial asbestos use in the area, such as asbestos product manufacturing, high-temperature industrial processes, heavy manufacturing industries, nuclear and chemical plants, power stations, shipyards, waste storage, transfer and landfill sites, and demolition waste;
- available data on soil contamination from illegal dumping, fly-tipping or buried infrastructure such as underground/basement boiler rooms from demolished structures.

If there is a risk that asbestos could be present, a site visit or examination of recent photographs may help to detect visible contamination. Where there is a suspicion that MCAs or NOA could be present in existing rock or soil and present a risk, samples should be taken. In some Member States (e.g. Netherlands), soil is screened for hazardous substances, including asbestos when suspected [551].

A ground assessment of terrain where there is a risk that asbestos may be present may involve [552]:

- a reconnaissance visit to gather information/details;
- identification of areas with similar characteristics to establish where sampling is needed, for example areas with comparable construction materials, history or geology;
- visual inspection;
- sampling and analysis of suspected materials or products (including layer-by-layer analysis for composite materials);
- determining quantities of materials or products likely to contain asbestos;
- reporting of findings.

### 16.4.1.2 Hardcore and made ground

MCAs have been both accidentally and intentionally used in hardcore and made ground. In 2022, a comprehensive Italian guidance document was published on the management of soils contaminated with man-made MCAs, including risk assessment procedures, see Box 16-1.

(551) CROW (2025), 'Working in and with contaminated soil – Guideline for safe, careful and risk-based working', https://www.crow.nl/kennisproducten/werken-in-en-met-verontreinigde-bodem/; Nederlands Normalisatie Instituut (NEN) (2017), 'Soil – Investigation and sampling of asbestos in soil and soil stockpiles – NEN 57007+C2', https://www.nen.nl/norm/pdf/preview/document/243402/.

(552) AFNOR (2020), 'NF X46-102:2020 – Asbestos survey – 'Survey of materials and products containing asbestos in civil engineering structures, transportation infrastructures and diverse networks – Mission and methodology', https://www.boutique.afnor.org/en-gb/standard/nf-x46102/asbestos-survey-survey-of-materials-and-products-containing-asbestos-in-civ/fa197188/261225.

**Box 16-1: Management of soils contaminated with MCAs (Italy)**

The Italian technical manual 'Gestione suoli contaminate amianto' [Safe management of soils contaminated with asbestos-containing materials] offers guidance on safely managing asbestos and MCA-contaminated soils, particularly those of anthropogenic origin. The manual's main aims are to:

- improve safety standards during remediation and containment at contaminated sites;
- provide clear, legally compliant procedures for operators;
- promote a culture of prevention among all stakeholders involved in asbestos risk management.

**Objectives**

The manual seeks to harmonise and promote correct safety procedures, mitigate occupational and environmental risks and support the development of a safety culture. It offers practical tools and reference information based on current legislation, technical standards and best practices, aiming to protect workers, the public and the environment from asbestos exposure.

**Approach**

It outlines a multidisciplinary approach that integrates regulatory compliance (national and international), technical-scientific expertise and operational experience. The manual stresses the need for site-specific risk assessments, detailed planning and ongoing monitoring. It addresses challenges such as detection, characterisation and remediation of asbestos in soil, while also noting gaps in current regulation and analytical methods.

**Work methods**

Key procedures include:

- initial site characterisation and risk assessment using both field and laboratory analysis;
- segregation of contaminated soil into manageable lots (500–1 000 $m^3$), followed by systematic sampling and MCA screening;
- decision-making based on asbestos concentration using flow charts, from hazardous levels to potentially low concentrations;
- strict safety measures, including containment, dust suppression, PPE, environmental and personal exposure monitoring, and proper waste containing asbestos (WCA) handling and disposal;
- regular communication with authorities, detailed record-keeping and mandatory training for all personnel involved;
- adaptation of procedures to site-specific conditions, with a consistent focus on exposure minimisation and legal compliance.

The manual is due to be translated into English.

*Source:* INAIL (2022), 'Safe management of soils contaminated by anthropogenic asbestos', https://www.inail.it/portale/it/inail-comunica/pubblicazioni/catalogo-generale/catalogo-generale-dettaglio.2022.02.gestione-in-sicurezza-di-suoli-contaminati-da-amianto-di-origine-antropica.html.

### 16.4.1.3 Underground pipelines

Underground pipelines made of asbestos cement are still widely present across many Member States. Several guidance documents are available to support control measures and risk assessment, see Box 16-2 and Box 16-3 for examples from Italy and the Netherlands.

**Box 16-2: Removal of underground asbestos-cement water pipes (Italy)**

The Italian document 'Safe removal of underground asbestos-cement water pipes' was developed by INAIL together with a multidisciplinary team. It provides harmonised guidelines for the safe removal of underground asbestos-cement water pipes.

**Objectives**

The primary aim is to protect workers and the public from asbestos exposure during maintenance, repair and replacement of underground pipes. The guidance promotes standardised procedures across Italy to support planning, reproducibility, operational consistency and data collection for national asbestos mapping.

**Approach**

The methodology is based on field research and best practices, developed with public and private stakeholders. It applies to both scheduled and emergency interventions, recognising the urgency often involved in water network work. It emphasises risk assessment, regulatory compliance and the involvement of qualified professionals and registered asbestos remediation companies. Preventive measures, such as encapsulation and wetting, are prioritised to minimise fibre dispersion. Frequent training for operators and coordinators is also emphasised.

**Working methods**

Key procedures include the following.

- **Preparation.** Gathering data on pipe locations, conducting site surveys and preparing a detailed work plan to submit to local health authorities.
- **Site set-up.** Fencing off work areas, displaying hazard warnings and restricting access to trained personnel.
- **Excavation and handling.** Using hand tools to expose pipes, wetting materials to suppress dust and applying encapsulation sprays.
- **Cutting and removal.** Using low-speed cutting tools in controlled conditions, applying glove-bag techniques where feasible and avoiding high-speed tools to reduce fibre release.
- **Waste management.** Packaging removed pipes and contaminated soil in sealed, labelled containers for hazardous waste disposal.
- **Decontamination and clean-up.** Cleaning tools and PPE, with visual inspections and soil sampling post-operation to verify site safety.
- Regular monitoring, documentation and reporting to national authorities are essential to support risk management and regulatory oversight.

*Sources:* INAIL (2020), 'Safe removal of underground asbestos-cement water pipes', https://www.inail.it/portale/it/inail-comunica/pubblicazioni/catalogo-generale/catalogo-generale-dettaglio.2020.12.safe-removal-of-underground-asbestos-cement-water-pipes.html; NL Network companies (n.d.), 'Safe working with asbestos-cement pipes in the underground public water supply, gas, and sewage wastewater', https://lwbg.nl/wp-content/uploads/2017/10/veilig-werken-met-asbestleidingen_webversie_20110520-1.pdf; BouwendNederland (updated 2025), 'Asbestos, amendment of the Working Conditions Decree: Asbestos rules amended', https://www.bouwendnederland.nl/vereniging/vakgroep-ondergrondse-netwerken-en-grondwaterbeheer/asbest.

## Box 16-3: Managing asbestos in underground pipelines (Netherlands)

The asbestos-cement work plan outlines safe working procedures for handling, replacing and removing asbestos-cement pipes and related materials in the Dutch utility sector (water, gas and other underground networks). It is designed to protect workers, the environment and the public from asbestos-related health risks.

### Working methods

The key principles are shown below.

- **Risk assessment.** A risk assessment must be conducted before any work begins to identify asbestos and determine control measures.
- **Training and certification.** Only trained and certified personnel are allowed to work with or near asbestos-cement materials. Training includes recognition of asbestos, safe handling and emergency procedures.
- **Safe working methods.** Work must be carried out using methods to minimise fibre release, such as wet-working techniques, local extraction and the use of appropriate PPE.
- **Containment and disposal.** WCA must be collected, contained and disposed of in line with legislation to prevent environmental contamination and exposure.
- **Communication.** Clear communication between all parties involved (workers, supervisors, clients) ensures that safety procedures are understood and followed.

### Work plan structure

- Preparation: planning, risk assessment and briefing of personnel.
- Execution: work procedures, such as cutting, removing and transporting asbestos-cement pipes, with strict attention to minimising dust and fibre release.
- Clean-up and disposal: final decontamination, packaging and disposal of WCA.
- Monitoring and evaluation: post-work review of the site and procedures are reviewed to ensure no residual risk remains.

### Legal and regulatory context

The work plan aligns with Dutch and EU asbestos regulations, including the Asbestos Removal Decree ([a]) and the Working Conditions Decree ([b]). It supports legal compliance and best practice in managing asbestos cement in underground networks.

The guidance includes task-specific graphics, checklists, work instructions and references to relevant legislation to support safe and compliant operations. Following these procedures allows maintenance, repair and removal of asbestos-cement pipes to be carried out without increasing health risks.

([a]) Official publication: Staatsblad (Bulletin des Lois et des Décrets royaux) (2005), Decree of 16 December 2005, establishing rules for the inventory of asbestos and the removal of asbestos in general and from a building in particular, and in connection with this, an amendment to the Working Conditions Decree (Asbestos Removal Decree 2005), https://wetten.overheid.nl/BWBR0019316/2024-08-01.

([b]) Official publication: Staatsblad (Bulletin des Lois et des Décrets royaux) (1997), Decree containing rules in the interest of safety, health and well-being in connection with work (Working Conditions Decree) of 15/01/1997, Official Gazette number 60 of 1997, https://wetten.overheid.nl/BWBR0008498/2025-07-01.

*Sources:* BouwendNederland (updated 2025), 'Asbestos, amendment of the Working Conditions Decree: Asbestos rules amended', https://www.bouwendnederland.nl/vereniging/vakgroep-ondergrondse-netwerken-en-grondwaterbeheer/asbest.

### 16.4.2 Notification

Before work begins on any activity likely to involve a risk of exposure to asbestos dust, a notification must be submitted to the competent authority in the relevant Member State. This requirement applies unless the Member State has made use of the derogation provided under Article 3(3) of the AWD [553], see Section 4.3.

### 16.4.3 Plan of work

A plan of work must be drawn up before demolition work or work on removing asbestos and/or MCAs from buildings, structures, plants or installations [554], see Section 4.2. A plan of work should be based on a risk assessment tailored to the specific situation and activities to be undertaken.

## 16.5 Air monitoring

No additional details are required for air monitoring in civil engineering settings, see Section 6 for general requirements and procedures.

(553) Directive 2009/148/EC, Article 4.
(554) Directive 2009/148/EC, Article 13.

## 16.6 Control measures

Control measures for open-air civil engineering work are context-specific and differ from those used in enclosed environments. They should be evaluated by competent persons. For general control measures related to direct asbestos exposure, see Section 8.

Most control measures for open-air civil engineering are similar to those used in mining and quarrying, see Section 15.5.

The main principles include:

- use of dust suppression techniques (spraying and mist);
- use of hand tools instead of high energy tools, where feasible;
- use of machinery (trucks, cranes) with cabins under positive pressure and H-Class filtered air systems;
- use of full PPE, including boots, coveralls, disposable underwear, gloves and respiratory protective devices (RPDs).

Where a transit route is used to enter or leave a work area from which MCAs are being or have been removed, an indirect decontamination procedure should be followed. This involves installing a decontamination lock with at least two compartments (known as a transit lock, consisting of a dirty area and a clean area) at the access point to the work area. This transit route should lead to a decontamination facility, even if it is located some distance from the work area ([555]).

## 16.7 Passive exposure of workers

For general information on passive exposure of workers, see Section 7.

Examples of passive exposure in civil engineering include:

- accidental bystander exposure to airborne asbestos fibres during excavation or ground disturbance;
- exposure from machinery stirring up used ballast or transporting asbestos-contaminated dust;
- residual asbestos in soil at historic industrial or demolition sites, leading to occasional airborne fibre release even in the absence of active construction work;
- civil engineering work near former MCA manufacturing sites, power stations, heavy industrial plants or other historic users of asbestos (such as embankments, road bases or foundations), where asbestos fibres may still be present in ambient air due to past contamination.

([555]) Stitching Ascert (2022), 'SCi Indirecte decontaminatieprocedure', https://www.ascert.nl/images/img-1648142664-623ca94845aaa.pdf.

## 16.8 Training

Workers involved in soil excavation should receive appropriate training. This group may lack prior asbestos awareness. No additional detail is required here, see Section 9.

## 16.9 Health surveillance

For health surveillance, see Section 10.

## 16.10 Incident management

For incident management, see Section 11. An example of incident management involving blasting grit is provided in Section 11.4, Box 11-3.

## 16.11 Waste management

For waste management in civil engineering, see Section 12.

# 17 Emergency services

## 17.1 Scope

### 17.1.1 Who is at risk?

**Box 17-1: Emergency services**

**Article 3 of Directive 2009/148/EC (AWD):**

1. This Directive shall apply to activities in which workers are or may be exposed in the course of their work to dust arising from asbestos or materials containing asbestos.

**Recital 28 of Directive (EU) 2023/2668 amending the AWD:**

Firefighters and emergency services personnel are at risk of exposure to asbestos in the course of their work. It is therefore important that the employers of those workers assess, in accordance with this Directive, the risk to workers of exposure to asbestos and that they take the necessary measures to protect the safety and health of those workers. [...]

Those at risk of asbestos exposure during an emergency, such as a natural disaster or building fire, due to involvement in first response, include:

- emergency responders (including public health professionals, paramedics, firefighters, charity workers, volunteers and humanitarian aid workers);
- military and police personnel.

Further groups of workers, who are involved in the aftermath and remedial activities, are also at risk of asbestos exposure after an emergency. These include:

- private contractors involved in clean-up and waste removal;
- insurance loss adjusters;
- utility service providers (such as gas, electricity and water).

Some of these roles may fall under different legal frameworks (e.g. military personnel) and may be subject to specific rules regarding coverage by OSH legislation.

Under Article 2(2) of the OSH Framework Directive, the directive does not apply where characteristics peculiar to certain specific public service activities, such as the armed forces or the police, or to certain specific activities in the civil protection services, inevitably conflict with it. In that event, the safety and health of workers must be ensured as far as possible in line with the objectives of the directive ([556]). Accordingly, these services should follow the legislation after an emergency event and during routine work, for example in police stations or fire stations.

In some Member States, volunteers responding to emergencies may not be considered 'workers'. However, they remain an important group in risk assessments and communications, see Section 3.5. Provisions should be made to control their potential asbestos exposure and ensure they are included in planning risk assessment and control measures alongside employed workers.

([556]) Directive 89/391/EEC, Article 2(2).

## 17.1.2 First response in an emergency


Figure 17-1: A firefighter wearing thermal protective PPE and a self-contained breathing apparatus (SCBA), undergoing the initial stage of asbestos decontamination at the fire site

This image is not available for reuse, see inside front cover.

At the outset of an emergency, the presence of asbestos is unlikely to be identified. Emergency responders should therefore be made aware of the potential risk and adopt systematic precautionary measures. This includes wearing appropriate PPE, especially respiratory protection, when there is any doubt, see Section 17.6.

The first response in an emergency typically involves immediate action to control the situation, often under severe time constraints and with the primary aim of saving life. First responders may include police, medical services (such as paramedics), fire services and search and rescue teams.

In situations such as fires involving asbestos, airborne fibre concentrations may be significant. Regardless of whether first responders are operating within or outside the immediate emergency zone, they may be at risk of asbestos exposure if materials containing asbestos (MCAs) are involved. For the appropriate control measures, see Section 17.6.

# 17.2 Coordination

Where asbestos-related work is carried out during the remediation after the emergency, a coordinator (similar to the SHC in the construction sector) could be appointed for any site on which more than one contractor is present, see Section 3.2.2.

# 17.3 Risk assessment

## 17.3.1 Risk assessment

For any activity likely to involve a risk of exposure to dust arising from asbestos or MCAs (see Annex 4) ([557]), the risk must be assessed in such a way as to determine the nature and degree of the workers' exposure to dust arising from asbestos or MCAs and to prioritise removal of asbestos or MCAs over other forms of asbestos handling ([558]), see Section 4.1. Where feasible, the risk assessment should be site-specific.

In disaster situations, multiple risks should be considered and covered in the risk assessment, for example electrical risks, fire, unstable infrastructure and moving heavy objects. Responsibility for conducting the risk assessment rests with the employer of the workers involved ([559]). Employers must consult with workers and/or their representatives ([560]).

To enable an efficient emergency response, a general risk assessment form or generic questionnaire may be developed to cover sites where site-specific information is unavailable, or time-constraints prevent site-specific risk assessments. This general risk assessment form should include recommendations based on a worst-case scenario to ensure sufficient protection for emergency workers in all possible exposure situations.

The risk assessment should cover all personnel involved at the emergency site, including those inside the emergency zone and those assisting from outside.

For post-emergency clean-up and remedial action, after the site has been cleared of immediate danger, a site-specific risk assessment should be carried out if asbestos is present, see Section 17.4.2.

Box 17-2 provides an example of a categorisation system used in the Netherlands for fire events involving MCAs. This classification helps determine appropriate response measures and safety protocols and could be used for all emergency situations.

([557]) Directive 2009/148/EC, Article 3(2).

([558]) Directive 2009/148/EC, Article 3(2).

([559]) Directive 2009/148/EC, Article 3(2); Directive 89/391/EEC, Articles 5, 6 and 9.

([560]) Directive 2009/148/EC, Article 3(5).

**Box 17-2: Example of categorisation of asbestos incidents**

In the Netherlands, a categorisation system for fire events involving MCAs has been implemented. This system is also applicable to other emergency situations involving asbestos. It determines the appropriate response measures and safety protocols.

The response of emergency services, such as firefighting, flood control or structural collapse response, is generally consistent across all categories, with a focus on controlling the incident. However, the categorisation becomes particularly important for other services, such as environmental authorities, public health bodies and the police. Categories II and III (see below), which involve larger impacted areas and higher potential for harm, require additional measures and resources from these services.

Decision-makers responsible for assigning the incident category should be properly trained. Misclassification may have serious consequences for both workers and members of the public within the affected area.

Incidents involving asbestos are categorised into three types, based on the extent and location of asbestos fibre release.

- **Category I.** Asbestos release is confined to the building or site of origin. Contamination remains within the immediate premises, posing minimal risk to surrounding areas.
- **Category II.** Asbestos is released beyond the premises or site but not in locations where people live, work or gather, such as an industrial area or construction site with no residential or office buildings. While contamination extends beyond the immediate site, the risk to public health is lower than for Category III.
- **Category III.** Asbestos is released into residential, work or recreational areas, such as houses, offices or schools. This category poses the highest risk to public health and requires extensive containment, potential evacuation and public health intervention.

*Source:* Brandweer (2022), 'Fire department response in the event of asbestos incidents', https://nipv.nl/wp-content/uploads/2022/04/201811-BRWNL-Brancherichtlijn-en-publicatie-Brandweeroptreden-bij-asbestincidenten-1.pdf.

## 17.3.2 Risk communication

The risk assessment should indicate how essential information will be communicated to workers on site. Emergency situations involve multiple risks, such as flooding, risks of landslides, collapsing infrastructure and biological agents, which require immediate action and may therefore require different communication methods (see Section 3.5) than those used for managing longer-term risks of asbestos exposure.

In addition to occupational health and safety measures for the workers involved, if MCAs are suspected in damaged buildings or debris, an immediate public awareness campaign, supported by local and regional authorities, may be required to help raise awareness.

The campaign should target relevant sections of the general population, using accessible formats such as written, visual or radio communication, and may require translation into multiple languages. It should provide clear, easy to understand information covering:

- what asbestos is;
- where it might be found;
- the associated hazards and risks;
- that only trained personnel with adequate protective equipment should access potentially contaminated sites or handle MCAs;
- who to contact if they encounter, or are concerned about, suspected MCAs.

**Box 17-3: Example of an official communication relating to asbestos risk after flooding (Greece)**

The following content was translated from Greek to English and adapted from official guidance ([a]).

Dwellings or other buildings in flood-affected areas may, due to the date of their construction, contain MCAs (e.g. insulation, roofs, tiles, doors, chimneys, ovens, walls).

Asbestos is a material that does not cause health problems when it is firmly embedded in intact products, such as walls, tiles and pipes, provided it is not destroyed or subjected to stress and damage. However, scientific research has shown that health problems may arise from inhalation of asbestos fibres during the cutting, replacement, removal and demolition of MCAs or from damaged materials. It should be noted that when they are wet, destroyed MCAs are not considered as hazardous as when they are dry.

Considering the above, the following steps are recommended.

- Appropriate PPE – including, as a minimum, type FFP3 masks conforming to EN 149:2001+A1:2009 ([561]), heavy gloves and durable footwear – should be worn during the cleaning or removal of materials that may contain asbestos.
- Materials that might contain asbestos should be cleaned with water and mild cleaners, taking care not to cause damage. The use of strong cleaners, abrasive products or tools (e.g. wire or hard brushes, sanders) and high-pressure water must be avoided, and surfaces must be checked for possible damage.
- Minor damage (e.g. cracks) to materials may be sealed on-site by special dyeing or glue until their final removal.
- The removal of asbestos-containing materials is to be carried out by specialised companies with a special permit from the Ministry of Labour (Article 14 of Presidential Decree 212/2006 – Government Gazette, Series II, No 212/A/9.10.2006) ([a]).
- The immediate removal of materials that may contain asbestos is to take place only when necessary, keeping the material wet and using PPE. Materials should be placed in a suitable container or at least covered until final collection.
- Materials that may contain asbestos are to be disposed of in dedicated spaces and, as far as possible, are not to be mixed with other materials. For the removal of hazardous waste, including asbestos, in the event of land pollution due to a natural disaster, Article 48(5) of Law 4819/2021 ([b]) applies, in cooperation with the competent authorities.

*Source:* Greek Ministry of Health (2023), 'Circular on flood services', https://www.moh.gov.gr/articles/health/dieythynsh-dhmosias-ygieinhs/ygieinh-periballontos/odhgies-gia-prostasia-ths-dhmosias-ygeias-meta-apo-plhmmyra/11770-egkyklios-gia-yphresies-gia-plhmmyres.

([a]) Greece, Government Gazette (2006), Presidential Decree 212/2006 'Protection of workers exposed to asbestos at work, in compliance with Council Directive 83/477/EEC, as amended by Council Directive 91/382/EEC and Directive 2003/18/EC of the European Parliament and of the Council' (Government Gazette 212/A/09.10.2006), https://www.elinyae.gr/ethniki-nomothesia/pd-2122006-fek-212a-9102006.

([b]) Greece, Government Gazette (2021), Law 4819/2021, Integrated Framework for Waste Management –Incorporation of Directives 2018/851 and 2018/852 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste and Directive 94/62/EC on packaging and packaging waste, organisational framework of the Hellenic Recycling Organisation, provisions on plastic products and the protection of the natural environment; Spatial–Urban, Energy and Related Urgent Regulations (Government Gazette 129/A/ 23.7.2021), https://www.elinyae.gr/ethniki-nomothesia/n-48192021-fek-129a-2372021.

([561]) CEN (2009), 'EN 149:2001+A1:2009, Respiratory protective devices – Filtering half masks to protect against particles – Requirements, testing, marking', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:32928,6062&cs=177A454543AEF0B8CDF44D4BA501112ED.

# 17.4 Identifying asbestos – aftermath and remedial action

Information on the presence of asbestos, whether for a general or site-specific risk assessment, can be obtained from existing asbestos notifications, asbestos registers and on-site risk assessments, or inferred based on the age of the structure. Emergency services should have prior access to such information wherever possible. Local authorities should develop mapping tools to provide emergency responders with accessible and up-to date data on potential asbestos presence.

The commanding officer leading the emergency response should confirm the presence of MCAs on site whenever feasible.

Asbestos may be released and dispersed by various events, including explosions, structural collapses, improper handling, illegal dumping or extreme weather. Each of these scenarios has a unique risk profile and dispersion pattern, requiring a tailored risk assessment that considers both immediate and long-term impacts.

Table 17-1 outlines the types of MCAs that may be encountered in different asbestos exposure scenarios. For a list of MCAs, see Annex 4.

Asbestos exposure will vary significantly depending on factors such as the nature of the emergency, the amount of asbestos present and environmental dispersal factors. Asbestos may not be the only hazardous material released during such an exposure situation. The risk assessment should consider all possible hazardous materials present.

Table 17-1: **Types of asbestos exposure in emergency situations**

| Exposure situation | Brief description |
|---|---|
| Explosion ([a]) | Asbestos may be dispersed by a pressure wave.<br><br>Explosion fragments of asbestos cement are typically solid and therefore less likely to crumble and become airborne or adhere to clothing/footwear.<br><br>Explosions near insulation materials, such as those from storage tanks or pipelines, can generate a high fraction of respirable asbestos fibres, increasing the risk of primary and passive exposure, see Section 7.<br><br>Explosions involving fire require two separate risk assessments (see Section 4.1): both the fire and the explosion need separate assessments. |
| Fire ([b]) | Sheet MCAs, such as those found in roofs, facades and walls, can be released during a fire due to rapid temperature increases and intense heat. Weathering and moisture worsen this effect. As the sheets break apart, large debris and small shards are created.<br><br>During a fire, asbestos cement can delaminate, causing its layers to separate and fragment into thin flakes and airborne fibres. These are dispersed by air currents (such as the plume rising from fire and wind).<br><br>Mechanical impacts, such as trampling or running over the debris, can further break the material and release breathable fibres. |
| Structural collapses ([a]) | Fragments released during a collapse are typically larger and less likely to flake, but the release of breathable fibres is still possible.<br><br>Pressure waves are typically less intense than explosions. Fragments are less likely to adhere to footwear or clothing. However, rescue activity or movement on debris can cause breakdown of pieces and fibre release.<br><br>Flake formation is less likely than during a fire (as the total fracture area is usually smaller than that produced by a fire). |

Table 17-1: **Types of asbestos exposure in emergency situations**

| Exposure situation | Brief description |
|---|---|
| Natural events ([a]) | Severe weather events can damage asbestos-cement roofs, facade panels or roof slates, creating fracture surfaces that release fibres.<br>Fragments are generally large, and wind dispersion is limited to the immediate area.<br>Additional contamination risks exist if asbestos fibres enter watercourses, animal feed or manure. |

*Sources:*

([a]) Instituut Fysieke Veiligheid (2018), 'Guidelines for tackling asbestos incidents', https://nipv.nl/wp-content/uploads/2022/05/20181212-IFV-IenW-Handreiking-aanpak-Asbestincidenten-werkversie-1-1.pdf.

([b]) Brandweer (2018), 'Fire department response in the event of asbestos incidents', https://nipv.nl/wp-content/uploads/2022/04/201811-BRWNL-Brancherichtlijn-en-publicatie-Brandweeroptreden-bij-asbestincidenten-1.pdf.

**Box 17-4: Example of management of rubble following an earthquake**

In Italy, guidance has been developed on relevant practices for minimising the risk of asbestos exposure following an earthquake.

The guide includes the following advice to minimise exposure risk:

- quickly identify locations where waste containing asbestos (WCA) is present to reduce the risk of fibre dispersion;
- ensure that emergency operators, personnel responsible for assessing the presence of WCA and operators involved in remediation are informed and trained on the risks and best practices;
- minimise disturbance to WCA;
- wet rubble to reduce dust emissions;
- minimise personnel exposure;
- encapsulate and/or cover debris containing WCA;
- ensure debris containing WCA is separated from other waste, stored safely and labelled before disposal.

*Source:* Italian Department of Civil Protection (n.d.), 'Operational indications for the management of rubble following a seismic event', https://www.protezionecivile.gov.it/static/18a2bbfcd6c913386a2d6acc9affd486/io-17112023-3.pdf.

## 17.4.1 Aftermath

After a disaster such as a tsunami, earthquake, flood, fire or hurricane, MCAs may be damaged, creating a need to handle, break up and dispose of MCAs.

To minimise the risk:

- identify the locations of MCAs and carry out a risk assessment, see Section 4.1;
- ensure that all individuals involved in clean-up are adequately informed of the risks and trained in control measures / safe working practices;
- minimise the disturbance of MCAs by following control measures.

Some issues that may not be immediately obvious are:

- due to the 'snowflake effect', asbestos flakes can settle in unexpected areas such as gutters and under roof tiles;
- most asbestos flakes will remain on the surface and not penetrate the soil;
- in source areas where heavy machinery is used for remediation, asbestos residues may be pushed deeper into the soil;
- if windows are open in homes or buildings located within the smoke plume of a fire or explosion pressure wave, indoor contamination may occur: if this applies to buildings used as workplaces, an indoor risk assessment may be required ([562]).

([562]) NEN 2991:2015.

Inspection of the area/facility for the presence of MCAs should be carried out after urgent emergency measures have been completed, including life-saving operations, protection of health and containment of the emergency zone.

## 17.4.2 Remedial action

Remedial action following an emergency typically involves clean-up operations to remove risks to human health (such as from collapsed building materials). This process may involve handling debris from both residential and industrial properties, which can further complicate asbestos risk management.

A notification must be submitted to the responsible authority of the Member State before any activity likely to involve exposure to asbestos dust begins, unless the Member State has granted a derogation under Article 3(3) of the AWD, see Section 4.3.

The person responsible for emergency response at the site should contact:

- municipal authorities;
- environmental services;
- the relevant national authority for asbestos-related emergencies;
- water authorities, if MCAs enter surface water or sewer systems.

Based on the mapping of potentially contaminated areas (see Section 17.4), a plan of work should be developed to either remove or encapsulate the asbestos.

The final inspection should be performed by an accredited inspection body ([563]) or other competent body/person ([564]). Accurate documentation of inspection results, including mapped areas, is essential to establish an appropriate boundary for the contamination zone / distribution area and evaluate the remediation's effectiveness.

The final inspection area should correspond to the distribution area. This inspection should be independent of previous steps, and findings may reveal that the dispersion area has shifted, for example due to wind direction changes during remediation.

In some cases, asbestos inspection may not be immediately feasible due to damaged infrastructure, shortage of trained personnel and the scale of the damage. In such situations, the precautionary principle should be applied: seek information on local construction practices and, if in doubt, assume that debris contains asbestos, especially in urban settings, where the historical use of asbestos was widespread.

In fire or explosion scenarios, fibre properties may be altered, particularly when temperatures exceed 1 200 °C. While these temperatures are rarely reached in fires ([565]), this possibility should be considered during assessment. Additional sampling may be necessary at various depths and across different locations as a precaution.

([563]) Netherlands Institute for Physical Safety (2018), 'Guidance on handling asbestos incidents', https://nipv.nl/wp-content/uploads/2022/05/20181212-IFV-IenW-Handreiking-aanpak-Asbestincidenten-werkversie-1-1.pdf.

([564]) If 'accredited inspection bodies' are not applicable, for example in Ireland.

([565]) Informatiepunt Leefomgeving (n.d.), 'Asbestbrand en incidenten', https://iplo.nl/thema/asbest/asbest-leefomgeving/asbestbrand-incidenten/.

# 17.5 Air monitoring

Air sampling is unlikely to be conducted during the first emergency response. However, it may be required during subsequent remedial activities to ensure safe removal and demolition works. In such cases, refer to guidance provided in Section 6 on air monitoring.

# 17.6 Control measures

Worker exposure to asbestos or MCA dust at the workplace must be reduced to a minimum and, in any case, to as low a level as is technically possible below the relevant limit value ([566]) (OEL) specified in Section 6.2.2. ([567]) The following examples of suitable control measures are aimed at managing emergency situations ([568]).

For any subsequent remedial action, the control measures outlined in Section 8 should be applied where possible.

## 17.6.1 Organisational and technical measures

Cordon off potentially contaminated areas:

- close windows and doors, and turn off ventilation systems to reduce asbestos fibre entry into nearby buildings;
- use signage to warn of asbestos risks within the cordoned-off area;
- permit eating and drinking only in designated clean zones to prevent contamination;
- if possible, emergency workers should avoid kneeling or lying in contaminated areas unless this is unavoidable ([569]);
- keep vehicle windows shut and set ventilation to internal circulation;
- minimise movement between contaminated areas and vehicles.

Set up a decontamination site:

- locate the site upwind of the transition between clean and contaminated areas;
- establish marked walking routes between the decontamination site and incident area; keep them damp to prevent asbestos spread.

Limit release of MCAs:

- wetting asbestos-containing debris can help prevent the dispersion of fibres into the air, but only do so when it does not endanger trapped individuals, for example through hypothermia, drowning, structural collapse from soil erosion or electrocution.

Urgent removal of MCAs:

- in specific emergency situations, such as rescuing people or animals from hard-to-access locations (e.g. old stables, mine shafts or slurry pits), urgent removal of MCAs (e.g. corrugated sheets) may be necessary;
- before removal, wet the material to limit fibre release.

([566]) Directive 2009/148/EC, Article 6.

([567]) Directive 2009/148/EC, Article 6.

([568]) Brandweer (2018), 'Fire department response in the event of asbestos incidents', https://nipv.nl/wp-content/uploads/2022/04/201811-BRWNL-Brancherichtlijn-en-publicatie-Brandweeroptreden-bij-asbestincidenten-1.pdf.

([569]) University of Central Lancashire (2023), 'Minimising firefighters' exposure to toxic fire effluents: Best practice report', commissioned by the Fire Brigades Union, https://www.fbu.org.uk/publications/minimising-firefighters-exposure-toxic-fire-effluents-best-practice-report.

Decontaminate the area using a specialist company:

- where possible, a specialist company should be deployed to clear asbestos debris to prevent further deterioration and fibre release.

#### 17.6.1.1 Decontamination

Decontamination is critically important for emergency workers and should be carried out thoroughly to prevent the spread of asbestos fibres and reduce secondary exposure risks. Workers must follow appropriate decontamination procedures when leaving the contaminated (dirty) area ([570]), see Section 8.2.2.2.

The Skellefteå Model ([571]) emphasises the importance of well-structured routines and workflows to ensure effective decontamination following accidents or fires. For firefighters, disposable PPE is not a viable option, so simple and effective decontamination is required. During decontamination, respiratory protective device (RPD) should be removed last to avoid inhaling fibres during cleaning. Whenever dirty clothing or equipment is handled, proper hygiene should be observed, for example by keeping clean and dirty clothes/equipment separate, and thoroughly washing skin, hair and nails. After decontamination, firefighters should change into clean, dry clothes. The model recommends packing all decontaminated clothing, breathing apparatuses and equipment, such as hoses, into airtight cases for additional washing back at the workstation. Workers and equipment should only return to vehicles after thorough decontamination. Once back at the workstation, contaminated items should enter by one route and any clean items by a different route. Dirty equipment should be washed using safe practices, including wearing suitable PPE and RPDs, washing and drying contaminated items separately from other items, and using purpose-built machines with sufficient capacity.

**Figure 17-2: Sealed box containing asbestos-contaminated clothing and equipment for thorough cleaning at the fire station**


This image is not available for reuse, see inside front cover.

([570]) Directive 2009/148/EC, Article 14(2)(g).

([571]) Swedish Civil Contingencies Agency (MSB) (2015), 'Healthy firefighters – The Skellefteå Model improves the work environment', https://www.msb.se/siteassets/dokument/publikationer/english-publications/healthy-firefighters-the-skelleftea-model-improves-the-work-environment.pdf.

For other first responders and remedial workers, personal decontamination procedures are detailed in Section 8.2.2.2. If disposable PPE is unavailable during emergency situations, all contaminated clothing should be either treated as WCA or sealed and sent to a specialist laundry. Affected workers should first wash skin and hair with a wet cloth and soap, which can then be discarded. They should then wash thoroughly with water, such as 'shower within an hour' ([572]), in the designated decontamination area. Waste water should be filtered before discharge into a sewer, see Section 8.2.3 and Section 17.9.1.

Workers performing decontamination activities should wear PPE as outlined in Section 17.6.1. The following summarises key advice for decontamination of equipment and vehicles on an emergency site ([573]).

- Equipment:
  - clean any equipment (such as hoses, nozzles) used in the contaminated area with a wet cloth and soap where possible to avoid bringing contaminated equipment off-site;
  - if wet-wiping is not feasible, establish a decontamination procedure (e.g. pack into a sealed container or inside a double-sealed bag to be cleaned back at the workstation using a HEPA-filtered vacuum cleaner or by a specialist company).
- Vehicles:
  - clean vehicles exposed to asbestos with water and soap on site, paying particular attention to the roof, wheel arches and tyres;
  - determine whether air filters in the vehicle need to be replaced following exposure.

**Box 17-5: Example of decontamination in the fire service – asbestos decontamination protocol of the Bas-Rhin SIS 67 firefighters (France)**

**Background and context**

In 2018, a silo covered with a roof containing asbestos caught fire, leading to a large emergency response. The intervention led to the asbestos contamination of 80 firefighter outfits. The Fire and Rescue Service of Bas-Rhin (SIS 67) decided to study whether it was possible to safely decontaminate the fire suits with a view to repeated use. Asbestos contamination is part of a broader concern regarding the contamination of equipment, which includes PAHs and volatile organic compounds. However, since asbestos fibres are mineral, not organic like PAHs, it was necessary to verify whether stringent decontamination protocols could work in the case of asbestos. In collaboration with a private company and an external certified laboratory, and in coordination with national authorities, an asbestos decontamination protocol was developed.

The protocol covers all stages of decontamination, from the removal of contaminated equipment, materials and PPE from the fire site, their transport to a logistics platform, the washing of firefighting jackets and trousers at an industrial laundry, to waste management. The protocol for the logistics platform is validated at each stage by air and surface measurements confirming the absence of asbestos.

**Decontamination protocol**

- Decontamination protocol steps
  - The protocol includes clear instructions for establishing operational zones, the removal of contaminated PPE at the fire site, the decontamination of equipment on site and the safe transport of fire clothing to the laundry on the logistics platform.

([572]) University of Central Lancashire (2023), 'Minimising firefighters' exposure to toxic fire effluents: Best practice report', commissioned by the Fire Brigades Union, https://www.fbu.org.uk/publications/minimising-firefighters-exposure-toxic-fire-effluents-best-practice-report.

([573]) Brandweer (2018), 'Fire department response in the event of asbestos incidents', https://nipv.nl/wp-content/uploads/2022/04/201811-BRWNL-Brancherichtlijn-en-publicatie-Brandweeroptreden-bij-asbestincidenten-1.pdf.

**Box 17-5: Example of decontamination in the fire service – asbestos decontamination protocol of the Bas-Rhin SIS 67 firefighters (France)**

- On-site decontamination
  - The protocol covers, for example, the establishment of a secure area for contaminated equipment, detailed procedures for the removal of contaminated clothing for personnel who assist the responder in removing equipment (such as helmet, gloves, breathing apparatus) and clothing (jacket and overtrousers).
- Transport of contaminated equipment and clothing to the decontamination facility
  - All contaminated fire clothing is placed in double packaging consisting of waterproof bags sealed with a water-soluble tie, which are themselves placed in transport boxes made of PVC. These boxes are secured with adhesive tape and clearly labelled as an asbestos risk.
- Centralisation of the processing of asbestos-contaminated items
  - The decontamination of contaminated firefighting clothing is centralised regionally at the logistics platform of the fire service. This also ensures that contaminated equipment and clothing are stored in a dedicated storage area before washing, and guarantees that decontamination procedures are followed safely.
- Protocol for washing contaminated clothing
  - The use of a water-soluble tie for transport ensures that the bag containing the contaminated clothing can be placed directly into the washing machine without unpacking – the tie dissolves during the pre-wash cycle. A washing protocol (such as load limit, minimum duration and temperature of the cycle) is specifically defined for washing asbestos-contaminated PPE. Each decontamination wash is followed by an empty wash to rinse the washing machine.
- Decontamination protocol for other equipment
  - The protocol lists the equipment to be decontaminated and the corresponding methods.

**Validation of the decontamination protocol**

- Effectiveness of washing
  - The protocol for SIS 67 garments was validated using measurements from decontaminated garments analysed post-washing by a certified external laboratory. Samples were also taken from the laundry and from the drums of the washing machines to ensure the absence of asbestos after a decontamination wash.
- Effectiveness of wastewater filtration
  - The effectiveness of the micrometric filtration of waste water from washing was been validated.
- Exposure of staff involved in handling clothes contaminated with asbestos in the laundry room
  - No traces of asbestos were detected in the air sample from the laundry after the laundry protocol was carried out in the room and the filters of the waste water were changed.

**Information, communication and training**

- Communication
  - The protocol is available in a dedicated document, including instructional images, a training certification for staff and blank versions of the forms to be completed when the process is undertaken. It is accompanied by a two-page summary document.
- Regular training
  - All staff involved in the process receive certified training on asbestos awareness and task-specific training. Refresher courses for this training take place every two years, in accordance with regulatory requirements.

**Box 17-5: Example of decontamination in the fire service – asbestos decontamination protocol of the Bas-Rhin SIS 67 firefighters (France)**

**Waste management**

- PPE used in asbestos decontamination
  - The PPE used during asbestos decontamination (e.g. FFP3 masks, nitrile gloves) is treated as asbestos waste.
- Packaging and labelling
  - Asbestos waste, including PPE, is bagged in marked, sealed containers and transported by licensed carriers to asbestos waste management facilities.
- Wastewater treatment
  - A filtration system (comprising 25-, 10- and 1-micron filters) is connected to washing machines to filter the waste water. The system alerts the user when the filters need to be replaced. The replacement of the filters is carried out by a qualified worker using appropriate PPE and the used filters are treated as asbestos waste.
- Documentation of waste
  - All waste movements are tracked, fulfilling regulatory requirements for hazardous waste. A form is completed regarding bagging, marking and the condition of the waste.

**Outcomes and lessons learnt**

- Documentation
  - The protocol was described in a detailed document that covers the entire decontamination process step by step, the certification of training and the forms to be completed. All the required information is provided in one place, which ensures simplicity and allows it to be easily shared internally and externally.
- Use of different sources of expertise
  - The protocol was designed with external expertise, which also provided training on asbestos to the staff of SIS 67, and a certified laboratory based in Germany that was able to use measurement techniques based on ISO standards to validate decontamination.
- Internal control of the entire process
  - The entire asbestos decontamination process is carried out internally within the fire service. This allows for full control but also avoids any delays in the availability of suits for future use.

**Further information**

The protocol can be requested from SIS 67 by sending an email to sis67@sis67.alsace.

*Sources:* Site visit to SIS 67, Strasbourg, France, 2025; SIS 67 (2025): Fiche opérationnelle Spécialités No 54002 – Amiante ; SIS 67 – Petit P. – Cron R. (2022): Décontamination des EPI contaminés à l'amiante. ; SIS 67 – Girard B. (2020): Nettoyage des tenues de feu textiles des sapeurs-pompiers contaminées par des fibres d'amiante ; DGSCGC (2022): Partage d'information opérationnelle – Principe de gestion opérationnelle en présence d'amiante, https://pnrs.ensosp.fr/Plateformes/Risques/Autres-risques-particuliers/Partage-d-Information-Operationnelle-Principes-de-gestion-operationnelle-en-presence-d-amiante/.

### 17.6.2 Individual measures

The required PPE (see Section 8.2.7) should be outlined in the risk assessment and followed by all workers. At a minimum, gloves, disposable or replaceable protective clothing and RPDs should be provided ([574]). With respect to PPE:

- for non-fire interventions: level II chemical protection PPE should be used (a disposable type 3 chemical protection suit, with chemical protection boots and chemical protection gloves);
- for firefighting interventions: thermal protection PPE ([575]);
- for support personnel outside the incident area at risk of secondary exposure: level II chemical protection (e.g. type 3 or 4 EN 14605:2005+A1:2009 ([576]) or type 5 EN ISO 13982–1:2004, EN ISO 13982-1:2004/A1:2010) PPE;
- if disposable clothing is not available, all workwear, skin and hair should be thoroughly decontaminated as soon as possible after the emergency event, see Section 17.6.1.1.

During any urgent asbestos removal, workers must be provided with appropriate protective clothing ([577]), see Section 8.2.7.

With respect to (well-fitting) RPDs, see Section 8.2.6.

- For non-fire interventions: an RPD includes self-contained breathing apparatus (SCBA) or, at a minimum, an FFP3 certified respirator.
- During firefighting operations: full-face respirators with breathing air are standard equipment. These provide optimal protection from asbestos exposure, provided proper decontamination is carried out before removing the apparatus. Breathing air bottles should be changed next to the decontamination site. An RPD should be worn at all times until all PPE and work equipment are decontaminated.
- Personnel present in the vicinity who are not directly involved in intervention: an FFP3 certified respirator should be worn.
- During any urgent removal of asbestos: tight-fitting, independent respiratory protection should be worn, see Section 8.2.6.

## 17.7 Training

Workers must be informed of the dangers of asbestos and trained in the protective measures required. Emergency services personnel who may be exposed to asbestos must receive specialised training ([578]), see Section 9. In addition, emergency workers who become aware of the suspected presence of asbestos on site should inform other relevant parties ([579]).

The Skellefteå Model ([580]) outlines the importance of educating firefighters about the risk of exposure to hazardous substances such as asbestos. It recommends delivering training to all workers at all organisational levels, with content and timing tailored to each role, to encourage a culture of prevention.

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([574]) The Global Interagency Security Forum (GISF) (2016), 'A brief guide to asbestos in emergencies: Safer handling and breaking the cycle', https://gisf.ngo/resource/a-brief-guide-to-asbestos-in-emergencies-safer-handling-and-breaking-the-cycle/.

([575]) University of Central Lancashire (2023), 'Minimising firefighters' exposure to toxic fire effluents: Best practice report', commissioned by the Fire Brigades Union, https://www.fbu.org.uk/publications/minimising-firefighters-exposure-toxic-fire-effluents-best-practice-report.

([576]) CEN (2009), 'EN 14605:2005+A1:2009 – Protective clothing against liquid chemicals – performance requirements for clothing with liquid-tight (Type 3) or spray-tight (Type 4) connections, including items providing protection to parts of the body only (Types PB [3] and PB [4])', https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:32983,6143&cs=17C6CDCAD895237EB4FE0671690D6BEF4.

([577]) Directive 2009/148/EC, Article 12(a) and Article 16.

([578]) Directive 2009/148/EC, Article 14.

([579]) Brandweer (2018), 'Fire department response in the event of asbestos incidents', https://nipv.nl/wp-content/uploads/2022/04/201811-BRWNL-Brancherichtlijn-en-publicatie-Brandweeroptreden-bij-asbestincidenten-1.pdf.

([580]) Swedish Civil Contingencies Agency (MSB) (2015), 'Healthy firefighters – The Skellefteå Model improves the work environment', https://www.msb.se/siteassets/dokument/publikationer/english-publications/healthy-firefighters-the-skelleftea-model-improves-the-work-environment.pdf.

Emergency response leads should be trained to recognise the presence of asbestos at the site of the emergency. This is also important for other workers involved as first responders and/or as part of the remedial action.

In addition, workers' representatives should be involved in the development and evaluation of the effectiveness of training.

## 17.8 Health surveillance

Identifying workers who have been exposed to asbestos can be particularly challenging in emergency response situations. Where exposure is identified or suspected, health surveillance requirements should be followed, see Section 10.

## 17.9 Waste management

All WCA must be collected and removed from the workplace as soon as possible, in suitable sealed packing and labelled as containing asbestos. Disposal must comply with the WFD ([581]). Waste should be stored as follows:

- store WCA in sealable containers until safe disposal is possible;
- store (suspected) asbestos and MCAs in sealed, secure containers, skips or packaging to prevent fibre release until transported to an appropriate site;
- containers designated for WCA must contain a sealable inner plastic bag, or the waste must be encapsulated by wrapping it in plastic before placing it in the container, to prevent fibre dispersion during tipping at the disposal site;
- if using bags, double bag with strong plastic bags (0.095 mm thick), sealed airtight (e.g. with a gooseneck-type closure) with tape labelled 'Asbestos';
- label the containers in accordance with national legislation ([582]) and include a warning sign before disposal ([583]), see Annex 12.

Further details on WCA procedures are described in Section 12.

If appropriate disposal facilities are unavailable, WCA should be sealed in double-lined bags or labelled big bags, disposed of at a secure waste site and kept separate from other types of waste. In coordination with the local authorities, a suitable disposal site should be identified and records of the disposal site should be maintained ([584]).

([581]) Directive 2008/98/EC; Directive 2009/148/EC, Article 6(e).

([582]) See Directive 2008/98/EC, Article 19.

([583]) See Directive 92/58/EEC, Annexes 2 and 3.

([584]) GISF (2016), 'A brief guide to asbestos in emergencies: Safer handling and breaking the cycle', https://gisf.ngo/resource/a-brief-guide-to-asbestos-in-emergencies-safer-handling-and-breaking-the-cycle/.

**Figure 17-3: WCA from decontamination at a fire station stored in a secure area before appropriate disposal**


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### 17.9.1 Wastewater

Waste water from laundering asbestos-contaminated clothes and reusable PPE and asbestos decontamination activities (wash-down and run-off) should be filtered before discharge into a sewer (an example of a wastewater filter is provided in Figure 17-4), see Section 8.2.3. Alternatively, this waste water should be contained and disposed of appropriately, to prevent it from entering sewers and water courses, or soaking into the ground where it would eventually reach underground freshwater aquifers ([585]).

**Figure 17-4: Filters installed in a fire station to remove asbestos fibres from waste water**

This image is not available for reuse, see inside front cover.

([585]) University of Central Lancashire (2023), 'Minimising firefighters' exposure to toxic fire effluents: Best practice report', commissioned by the Fire Brigades Union, https://www.fbu.org.uk/publications/minimising-firefighters-exposure-toxic-fire-effluents-best-practice-report.

# ANNEXES

# Annex 1 Glossary and abbreviations

| Term | Definition |
|---|---|
| ACM | asbestos-containing material |
| ADR | Agreement concerning the International Carriage of Dangerous Goods by Road |
| AFNOR | Association française de normalisation (French standardisation association) |
| AGS | Committee on Hazardous Substances |
| AIRSystem | asbestos identification and rating system |
| AMP | asbestos management plan |
| APF | assigned protection factor |
| AWD | Asbestos at Work Directive (Directive 2009/148/EC) |
| BALF | bronchoalveolar lavage fluid |
| BRGM | Bureau de ressources géologiques et minières |
| CAS numbers | Chemicals Abstracts Service numbers |
| CDB | container depot bag |
| CDW | construction and demolition waste |
| CEN | European Committee for Standardisation |
| CLP | Classification, Packaging and Labelling Regulation (Regulation (EC) No 1272/2008) |
| CMRD | Carcinogens, Mutagens and Reprotoxic Substances Directive (Directive 2004/37/EC) |
| CORDIS | Community Research and Development Information Service |
| DCU | decontamination unit |
| DGUV | German social accident insurance (Deutsche Gesetzliche Unfallversicherung) |
| EDS | energy dispersive spectroscopy (see also EDXA) |
| EDXA | energy dispersive X-ray analysis (EDXA) or energy dispersive spectroscopy (EDS) |
| EM | electron microscopy |
| employer | any natural or legal person who has an employment relationship with the worker and has responsibility for the undertaking and/or establishment (586) |
| EU | European Union |
| EU-OSHA | European Agency for Safety and Health at Work |
| FEV1 | forced expiratory volume in one second |
| FFP | filtering facepiece (mask) |
| FFP3 | type of FFP with high filter performance (99.97 % efficiency) |
| FIOH | Finnish Institute of Occupational Health |
| FVC | forced vital capacity |
| health surveillance | assessment of an individual worker to determine the state of health of that individual, as related to exposure to specific carcinogens, mutagens or reprotoxic substances at work (587) |

(586) Directive 89/391/EEC, Article 3(b).
(587) Directive 2004/37/EC, Article 2(e).

| Term | Definition |
|---|---|
| **H-Class** | high-hazard dusts |
| **HEPA** | high-efficiency particulate air |
| **HRCT** | high-resolution computed tomography |
| **HR-SEM** | high-resolution scanning elector microscopy |
| **HVAC** | heating, ventilation and air-conditioning |
| **ICOERD** | International Classification of HRCT for Occupational and Environmental Respiratory Diseases – a method of classification of HRCT of occupational and environmental respiratory diseases |
| **IHM** | Inventory of Hazardous Materials |
| **ILO** | International Labour Organization |
| **ILT** | Human Environment and Transport Inspectorate (Netherlands) |
| **IMO** | International Maritime Organization |
| **INRS** | French National Institute for Research and Safety |
| **ISO** | International Organization for Standardization |
| **LAVS** | National Asbestos Monitoring System (Netherlands) |
| **limit value** | Limit of the TWA of the concentration for a carcinogen, mutagen or reprotoxic substance in the air within the breathing zone of a worker in relation to a specified reference period as set out in Annex III of the CMRD (588) |
| **LOD** | limit of detection: the lowest concentration that can be measured with 90 % certainty (based on Poisson distribution) with standard microscope settings for fibre counting (589) |
| **LOQ** | limit of quantification |
| **LOW** | European List of Waste |
| **MCAs** | materials containing asbestos |
| **NOA** | naturally occurring asbestos |
| **OEL** | occupational exposure limit |
| **OELV** | occupational exposure limit value |
| **OSH** | occupational safety and health |
| **OSH FD** | Occupational Safety and Health Framework Directive (Council Directive 89/391/EEC) |
| **OVAM** | Flanders Public Waste Agency |
| **PAHs** | polycyclic aromatic hydrocarbons |
| **PAPR** | powered air purifying respirator |
| **PCM** | phase-contrast optical microscopy |
| **PLM** | polarised light microscopy |
| **PPE** | personal protective equipment: any equipment intended to be worn or held by the worker to protect them from one or more risks likely to threaten their safety or health, and any interchangeable components or connection systems for this equipment (590) |
| **PPED** | Personal Protective Equipment Directive (Council Directive 89/656/EEC) |
| **PPER** | Personal Protective Equipment Regulation (Regulation (EU) 2016/425) |

(588) Directive 2004/37/EC, Article 2(c).

(589) TNO (2021), 'Annex: Information on the measurement method(s) for asbestos and difficulties measuring asbestos in relation to a low occupational exposure limit value (OELV) or in a dusty (work) environment in view of lowering the European OELV for asbestos', R12180, https://perosh.eu/wp-content/uploads/2022/06/Memorandum-Measuring-Methods-Asbestos_TNO-R12180-Nov-2021.pdf.

(590) Regulation (EU) 2016/425, Article 3(1).

| Term | Definition |
|---|---|
| **prevention** | all the steps or measures taken or planned at all stages of work in the undertaking to prevent or reduce occupational risks ([591]) |
| **QA** | quality assurance |
| **QC** | quality control |
| **REACH** | Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (Regulation (EC) No 1907/2006) |
| **RIVM** | Dutch National Institute for Public Health and the Environment |
| **RPD** | respiratory protective device |
| **SAED** | selected area electron diffraction |
| **SCBA** | self-contained breathing apparatus |
| **SEG** | similar exposure group |
| **SEM** | scanning electron microscopy |
| **SHC** | safety and health coordinator |
| **SLIC** | Senior Labour Inspectors Committee |
| **SOLAS** | International Convention for the Safety of Life at Sea |
| **SWPF** | simulated workplace protection factor |
| **TEM** | transmission electron microscopy |
| **TREM Card** | Transport Emergency Card |
| **TRGS** | Technical Rules for Hazardous Substances |
| **TWA** | time-weighted average |
| **UKATA** | UK Asbestos Training Association |
| **UN Number** | in relation to dangerous goods: the number assigned to the dangerous goods by the UN Committee of Experts on the Transport of Dangerous Goods; the chemical identification serial number shown in the list of dangerous goods mentioned in the ADG Code (e.g. asbestos that meet the classification criteria of Class 6.1 are listed in the ADG Code as UN Number 2810 or UN Number 2811) |
| **VAEA** | Victorian Asbestos Eradication Agency (Australia) |
| **WCA** | waste containing asbestos |
| **WFD** | Waste Framework Directive (Directive 2008/98/EC) |
| **WHO** | World Health Organization |
| **worker** | any person employed by an employer, including trainees and apprentices ([592]); this guide, it also includes workers from external organisations or external persons (such as contractors or self-employed workers; casual, agency or temporary workers; or volunteers) |
| **workers' representative (with specific responsibility for the safety and health of workers)** | any person elected, chosen or designated in accordance with national laws and/or practices to represent workers where problems arise relating to the safety and health protection of workers at work ([593]) |

([591]) Directive 89/391/EEC, Article 3(d).
([592]) Directive 89/391/EEC, Article 3(a).
([593]) Directive 89/391/EEC, Article 3(c).

# Annex 2 Guides identified by literature review

The guides reviewed as part of the literature review are listed below. Those documents that were specifically used to help write this guide are indicated with 'Yes' in the Checklist column.

**Table A2-1: Guides identified through literature review**

| Code | Year | Author and/or title | |
|---|---|---|---|
| **Australia** | | | |
| AU01 | 2018 | Safe Work Australia | How to manage and control asbestos in the workplace: Code of Practice |
| AU02 | 2014 | Work Cover NSW | Managing asbestos in or on soil |
| AU03 | 2021 | Asbestos Awareness & the Asbestos Education Committee | Asbestos management handbook for commercial & non-residential properties |
| AU04 | 2021 | Asbestos Awareness & the Asbestos Education Committee | A tradie's guide to safe practices in managing asbestos in residential properties |
| AU05 | 2020 | Safe Work Australia | Model Code of Practice: How to manage and control asbestos in the workplace |
| AU06 | 2021 | WA Gov Department of Health | Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia |
| AU07 | 2019 | WorkSafe Victoria | Compliance code – Managing asbestos in workplaces |
| AU08 | 2019 | WorkSafe Victoria | Compliance code – Removing asbestos in workplaces |
| AU09 | 2020 | Safe Work Australia | How to safely remove asbestos: Code of Practice |
| AU10 | 2020 | The Asbestos Safety and Eradication Agency (ASEA) | Action on illegal disposal of asbestos – A Guide for Local Government |
| **Austria** | | | |
| AT01 | 2015 | Bundesinnungsgruppe Baunebengewerbe Asbestzement-Leitfaden zum Umgang | Federal Guild Group for the Construction Industry Asbestos Cement Handling Guide |
| AT02 | 2015 | Bundesinnungsgruppe Baunebengewerbe Arbeitsplan Umgang mit Asbest | Federal Guild Group for the Construction Industry Work Plan for Handling Asbestos |
| AT03 | 2007 | Umweltbundesamt Asbest Materialienband | Federal Environment Agency Asbestos Materials Book |
| AT04 | 2021 | Die Umweltberatung Sicherer Umgang mit Asbest | Environmental Advisory Service Safe Handling of Asbestos |
| AT05 | 2013 | Land Tirol Umgang mit Asbestzementplatten | State of Tyrol Handling Asbestos-Cement Boards |
| AT06 | 2023 | Amt der NO LReg Abteilung Handlungsleitfaden Asbest | Office of the Lower Saxony Regional Government Department Asbestos Handling Guide |
| AT07 | 2014 | AUVA Asbest – Richtiger Umgang M367 | AUVA Asbestos – Correct Handling M367 |

**Table A2-1: Guides identified through literature review**

| Code | Year | Author and/or title | |
|---|---|---|---|
| **Bulgaria** | | | |
| BG01 | 2018 | Occupational medicine service LTM Ltd Instructions for working with asbestos | |
| BG02 | n.d. | zbut.eu Instructions for safe work with materials that contain asbestos | |
| BG03 | 2020 | Recommendations for protecting the health of workers at exposure to asbestos | |
| BG04 | 2016 | Methodological guidelines for assessing exposure to asbestos fibres during removal and repair of asbestos materials | |
| BG05 | 2017 | Identification and risk evaluation of asbestos exposure in the disposal of asbestos containing materials | |
| BG06 | 2013 | Risk assessment of exposition to asbestos | |
| BG07 | 2014 | Identification of activities associated with incidental and low intensity asbestos exposure | |
| **Croatia** | | | |
| HR01 | 2018 | Nastavni zavod za javno zdravstvo „Dr Andrija Štampar“ | HR 01 2018 NZJZ Stampar Brosura-azbest-smjernice |
| **Cyprus** | | | |
| CY01 | 2011 | Labour Inspection Office, Ministry of Labour and Social Security | Asbestos: What you need to know |
| CY02 | 2020 | Labour Inspection Office, Ministry of Labour and Social Security | Special terms for the performance of works with asbestos or MCAs |
| **Czechia** | | | |
| CZ01 | 2018 | MZP | Methodological guidance for the management and disposal of asbestos-containing waste during construction and demolition |
| CZ02 | n.d. | SZU | Handling Asbestos Containing Waste |
| CZ03 | 2022 | SZU | Health/working with asbestos |
| Denmark | | | |
| DK01 | 2019 | Danish Industry-Asbestosguide | |
| DK02 | 2010 | Industriens branchemiljøråd asbestos in ships | |
| Estonia | | | |
| EE01 | 2011 | Tervise Arengu Instituut / Maie Kangur | Low-risk asbestos work methods for demolition, renovation and for maintenance work; Guidelines |
| EE02 | 2003 | Töötervishoiu Keskus / Occupational Health Centre | Methodical guide: Chemical safety in the field of construction |
| **Europe and international** | | | |
| EU01 | 2011 | European Union | Non-binding guide to good practice for understanding and implementing Directive 92/57/EEC on the implementation of minimum safety and health requirements at temporary or mobile construction sites |

**Table A2-1: Guides identified through literature review**

| Code | Year | Author and/or title | |
|---|---|---|---|
| **Finland** | | | |
| FI 01 | 2019 | Työturvallisuuskeskus | Effective asbestos removal |
| FI 02 | 2019 | Hengitysliitto | A guide to asbestos and exposure |
| FI 03 | 2019 | Työterveyslaitos | Developing the safety of asbestos removal work |
| FI 04 | 2016 | Työterveyslaitos | Discovering asbestos fibers in workplaces |
| FI 05 | 2016 | Työterveyslaitos | Asbestos risk management guidelines for mines |
| FI 06 | 2022 | Työsuojeluhallinto | Asbestos Regulation application guidelines |
| FI 07 | 2016 | Kiinteistöliitto & Isännöintiliitto | Asbestos survey obligation in apartment renovations for shareholders |
| **France** | | | |
| FR01 | 2014 | French Health Ministry | Asbestos in buildings |
| FR02 | 2023 | French professional associations | Asbestos guide |
| FR03 | 2020 | INRS | Choice and use of breathing apparatus |
| FR04 | 2021 | French Justice Ministry | Guide to Asbestos |
| FR05 | 2014 | French Education Ministry | Asbestos – What to know |
| FR06 | 2020 | Social Housing Union | Asbestos |
| FR07 | 2017 | SNCF | Technical document Asbestos |
| FR08 | 2022 | SNCF | Safety plan |
| FR09 | 2022 | INRS | Asbestos risks |
| FR10 | 2022 | French Interior Ministry | Firemen- Operational guide to prevent asbestos risk |
| FR11 | 2021 | French Economy Ministry | Guide on asbestos in managing buildings |
| FR12 | 2014 | INRS | The products and suppliers |
| FR13 | 2021 | Bureau de recherches géologiques et minières (BRGM) | Asbestos in the natural environment |
| FR14 | 2012 | INRS | Work situations exposed to asbestos |
| FR15 | 2017 | OPPBTP | Prevention of Asbestos risk |
| FR16 | 2019 | AFNOR | Standards on asbestos in ships, boats and other floating structures |
| FR17 | 2020 | AFNOR | Standards on asbestos in civil engineering structures |
| FR18 | | Various | Fundamentals in preventing asbestos risk in buildings |
| FR19 | 2019 | AFNOR | NF X46-100:2019 Asbestos identification – Identification of materials and products containing asbestos in installations, structures or equipment contributing to the realization or implementation of an activity – Mission and methodology |
| FR20 | 2019 | AFNOR | NF F01-020:2019 Railway applications – Asbestos identification – Identification of asbestos-containing materials and products in railway rolling stock |

**Table A2-1: Guides identified through literature review**

| Code | Year | Author and/or title | |
|---|---|---|---|
| FR21 | 2020 | AFNOR | NF L80-001:2020 Aerospace series –Pre-work identification of asbestos in aircraft – Mission and methodology |
| FR22 | 2021 | AFNOR | NF P94-001:2021 Environmental asbestos survey – Geological investigation of in-place soils and rocks – Mission and methodology |
| FR23 | 2017 | AFNOR | NF X43-269:2017 Air quality – Workplace atmospheres – Sampling on membrane filters for the determination of the fibre number concentration by microscopic techniques: phase contrast optical microscopy, scanning electron microscopy analysis and transmission electron microscopy analysis – Counting by phase contrast optical |
| FR24 | 1996 | AFNOR | NF X43-050:2021 Air quality. Determination of the asbestos fiber concentration by transmission electron microscopy. Indirect method |
| **Germany** | | | |
| DE01 | 2018 | Bayerisches Landesamt für Umwelt_Asbest | Bavarian State Office for the Environment_ Asbestos |
| DE02 | 2017 | Stiftung Warentest Asbest Tipps | Stiftung Warentest Asbestos Tips |
| DE03 | 2012 | Stadt Oberhausen Asbest Merkblatt | City of Oberhausen Asbestos Information Sheet |
| DE04 | 2020 | BAuA Leitlinie für Asbesterkundung | BAuA Guidelines for Asbestos Assessment |
| DE05 | 2019 | BG RCI Asbesthaltige Bodenbeläge – Was ist zu tun | BG RCI Asbestos-Containing Flooring –What to Do |
| DE06 | 2022 | LAGA Vollzugshilfe zur Entsorgung asbesthaltiger Abfälle | LAGA Enforcement Guidelines for the Disposal of Asbestos-Containing Waste |
| DE07 | n.d. | D Landesamt für Umwelt- und Arbeitsschutz Saarland Asbest | D Saarland State Office for the Environment and Occupational Safety Asbestos |
| DE08 | | Ministerium für Umwelt Klima und Energiewirtschaft B-W Asbest in Gebäuden-Sachgerechte Vorgehensweise | Ministry for the Environment, Climate and Energy B-W Asbestos in Buildings – Proper Procedure |
| DE09 | 2022 | Ausschuss für Gefahrenstoffe TRGS 519 | Committee on Hazardous Substances TRGS 519 |
| DE10 | 2015 | Ausschuss für Gefahrenstoffe TRGS 517 | Committee on Hazardous Substances TRGS 517 |
| DE11 | 2023 | Ausschuss für Gefahrenstoffe TRGS 910 | Committee on Hazardous Substances TRGS 910 |
| DE12 | 2019 | MAGS Asbest im Haus | MAGS Asbestos in the House |
| DE13 | n.d. | BG Verkehr Asbest an Bord – Was tun | BG Verkehr Asbestos on Board – What to Do |
| DE14 | 2019 | NGS Merkblatt asbesthaltige Abfaelle | NGS Information Sheet Asbestos-Containing Waste |
| DE15 | 2021 | BG Bau Branchenlösung Asbest beim Bauen im Bestand | BG Bau Industry Solution for Asbestos in Existing Buildings |
| DE16 | n.d. | BIA_Arbeitsumweltdossier Asbest | BIA Work Environment Dossier on Asbestos |
| DE17 | 2009 | OHAS-Good-practice-award-Risk-assessment-2008-09 asbestos page 21 22 | |
| DE18 | 2023 | BMDV Asbest-PAK-PCB-Blei-Leitfaden 2023 | BMDV Asbestos-PAH-PCB-Lead Guidelines 2023 |

**Table A2-1: Guides identified through literature review**

| Code | Year | Author and/or title | |
|---|---|---|---|
| DE19 | 2021 | Verband der Feuerwehren NRW Umgang mit Asbestverdachtsfaellen | Association of Fire Brigades NRW Dealing with Suspected Asbestos Cases |
| DE20 | 2021 | Freistaat Sachsen Gefahrstoff Asbest-Informationen fuer Bauherren und Unternehmer | Free State of Saxony Asbestos Hazardous Substance Information for Building Owners and Contractors |
| DE21 | 2023 | BG Verkehr Seeschifffahrt Asbest-an-Bord-von-Seeschiffen Leitfaden fuer Reedereien | BG Verkehr Maritime Shipping Asbestos on Board of Seagoing Vessels Guidelines for Shipping Companies |
| DE22 | 2010 | BBSR Gefahrstoff Asbest | BBSR Asbestos Hazardous Substance |
| DE23 | 2015 | VDI Handlungsfehler Asbesthaltige Putze Spachtelmasse und Fliesenkleber discussion paper | VDI Errors in Handling Asbestos-Containing Plasters, Filler, and Tile Adhesive Discussion Paper |
| DE24 | 2016 | DGUV IFA Leitfaden fuer Expositionsmessungen im Antragsverfahren | DGUV IFA Guidelines for Exposure Measurements in the Application Process |
| DE25 | 2017 | WSV Asbest Entschichtung Schifffahrt | WSV Asbestos Stripping Shipping |
| DE26 | 2020 | Land Niedersachen Handreichung Qualifizierter Umgang mit mineralischen Abfaellen im Strassenbau | State of Lower Saxony Handbook on Qualified Handling of Mineral Waste in Road Construction |
| DE27 | 2021 | Feuerwehrunfallkasse Asbest in der Feuerwehr | Fire Brigade Accident Insurance Fund Asbestos in the Fire Service |
| DE28 | 2018 | LASI LV 45 Leitlinien zur Gefahrstoffverordnung Abschnitt I Asbest | LASI_LV 45 Guidelines for Hazardous Substances Ordinance Section I Asbestos |
| DE29 | 2021 | DGUV Emissionsarme Verfahren nach TRGS 519 für Tätigkeiten mit asbesthaltigen Materialien | DGUV Low-emission procedures according to TRGS 519 for activities involving asbestos-containing materials |
| DE30 | 2024 | BAuA Asbestos RoC April 2024_shared by Clever (BAuA) WORK IN PROGRESS | BAuA Asbestos RoC April 2024 shared by Clever (BAuA) WORK IN PROGRESS |
| **Greece** | | | |
| EL01 | 2007 | Spiros Drivas | Asbestos Diseases |
| EL02 | 2024 | Medicines Sans Frontieres | Protection from Asbestos |
| EL03 | 2003 | Christos Gandas | Asbestos – Safe Removal Methods |
| **Hungary** | | | |
| HU01 | n.d. | MASZ Asbestos handling guidelines notebook 1.0 | |
| HU02 | n.d. | Asbestos demolition guide | |
| **Ireland** | | | |
| IE01 | 2023 | Local Government Ireland | Best Practice Guidance for Handling Asbestos |
| IE02 | 2013 | Health and Safety Authority | Practical Guidelines on ACM (Asbestos Containing Material)<br><br>Management and Abatement |
| IE03 | 2013 | Health and Safety Authority | Asbestos flyer |
| IE04 | 2020 | Ireland Brownfield Network | Management of Asbestos in Soils – An All-Ireland Guidance Document |
| **Italy** | | | |
| IT01 | 2020 | National Institute for Insurance against Accidents at Work [Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro (INAIL)] | Asbestos Remediation: Procedural Processes and Professional Figures Involved |

**Table A2-1: Guides identified through literature review**

| Code | Year | Author and/or title | |
|---|---|---|---|
| IT02 | 2023 | Regional authority (Friuli Venezia Giulia) | Guidelines for reporting, traceability and method of assessing the state of conservation and dangerousness of artefacts containing asbestos – Revised 2023 |
| IT03 | 2013 | Regional authority (Abruzzo) | Regional Guidelines: Asbestos Risk Management Procedures to Protect Public Health; Procedures for the Application of Legislative Decree 81/08 Title IX Chapter III to Protect Workers and the Community from Asbestos Risk |
| IT04 | 2002 | Assoamianto | Micro-Collection of Waste Containing Asbestos – Guidelines for the removal, transport and temporary storage of small quantities of materials containing asbestos |
| IT05 | 2020 | National System for Environmental Protection [Sistema Nazionale per la Protezione dell'Ambiente (SNPA)] | Guideline document for the assessment of asbestos risk in the SNPA |
| IT06 | 2019 | Regional authority (Emilia Romagna) | How to Work Protected from the Risk of Asbestos – Prevention Manual Intended for Construction Site Workers Employed in Contact with Materials Containing Asbestos |
| IT07 | 2017 | The Italian Labour Union [Unione Italiana del Lavoro (UIL)] | Health and safety at work – asbestos |
| IT08 | 2023 | Civil Protection Department of the Italian Government | Operational Indications for the Management of Rubble Following a Seismic Event |
| IT09 | 2024 | AssoAmbiente | Operating procedures relating to asbestos waste |
| **Latvia** | | | |
| LV01 | 2023 | The Ministry of Smart Administration and Regional Development of the Republic of Latvia | Manual on handling asbestos-containing waste |
| LV02 | 2014 | Riga Stradins University, Institute of Occupational Safety and Environmental Health | Occupational health and safety requirements when working with asbestos |
| LV03 | 2015 | Riga Stradins University, Laboratory of Hygiene and Occupational Diseases | Inventory, recognition and identification of MCAs in buildings |
| **Lithuania** | | | |
| LT01 | 2011 | Institute of Hygiene | Practical recommendations for identification, detection and exposure prevention of asbestos fibres [Asbesto plaušelių identifikavimo, nustatymo ir poveikio prevencijos praktinės rekomendacijos] |
| LT02 | 2020 | State Labour Inspectorate | Repair and disassembling (demolition) buildings and equipment containing asbestos [Statinių ir įrenginių, kuriose yra asbesto, taisymas ir ardymas (griovimas)] |
| LT03 | 2023 | State Labour Inspectorate | Personal protective equipment in asbestos removal work [Asmeninės apsaugos priemonės vykdant asbesto šalinimo darbus] |
| LT04 | 2008 | Institute of Hygiene | Detection of accidental or low-intensity employee asbestos exposure: practical recommendations [Atsitiktinio ir mažo intensyvumo asbesto veikimo darbuotojams nustatymas: praktinės rekomendacijos] |

**Table A2-1: Guides identified through literature review**

| Code | Year | Author and/or title | |
|---|---|---|---|
| LT05 | 2012 | State Labour Inspectorate | How to safely replace asbestos-cement roofs: advice for employees [Kaip saugiai pakeisti asbestcemenčio dangų stogus: patarimai darbuotojams] |
| LT06 | 2012 | State Labour Inspectorate | How to safely replace asbestos-cement roofs: advice for employers [Kaip saugiai pakeisti asbestcemenčio dangų stogus: patarimai darbdaviams] |
| **Luxembourg** | | | |
| LU01 | 2018 | Mines Inspectorate | Asbestos cement practical guide |
| LU02 | 2023 | Chamber of Trade | Asbestos |
| LU03 | 2013 | Various | Asbestos in buildings Prevention of Risks |
| Malta | | | |
| n/a | n/a | n/a | n/a |
| **Netherlands** | | | |
| NL01 | 2018 | Brandweer academie | Sector guideline and publication Fire brigade action in the event of asbestos incidents |
| NL02 | 2018 | Instituut Fysieke Veiligheid | Guideline approach to asbestos incidents work version 1.1 |
| NL03 | 2014 | GGD | Health risk of asbestos in homes and public buildings |
| NL04 | 2016 | Aedes | Asbestos Handbook |
| NL05 | 2022 | Milieu Centraal | Manual for removing asbestos from (shed) roofs |
| NL06 | 2021 | Ascert | Ascert examination regulations for examinations. Expert Inventory Manager, Asbestos Expert, Expert Asbestos Acceptor. |
| NL07 | 2024 | Ascert | Further interpretations of certification schemes SCA 100 |
| NL08 | 2023 | Ascert | Sci Requirements for work equipment |
| NL09 | 2022 | Ascert | SCi- direct decontamination procedure |
| NL10 | 2022 | Ascert | SCi- indirect decontamination procedure |
| NL11 | 2024 | Netwerkbedrijven | Arbo catalogue Network companies |
| NL12 | 2024 | Xerio | Asbestos inspections |
| NL13 | 2015 | NEN | Air – Determination of asbestos concentrations in the air and risk assessment in and around buildings, constructions or objects in which asbestos-containing materials have been processed. |
| **Poland** | | | |
| PL01 | 2018 | Dariusz Koba | PORADNIK DLA ZAMAWIAJĄCYCH USUWANIE AZBESTU [Guidance for customers procuring asbestos removal] |
| PL02 | n.d. | n/a | POSTĘPOWANIE Z AZBESTEM W SYTUACJACH NADZWYCZAJNYCH (WYSTĄPIENIE KLĘSK ŻYWIOŁOWYCH) [Handling asbestos in emergency situations (in the event of natural disasters)] |

**Table A2-1: Guides identified through literature review**

| Code | Year | Author and/or title | |
|---|---|---|---|
| PL03 | 2016 | Ministry of Funds and Regional Policy | Ocena użytkowania wyrobów zawierających azbest [Assessment of the use of products containing asbestos] + Annex 1 OCENA stanu i możliwości bezpiecznego użytkowania wyrobów zawierających azbest [Assessment of the condition and possibilities of safe use of products containing asbestos] |
| PL04 | 2008 | Ministry of Economy, Department of Support Instruments | PORADNIK DLA UŻYTKOWNIKÓW WYROBÓW AZBESTOWYCH [Guide for users of asbestos products] |
| PL05 | n.d. | Główny Instytut Górnictwa (Central Mining Institute) | E-learning modules, 4 modules:<br>I. Szkolenie dla Państwowej Inspekcji Sanitarnej [Training for the State Sanitary Inspectorate]<br>II. Szkolenie dla Państwowej Inspekcji Pracy [Training for the State Labour Inspectorate]<br>III. Szkolenie dla organów Nadzoru Budowlanego [Training for Building Supervision Authorities]<br>IV. Szkolenie dla Jednostek Samorządu Terytorialnego [Training for Local Government Units] |
| PL06 | 2019 | Sylwia Oziembło-Brzykczy, Państwowa Inspekcja Pracy (National Labour Inspectorate) | Niebezpieczny azbest [Dangerous asbestos] |
| PL07 | n.d. | Państwowa Inspekcja Pracy (National Labour Inspectorate) | Rolnictwo. Uwaga azbest! [Agriculture. Beware of asbestos!] |
| PL08 | 2008 | Jerzy Dyczek et al. | Bezpieczne postępowanie z azbestem i materiałami zawierającymi azbest [Safe handling of asbestos and MCAs] |
| PL09 | 2014 | Halina Wojciechowska-Piskorska | AZBEST – PORADNIK DLA PRACODAWCY I PRACOWNIKÓW. ASPEKTY TECHNICZNE I PRAWNE W ZAKRESIE ZABEZPIECZANIA I USUWANIA WYROBÓW ORAZ MATERIAŁÓW ZAWIERAJĄCYCH AZBEST [Asbestos – Guide for employers and employees. technical and legal aspects in the field of protection and removal of products and materials containing asbestos] |
| PL10 | 2004 | Jerzy Dyczek | Surface of Asbestos-cement (AC) Roof Sheets and Assessment of the Risk of Asbestos Release |
| **Portugal** | | | |
| PT01 | 2011 | ACSS | Material inventory procedures with guide to asbestos and control actions in healthcare facilities |
| PT02 | 2018 | DGS | Technical Guide: Surveillance of workers exposed to CMR chemical agents |
| PT03 | 2015 | ACT | Asbestos fiber-cement |
| PT04 | 2015 | ACT | Preventing the Risks of Asbestos Exposure What We All Should Know |
| PT05 | 2015 | ACT | Preventing the Risks of Asbestos Exposure What Workers Should Know |
| PT06 | 2015 | ACT | Preventing the Risks of Asbestos Exposure What Employers Should Know |

**Table A2-1: Guides identified through literature review**

| Code | Year | Author and/or title | |
|---|---|---|---|
| PT07 | 2017 | J. M. Delgado | UGT Brochure Asbestos in Public Schools and Buildings |
| PT08 | 2017 | J. M. Delgado | UGT Best Practices Guide for the Removal of Asbestos |
| **Romania** | | | |
| RO01 | 2013 | Anca Antonov, coordinator | Ghid de sănătate și securitate în muncă privind riscurile datorate expunerii la azbest [Occupational health and safety guidance on the risks from exposure to asbestos] |
| RO02 | 2012 | Dana Mateș | Ghid de supraveghere a riscului de expunere profesională la azbest [Occupational health and safety guidelines on the risks due to occupational exposure to asbestos] |
| RO03 | 2012 | Grigorița Năpar, coordinator | Ghid metodologic pentru prevenirea riscurilor legate de expunerea la azbest [Methodological guide for the prevention of risks related to asbestos exposure] |
| RO04 | 2010 | Grigorița Năpar, coordinator | Ghid metodologic pentru prevenirea riscurilor legate de expunerea la agenți cancerigeni, mutageni și toxici pentru reproducere [Methodological guide for the prevention of risks related to exposure to carcinogens, mutagens, and substances toxic to reproduction] |
| RO05 | 2013 | Elena Nisipeanu, Elena Ruxandra Chiurtu, Maria Haiducu, Iuliana Pamela Scarlat, Roxana Avram | Ghid de sănătate și securitate în muncă privind utilizarea valorilor limită de expunere profesională pentru agenți chimici, cancerigeni și mutageni [Occupational health and safety guidance on the use of OELVs for chemical agents, carcinogens and mutagens] |
| **Slovakia** | | | |
| SK01 | n.d. | Public Health Authority of the Slovak Republic | Asbestos removal from buildings (information) |
| **Slovenia** | | | |
| SI01 | 2006 | Committee of Senior Labour Inspector (SLIC) | A practical guide on best practice to prevent or minimise asbestos risks |
| **Spain** | | | |
| ES01 | 2021 | National Institute for Occupational Safety and Health | Assessment and prevention of risks related to asbestos exposure |
| ES02 | 2013 | Health Ministry | Protocols for specific health surveillance – Asbestos |
| ES03 | 2016 | INVASSAT | Guidelines for the management of asbestos working plans |
| ES04 | 2013 | Community of Madrid | Jobs in the presence of asbestos |
| ES05 | 2016 | INSHT | Asbestos waste from the producer to the manager |
| ES06 | 2024 | National Institute for Occupational Safety and Health | Guidelines for the removal of installed asbestos |
| ES07 | 2019 | Construction Labor Foundation | Jobs that may have asbestos exposure in construction |

**Table A2-1: Guides identified through literature review**

| Code | Year | Author and/or title | |
|---|---|---|---|
| **Sweden** | | | |
| SE01 | 2006 | Arbetsmiljoværket asbest | |
| SE02 | 2007 | Prevent Asbestos | |
| SE03 | 2023 | Prevent asbestarbejde | |
| **Switzerland** | | | |
| CH01 | 2016 | Office for Public Health | Asbestos in houses |
| CH02 | 2006 | Office for Public Health | Warning for certain construction materials |
| **United Kingdom** | | | |
| UK01 | 2014 | Ciria | Asbestos in soil and made ground: a guide to understanding and managing risks (C733D) |
| UK02 | 2012 | Health and Safety Executive | L143 Managing and working with asbestos – Control of Asbestos Regulations 2012 |
| UK03 | 2006 | Health and Safety Executive | HSG247 Asbestos: The licensed contractors' guide |
| UK04 | 2019 | National Federation of Demolition Contractors (NFDC) | Notifiable Non Licensed Work (NNLW): Asbestos guidance notes |
| UK05 | 2012 | Health and Safety Executive | HSG264 Asbestos: The survey guide |
| UK06 | 2021 | Health and Safety Executive | HSG248 (2nd Edition) *Asbestos: The Analysts' Guide* |
| UK07 | 2002 | Health and Safety Executive | HSG227 A comprehensive guide to Managing Asbestos in premises |
| UK08 | 2022 | Welsh Government | Asbestos management in schools |
| UK09 | 2024 | UK Health Security Agency | Asbestos Incident management |
| UK10 | 2023 | National Fire Chiefs Council | Guidance Hazardous Materials – Health Hazards |
| UK11 | 2012 | Chief Fire & Rescue Adviser | Fire and Rescue Service Operational Guidance – Incidents involving hazardous material |
| UK12 | 2006 | Senior Labour Inspectors Committee (SLIC) | A practical guide on best practice to prevent or minimise asbestos risks in work that involves (or may involve) asbestos: for the employer, the workers and the labour inspector. |
| UK13 | 2018 | Health and Safety Executive | HSG210 Asbestos Essentials: A Task Manual for Building, Maintenance and Allied Trades of Non-licensed Asbestos Work |
| **United States** | | | |
| USA01 | 2024 | Occupational Safety and Health Administration (OSHA) | Asbestos Standard for the Construction Industry |
| USA02 | 2024 | Occupational Safety and Health Administration (OSHA) | 1910.1001 – Asbestos Standard for the General Industry |
| USA03 | 2024 | Occupational Safety and Health Administration (OSHA) | 1915 – Asbestos Standard for Shipyard Employment |
| USA04 | 1985 | US Environmental Protection Agency | Guidance for Controlling MCAs in Buildings, |
| USA05 | 2011 | US Environmental Protection Agency | CFR-2011The National Emission Standards for Hazardous Air Pollutants (NESHAP) |
| USA06 | 2011 | US Environmental Protection Agency | Asbestos Model Accreditation Plan Enforcement Response Policy |

**Table A2-1: Guides identified through literature review**

| Code | Year | Author and/or title | |
|---|---|---|---|
| USA07 | 1986 | US Congress | Asbestos Hazard Emergency Response Act (AHERA) |
| USA08 | 1985 | US Environmental Protection Agency | Asbestos Waste Management Guidance |
| USA09 | 2024 | Code of Federal Regulations | 173.216 Transportation Asbestos blue brown or white |
| USA10 | 2024 | Code of Federal Regulations | 61.150 Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations. |

# **Annex 3** Countries with asbestos bans

The following countries have implemented a ban on asbestos, typically including manufacture, import and use of all six types of asbestos ([594]). For more details about the implementation of bans in Member States, see Table 5-1.

**Table A3-1: Countries with a ban on asbestos**

| | | | | |
|---|---|---|---|---|
| Algeria | Denmark | Iraq | Mozambique | Slovenia |
| Argentina | Djibouti | Ireland | Netherlands | South Africa |
| Australia | Egypt | Israel | New Caledonia | South Korea |
| Austria | Estonia | Italy | New Zealand | Spain |
| Bahrain | Finland | Ivory Coast | North Macedonia | Sweden |
| Belgium | France | Japan | Norway | Switzerland |
| Brazil | Gabon | Jordan | Oman | Taiwan |
| Brunei | Germany | Kuwait | Poland | Türkiye |
| Bulgaria | Gibraltar | Latvia | Portugal | Ukraine |
| Canada | Greece | Liechtenstein | Qatar | United Kingdom |
| Chile | Greenland | Lithuania | Romania | United States |
| Colombia | Honduras | Luxembourg | Saudi Arabia | Uruguay |
| Croatia | Hungary | Malta | Serbia | |
| Cyprus | Iceland | Mauritius | Seychelles | |
| Czechia | Iran | Monaco | Slovakia | |

([594]) Kazan-Allen, L. (2025), 'Current abestos bans', International Ban Asbestos Secretariat, https://ibasecretariat.org/alpha_ban_list.php.

# **Annex 4** Materials containing asbestos

**Table A4-1: Non-exhaustive overview of different products that (may) contain asbestos**

| Type | Product | Indoor/outdoor use | Residential/industrial use |
|---|---|---|---|
| **Technical installations** | Waste chutes | Indoor | Industrial |
| | Pressure pipes | Both | Industrial |
| | Cover over pipe channels | Outdoor | Industrial |
| | Elevator brakes | Indoor | Industrial |
| | Brakes and clutch plates in transport vehicles and machinery | Indoor | Industrial |
| | Resin-based materials in brakes and clutch plates | Indoor | Industrial |
| | Drive belts and conveyor belts | Indoor | Industrial |
| | Underseals on transport vehicles and machinery | Outdoor | Industrial |
| | Bituminous products used in underseals | Outdoor | Industrial |
| | Gaskets and washers | Indoor | Both |
| **Gas and electricity networks** | Low-voltage knife cartridges (fuses) | Both | Both |
| | Flange gaskets | Indoor | Industrial |
| | Metal house connection boxes | Indoor | Both |
| | Asbestos-cement gas pipes | | Both |
| | Casing pipes for electrical cables | Indoor | Industrial |
| | Older end closures with cord containing asbestos | Indoor | Industrial |
| | Heat insulating cables | Indoor | Industrial |
| | Boards and paper | Indoor | Both |
| | Fireproof cables | Indoor | Both |
| | Sockets | Indoor | Residential |

**Table A4-1: Non-exhaustive overview of different products that (may) contain asbestos**

| Type | Product | Indoor/outdoor use | Residential/industrial use |
|---|---|---|---|
| **Heating and ventilation components** | Extractor hoods, exhaust and ventilation ducts | Indoor | Industrial |
| | Flue pipes | Indoor | Both |
| | Gaskets and washers for high temperature/pressure, such as compressed asbestos fibre gaskets | Indoor | Both |
| | Pipe lagging around heating systems | Indoor | Both |
| | Insulation around boilers | Indoor | Both |
| | Panels lining airing cupboards | Indoor | Both |
| | Fire dampers | Indoor | Industrial |
| | Heat exchangers | Indoor | Industrial |
| | Flexible connections | Indoor | Industrial |
| | Air heating systems such as seals | Indoor | Both |
| **Water and sewage pipelines** | Asbestos-cement pipes | Both | Both |
| **Interior surface materials and chemicals** | Flange gaskets | Both | Both |
| | Casing pipes for electrical cables | Both | Both |
| | Metal house connection boxes | Both | Both |
| | Older end closures | Both | Both |
| | Asbestos-cement gas pipes | Both | Both |
| | Sealant (used to fit a main valve, pressure regulator, connection pipe or riser) | Both | Both |
| | Floor covering underlays | Indoor | Both |
| | Cast floors | Indoor | Both |
| | Plasters and sealants | Indoor | Both |
| | Paints and textured coatings | Indoor | Both |
| | Tile adhesives, mastics | Indoor | Both |
| **Roof products** | Asbestos-cement tiles or sheets | Outdoor | Both |
| | Roofing felt and underlayment | Indoor | Both |
| | Cement products in flue pipes and extractor hoods | Indoor | Both |
| | Gutters and downpipes | Outdoor | Both |
| | Fillers and sealants | Outdoor | Both |
| | Asbestos slate | Outdoor | Both |
| | Corrugated sheet profiles | Outdoor | Both |
| | Special elements, asbestos products | Outdoor | Both |
| | Asphalt products | Outdoor | Both |
| | Roofing membranes | Outdoor | Both |
| | Roofing felt | Outdoor | Both |
| | Roof underlay | Outdoor | Both |

Table A4-1: Non-exhaustive overview of different products that (may) contain asbestos

| Type | Product | Indoor/outdoor use | Residential/industrial use |
|---|---|---|---|
| **Facade elements** | Asbestos-cement cladding boards | Outdoor | Both |
| | Soffits and fascia boards | Outdoor | Both |
| | Asbestos facade board, type A | Outdoor | Both |
| | Asbestos fibre cement sheet | Outdoor | Both |
| | Asbestos structure | Outdoor | Both |
| | Infill panels | Outdoor | Both |
| | Steel plates | Outdoor | Both |
| | Wall capping | Outdoor | Both |
| | Windowsills | Outdoor | Both |
| | Asbestos-cement window boxes | Outdoor | Both |
| | Window putty and sealants | Both | Both |
| | Natural stone with asbestos | Outdoor | Both |
| | Render, pebbledash | Outdoor | Both |
| **Insulation and fire protection** | Thermal insulation lagging, felts, millboard, blankets for pipes, boilers, pressure vessels and calorifiers, attics | Indoor | Both |
| | Loose fill insulation in lofts or cavity walls | Indoor | Residential |
| | Asbestos insulating ceiling tiles | Indoor | Residential |
| | Asbestos insulating board (*) in fire doors, partition walls or ceilings | Indoor | Residential |
| | Paper, felt, cardboard for electrical/heat insulation | Indoor | Both |
| | Technical insulation | Indoor | Industrial |
| | Sprayed asbestos coatings on ceilings or walls | Indoor | Both |
| | Fire protection around structural steelwork | Indoor | Industrial |
| | Fire insulating elevator top | Indoor | Industrial |
| | Fire insulation of ventilation systems | Indoor | Both |
| | Asbestos rope, yarn or string seals on radiators, boiler and oven doors | Indoor | Both |
| | Fire doors | Indoor | Both |
| | Fire blankets | Indoor | Both |
| | Protective clothing | Both | Both |
| | Ropes, yarns, felts, cloth and woven textiles for sealing, lagging, jointing, packing, blankets, mattresses, curtains, gloves, aprons, overalls | Indoor | Both |
| | Plaited tubing for electrical cables | Indoor | Industrial |
| | Duct tapes | Indoor | Industrial |

**Table A4-1: Non-exhaustive overview of different products that (may) contain asbestos**

| Type | Product | Indoor/outdoor use | Residential/industrial use |
|---|---|---|---|
| **Panels and boards** | Wood fibreboard (with asbestos cardboard on one side) | Indoor | Both |
| | Asbestos-cement boards with metal cover | Indoor | Both |
| | Asbestos insulating board | Indoor | Both |
| | Asbestos boards, type A | Indoor | Both |
| | Polished or glazed asbestos panels | Indoor | Both |
| **Rail ballast** | Crushed stone or aggregate | Outdoor | Both |
| **Road construction materials** | Asphalt | Outdoor | Both |
| | Hardcore | Outdoor | Both |
| | Cement | Outdoor | Both |
| | Road paving | Outdoor | Both |
| **Special components and equipment** | Spacers in reinforced concrete | Both | Both |
| | Spacers for wall panels | Indoor | Both |
| | Formwork anchor sleeves | Indoor | Both |
| | Asbestos-cement tiles | Outdoor | Both |
| | Toilet cisterns (asbestos cement) | Indoor | Both |
| | Wall plugs | Both | Both |
| | Pigsty elements (separation wall elements) | Indoor | Industrial |
| | Motor vehicle components, brake pads | Motor vehicle | - |
| | Motor vehicle components, clutches | Motor vehicle | - |
| | Safes and security devices | Indoor | Both |
| | Textiles | Both | Both |
| | Asbestos rope, yarn and string | Both | Both |

(*) For thermal and acoustic insulation.

*Sources:* Environment Protection Agency (Ireland) (2023), 'Best practice guidance for handling asbestos', https://www.epa.ie/publications/monitoring–assessment/waste/hazardous-waste/best-practice-guidance-for-handling-asbestos.php; Health and Safety Executive (HSE) (2012), 'Asbestos: The survey guide', https://www.hse.gov.uk/pubns/books/hsg264.htm.

# Annex 5 Standards (non-exhaustive list)

Table A5-1: Non-exhaustive list of standards

| Guide | Country | Relevant information |
|---|---|---|
| **EN 149:2001+A1:2009** | All | RPDs; filtering half-masks to protect against particles, requirements, testing, marking, see Section 8.2.6 |
| **EN 529:2005** | All | RPDs; recommendations for selection, use, care and maintenance, see Section 8.2.6 |
| **EN 689:2018+AC:2019** | All | Strategy to demonstrate compliance with OELs for air monitoring, see Section 6 |
| **EN 1822-1:2019** | All | High-efficiency air filters (EPA, HEPA and ULPA) classification, performance testing, marking, see Section 8.2.6 |
| **EN 12941:2023** | All | RPDs, powered filtering devices incorporating a loose-fitting respiratory interface; requirements, testing, marking, see Section 8.2.6 |
| **EN ISO 13982-1:2004** | All | Protective clothing for use against solid particulates; performance requirements for chemical protective clothing providing protection to the full body against airborne solid particulates, see Section 8.2.7 |
| **EN ISO 16000-32:2014** | All | Materials assessment for the identification of MCAs, see Section 5.7 |
| **EN ISO/IEC 17025:2017** | All | Laboratory accreditation for identification of MCAs, see Section 5.7 and Section 6.7 |
| **HSG248:2021** | United Kingdom | Sample analysis for the identification of MCAs, see Section 5.7<br><br>Control measures, such as a final inspection, see Section 8 |
| **HSG264:2012** | United Kingdom | Materials assessment for the identification of MCAs, see Section 5.7 |
| **ISO 10312:2019** | All | Analysis of air monitoring samples by direct transfer transmission electron microscopy (TEM) method, see Section 6 |
| **ISO 13794:2019** | All | Analysis of air monitoring samples by indirect-transfer transmission electron microscopy (TEM) method, see Section 6 |
| **ISO 14966:2019** | All | Analysis of air monitoring samples by scanning electron microscopy (SEM) method, see Section 6 |
| **ISO 16000-27:2014** | All | Determination of settled fibrous dust on surfaces by SEM, see Section 6 |
| **ISO 16975-3:2017** | All | RPDs: selection, use and maintenance, fit-testing procedures, see Section 8.2.6 |

Table A5-1: Non-exhaustive list of standards

| Guide | Country | Relevant information |
|---|---|---|
| **ISO 22262-1:2012** | All | Sample analysis for the identification of MCAs, see Section 5.7 |
| **ISO 22262-2:2014** | All | Sample analysis for the quantification of asbestos in MCAs, see Section 5.7 |
| **MTA/PI-010/A09** | Spain | Sample analysis for the identification of MCAs, see Section 5.7 |
| **NBN T96-102:1999** | Belgium | Workplace atmospheres – Determination of asbestos fibre concentration – Membrane filter method with optical phase contrast microscopy, see Section 6 |
| **NEN 2939:2021** | Netherlands | Air monitoring, see Section 6 |
| **NEN 2990:2020+C1:2020** | Netherlands | Air monitoring for clearance sampling, see Section 6<br><br>Decontamination and formal assessment of a containment (sealed work area), see Section 8.2.2.2 |
| **NEN 2991:2015** | Netherlands | Risk assessment, see Section 4.1<br><br>Air monitoring, see Section 6 |
| **NEN 5707+C1:2016/C2:2017** | Netherlands | Sample analysis for the identification of asbestos in soil, see Section 5.7 |
| **NEN 5896:2003** | Netherlands | Sample analysis for the identification of MCAs, see Section 5.7 |
| **NEN 5897+C2:2017** | Netherlands | Sampling of asbestos in waste materials and demolition waste, see Section 5.7 |
| **NEN 5898+C1:2016** | Netherlands | Sample analysis of asbestos in soil, sediment, dredged sludge, waste materials and demolition waste, see Section 5.7 |
| **NF F01-020:2019** | France | Materials assessment for the identification of MCAs in trains, see Section 5.7 |
| **NF L80-001:2020** | France | Materials assessment for the identification of MCAs in aircrafts, see Section 5.7 |
| **NF P94-001:2021** | France | Materials assessment for the identification of MCAs in rocks and soils, see Section 5.7 |
| **NF X43-050:2021** | France | Indirect TEM method for identification of asbestos fibres in air, see Section 6. This method can also be applied to the sample analysis for the identification of MCAs, see Section 5.7 |
| **NF X43-269:2017** | France | Operator air monitoring, see Section 6 |
| **NF X46-020:2017** | France | Asbestos identification – Identification of materials and products containing asbestos in built buildings – Mission and methodology, see Section 5 |
| **NF X46-100:2019** | France | Materials assessment for the identification of MCAs for industries, see Section 5.7 |
| **NF X46-101:2019** | France | Asbestos identification – Identification of materials and products containing asbestos in ships, boats and other floating constructions – Mission and methodology, see Section 5 |

Table A5-1: Non-exhaustive list of standards

| Guide | Country | Relevant information |
|---|---|---|
| **NF X46-102:2020** | France | Asbestos identification – Identification of materials and products containing asbestos in civil engineering works, transport infrastructures and various networks – Mission and methodology, see Section 5 |
| **UNE 171370-2:2021 Asbestos, Part 2** | Spain | Materials assessment for the identification of MCAs, see Section 5.7 |
| **UNI 11903:2023** | Italy | Sample analysis for the identification of MCAs, see Section 5.7 |
| **VDI 3492:2013-06** | Germany | Analysis of air monitoring samples by scanning electron microscope / energy-dispersive X-ray analysis (SEM/EDXA) method, see Section 6 |
| **VDI 3866 Blatt 5:2017-06** | Germany | Sample analysis by scanning electron microscopy (SEM) for the identification of MCAs, see Section 5 |
| **VDI 6202 Blatt3:2021-09** | Germany | Materials assessment for the identification of MCAs, see Section 5.7 |

# **Annex 6** Laboratory quality assurance and quality control

## A6.1 Effective quality assurance / quality control programmes

- Details of standard procedures to ensure validity of results are defined in EN ISO/IEC 17025:2017. The following are some examples of the key determinants of an effective QA programme:
  - written protocols describing the procedures of each step;
  - all equipment should be maintained in good order, and sufficient checks carried out before each use;
  - for companies conducting materials assessments, a portion of materials assessments should be ‘reinspected’ (i.e. rechecked) while the materials assessment is still in progress;
  - for analytical procedures, limits on maximum samples analysed in one day should be set and details provided of any requirements for reanalysis by other analysts;
  - use of reference materials or QC materials;
  - routine QA checks to assess the quality of results produced;
  - analysts/laboratories should perform satisfactorily in the external proficiency testing schemes;
  - all reports should be checked before being issued to clients;
  - routine checks on records should be conducted.

## A6.2 Internal and external audits

Organisations used for sampling and analysis should have robust internal QC and auditing procedures. These are also conditions to obtain accreditation. Accreditation also requires a laboratory to have a documented training and competence procedure which should include an element of supervised laboratory and on-site experience for staff.

Auditing procedures should be developed for each area of the analyst’s work. They should be part of documented performance management for individuals ([595]). Annual auditing of each analyst’s performance is needed as a minimum. Auditing is normally carried out by a designated ‘competent auditor’ within the organisation. This person needs to possess a suitable combination of qualifications, training, experience and knowledge for the work. Records of analysts’ training are required to be kept. Records of auditing and performance need to be retained and be available for inspection as part of external audits. The information is then used by the analyst organisation to ensure consistency of standards and to identify training needs, operational issues and competence improvements where appropriate.

([595]) HSE (2021), *Asbestos: The Analysts’ Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.

Another requirement for accreditation is that laboratories actively participate in external fibre suitability testing schemes ([596]). Such schemes are available for fibre counting by PCM, EM fibre counting, identification of asbestos in bulk samples and asbestos in soils. In some Member States a national scheme is available.

## A6.3 Calibration of instruments

As stated above, an effective QA programme includes maintaining all equipment in good working order and carrying out sufficient checks before each use. A list of instruments that are out of service and cannot be used should also be maintained. Keeping records of regular calibration of equipment is a requirement of accreditation schemes.

The primary standard or master flow meter should be a flow meter whose accuracy is traceable to national standards. These should only be used for in-house calibration of the working flow meters and should be used by paying careful attention to the conditions of the calibration certificate. Master flow meters should be visually checked for damage regularly and at least every three months and calibrated to traceable national standards annually. The working flow meters should be calibrated monthly (or necessary documentary evidence of at least one year to justify longer intervals between calibration, such as on a quarterly basis). Records of the checks and calibrations should be kept ([597]).

Similarly, any timekeeping devices can be calibrated in a similar manner to flow meters by calibrating against a standard timepiece.

The SEM should be calibrated against a standard grating covering the full magnification range used for measuring and sizing fibres ([598]). Normally the EDXA will require calibration using one or more known elements in reference sample(s) to position the peaks at the correct energy. A TEM should also be calibrated against a suitable method. Gold or aluminium grids are used to specifically calibrate electron diffraction.

All other equipment used should be checked regularly (at least monthly) for any faults and be calibrated, where possible, annually.

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([596]) European proficiency testing information system (EPTIS) (n.d.), 'Welcome to EPTIS', https://www.eptis.org/.

([597]) HSE (2021), *Asbestos: The Analysts' Guide*, HSG248, https://www.hse.gov.uk/pubns/priced/hsg248.pdf.

([598]) ISO, ISO 14966:2019.

# Annex 7 Overview of certification and accreditation schemes for asbestos

**Table A7-1: Overview of certification and accreditation schemes for asbestos**

| Country | National organisation(s) organising certification and/or accreditation | Details on certification/accreditation scheme |
|---|---|---|
| **Austria** | Akkreditierung Austria<br>TÜV AUSTRIA<br>Austrian Standards (Österreichisches Normungsinstitut – ASI) | Certification required for asbestos handling and removal specialists |
| **Belgium** | Belgian Accreditation Body (BELAC)<br>Flanders Public Waste Agency (OVAM)<br>Federal Public Service Employment, Labour and Social Dialogue (FPS Employment)<br>Federal Public Service Health, Food Chain Safety and Environment (FPS Health) | Mandatory asbestos certificate for property transfers in Flanders; certification required for asbestos removal and management specialists |
| **Bulgaria** | Executive Agency 'Bulgarian Accreditation Service' (EA BAS)<br>National Center of Public Health and Analyses (NCPHA) | Certification scheme required for asbestos abatement and removal workers |
| **Croatia** | Croatian Accreditation Agency (HAA)<br>Croatian Institute for Health Protection and Safety at Work (CIHPSW) | Certification and licensing required for asbestos removal specialists |
| **Cyprus** | Department of Labour Inspection (DLI) | Training and certification required for asbestos removal and inspection specialists |
| **Czechia** | Czech Accreditation Institute (CAI)<br>SGS Czech Republic | Specific licensing and certification required for asbestos specialists |
| **Denmark** | Danish Working Environment Authority (Arbejdstilsynet)<br>Danish Safety Technology Authority (Sikkerhedsstyrelsen) | Mandatory certification for asbestos workers; permits required for asbestos-related activities |
| **Estonia** | Estonian Accreditation Centre (EAK – Eesti Akrediteerimiskeskus)<br>Labour Inspectorate of Estonia (Tööinspektsioon) | Certification for asbestos handling and removal specialists required |
| **Finland** | Division of Occupational Safety and Health of the Regional State Administrative Agency for Western and Inland Finland | Strict asbestos handling and removal certification regulations in place |

### Table A7-1: Overview of certification and accreditation schemes for asbestos

| Country | National organisation(s) organising certification and/or accreditation | Details on certification/accreditation scheme |
|---|---|---|
| **France** | Accreditation by COFRAC (French accreditation institute)<br><br>For asbestos removal or encapsulation companies: certification of companies by QUALIBAT, AFNOR and GLOBAL accredited certification bodies<br><br>For training bodies for workers in asbestos removal or encapsulation companies: certification of bodies by CERTIBAT, I-CERT and GLOBAL accredited certification bodies ;for analysis laboratories: accredited by COFRAC: certification of organisations by accredited certification bodies CERTIBAT, I-CERT and GLOBAL<br><br>For analysis laboratories: accredited by COFRAC<br><br>For building surveyors: certification of individuals issued by an accredited certification body | Certification required for:<br>• asbestos removal or encapsulation companies;<br>• asbestos removal or encapsulation company worker training organisations;<br>• building surveyors.<br><br>Accreditation required for:<br>• air sampling and analysis laboratories (for filters used during air sampling and for samples taken from materials and products likely to contain asbestos);<br>• asbestos removal or encapsulation company certification bodies;<br>• asbestos removal or encapsulation company worker training bodies. |
| **Germany** | Federal Institute for Occupational Safety and Health (BAuA – Bundesanstalt für Arbeitsschutz und Arbeitsmedizin)<br><br>German social accident insurance (DGUV – Deutsche Gesetzliche Unfallversicherung) | Certification required for asbestos surveyors and licensed asbestos removal contractors |
| **Greece** | Hellenic Accreditation System S.A. (ESYD)<br><br>Ministry of Labour and Social Affairs (Υπουργείο Εργασίας και Κοινωνικών Υποθέσεων) | Certification and training required for asbestos management and removal specialists |
| **Hungary** | National Accreditation Authority (Nemzeti Akkreditáló Hatóság – NAH)<br><br>National Public Health Center (Nemzeti Népegészségügyi Központ – NNK) | National certification schemes apply to asbestos handling and removal workers |
| **Ireland** | Irish National Accreditation Board (INAB)<br><br>Health and Safety Authority (HSA) | Certification and registration mandatory for asbestos removal and inspection specialists |
| **Italy** | The certification and accreditation schemes for asbestos specialists are primarily managed by regional authorities. | Certification process is in place for asbestos removal companies and workers |
| **Latvia** | Latvian National Accreditation Bureau (LATAK)<br><br>Certified bodies | Certification required for asbestos specialists involved in removal and inspection |
| **Lithuania** | Nacionalinis akreditacijos biuras (NAAB) | National certification scheme in place for asbestos handling and disposal specialists |
| **Luxembourg** | Office Luxembourgeois d'Accréditation et de Surveillance (OLAS) | Accreditation and certification required for asbestos specialists |
| **Malta** | Occupational Health and Safety Authority (OHSA) | Certification and licensing necessary for asbestos removal specialists |
| **Netherlands** | Ascert (Foundation for Asbestos Certification)<br><br>TÜV Nederland<br><br>DNV | Asbestos removal and asbestos risk assessment specialists require government-approved certification<br><br>TÜV Nederland provides process certificates for asbestos risk assessment and removal companies<br><br>DNV offers personal certificates for professional asbestos removers and supervisors |

Table A7-1: Overview of certification and accreditation schemes for asbestos

| Country | National organisation(s) organising certification and/or accreditation | Details on certification/accreditation scheme |
|---|---|---|
| **Norway** | Norwegian Accreditation (Norsk Akkreditering); accredited certification bodie<br><br>Norwegian Labour Inspection Authority (Arbeidstilsynet) | Asbestos removal and disposal companies must be approved by the Norwegian Labour Inspection Authority. Certification bodies accredited by Norwegian Accreditation may provide relevant competence or management system certification. |
| **Poland** | Polish Centre for Accreditation (Polskie Centrum Akredytacji – PCA) | Certification required for asbestos abatement workers and companies |
| **Portugal** | Instituto Português de Acreditação (IPAC) | Certification and accreditation needed for asbestos handling specialists |
| **Romania** | Romanian Accreditation Association (Asociația de Acreditare din România – RENAR) | Certification required for asbestos specialists, including inspectors and removers |
| **Slovakia** | Slovak National Accreditation Service (SNAS) | Mandatory certification for asbestos-related work |
| **Slovenia** | Slovenian Accreditation (Slovenska Akreditacija – SA)<br><br>Igmat d.d. | Licensing and certification needed for asbestos-handling specialists |
| **Spain** | National Accreditation Entity (Entidad Nacional de Acreditación – ENAC)<br><br>Spanish Association for Standardisation and Certification (AENOR) | Certification and accreditation required for asbestos management specialists |
| **Sweden** | Swedish Work Environment Authority (Arbetsmiljöverket)<br><br>Swedish Board for Accreditation and Conformity Assessment (SWEDAC) | Strict permit requirements and certification schemes in place for asbestos specialists |
| **Switzerland** | Swiss Accreditation Service (SAS)<br><br>Swiss Asbestos Removal Association (SAA)<br><br>Swiss Society of Occupational Medicine (SSOM) | Certification and accreditation necessary for asbestos-handling specialists |
| **United Kingdom** | United Kingdom Accreditation Service (UKAS)<br><br>Health and Safety Executive (HSE)<br><br>UK Asbestos Training Association (UKATA)<br><br>British Occupational Hygiene Society (BOHS) | Licensing and certification necessary for asbestos contractors and training providers |

# Annex 8 Overview of Member States with national asbestos registers

**Table A8-1: Overview of Member States with national asbestos registers**

| Member State | Mandatory central asbestos register | Details |
|---|---|---|
| **Belgium** | Yes, for specific regions | In Flanders there is a central register for asbestos, especially for buildings constructed before 2001. |
| **France** | No, except for buildings owned by the state or leased by its departments | While France does not have a centralised national register, there are requirements for an asbestos inventory in all buildings constructed before 1997. These inventories are managed locally, not centrally.<br><br>A register is currently (2025) being compiled for buildings owned by the state or leased by its departments. |
| **Germany** | No, only regional databases | Germany does not have a single, centralised national register but has various regional databases to track asbestos in public buildings and workplaces. |
| **Netherlands** | Yes | The National Asbestos Monitoring System (LAVS) is a web application for monitoring and registering asbestos removal by various chain parties. Inventory experts and asbestos removal companies are required to register their activities in LAVS, which is managed by the Informatiepunt Leefomgeving (IPLO) of the Dutch authorities. |
| **Poland** | Yes | Poland has a central database for asbestos, which tracks the quantity of MCAs still present in buildings. |
| **Sweden** | Yes | The Swedish Environmental Protection Agency (Naturvårdsverket) oversees the management and tracking of MCAs in buildings. |

# **Annex 9** Tools for materials assessment

## A9.1 Materials assessment algorithm: Ireland and United Kingdom

In Ireland and the United Kingdom, the 'Materials assessment algorithm' is widely used as a tool in the materials assessment phase of the asbestos risk assessment ([599]). Each ACM ([600]) identified in a survey and described in an asbestos register will normally be assessed for the potential to release asbestos fibres using the algorithm.

Section 6 of the document *Asbestos-containing materials (ACMs) in workplaces* – Practical guidelines on ACM management and abatement' explains in detail how the materials assessment algorithm can be used. The materials assessment algorithm is visualised in Table A9-1. It looks at the type and condition of the ACM and the potential for fibre release if disturbed. The materials assessment will depend on four different parameters:

- asbestos type
- product type
- extent of damage
- surface treatment.

Each parameter is scored high (3), medium (2), low (1) or very low (0). In the table, where applicable, some guidance is given on the interpretation of the wording.

Presumed ACMs are scored as crocidolite (3) unless there is a reasonable argument that another type of asbestos was almost always used in that type of application. The chosen scores from each parameter are added to give a total materials assessment score. It does not necessarily follow that those materials with the highest scores will be the materials that should be given priority for remedial action.

([599]) HSA (2013), *Asbestos-containing materials (ACMs) in workplaces* – Practical guidelines on ACM management and abatement, https://www.hsa.ie/eng/Publications_and_Forms/Publications/Chemical_and_Hazardous_Substances/Asbestos_Guidelines.pdf.

([600]) In the United Kingdom, MCAs are mentioned as asbestos-containing materials (ACM). In this subsection, the term ACM as mentioned in the document *Asbestos-containing materials (ACMs) in workplaces* – Practical guidelines on ACM management and abatement is used.

Table A9-1: Materials assessment for asbestos-containing materials

| Sample variable | Score | Examples of scores |
|---|---|---|
| **Product type (or debris from product)** | 1 | Asbestos-reinforced composites (plastic, resins, mastics, roofing felts, vinyl floor tiles, semi-rigid paints or decorative finishes, asbestos cement) |
| | 2 | Asbestos insulating board, mill boards, other low density insulation boards, asbestos textiles, gaskets, ropes and woven textiles, asbestos paper and felt |
| | 3 | Thermal installation (i.e. pipe and boiler lagging), sprayed asbestos, loose asbestos, asbestos mattresses and packing |
| **Extent of damage/ deterioration** | 0 | Good condition; no visible damage |
| | 1 | Low damage: for example, a few scratches or surfaces marks, broken edges of tiles |
| | 2 | Medium damage: significant breakage of materials or several small areas where material has been damaged, revealing loose asbestos fibres |
| | 3 | High damage or delamination of materials, sprays and thermal insulation; visible asbestos debris |
| **Surface treatment** | 0 | Composite MCAs: reinforced plastics, resins, vinyl tiles |
| | 1 | Enclosed sprays and lagging, asbestos insulating board (with exposed face painted or encapsulated) asbestos-cement sheet, etc. |
| | 2 | Encapsulated sprays and lagging, unsealed asbestos insulating board |
| | 3 | Unsealed laggings and sprays |
| **Asbestos type (601)** | 1 | Chrysotile |
| | 2 | Amphibole asbestos excluding crocidolite |
| | 3 | Crocidolite |
| **Total score** | | |

# A9.2 Materials assessment: Netherlands

In the Netherlands, it is mandatory to use the NEN 2991:2015 standard to perform a risk assessment to determine whether the OEL can be exceeded. Annex A lists the most common MCAs (friable and non-friable) that can be used in the material assessments phase of the asbestos risk assessment. Annex A contains the following three tables giving information on MCAs:

- Table A.1 – Examples of asbestos-cement products and other products in which asbestos occurs in a non-friable form;
- Table A.2 – Examples of products in which asbestos occurs in a friable form;
- Table A.3 – Examples of asbestos-containing products used on ships and drilling rigs.

(601) There is a large difference in the relative risk between chrysotile versus amphiboles.

# A9.3 Materials assessment: France

In France, asbestos legislation outlines two distinct assessment routes.

- Screening for daily use of the building:
  - responsibility: building owner;
  - status: mandatory, required by French legislation;
  - screening for daily use of the building includes assessment of the material's condition, known as 'Évaluation de l'état de conservation' (details are included in NF X46-020 ([602]).
- Screening before work:
  - responsibility: sponsor of the work;
  - status: this is prescribed in the French labour code, which is based on several standards (six areas of activity concerned by the obligation: buildings; land and everything related to it: transport infrastructure, networks and structures, ships, aircraft, railway rolling stock, industries);
  - screening before work does not include the assessment of the material's condition.

## Assessment of the material's condition

In France, in the assessment of the asbestos materials, a differentiation is made in the material's physical protection that is key for determining the risk of fibre release and the appropriate management strategy.

- **Sealed protection (protection étanche).** A covering or encapsulation that prevents the release of asbestos fibres. It is intact and effectively isolates the MCA from the environment. Examples: coatings (like encapsulants), tightly sealed cladding or sheeting, or materials enclosed in a sealed, undamaged casing. Implications for risk assessment: if the MCA has sealed protection, even if the MCA itself is deteriorating underneath, the risk of fibre release is significantly reduced.
- **Non-sealed protection or no protection (protection non étanche ou absence de protection).** The MCA is either not protected at all or the protection is damaged, incomplete or permeable, allowing fibres to potentially be released into the air. Examples: cracked or peeling paint on MCAs, loosely fixed coverings, damaged lagging or exposed MCAs. Implications for risk assessment: these MCAs are much more likely to release fibres if disturbed or if they deteriorate further.

The screening for daily use of the building contains an assessment of the asbestos material's condition. This assessment is part of the 'évaluation de l'état de conservation' (evaluation of the conservation state), required under the Code de la santé publique (Public Health Code) and related decrees.

A synthesis of the material's condition assessment process is given. For full information on the assessment process, see the Code de la santé publique (Public Health Code) and related decrees, particularly Decree No 2011-629 ([603]) and Annex 1 to the arrêtés of 12 December 2012 ([604]). The French standard guide FD X 46-038 ([605]) provides information on how to assess each of the four criteria.

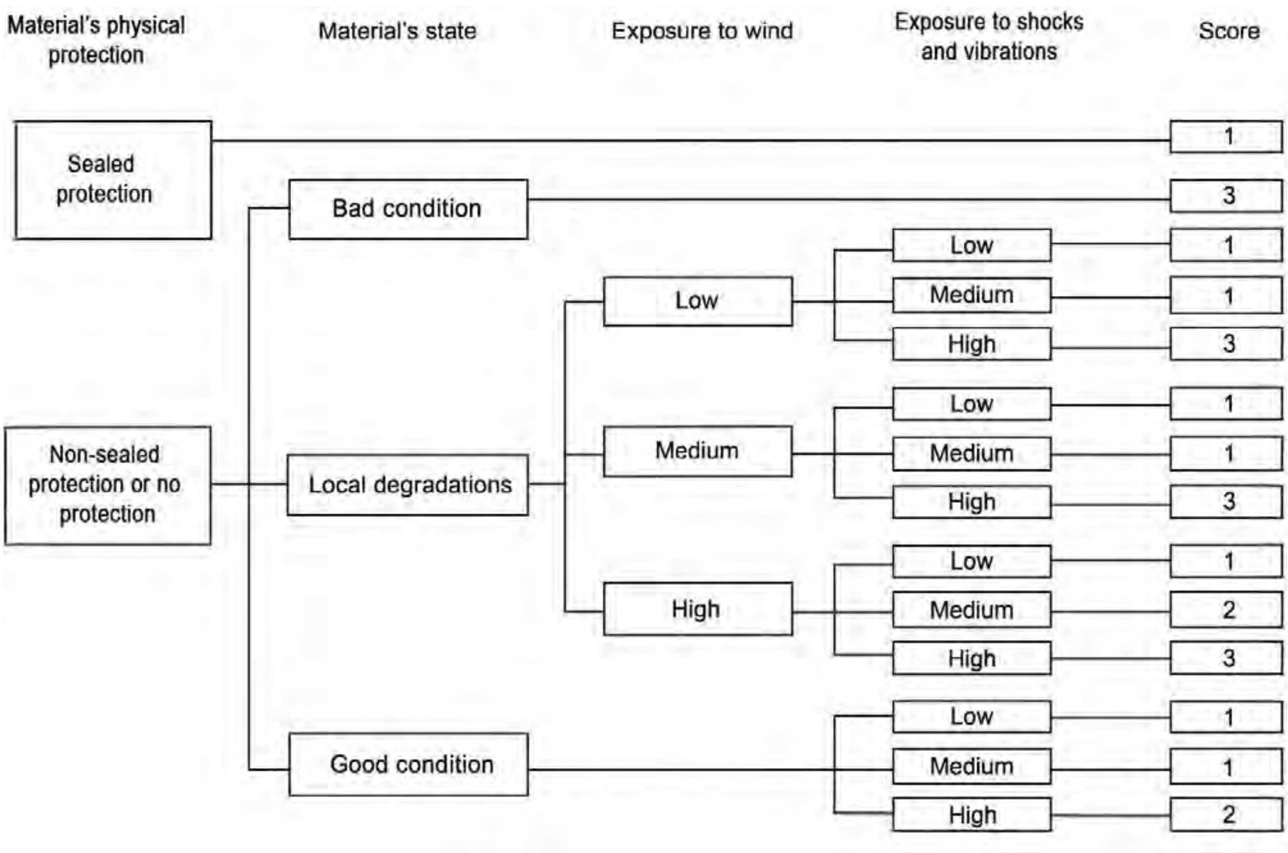
([602]) AFNOR (2017), 'NF X46-020:2017 – Asbestos survey – Survey of materials and products containing asbestos in buildings – Mission and methodology', https://www.boutique.afnor.org/en-gb/standard/nf-x46020/asbestos-survey-survey-of-materials-and-products-containing-asbestos-in-bui/fa186482/1669.

([603]) Journal officiel de la République française (JORF) (2012), Decree No 2012-639 of 4 May 2012 on risks of exposure to asbestos, https://www.legifrance.gouv.fr/loda/id/JORFTEXT000024114426.

([604]) JORF (2012), Annexes to Order of 12 December 2012 relating to the criteria for assessing the state of conservation of materials and products on list A containing asbestos and the content of the identification report, https://www.legifrance.gouv.fr/loda/id/JORFTEXT000026843891.

([605]) AFNOR (2023), 'FD X46-038 – Guide pour l'évaluation de l'état de conservation des matériaux et produits contenant de l'amiante repérés dans les immeubles bâtis', https://www.boutique.afnor.org/fr-fr/norme/fd-x46038/guide-pour-levaluation-de-letat-de-conservation-des-materiaux-et-produits-c/fa205979/349232.

**Figure A9-1: Summary of the assessment of the asbestos material's condition in the Code de la santé publique [Public Health Code] and related decrees** ([606])




This image is not available for reuse, see inside front cover.

NB: This is a synthesis of the French regulation (the real assessment grids are tailored to each material type; the summary figure was designed to keep it simple.

Details on how to perform the screening before work is given in standard NF X46-020 ([607]).

([606]) Code de la santé publique (Public Health Code) and related decrees, particularly Decree No 2011-629 and Annex 1 of the arrêté of 12 December 2012. See JORF (2012), Decree No 2012-639 of 4 May 2012 on risks of exposure to asbestos, https://www.legifrance.gouv.fr/loda/id/JORFTEXT000024114426; and JORF (2012), Annexes to Order of 12 December 2012 relating to the criteria for assessing the state of conservation of materials and products on list A containing asbestos and the content of the identification report, https://www.legifrance.gouv.fr/loda/id/JORFTEXT000026843891.

([607]) AFNOR (2017), 'NF X46-020:2017 – Asbestos survey – Survey of materials and products containing asbestos in buildings – Mission and methodology', https://www.boutique.afnor.org/en-gb/standard/nf-x46020/asbestos-survey-survey-of-materials-and-products-containing-asbestos-in-bui/fa186482/1669.

## Management measures

The assessment of the materials condition will give a score that refers to a set of management measures for the MCA.

**Table A9-2: Management measures for the MCA**

| Score | Management measure | Timing | Details |
|---|---|---|---|
| **1** | Update the evaluation of the material's condition | Within three years | |
| **2** | Air analysis to assess the fibre concentration in the air (certified lab) | Within two months | If < 5 fibres/litre: go to 1<br>If > 5 fibres/litre: go to 3 |
| **3** | (1) conservatory measures to implement to lower the fibre concentration in the air < 5 fibres/litre | Within two months | Works planning to communicate to the local state administration within one year |
| | (2) works: material removal or recovery | Within three years | A screening before works will have to be ordered by the sponsor of the works before material removal or recovery |

While sealed protection versus non-sealed / no protection seems to be historically linked to the distinction between friable and non-friable asbestos, this link is now abandoned in the French asbestos regulation. Within the French regulation for the materials assessment, no focus is set at the distinction between friable versus non-friable.

- Friable versus non-friable refers to the intrinsic physical nature of the MCA. Friable means that the material can easily release fibres when deteriorated, handled or disturbed. Non-friable means that the asbestos is bound into a solid matrix and fibres are less likely to be released unless the material is damaged or cut.
- Sealed protection versus non-sealed is about the condition and coverage of the MCA, i.e. how well it is encapsulated or isolated to prevent fibre release, regardless of whether the material is friable.
- Sealed protection helps reduce the risk of fibre release, even for friable materials.
- Non-sealed or no protection increases the risk – especially critical if the material is friable.

Connection summary:

- a friable material with no protection will pose a very high risk (requires immediate action);
- a friable material with good, sealed protection will mean a lower risk but still needs to be monitored;
- a non-friable material may not need protection unless it is damaged – then it behaves more like a friable material in terms of risk.

# Annex 10 Non-exhaustive list of non-specialist occupations potentially exposed to asbestos (except demolition and renovation workers)

## A10.1 Maintenance staff

'Maintenance staff' encompasses a range of professionals responsible for ensuring the proper functioning and safety of equipment used across various operations. Due to the historical widespread use of asbestos in industrial components, the relatively recent ban on its use in the EU and the continuing potential for unlawful incorporation of MCAs in equipment imported (e.g. conveyor belts) or serviced outside the EU, the risk of asbestos exposure among these workers remains significant. Maintenance staff potentially at risk include ([608]):

- engine and mechanical systems maintainers;
- furnace maintenance staff (such as in cement works, foundries, glassworks, steelworks);
- maintenance workers in incineration and district heating plants;
- maintainers in the chemical and petrochemical sectors;
- fitters;
- pipefitters;
- lift and escalator maintenance staff.

These occupations can involve tasks such as stripping, replacing and cleaning machinery like engines, turbines, insulated pipes, boilers and thermal shields ([609]), which can involve direct handling of a range of MCAs, see Annex 4. Exposure levels of these workers can reach relevant levels. For instance, the stripping of 3 metres of severely degraded asbestos from a boiler door seal may result in exposure levels of 6–27 fibres/cm$^3$ when dry and 0.2 fibres/cm$^3$ when wet ([610]). Friction materials used for cleaning or work are especially dangerous because they cause asbestos dust to be released during work or cleaning. Removing asbestos-cement sheets by hand without suction, for example, produces asbestos fibres ranging from 1.27 to 2.07 fibres/cm$^3$ ([611]). Furthermore, vacuum cleaning enclosed elevator machinery can expose employees to 0.22 fibres/cm$^3$ ([612]).

([608]) Lift and Escalator Industry Association (2015), 'Safety information sheet: Guidance on the duty to manage asbestos in a building', PA38, https://www.leia.co.uk/safety/asbestos-information/; INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

([609]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

([610]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

([611]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

([612]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

## A10.2 Bricklayers, tilers and plasterers

Bricklayers, wall tilers and plasterers can be exposed to asbestos by contact with MCAs such as insulation, false ceilings, asbestos-cement products, asbestos tiles, asbestos plaster and floor and wall covers. Working on old structures by drilling, cutting walls or floor renovation can expose bricklayers to high levels of asbestos. For example, cutting an asbestos-cement pipe with a dry thermal saw can release up to 54.8 fibres/cm$^3$, while cutting an asbestos-cement pipe with a dry saw can release up to 3.7 fibres/cm$^3$ to the surrounding environment ([613]).

## A10.3 Rendering specialists, brick restorers or repointers

Rendering specialists, brick restorers or repointers (and even some plasterers) can remove or render pebbledash which may contain asbestos, which when disturbed constitutes a source of asbestos dust exposure.

## A10.4 Scaffolders and roofers

Working in environments with MCAs such as flocking, false ceilings, asbestos-cement cladding, asbestos render and roofing felt/gutters/downpipes may expose scaffolders or roofers to asbestos, see 'Roof products' in Annex 4. Scaffolders or roofers may need to cut roofing, puncture walls and deal with scaffolding decks covered with asbestos dust. Exposure levels for drilling asbestos-cement panels inside a room can go up to 14.1 fibres/cm$^3$ ([614]). Handling gear that has gathered asbestos fibres or moving about in asbestos-contaminated areas are examples of direct exposure at the workplace.

## A10.5 Carpenters

Carpenters can be exposed to asbestos when working directly on MCAs, but also by working in asbestos-contaminated environments. Activities such as installation of partitions in enclosed spaces can release up to 3.1 fibres/cm$^3$ ([615]).

## A10.6 Flooring installers

Flooring installers may encounter MCAs during the replacement or cleaning of floor coverings such as vinyl asbestos tiles, adhesives, levelling compounds or carpets. Exposure risks also exist during tasks such as drilling, cutting or sanding floors, particularly in areas where MCAs are present and possibly degraded. The removal of vinyl asbestos tiles using tools like a squeegee, spatula, hand scraper or sack can release up to 0.21 fibres/cm$^3$. When using a short-handled wet scraper without suction to remove vinyl tiles backed with asbestos paper, airborne fibre concentrations of up to 0.034 fibres/cm$^3$ may be observed ([616]).

([613]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.
([614]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.
([615]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.
([616]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

## A10.7 Painters and decorators

Painters and decorators may be exposed to asbestos through removing paint, removal of old finishes, surface preparation or removal of textured coatings fixed to MCAs. Other types of risk exposure include installing decorations that penetrate, puncture or damage MCAs. Exposure levels can reach from 0.5 to 0.62 fibres/cm³ as a consequence of shearing and nibbling of asbestos paper sheets on a wall ([617]).

## A10.8 Electricians

Electricians may be exposed to asbestos by working on MCAs such as electrical resistors, cable sheaths and insulation. Common activities which may also result in the release of asbestos fibres from MCAs include projects to remove, replace and clean electrical elements in areas containing MCAs, along with attaching or drilling wires into walls containing MCAs. For example, cutting asbestos-insulated wires may result in exposure levels ranging from 0.14 to 0.91 fibres/cm³ ([618]). Pulling wires across flocked cable trays also releases fibres, which may have an exposure of 0.07 fibres/cm³ ([619]).

## A10.9 Plumbers and heating/ventilation engineers

Plumbers and heating engineers may be exposed to potentially degraded MCAs (such as flocked insulation) during installation or maintenance work in buildings or while working on heating or ventilation systems. High-risk activities, such as replacing a gasket on a boiler valve, may lead to asbestos exposure if the gasket has deteriorated and asbestos-containing dust is released during the cleaning of the gasket seat. Also, retracting severely degraded asbestos braid from a dry boiler can release up to 27 fibres/cm³; if the braid is wet, the release may be limited to 0.2 fibres/cm³. Similarly, removing a boiler that includes asbestos flocking can result in airborne concentrations of up to 4.7 fibres/cm³ ([620]).

## A10.10 Insulation installers

Insulation installers can be exposed to asbestos from many types of insulation products. The use of asbestos in insulation from the mid-1860s to about 1978 indicates a potentially large range of MCAs. Some previously marketed asbestos-containing products, such as amphibole-contaminated vermiculite insulation, remain in many homes and other buildings ([621]). Today, insulation installers may still encounter asbestos insulation in locations such as older homes, schools, buildings, ships and insulation of machinery components ([622]).

([617]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

([618]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

([619]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

([620]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

([621]) US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry (ATSDR) (2014), 'Who is at risk of exposure to asbestos?', https://archive.cdc.gov/www_atsdr_cdc_gov/csem/asbestos/who_is_at_risk.html.

([622]) Kupczewska-Dobecka, M., Konieczko, K. and Czerczak, S. (2020), 'Occupational risk resulting from exposure to mineral wool when installing insulation in buildings', *International Journal of Occupational Medicine and Environmental Health*, Vol. 33, Issue 6, pp. 757–769, https://pubmed.ncbi.nlm.nih.gov/33051631/.

## A10.11 Glaziers

A glass fitter (glazier) may be exposed to asbestos by working with soffits, facias and rainwater goods which contain asbestos cement, for buildings built earlier than 2000 ([623]).

## A10.12 Professional service workers (architects, engineers and surveyors)

Professional service workers, such as architects, engineers and surveyors, working in all exposure scenarios, such as buildings, civil engineering, mining and quarrying, and trains, ships and aircraft, can be exposed to asbestos from many different sources during their work. The risk of exposure comes from the disturbance of asbestos fibres present in materials used in the construction or maintenance of the exposure scenario structures. Additionally, contamination may come from a wide range of legacy components and, in many exposure scenarios, from NOA in soil and rocks excavated during the work.

## A10.13 Civil engineering workers

Civil engineering workers (see Section 16), can be exposed to asbestos from different sources during their work. The risk of exposure comes from the disturbance of asbestos fibres present in building materials used in the construction or maintenance of infrastructure (roads, railways, tunnels, harbours, dams, airports) and networks (gas, electricity, water pipelines). Additionally, contamination from legacy components in old machinery (e.g. excavators containing MCAs in brakes and clutches) and NOA in soil and rocks excavated during constructions, remediation of a NOA-contaminated site, and restoration can also result in risk for civil engineering workers.

## A10.14 Road workers

Asbestos can be present in a variety of materials which road workers work with, such as in bitumen, asphalt, asbestos-cement products and manholes. Exposure to asbestos of road workers during the removal of road surfaces without suction with humidification can release up to 0.16 fibres/$cm^3$ and asbestos exposure of a planer operator during the removal of road surfaces can reach levels of up to 0.116 fibres/$cm^3$ ([624]).

([623]) British Occupational Hygiene Safety (BOHS) (2021), 'Breathe Freely fact sheet – Glazier/glass fitter', https://breathefreely.org.uk/wp-content/uploads/2021/07/glazier_glass_fitter_fact_sheet.pdf.

([624]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

## A10.15 Railway workers

Railway workers can be exposed to asbestos while performing tasks in various parts of a train and the surrounding infrastructure. In older train models, MCAs may be present in gaskets, boiler and carriage insulation, and in the sealing and insulation of ducts, pipes and electrical components in technical areas, including switchgear and circuit boards ([625]). Exposure can also occur from contaminated railway ballast, particularly where legacy components have degraded over time. Additionally, MCAs may be found in signal boxes, depots, outbuildings and other electrical equipment along the railway line ([626]). There is also a risk of asbestos exposure in trains that undergo maintenance outside the EU, where asbestos regulations may be less stringent and MCAs might still be used.

## A10.16 Automotive service technicians/mechanics

Auto mechanics can encounter MCAs while servicing cars and replacing parts in automobiles. Components such as brakes, clutches and heat shields can have asbestos in their composition and replacing and/or moving such components can disturb asbestos, releasing fibres into the environment. The risk is higher when these professionals service older vehicles built before the asbestos ban. A previous study has shown that 8-hour TWA personal exposures can range between 0.003 and 0.157 fibres/cm$^3$ for auto mechanics ([627]). Dismantling and dusting two brake drums with a brush can release up to 0.18 fibres/cm$^3$ ([628]). A previous study suggests that exposure of these professionals results in health issues ([629]).

## A10.17 Aircraft mechanics

Aircraft mechanics can experience asbestos exposure while servicing various aircraft systems, as asbestos is often found in brake and landing gear systems. Asbestos content can be relatively high in the aircraft brakes, ranging from 16 to 23 % by weight in some types ([630]). As a result, mechanics working on these systems may have been exposed to asbestos.

## A10.18 Shipbreakers

Shipbreaking has been shown to pose significant risks to workers. This is due to the potential presence of asbestos (among other hazardous materials) in many ships that can be released during dismantling (shipbreaking) ([631]). Workers directly involved in dismantling operations have been estimated to be exposed to up to 320 fibres/millilitre during the demolition of accommodation areas, 103 fibres/millilitre during

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([625]) Battista, G., Belli, S., Comba, P., Fiumalbi, C., Grignoli, M. et al. (1999), 'Mortality due to asbestos-related causes among railway carriage construction and repair workers', *Occupational Medicine*, Vol. 49, Issue 8, pp. 536–539, https://pubmed.ncbi.nlm.nih.gov/10658307/.

([626]) Office of Rail and Road (2014), 'ORR position paper on asbestos in the rail industry 2014', https://www.orr.gov.uk/media/15531.

([627]) Cely-García, M., Torres-Duque, C., Durán, M., Parada, P., Sarmiento, O. L. et al. (2015), 'Personal exposure to asbestos and respiratory health of heavy vehicle brake mechanics', *Journal of Exposure Science and Environmental Epidemiology*, Vol. 25, pp. 26–36, https://doi.org/10.1038/jes.2014.8.

([628]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

([629]) Cely-García, M., Torres-Duque, C., Durán, M., Parada, P., Sarmiento, O. L. et al. (2015), 'Personal exposure to asbestos and respiratory health of heavy vehicle brake mechanics', *Journal of Exposure Science and Environmental Epidemiology*, Vol. 25, pp. 26–36, https://doi.org/10.1038/jes.2014.8.

([630]) Bianchi, C. and Bianchi, T. (2010), 'Aircraft maintenance and mesothelioma', *Indian Journal of Occupational and Environmental Medicine*, Vol. 14, Issue 1, p. 24, https://www.researchgate.net/publication/46108413_Aircraft_maintenance_and_mesothelioma.

([631]) Du, Z., Zhang, S., Zhou, Q., Yuen, K. F. and Wong, Y. D. (2018), 'Hazardous materials analysis and disposal procedures during ship recycling', *Resources, Conservation and Recycling*, Vol. 131, pp. 158–171, https://doi.org/10.1016/j.resconrec.2018.01.006; Lin, L., Feng, K., Wang, P., Wan, Z., Kong, X. et al. (2022), 'Hazardous waste from the global shipbreaking industry: Historical inventory and future pathways', *Global Environmental Change*, Vol. 76, 102581, https://doi.org/10.1016/j.gloenvcha.2022.102581.

the demolition of engine rooms and boiler rooms, and 42 fibres/millilitre when removing MCAs from inside ships ([632]). Studies have shown an excess mortality from all considered cancers among shipbreaking workers ([633]).

## A10.19 Telecom engineers and cable layers, and fire and burglar alarm installers

Telephone engineers, cable layers (including fibre optic cable layers) and fire and burglar alarm installers are at risk of exposure to asbestos due to drilling into MCAs hidden in walls, floors and ceilings or conducting repairs to cable-carrying pipes ([634]).

## A10.20 Petroleum industry workers

Oil or petroleum refinery workers can be exposed to asbestos in old electrical equipment, asbestos cement, protective clothing and thermal insulation. Research has shown that workers in this industry can be exposed to asbestos. For example, workers at oil refineries in Australia ([635]) and Italy ([636]) presented considerably higher mesothelioma incidence rates compared with the control population.

## A10.21 Mining and quarrying

Mining and quarrying workers can be at risk of asbestos exposure, for example during mining or quarrying activities, or processing and packaging processes. Working in mines has been associated with elevated rates of lung cancer and mesothelioma ([637]). In Canada the exposure levels of miners have been documented to be 10–100 times higher than the Canadian legal limit of 1 fibre/cm$^3$ ([638]). This is concerning since asbestos has a significant risk even at lower concentrations.

([632]) Singh, R., Cherrie, J. W., Rao, B. and Asolekar, S. R. (2020), 'Assessment of the future mesothelioma disease burden from past exposure to asbestos in ship recycling yards in India', *International Journal Hygiene and Environmental Health*, Vol. 225, 113478, https://doi.org/10.1016/j.ijheh.2020.113478.

([633]) Puntoni, R., Merlo, F., Borsa, L., Reggiardo, G., Garrone, E. et al. (2001), 'A historical cohort mortality study among shipyard workers in Genoa, Italy', *American Journal of Indian Medicine*, Vol. 40, Issue 4, pp. 363–370, https://doi.org/10.1002/ajim.1110; Wu, W., Lu, Y., Lin, Y.J., Yang, Y., Shiue, H. et al. (2013), 'Mortality among shipbreaking workers in Taiwan-A retrospective cohort study from 1985 to 2008', *American Journal of Industrial Medicine*, Vol. 56, Issue 6, pp. 701–708, https://doi.org/10.1002/ajim.22135; Merlo, D. F., Bruzzone, M., Bruzzi, P., Garrone, E., Puntoni, R. et al. (2018), 'Mortality among workers exposed to asbestos at the shipyard of Genoa, Italy: A 55 years follow-up', *Environmental Health*, Vol. 17, pp. 1–11, https://doi.org/10.1186/s12940-018-0439-1.

([634]) Asbestos compensation and claim lawyers and mesothelioma compensation and claims. See WE Solicitors LLP (2012), 'Telecom engineers and cable layers – A new wave of asbestos victims?', https://asbestosisclaim.co.uk/2016/03/telecom-engineers-and-cable-layers-a-new-wave-of-asbestos-victims/.

([635]) Gun, R., Pratt, N. L., Roder, D. M. and Ryan, P. (2006), 'Asbestos-related cancers in refinery workers in the Australian petroleum industry', *Archives of Environmental & Occupational Health*, Vol. 61, Issue 1, pp. 11–16, https://doi.org/10.3200/AEOH.61.1.11-16.

([636]) Gennaro, V., Ceppi, M., Boffetta, P., Fontana, V. and Perrotta, A. (1994), 'Pleural mesothelioma and asbestos exposure among Italian oil refinery workers', *Scandinavian Journal of Work*, Environment & Health, Vol. 20, Issue 3, pp. 213–215, http://www.jstor.org/stable/40966252.

([637]) Kristina, L. (2007), 'Asbestos: Mining exposure, health effects and policy implications', *McGill Journal of Medicine*, Vol. 10, Issue 2, pp. 121–126, https://pubmed.ncbi.nlm.nih.gov/18523609/.

([638]) Kristina, L. (2007), 'Asbestos: mining exposure, health effects and policy implications', *McGill Journal of Medicine*, Vol. 10, Issue 2, pp. 121–126, https://pubmed.ncbi.nlm.nih.gov/18523609/.

## A10.22 Farmers

Farmers using older, non-automated heavy equipment (such as tractors) may be exposed to asbestos used in brake and clutch linings while operating or maintaining this equipment ([639]). Depending upon the geology of their land, they may be exposed to NOA while tiling or ploughing the land, when the soil is disturbed and dust is released into the air.

## A10.23 Emergency workers

In the aftermath of a catastrophic event that damages or destroys buildings, there is a potential for exposure to disturbed asbestos. This scenario can result in risks to the people affected in the area but also to rescue workers and emergency responders. Moreover, an additional risk arises from the disturbance of asbestos fibres during the debris clean-up and waste removal ([640]).

## A10.24 Firefighters

In addition to their activities as emergency responders, firefighters are among the most likely to encounter asbestos fibres. Firefighters are equipped with PPE, including garments and SCBA, which protect them from inhaling airborne chemicals during fire suppression ([641]). However, SCBA might not be worn during the overhaul phase, when firefighters search for hot spots after a fire, as the environment typically has little or no visible smoke. This can result in exposure to asbestos fibres from building materials ([642]).

## A10.25 Hygiene and waste workers

Hygiene and waste workers, such as cleaners, waste collection staff, sorting staff, landfill workers and recyclers, may come into contact with MCAs in activities such as cleaning rooms, collecting and sorting waste, recovering, dismantling and sorting equipment or moving MCAs around in narrow spaces. Additionally, because of the diversity of the materials stored, recyclers may be exposed to asbestos mainly during compacting and shredding operations. The stripping and re-waxing of floor coverings by cleaners, for example, can also lead to significant emissions of asbestos fibres into the air, particularly if these operations are carried out in the dry. For example, stripping/brushing of slabs of asbestos-containing flooring in the dry without vacuuming can release up to 1.6 fibres/cm$^3$ ([643]).

([639]) Sahmel, J., Avens, H., Ferracini, T., Banducci, A. and Rickabaugh, K. (2022), 'Evaluation of airborne asbestos concentrations associated with the operation and maintenance of brakes and clutches on non-automated heavy equipment', *Journal of Environmental Public Health*, Vol. 22, 9831883, https://pubmed.ncbi.nlm.nih.gov/35495363/.

([640]) US Environmental Protection Agency Office of Enforcement and Compliance Assurance Office of Compliance (OECA) (2009), *Guidance for Catastrophic Emergency Situations Involving Asbestos*, https://www.epa.gov/sites/default/files/documents/guidance-catastrophic-emergency-asbestos-200912.pdf.

([641]) International Agency for Research on Cancer (IARC) (2023), 'Occupational exposure as a firefighter', *IARC Monographs on the Identification of Carcinogenic Hazards to Humans*, No 132, pp. 1–730, https://www.ncbi.nlm.nih.gov/books/NBK597253/; Pukkala, E., Martinsen, J. I., Weiderpass, E., Kjaerheim, K., Lynge, E. et al. (2014), 'Cancer incidence among firefighters: 45 years of follow-up in five Nordic countries', *Occupational & Environmental Medicine*, Vol. 71, pp. 398–404, https://doi.org/10.1136/oemed-2013-101803.

([642]) Bolstad-Johnson, D. M., Burgess, J. L., Crutchfield, C. D., Storment, S., Gerkin, R. et al. (2000), 'Characterization of firefighter exposures during fire overhaul', *American Industrial Hygiene Association Journal*, Vol. 61, pp. 636–641, https://doi.org/10.1080/15298660008984572; Pukkala, E., Martinsen, J. I., Weiderpass, E., Kjaerheim, K., Lynge, E. et al. (2014), 'Cancer incidence among firefighters: 45 years of follow-up in five Nordic countries', *Occupational & Environmental Medicine*, Vol. 71, pp. 398–404, https://doi.org/10.1136/oemed-2013-101803.

([643]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

# A10.26 Printer professionals

In the past, printer rollers contained asbestos-coated rubber to limit wear and tear. On this type of machine, the friction parts (the clutch and the brake), which contained asbestos, were subject to heavy stress, resulting in the emission of fibres into the room. Additionally, asbestos-covered boxes were used to control the noise produced by the printer. The friction of components of the printers could release up to 0.11 fibres/$cm^3$ into the working room ([644]).

# A10.27 Locksmiths

Asbestos was previously used by some safe and cabinet manufacturers, due to its fire-retardant properties, particularly as a door-jointing seal and as a sealed packing or barrier material within doors or walls ([645]). Asbestos was used for this purpose up until 1999, and the original manufacturers may be able to confirm whether this was the case for a certain make/model. Normal use of a safe or cabinet with MCA will not result in worker exposure to asbestos fibres, as the material is sealed inside. However, emergency safe-opening practices such as destructive cutting of a safe or cabinet could result in the release of asbestos fibres from the internal packing and exposure to the locksmith undertaking this activity (and other workers who may be present in these circumstances, such as the police, security service, antique dealers or even criminals). For this reason, destructive cutting of a safe with MCA is not permitted in Ireland. Non-destructive methods, such as precision drilling of a safe with MCA, should only be undertaken under strict control when asbestos is presumed to be present. Similarly, any modification that involves cutting into the door or walls of a safe with MCA, for example to install a slot deposit system, is not considered safe, so this should also only be undertaken under controlled conditions to protect workers. In a study of a subgroup ([646]) of mesothelioma patients diagnosed between 1987 and 1999 on the German mesothelioma register, of 1 605 mesothelioma patients, 116 (7 %) were in the occupational category 'locksmiths and machine building sector' ([647]).

# A10.28 Workers in public and commercial buildings built before the asbestos ban

Since asbestos was used in construction materials of buildings before asbestos was banned in the Member States, many public and commercial buildings still operating may contain MCA in their structure, see Annex 4. In this context, workers can be passively exposed to asbestos in their occupational settings. As the buildings were built before the asbestos ban, they contain older asbestos materials which can decay and release fibres. As a result, people working in these buildings can be passively exposed to asbestos without working directly on or with MCAs.

([644]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

([645]) Health and Safety Authority, Ireland (2023), 'Asbestos risks in safes and fire-resistant cabinets', https://www.hsa.ie/eng/your_industry/chemicals/legislation_enforcement/asbestos/asbestos_introduction/asbestos_risks_in_safes_and_fire_resistant_cabinets.

([646]) With lung tissue available for lung dust analyses.

([647]) Neumann, V., Günthe, S., Mülle, K. M. and Fischer, M. (2001), 'Malignant mesothelioma – German mesothelioma register 1987–1999', *International Archives of Occupational and Environmental Health*, Vol. 74, Issue 6, pp. 383–395, https://doi.org/10.1007/s004200100240.

## A10.29 Lift operators

While operating lifts, operators may be passively exposed to degrading asbestos present in lift components, including flocking on the walls of the lift, cable sheaths, brakes and asbestos-cement sheets. In escalator caissons, operators may encounter asbestos-containing spray coatings located beneath the concrete slab. Asbestos dust can settle on all surrounding components ([648]).

## A10.30 Stage professionals

MCAs were used for fire prevention in theatres, lecture theatres and cinemas. In the stage area, MCAs were used to improve sound insulation or to enable the use of special effects. The curtain that provides the firebreak between the stage and the auditorium was sometimes covered on the stage side with asbestos flocking ([649]). If these MCAs are still in use, this can result in passive exposure to stage professionals.

([648]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.
([649]) INRS (2012), 'Work situations involving exposure to asbestos', ED 6005, https://www.inrs.fr/media.html?refINRS=ED %206005.

# **Annex 11** Awareness points for passive exposure

Awareness points that interested parties may find useful when raising the issue of passive exposure in their organisations are provided below for illustrative purposes. These are not comprehensive and should be tailored to the specific circumstances of the company and national legislation in each Member State.

- Has an asbestos inventory ruled out the presence of asbestos and MCAs for the building in which you work? For example, a relevant consideration would be if the building you work in was built before the asbestos ban in your Member State, see Table 5-1. For details on asbestos identification, see Section 5.
- Has a risk assessment ruled out passive exposure to asbestos? Is there a risk of passive exposure to asbestos for workers in the building? For details on risk assessment, see Section 4.1.
- Have measurements been made to measure the presence of asbestos fibres in the air in the building (see Section 6)?
  - If asbestos fibres have not been detected:
    - have staff been informed?
  - If asbestos fibres have been detected:
    - have staff been informed?
    - what measures have been implemented to remove or reduce risks (see Section 8)?
    - is staff health being monitored (see Section 10)?
- Will there be regular remeasurements for the presence of asbestos fibres in the air in the building?
- Is the risk assessment being reviewed and, where appropriate, revised regularly?

The presence of asbestos fibres can be measured directly (air fibre concentration measured as a TWA over eight hours) or, as a general indication, indirectly (surface sample technique), see Section 6. For measures to eliminate or reduce risk, see Section 8.

# **Annex 12** Examples of asbestos warning signs

Below are examples of signs warning that asbestos is present. The warning sign in Figure A12-1 is used on items and packaging. The warning sign in Figure A12-2 is used for areas, rooms or enclosures used for the storage of significant quantities of asbestos. It is also used where asbestos is not, strictly speaking, stored, but is simply present. The warning signs in Figure A12-3 indicate an asbestos work area. The warning sign in Figure A12-4 is for asbestos and WCA being transported outside of buildings, which must comply with the ADR ([650]). Under the ADR, asbestos has a class number of 9.

The examples are given in English but are generally available in a wider range of European languages.

**Figure A12-1: 'Warning contains asbestos' label**


This image is not available for reuse, see inside front cover.

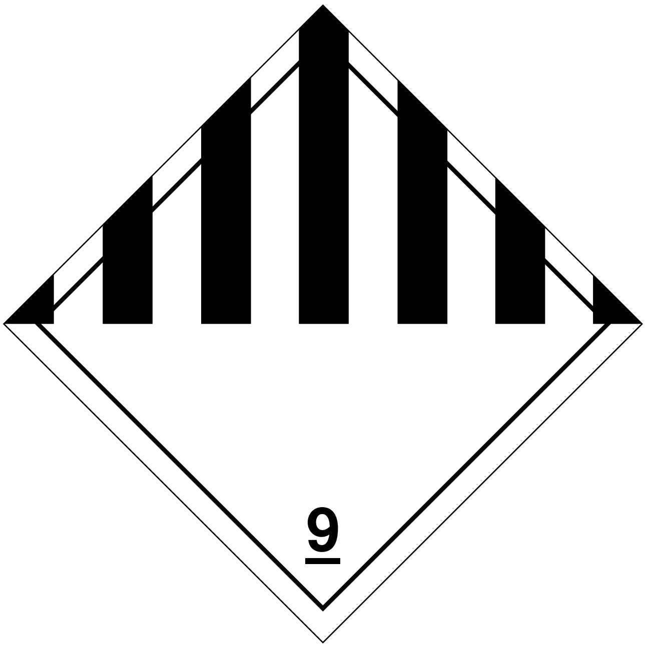
**Figure A12-2: Asbestos warning label**


([650]) United Nations Economic Commission for Europe (UNECE) (2021), 'Agreement concerning the International Carriage of Dangerous Goods by Road (ADR 2021)', https://unece.org/transport/publications/agreement-concerning-international-carriage-dangerous-goods-road-adr-2021.

**Figure A12-3: Examples of warning signs indicating an asbestos working area**


These images are not available for reuse, see inside front cover.

**Figure A12-4: ADR Class 9: Miscellaneous – hazard label**




This image is not available for reuse, see inside front cover.

# **Annex 13** Diagnostic criteria for medical surveillance

In this annex, the *Information Notices on Occupational Diseases: A guide to diagnosis*, the Helsinki Criteria for identifying asbestos-related diseases and symptomology for asbestos-related diseases are summarised.

## A13.1 EU diagnostic criteria for asbestos-related diseases (2009)

The European Commission's 2009 *Information Notices on Occupational Diseases: A guide to diagnosis* establishes standardised diagnostic criteria for six asbestos-related diseases under the European Schedule of Occupational Diseases (Commission Recommendation 2003/670/EC). These criteria emphasise causal relationships between occupational exposure and disease development through systematic evaluation of exposure history, clinical presentation and temporal requirements.

The diagnostic approach requires confirmation of minimum exposure intensity and duration through occupational history, hygiene assessments and biological monitoring when available. All asbestos-related diseases develop slowly, typically requiring decades between initial exposure and disease onset, making comprehensive occupational history documentation essential.

### Disease-specific criteria

- Asbestosis (DIAG 301.21):
  - exposure: 10–15 years minimum significant exposure,
  - latency: 20–40 years post-exposure,
  - evidence: bilateral interstitial fibrosis (≥ 1/0 ILO classification), reticular opacities in lower lung zones,
  - function: reduced lung capacity (FVC < 80 %) or restrictive patterns.
- Mesothelioma (DIAG 301.22):
  - exposure: any occupational, domestic or environmental asbestos exposure,
  - latency: 30–50 years,
  - confirmation: histological evidence of malignant mesothelioma (epithelioid, sarcomatoid or biphasic),
  - support: asbestos bodies in pleural tissue (helpful but not mandatory).
- Lung cancer (DIAG 308):
  - exposure: substantial exposure equivalent to 25 fibre-years,
  - latency: 15–40 years,
  - evidence: histopathological confirmation plus radiological signs of asbestosis or elevated asbestos fibre counts,
  - risk factors: smoking amplifies risk but is not required.

- Fibrotic pleural diseases (DIAG 306):
  - exposure: documented asbestos exposure, even for a brief duration,
  - imaging: bilateral calcified pleural plaques or diffuse thickening > 5 mm,
  - function: reduced vital capacity (TLC < 80 %) or restrictive lung disease.
- Bronchial cancer (DIAG 302):
  - prerequisite: pre-existing confirmed asbestosis,
  - evidence: histopathological confirmation of bronchogenic carcinoma,
  - exclusion: no other primary cancer sources.
- Laryngeal cancer:
  - exposure: ≥ 40 fibre-years of substantial occupational exposure,
  - latency: 20–50 years,
  - pathology: squamous cell carcinoma confirmed via biopsy.

### General requirements

- **Occupational history.** Detailed documentation of job tasks, duration, workplace conditions and protective equipment use across entire working careers.
- **Biological monitoring.** Mineralogical analysis for asbestos fibres and bodies in biological samples provides additional exposure confirmation when workplace documentation is incomplete.
- **Multidisciplinary approach.** Collaboration between occupational physicians, radiologists, pathologists and industrial hygienists ensures comprehensive evaluation.
- **Differential diagnosis.** Systematic exclusion of non-occupational causes and other potential etiologies.

## A13.2 Helsinki Criteria

The Helsinki Criteria are guidelines for the diagnosis and attribution of asbestos-related diseases. First established in 1997 and revised in 2014, the criteria aim to harmonise clinical and exposure assessments across occupational health, medico-legal and compensation contexts.

This section provides examples of the broad types of considerations in the 2014 update of the Helsinki Criteria for the diagnosis and attribution of asbestos-related diseases, published by FIOH ([651]).

### Assessment components in the 2014 Helsinki Criteria

The 2014 Helsinki Criteria provide disease-specific guidance rather than a single, unified diagnostic framework. Examples of the broad themes considered include:

- exposure assessment,
- clinical assessment,
- radiological investigation,
- pulmonary function testing,
- histopathological analysis.

([651]) FIOH (2014), *Asbestos, Asbestosis, and Cancer: Helsinki Criteria for diagnosis and attribution 2014*, Helsinki, https://www.ttl.fi/sites/default/files/2023-04/asbestos-asbestosis-and-cancer-book.pdf.

Disease-specific diagnostic considerations are discussed for:

- asbestosis,
- lung cancer,
- mesothelioma,
- other malignancies either causally linked to asbestos or with suggestive evidence.

The Helsinki Criteria do not function as a stepwise diagnostic guideline. Instead, they present **expert consensus statements**, supported by epidemiological and clinical evidence, on how to attribute diseases to asbestos exposure in different contexts. The use of any particular assessment method depends on the disease being considered and the available evidence.

### Examples of scientific and methodological critiques

Several authors have raised concerns about potential limitations in the application or interpretation of the Helsinki Criteria. One such concern is the reliance on lung tissue fibre counts or asbestos body identification, which may lead to false negatives ([652]). Some have also pointed to the influence of the CAP/PPS 2010 pathology criteria, which require a minimum degree of fibrosis for histological diagnosis of asbestosis. This may contribute to underdiagnosis by excluding early-grade interstitial lung fibrosis ('grade 1' from the CAP/NIOSH 1982 classification) ([653]). In the absence of detailed historical exposure data, fibre-year estimates may be speculative ([654]). The Helsinki Criteria propose a threshold of 25 fibre-years/millilitre as indicating a doubling of lung cancer risk. However, some studies have reported increased lung cancer risk at exposure levels below 5 fibre-years/millilitre ([655]).

([652]) Baur, X., Woitowitz, H., Budnik, L. T., Egilman, D., Oliver, C. et al. (2017), *Asbestos, Asbestosis, and Cancer: The Helsinki Criteria for diagnosis and attribution – Critical need for revision of the 2014 update*, *American Journal of Industrial Medicine*, Vol. 60, Issue 5, https://pubmed.ncbi.nlm.nih.gov/28409857/; Tran, T., Egilman, D., Rigler, M. and Emory, T. (2021), 'A critique of Helsinki Criteria for using lung fiber levels to determine causation in mesothelioma cases', *Annals of Global Health*, Vol. 87, Issue 1, https://pmc.ncbi.nlm.nih.gov/articles/PMC8323524/; Collegium Ramazzini (2016), 'Collegium Ramazzini response to *Asbestos, Asbestosis, and Cancer:he Helsinki Criteria for diagnosis and attribution 2014: Recommendations*, *Scandinavian Journal of Work, Environment and Health*, Vol.42, Issue 1, pp. 91–94, https://pubmed.ncbi.nlm.nih.gov/26637163/.

([653]) Hammar, S. P. and Abraham, J. L. (2015), 'Commentary on pathologic diagnosis of asbestosis and critique of the 2010 Asbestosis Committee of the College of American Pathologists (CAP) and Pulmonary Pathology Society's (PPS) update on the diagnostic criteria for pathologic asbestosis', *American Journal of Industrial Medicine*, Vol. 58, Issue 10, pp. 1034–1039, https://pubmed.ncbi.nlm.nih.gov/26374489/; Roggli, V. L., Gibbs, A. R., Attanoos, R., Churg, A., Popper, H. et al. (2010), 'Pathology of asbestosis – An update of the diagnostic criteria: Report of the Asbestosis Committee of the College of American Pathologists and Pulmonary Pathology Society, *Archives of Pathology & Laboratory Medicine*, Vol. 134, Issue 3, pp. 462–480, https://pubmed.ncbi.nlm.nih.gov/20196674/.

([654]) Nielsen, L. S., Baelum, J., Rasmussen, J., Dahl, S., Olsen, K. E. et al. (2014), 'Occupational asbestos exposure and lung cancer – a systematic review of the literature', *Archives of Environmental & Occupational Health*, Vol. 69, Issue 4, pp. 191–206, https://pubmed.ncbi.nlm.nih.gov/24410115/; Egilman, D. (2009), 'Fiber types, asbestos potency, and environmental causation: A peer review of published work and legal and regulatory scientific testimony', *International Journal of Occupational & Environmental Health*, Vol. 15, Issue 2, pp. 202–228, https://pubmed.ncbi.nlm.nih.gov/19496487/.

([655]) Stayner, L., Smith, R., Bailer, J., Gilbert, S., Steenland, K. et al. (1997), 'Exposure-response analysis of risk of respiratory disease associated with occupational exposure to chrysotile asbestos', *Occupational and Environmental Medicine*, Vol. 54, Issue 9, pp. 646–652, https://pmc.ncbi.nlm.nih.gov/articles/PMC1128838/; Gustavsson, P., Nyberg, F., Pershagen, G., Schéele, P., Jackobsson, R. et al. (2002), 'Low-dose exposure to asbestos and lung cancer: Dose-response relations and interaction with smoking in a population-based case-referent study in Stockholm, Sweden', *American Journal of Epidemiology*, Vol. 155, Issue 11, pp. 1016–1022, https://pubmed.ncbi.nlm.nih.gov/12034580/.

# **Annex 14** Post-asbestos exposure programmes in six Member States

National asbestos surveillance programmes across Europe demonstrate significant methodological diversity, reflecting varying healthcare infrastructures, exposure histories and regulatory frameworks. The Polish Amiantus programme, Italian Tuscan programme, French SPIRALE initiative, Spanish PIVISTEA and Finnish Institute Model each offer distinct approaches to worker protection and health monitoring. The German programme is a federal insurance-based system with occupational health surveillance and compensation for asbestos-related diseases.

## A14.1 Programme structures and scope

### France

**Post-retirement Medical Surveillance (PRMS)** targets retirees exposed to asbestos and is funded by the National Health and Social Action Fund. It includes biennial chest X-rays and spirometry, with CT scans for high-risk groups. The SPIRALE programme (2010–present) actively identifies eligible retirees, increasing participation in PRMS ([656]).

The **Early Retirement Scheme (CAATA)** was established in 1999 for workers with heavy asbestos exposure. It is linked to compensation via the FIVA fund ([657]).

### Spain

The **integral health surveillance programme (PIVISTEA)** is a national registry tracking 5 778 workers as of 2008, with diagnoses including COPD, lung cancer and mesothelioma. It combines biennial clinical exams, spirometry and X-rays, enforced through collaboration between health authorities and unions. It emphasises harmonised protocols across regions to improve coverage ([658]).

([656]) Carton, M., Bonnaud, S., Nachtigal, M., Serrano, A., Carole, C. et al. (2011), 'Post-retirement surveillance of workers exposed to asbestos or wood dust: First results of the French national SPIRALE program', *Epidemiologia & Prevenzione*, Vol. 35, Issues 5–6, pp. 315–323, https://pmc.ncbi.nlm.nih.gov/articles/PMC3401973/.

([657]) Santé publique France (2019), 'Occupational health indicator. Occupational hazards due to asbestos', https://www.santepubliquefrance.fr/determinants-de-sante/exposition-a-des-agents-physiques/amiante/documents/rapport-synthese/occupational-health-indicators.-occupational-hazards-due-to-asbestos.

([658]) García Gómez, M., Pellejero, L. A., Buedo, V. E., Guzmán, Fernández, A. et al. (2006), 'Health surveillance of workers exposed to asbestos: An example of cooperation between the occupational prevention system and the national health system', *Revista Española de Salud Publica*, Vol. 80, Issue 1, pp. 27–39, https://pubmed.ncbi.nlm.nih.gov/16553258/; García Gómez, M., Castañeda, R., García López, V., Martínez Vidal, M., Villanueva, V. et al. (2011), 'Evaluation of the national health surveillance program of workers previously exposed in Spain (2008)', *Gaceta Sanitaria*, Vol. 26, Issue 1, pp. 45–50, https://www.sanidad.gob.es/areas/saludLaboral/amianto/docs/PIVISTEA008.pdf.

### Poland

The **Amiantus programme** (2000–present) represents one of the most comprehensive national asbestos surveillance initiatives ([659]). It provides lifelong medical monitoring for former asbestos-processing plant workers. Annual examinations include chest X-rays, spirometry and clinical evaluations. By 2019, 2 078 asbestos-related diseases were diagnosed, including asbestosis (90.5 %), lung cancer (5.8 %) and mesothelioma (3.7 %). It is managed by 13 regional occupational medicine units, with centralised data coordination.

### Germany

**Gesundheitsvorsorge Asbest (GVA)** is a central registry of approximately 600 000 workers exposed to asbestos, with 2–3-year medical exams (spirometry, X-rays). It is managed by statutory accident insurance institutions, emphasising early detection of pleural plaques and fibrosis. It tracks economic costs of asbestos-related diseases, including disability-adjusted life years ([660]).

### Finland

The **Occupational Health Guidelines** require systematic exposure monitoring in high-risk sectors (such as mining), with measurements every two years. Medical exams focus on respiratory function and compatibility with protective equipment. The **ASA Register** is used for mandatory reporting of workers exposed to carcinogens, including asbestos ([661]).

Finland implemented regulatory and technical measures from 1988 to 1992 through its national asbestos programme, which banned asbestos use. The Finnish approach emphasises the Helsinki Criteria for diagnosis, which were updated in 2014 to include new guidelines for screening asbestos-related lung cancer and follow-up of exposed workers.

### Italy

**Regional programmes (such as in Tuscany)** offer two-tiered health evaluations: basic (clinical exams, X-rays) and advanced (HRCT scans, specialist referrals). It follows 30-year post-exposure monitoring aligned with the Helsinki Criteria, prioritising high-exposure groups. It is funded regionally, with free access for residents under 80 years old and exposure within the last 30 years ([662]).

The **national framework** is mandated by Legislative Decree 81/2008, requiring registries of exposed workers and periodic exams ([663]).

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([659]) Kazan-Allen, L. (2004), 'Asbestos conference in Poland', https://ibasecretariat.org/lka_asb_conf_pol_may04.php.

([660]) Federal Institute for Occupational Safety and Health (BAUA) (2014), *National Asbestos Profile for Germany*, Dortmund, https://www.baua.de/EN/Service/Publications/Report/Gd80; Baur, X. (2018), 'Asbestos-related disorders in Germany: Background, politics, incidence, diagnostics and compensation', *International Journal of Environmental Research and Public Health*, Vol. 15, Issue 1, p. 143, https://pmc.ncbi.nlm.nih.gov/articles/PMC5800242/.

([661]) FIOH (2019), 'Asbestos risk management guidelines for mines', Helsinki, https://urn.fi/URN:ISBN:978-952-261-624-1.

([662]) Chellini, E., Battisti, F., Cristaudo, A., Sartorelli, P. and Calà, P. (2018), 'Health surveillance for former asbestos exposed worker: A specific programme developed in an Italian region', *Journal of Thoracic Disease*, Vol. 10, Issue 2, pp. 383–389, https://pmc.ncbi.nlm.nih.gov/articles/PMC5830570/.

([663]) Italy, Gazzetta Ufficiale (2008), Legislative Decree No 81/2008, Implementation of Article 1 of Law No 123 of 3 August 2007, on the protection of health and safety in the workplace work, https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2008-04-09;81!vig=2025-07-28.

**Table A14-1: Summary of programmes**

| Country | Ban year | Programme start year(s) | Programme name / key initiative | Notes |
|---|---|---|---|---|
| France | 1997 | 1995 (pilot), 2002 (national) | SPIRALE (pilot), PRMS (post-occupational medical surveillance) | Pilot in 1995; national roll-out in 2002 |
| Spain | 2002–2022 | 2003 (pilot), 2006 (broader implementation) | PIVISTEA (Programa Integral de Vigilancia de la Salud de los Trabajadores Expuestos a Amianto) | Pilots in Catalonia and Basque Country; national guidance in 2006, but implementation varies by region |
| Poland | 1997–1999 | 2000 (registry), 2009 (removal program) | Central register of workers exposed to asbestos, national programme for asbestos abatement (2009–2032) | Registry established in 2000; abatement and health surveillance programme in 2009 |
| Germany | 1993 | 1972 (registry), 1979 (follow-up), 1993 (ban) | BK 4103 (Occupational disease code), national surveillance | Registry and surveillance since the 1970s, with ongoing updates |
| Finland | 1994 | 1987 | National asbestos programme (screening), Finnish Institute of Occupational Health (FIOH) | Nationwide screening of exposed workers from 1987 to 1992 |
| Italy | 1992 | 1992 (law), 1994 (regional programmes), 2000s (expansion) | Law 257/92, regional surveillance programmes (such as Tuscany) | Law in 1992, regional programmes started in 1994, expanded in 2000s |

# A14.2 Diagnostic criteria and methods

Common tools used: HRCT preferred over X-rays for sensitivity. Helsinki Criteria (2014) widely referenced. France: CT scans recommended from age 50 under post-occupational surveillance. Germany: the stepwise diagnostic protocol combining exposure history, HRCT and lung function tests. Italy: the protocol includes baseline exams and follow-up for high-risk groups. Poland: a centralised reference centre coordinates standardised methodologies.

Diagnostic protocols generally include algorithm decisions, questionnaires, physical examinations, chest radiography, CT scans and spirometry. France employs particularly rigorous pathological confirmation, with three experts blindly classifying each case as certain, uncertain, unclassifiable or ruled out. When experts disagree, cases undergo collective review by at least 10 specialists.

Recognition criteria vary significantly between countries. Poland, Finland and other northern European countries often require either intense exposure (Helsinki Criteria or 25 fibres/millilitre/year threshold) or lung cancer associated with asbestosis. Southern European countries like France and Italy typically require only minimum exposure periods.

## A14.3 Population coverage and outcomes

**France** targets retirees via the SPIRALE programme, screening 50 000 newly retired individuals annually. 72 % of respondents were identified as possibly exposed to asbestos or wood dust (664).

**Spain**'s PIVISTEA programme included 22 158 workers by 2008 but faced regional disparities, with 24 % of regions lacking active surveillance (665).

**Poland**'s centralised registry covers workers from former asbestos-processing plants, with 18 943 screened (2003–2008) (666). A 2009–2032 programme targets 14.5 million tonnes of asbestos removal.

**Germany** registered 28 476 workers by 1979, with 6 582 under long-term follow-up (667). In 2016, 9 404 asbestos-related occupational disease cases were reported (668).

**Finland** screened 18 943 workers (1987–1992), identifying 4 133 with asbestos-related changes. There were an estimated 150+ annual asbestos-related deaths (669).

**Italy**'s regional programmes (such as in Tuscany) target residents aged < 80 with exposure within 30 years. There are an estimated 5 600 eligible subjects, with 1 405 screened (1994–2020) (670).

Disease recognition patterns across Europe show significant variations. Finland, Germany and Norway demonstrate high recognition ratios, likely reflecting effective detection systems for previously exposed workers. Conversely, extremely low ratios in Spain and certain other countries suggest under-reporting problems.

(664) Carton, M., Bonnaud, S., Nachtigal, M., Serrano, A., Carole, C. et al. (2011), 'Post-retirement surveillance of workers exposed to asbestos or wood dust: First results of the French national SPIRALE program', *Epidemiologia & Prevenzione*, Vol. 35, Issues 5–6, pp. 315–323, https://pmc.ncbi.nlm.nih.gov/articles/PMC3401973/.

(665) García Gómez, M., Castañeda, R., García López, V., Martínez Vidal, M.M., Villanueva, V. et al., 'Evaluation of the national health surveillance program of workers previously exposed in Spain (2008)', *Gaceta Sanitaria*, Vol. 26, Issue 1, pp. 45–50, https://www.sanidad.gob.es/areas/saludLaboral/amianto/docs/PIVISTEA008.pdf.

(666) Szeszenia-Dąbrowska, N., Świątkowska, B., Szubert, Z. and Wilczyńska, U. (2011), 'Asbestos in Poland: Occupational health problems', *International Journal of Occupational Medicine and Environmental Health*, Vol. 24, Issue 2, pp. 142–152, https://ijomeh.eu/pdf-2310-2086?filename=2086.pdf.

(667) Woitowitz, H. J., Beierl, L., Rathgeb, M., Schmidt, K., Rödelsperger, K. et al. (1981), 'Asbestos-related diseases in the Federal Republic of Germany', *American Journal of Industrial Medicine*, Vol. 2, Issue 1, pp. 71–78, https://pubmed.ncbi.nlm.nih.gov/7349037/.

(668) Baur, X. (2018), 'Asbestos-related disorders in Germany: Background, politics, incidence, diagnostics and compensation', *International Journal of Environmental Research and Public Health*, Vol. 15, Issue 1, p. 143, https://pmc.ncbi.nlm.nih.gov/articles/PMC5800242/.

(669) Huuskonen, M. S., Karjalainen, A., Tossavainen, A. and Rantanen, J. (1995), 'Asbestos and cancer in Finland', *La Medicina del Lavoro*, Vol. 86, Issue 5, pp. 426–434, https://pubmed.ncbi.nlm.nih.gov/8684292/.

(670) De Maria, L., Pentimone, F., Cavone, D., Caputi, A., Sponselli, S. et al. (2024), 'Clinical investigation of former workers exposed to asbestos: The health surveillance experience of an Italian university hospital', *Frontiers in Public Health*, Vol. 12, 1411910, https://pmc.ncbi.nlm.nih.gov/articles/PMC11215018/.

**Table A14-2: Examples of results of long-term follow-up post asbestos exposure**

| Country | Common diagnoses | Key statistics |
|---|---|---|
| France | Pleural plaques (70 % of compensated cases), mesothelioma, lung cancer | 15 000–20 000 annual occupational cancers ([a]). EUR 440 million paid via FIVA in 2015 ([b]) |
| Spain | Pleural plaques (74 %), asbestosis (22 %), mesothelioma (6 %), lung cancer (6 %) | 250–300 annual mesothelioma cases; new compensation fund established in 2022 ([c]) |
| Poland | Asbestosis, lung cancer, pleural mesothelioma | 4 983 asbestos-related cases reported (1970–2015), 3 193 post-1997 ban ([d]) |
| Germany | Mesothelioma (80 % compensation rate), lung cancer (20 % compensation rate) | 4 148 asbestos-related diseases recognised in 2016; under-reported lung cancer ([e]) |
| Finland | Mesothelioma, lung cancer, asbestosis | 150 annual asbestos-related deaths; peak incidence around 2010 ([f]) |
| Italy | Pleural plaques (49 %), asbestosis (36 %), mesothelioma (20 %), lung cancer (6 %) | 4 400 annual asbestos-related deaths (2010–2016) ([g]) |

*Sources:*

([a]) Carton, M., Bonnaud, S., Nachtigal, M., Serrano, A., Carole, C. et al. (2011), 'Post-retirement surveillance of workers exposed to asbestos or wood dust: First results of the French national SPIRALE Program', *Epidemiologia & Prevenzione*, Vol. 35, Issues 5–6, pp. 315–323, https://pmc.ncbi.nlm.nih.gov/articles/PMC3401973/.

([b]) EUROGIP (2016), 'France: Compensation claims sent to FIVA are constantly increasing', https://eurogip.fr/en/france-compensation-claims-sent-to-fiva-are-constantly-increasing/.

([c]) Ferrer Sancho, J. (2020), 'Registros de enfermedades causadas por el amianto – La importancia de conocer la dimension del problema' [Registry of diseases caused by asbestos – The importance of knowing the scale of the problem], *Archivos de Bronconeumologia*, Vol. 56, Issue 3, pp. 141–142, https://www.archbronconeumol.org/en-registry-diseases-caused-by-asbestos–articulo-S1579212920300069; EUROGIP (2022), 'Spain: Creation of a compensation fund for asbestos victims', https://eurogip.fr/en/spain-creation-of-a-compensation-fund-for-asbestos-victims/.

([d]) Świątkowska, B. and Szeszenia-Dąbrowska, N. (2017), 'Long-term epidemiological observation of asbestos-related diseases in Poland, 1970–2015, *Occupational Medicine*, Volume 67, Issue 3, 1 April 2017, pp. 182–187, https://academic.oup.com/occmed/article/67/3/182/2997523.

([e]) Baur, X. (2018), 'Asbestos-related disorders in Germany: Background, politics, incidence, diagnostics and compensation', *International Journal of Environmental Research and Public Health*, Vol. 15, Issue 1, p. 143, https://doi.org/10.3390/ijerph15010143.

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## A14.4 Key similarities and differences

All programmes have similarities; they share several fundamental characteristics:

- long-term follow-up recognition due to the extended latency periods of asbestos diseases (20–40 years);
- standardised diagnostic protocols incorporating chest imaging and clinical assessments;
- multi-disciplinary approaches involving pathologists, radiologists and occupational physicians;
- focus on major diseases: asbestosis, mesothelioma, lung cancer and pleural abnormalities.

The programmes also have differences, as shown below.

- Compensation approaches vary considerably. Poland provides comprehensive benefits including free medications and spa treatments. France awards compensation based solely on pleural plaque certification, while other countries require demonstrated lung capacity reduction.
- Diagnostic rigor differs significantly. France employs the most stringent pathological confirmation with multiple expert reviews, while other countries may rely more heavily on clinical assessment and standardised criteria.
- Population coverage ranges from Poland's targeted approach focusing on workers from specific plants to France's broader surveillance network covering all specialised medical facilities likely to encounter cases.
- Recognition systems show important variations in criteria for exposure assessment and disease attribution, with northern European countries generally requiring more stringent exposure documentation than southern European nations.
- The programmes collectively demonstrate the complexity of managing post-asbestos exposure surveillance while highlighting the need for continued international cooperation in standardising diagnostic criteria and sharing best practices for protecting former asbestos workers across Europe.

# **Annex 15** WCA waste codes and disposal methods

## A15.1 WCA waste codes

To correctly handle and dispose of WCA, this must be classified in accordance with the LOW. The LOW includes the following classes of asbestos waste and WCA ([671]):

- 06 07 01* Wastes containing asbestos from electrolysis;
- 06 13 04* Wastes from asbestos processing;
- 10 13 09* Wastes from asbestos-cement manufacture containing asbestos;
- 15 01 11* Metallic packaging containing a hazardous solid porous matrix (e.g. asbestos), including empty pressure containers;
- 16 01 11* Brake pads containing asbestos;
- 16 02 12* Discarded equipment containing free asbestos;
- 17 06 01* Insulation materials containing asbestos;
- 17 06 05* Construction materials containing asbestos.

The WCA may be potentially classified under other codes which, although they do not contain any specific mention of asbestos, are nevertheless used to classify and manage certain types of WCA ([672]):

- 01 04 07* Wastes containing dangerous substances produced by chemical and physical treatments of non-metallic minerals;
- 08 01 17* Wastes from paint or varnish removal containing organic solvents or other hazardous substances;
- 08 04 09* Waste adhesives and sealants containing organic solvents or other hazardous substances;
- 10 01 16* Fly ash from co-incineration containing hazardous substances;
- 15 02 02* Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated with hazardous substances;
- 15 01 10* Packaging containing residues of, or contaminated with hazardous substances;
- 16 10 01* Aqueous liquid wastes containing dangerous substances;
- 16 11 03* Other linings and refractories from metallurgical processes containing hazardous substances;
- 16 11 05* Linings and refractories from non-metallurgical processes containing hazardous substances;
- 17 01 06* Mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containingWaste containing asbestoszardous substances;

([671]) European Commission (2018), Commission notice on technical guidance on the classification of waste C/2018/1447, OJ C 124, 9.4.2018, pp. 1–134, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2018_124_R_0001.

([672]) Most of the codes listed were identified by INAIL, the Italian National Institute for Insurance against Accidents at Work, which has collected information on the LOW codes with which WCA is identified and accepted in landfills currently operating in Italy. For the full INAIL report see INAIL (2021), *Guidelines for classifying and managing asbestos-containing waste*, https://www.inail.it/portale/it/inail-comunica/pubblicazioni/catalogo-generale/catalogo-generale-dettaglio.2021.12.guidelines-for-classifying-and-managing-asbestos-containing-waste.html.

- 17 02 04* Glass, plastic and wood containing or contaminated with hazardous substances;
- 17 04 09* Metal waste contaminated with hazardous substances;
- 17 05 03* soil and stones containing hazardous substances;
- 17 06 03* Other insulation materials consisting of or containing hazardous substances;
- 17 08 01* Gypsum-based construction materials contaminated with hazardous substances;
- 17 09 03* Other wastes from construction and demolition activities (including mixed waste) containing dangerous substances;
- 19 03 04* Wastes marked as hazardous, partly stabilised;
- 19 03 06* Wastes marked as hazardous, solidified;
- 19 07 02* Landfill leachate containing hazardous substances;
- 19 12 11* Other wastes (including mixed materials) from mechanical waste treatment containing dangerous substances;
- 19 13 01* Solid waste produced by land reclamation operations containing dangerous substances;
- 19 03 03* Sludges from soil remediation containing hazardous substances;
- 20 01 35* End-of-life electrical and electronic equipment, other than those mentioned in 20 01 21 and 20 01 23, containing dangerous components.

## A15.2 Waste containing asbestos – national disposal methods

**Box A15-1 Disposal of waste containing asbestos across the EU**

- **Austria**: WCA must be landfilled in dedicated hazardous waste cells at authorised landfills. Waste must be double-bagged and labelled.
- **Belgium**: Flanders and Wallonia require sealed packaging and labelling. Only specific landfills accept WCA. Homeowners can use local collection points.
- **Bulgaria**: disposal is permitted at hazardous waste landfills. WCA must be sealed in double PE bags and labelled; handling and transport must be done by authorised operators.
- **Croatia**: WCA is disposed of in separate landfill sections for hazardous waste. It must be packed, labelled and transported by authorised companies.
- **Cyprus**: after each asbestos removal operation, the resulting waste must be disposed of in accordance with the relevant procedures. WCA is stored in sealed ISO containers and, at designated intervals when the Old Asbestos Mine in Amiantos Village is accessible, it is transported and buried there under the supervision of the Geological Survey Department of the Ministry of Agriculture, Natural Resources and Environment. For WCA originating from the British Sovereign Base Areas, it is similarly stored in sealed ISO containers at a designated temporary asbestos storage area before being transhipped to the United Kingdom for final disposal at authorised landfill sites.
- **Czechia**: WCA is sent to controlled landfills with dedicated cells. It must be packed in double plastic bags and properly labelled.

**Box A15-1 Disposal of waste containing asbestos across the EU**

- **Denmark**: non-dusty ACW is considered non-hazardous waste. Dusty ACW can only be disposed at landfills for mixed waste or mineral waste, but only if no other hazardous substances other than asbestos are present. It is disposed in separate cells or separate disposal units and covered daily to avoid the spreading of fibres with a minimum of 0.2 metres of soil. If the ACW is not wrapped in plastics, it must be moistened regularly. Landfilled ACW should not be compacted and there should be no unnecessary vehicle traffic. The final coverage of the unit containing ACW should be done as soon as possible and measures for tracing, locating and limiting access on landfilled ACW taken. ACW containing other hazardous substances is stored at waste management facilities, waiting for a permanent solution (such as export).
- **Estonia**: waste must be taken to licensed hazardous waste landfills. Local guidance specifies double packaging, labelling and record-keeping requirements.
- **Finland**: waste intended for inert landfills must be tested if there is suspicion of contamination or doubt regarding its conformity with inert waste criteria. Contaminated or materials with metals, asbestos, plastics, chemicals or substances posing an increased risk cannot be accepted in inert landfills. CDW with asbestos can go to non-hazardous landfills without testing if they meet specific WCA requirements. These requirements include no hazardous substances besides bound asbestos, daily covering, water sprinkling during depositing, capping to prevent asbestos fibre dispersion and post-closure land use restrictions to prevent human contact with the waste.
- **France**: WCA is accepted at dedicated asbestos landfills or in specific cells within hazardous waste landfills, in line with clear guidelines on wrapping and labelling. Around 7 000 tonnes of WCA per year is made thermally inert using a plasma torch. Additionally, WCA bound to inert materials that have retained their physical integrity – with no risk of fibre release – may be disposed of in non-hazardous waste storage facilities.
- **Germany**: in accordance with the German Regulation on ACW – LAGA M23, waste with asbestos below the assessment value of 0.010 mass % is 'asbestos-free' and can be used as recycled building material. WCA between 0.010 and 0.1 mass % is non-hazardous waste. WCA above 0.1 mass % is classified as hazardous. This can only be disposed at landfills for mixed waste or mineral waste, but only if no other hazardous substances other than asbestos are present. It is disposed in separate cells or separate disposal units and covered daily to avoid the spreading of fibres with a minimum of 0.25 metres of soil. If the WCA is not wrapped in plastics, it must be moistened regularly. Landfilled WCA should not be compacted and there should be no unnecessary vehicle traffic. The final coverage of the unit containing WCA should be done as soon as possible and measures for tracing, locating and limiting access on landfilled WCA taken. WCA contaminated with other hazardous substances is landfilled in underground storage facilities.
- **Greece**: waste must be transferred to licensed landfill sites that accept hazardous waste. Only trained and authorised personnel may handle it.
- **Hungary**: disposal is allowed at hazardous waste landfills. Waste must be double bagged and accompanied by proper documentation.
- **Ireland**: WCA must go to authorised hazardous waste landfills. Disposal is tightly regulated and coordinated through licensed contractors.
- **Italy**: waste is deposited in dedicated cells within hazardous waste landfills. Local authorities may provide collection services for small-scale waste.
- **Latvia**: disposal at designated hazardous waste landfills is mandatory. Strict packaging, labelling and handling procedures are in place.
- **Lithuania**: waste is deposited at licensed hazardous waste landfills. Public collection points are available in some municipalities.
- **Luxembourg**: WCA must be delivered to landfills authorised for hazardous waste; public campaigns support household-level disposal.

**Box A15-1 Disposal of waste containing asbestos across the EU**

- **Malta**: disposal is possible at the national hazardous waste facility, where WCA is properly labelled, packaged and handled under permit.
- **Netherlands**: WCA is landfilled in dedicated compartments within landfills. Municipalities support separate collection and public awareness.
- **Poland**: waste is disposed of at hazardous waste landfills, which must have specific licensing. Regional waste plans include guidance for asbestos disposal.
- **Portugal**: WCA is taken to landfills with hazardous waste permits. It must be tightly sealed, labelled and transported by licensed carriers.
- **Romania**: disposal is carried out in authorised landfill cells. Local authorities supervise the process and ensure packaging and labelling compliance.
- **Slovakia**: WCA is disposed of at specific landfills with dedicated cells. Packaging, sealing and labelling are regulated.
- **Slovenia**: waste is disposed of at authorised hazardous waste landfills, with mandatory sealing, labelling and record-keeping.
- **Spain**: WCA is taken to dedicated landfill cells that comply with national regulations. The use of certified containers and proper labelling is mandatory. Encapsulated non-friable asbestos materials may be disposed of in a Class II landfill, designated for non-hazardous waste, provided they are placed in a properly sealed cell. In contrast, encapsulated friable materials must be deposited in a Class III landfill, which is authorised to accept hazardous waste. WCA, whether from construction materials or other sources, may be accepted in Class II landfills (for non-hazardous waste) without the need for prior testing, provided specific conditions are met.
  - The waste must not contain any hazardous substances apart from asbestos, and the asbestos must be either bound in a matrix or securely packaged (such as in plastic or similar materials) to prevent fibre release during handling.
  - Construction and other asbestos-containing waste must be placed in a dedicated, well-sealed cell and must not be mixed with other waste types.
  - Packaged WCA delivered to the landfill must be handled carefully to ensure that neither the packaging nor its contents are damaged.
  - To avoid fibre dispersion, the waste must be covered daily and before each compaction using suitable, non-sharp materials. If the WCA is not packaged, it must be regularly moistened. The final closure of the cell or landfill must be completed with an appropriate top cover that also avoids sharp materials.
  - No activities should take place within the landfill or cell that could result in fibre release, such as drilling or puncturing.
  - After closure, the landfill operator must maintain and submit to the competent environmental authority a detailed map indicating the precise horizontal and vertical location of the WCA. Measures must also be put in place to restrict future land use and prevent any human exposure to the buried material.
- **Sweden**: Waste must be landfilled in separate, sealed compartments of authorised landfills. Transport and documentation are strictly regulated.

*Source:* European Commission: Directorate-General for Environment, Akelytė, R., Chiabrando, F., Camboni, M., Ledda, C. et al. (2024), *Study on asbestos waste management practices and treatment technologies*, Publications Office of the European Union, Luxembourg, https://data.europa.eu/doi/10.2779/251640.

# **Annex 16** Thresholds for audits and site-specific waste management plans in various countries

Below are some examples of thresholds for audits and site-specific waste management plans in various countries ([673]).

In Austria, pre-demolition audit is mandatory for demolition projects with an estimated waste production of more than 750 tonnes. The requirements for the audit depend on whether the volume of the building is greater or smaller than 3 500 $m^3$.

In Denmark, a screening and mapping with respect to hazardous substances must be carried out for buildings demolished or renovated and where more than one tonne of CDW is expected. An audit of the building must be carried out if the screening shows the potential presence of hazardous substances. There are also requirements on the removal of hazardous waste from CDW, which in practice means that contaminants other than PCB (Polychlorinated Biphenyls) must be included in the inventories to fulfil this obligation.

In Germany, the pre-demolition audit is, until now, mandatory only following the detection of harmful substances. These audits arise essentially due to the obligation to evaluate the risk and adopt safety measures when workers may be exposed to hazardous materials or materials containing dangerous substances.

In Belgium (Flanders), pre-demolition audits are not mandatory, but a pre-demolition inventory of the types/quantities of materials present in buildings is mandatory for non-residential buildings with an enclosed volume over 1 000 $m^3$. Hazardous waste and other waste materials are to be identified. Furthermore, the follow-up by a recognised demolition management organisation is mandatory (demolition follow-up plan for non-residential buildings with an enclosed volume over 1 000 $m^3$ and residential buildings with an enclosed volume over 5 000 $m^3$), and a demolition certificate is required upon completion of the works.

In Sweden, there is no threshold. Pre-demolition audits are always required.

In the Netherlands, Dutch municipalities require a pre-demolition audit for each demolition in which more than 10 $m^3$ of waste is produced. The audit corresponds to an inventory indicating the nature and quantity of expected waste and a statement regarding the intended destination of the materials.

In the Basque Country (northern Spain), a pre-demolition audit must be carried out for demolitions where the ground/soil or where the building/installation to be demolished is listed in the inventory of potentially contaminated soils – as elaborated by the government. Hazardous materials must be identified and removed under the supervision of an external environmental company that must give the ‘OK’ to demolish before starting the demolition. Non-hazardous materials, both prior to and after the demolition, must be managed under the supervision of the external environmental company and the government.

([673]) European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Oberender, A., Fruergaard Astrup, T., Frydkjær Witte, S., Camboni, M. et al. (2024), *EU construction & demolition waste management protocol including guidelines for pre-demolition and pre-renovation audits of construction works – Updated edition 2024*, Publications Office of the European Union, Luxembourg, https://data.europa.eu/doi/10.2873/77980.

In France, a compulsory audit is to be carried out for any significant demolition and renovation operation with a cumulative floor area greater than 1 000 $m^2$ and operations involving at least one building that has hosted an agricultural, industrial or commercial activity and has been the site for the use, storage, manufacturing or distribution of one or more substances classified as dangerous. At the end of the work, an inventory check must also be carried out.

In Norway, requirements are in place for carrying out an audit with respect to hazardous waste, CDW and products with potential for reuse.

In Portugal, the waste management legislation stipulates that in the case of demolition or renovation of public buildings or public infrastructures, the producers of CDW must carry out a pre-demolition audit.

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