Guide on Best Practice

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.

A guide issued by the Senior Labour Inspectors Committee (SLIC)

A non-binding guide to best practice

EUROPEAN COMMISSION
Employment, Social Affairs and Equal Opportunities DG
Social Dialogue, Social Rights, Working Conditions, Adaptation to Change
Health, safety and hygiene at work

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.

The Senior Labour Inspectors Committee (SLIC) identified the need for a practical guide on how best to prevent or minimise risks from asbestos in the diverse works that involve or may involve asbestos. This guide has been prepared for use in the 2006 asbestos campaign undertaken throughout Europe by an independent contractor (IOM – Institute of Occupational Medicine) further to an open call for tender. It provides a common basis of information for the labour inspector, the employer and the worker. The European Social Partners (trade union and employers representatives), members of the Advisory Committee for Safety and Health at Work, contributed to the discussion of drafts within the steering committee.

Within Europe, national legislation reflects the common requirements of the relevant European Directives. However, the legislation is implemented through national regulations that may differ between member states. There is also extensive guidance available within some member states. This guide seeks to promote the best practices, as available from any member state or elsewhere, and it includes state of the art improvements in practice.

The European Asbestos Conference in 2003 produced the "*Dresden Declaration on the Protection of Workers against Asbestos*", which recommended that the European Commission and the SLIC should produce practical guidelines such as these (Zieschang *et al,* 2003*)*.

The guide is focussed on practical prevention, and it covers a wide range of types of work that involve, or may involve, asbestos.

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FOREWORD

The European Conference on the Dangers of Asbestos, held 2003 in Dresden and attended by representatives from countries all over Europe, EU Commission and ILO, called attention to the fact that asbestos remains the primary carcinogenic toxic agent in the workplace in most countries. With an estimated 20,000 lung-cancer deaths and 10,000 mesothelioma cases per year in the industrialised countries of Western Europe North America and Japan, it is clear that asbestos exposure is still a major health problem which needs to be put back on the agenda and given top priority in our prevention activities. Asbestos continues to be of central concern in measures to secure workers' health.

According to European legislation, the marketing and use of products or substances containing asbestos has been banned since January 2005 (1999/77/EC Directive). More stringent measures to protect workers from the risks of exposure to asbestos fibres are in force from the 15th April 2006. (2003/18/EC Directive amending Directive 83/477/EEC). Despite these legal advances, the practical problem of preventing exposure to asbestos in the course of removal, demolition, servicing and maintenance activities remains. Additionally, in times of close economic ties and globalisation, we have to pay attention not to counteract our efforts by re-import of asbestos-containing materials.

Following the recommendations of the *Dresden Declaration* the Senior Labour Inspectors Committee (SLIC) set up a working group to produce practical guidelines on best practices for the remaining activities at risk of asbestos exposure, and to launch a European Campaign in 2006 to monitor the implementation of the relevant directives.

The "Good Practice Guide" will

- help identify asbestos and asbestos products during use, maintenance and servicing of plant, equipment and buildings and raise awareness of their presence;
- describe good practice on how to remove asbestos (*inter alia* by dust suppression, enclosure and protective equipment) and how to handle asbestos-cement products and wastes;
- encourage an approach to protective equipment and clothing which takes into account human factors and individual variability.

It will be made available to employers and employees.

The Labour Inspection Campaign will be accomplished in the second half of 2006 in all Member States of the European Union, where maintenance, demolition, removal or disposal of asbestos containing materials take place, to protect the workers' health. The inspections will be carried out by the national Labour Inspectorates (and when appropriate by the Labour Health Authorities). The objective of the campaign is to support the implementation of the Directive 2003/18/EC amending Directive 83/477/EEC, the provisions of which all Member States of the European Union should have implemented by 15th April 2006 at the latest. The inspection campaign will be preceded by information and training activities.

With regard to our partners outside Europe, Labour Inspectorates of EU Member States offer their assistance. Existing SLIC training material, the documents of the

2006 Campaign and the Best Practice Guideline can be used in any other country which is willing to tackle the health hazards of asbestos and asbestos use. For them, ILO Convention 162 can serve as a minimum standard; this Convention and the best practice examples represent the base level below which the international community should not fall.

Dear Reader,

This *"Practical Guide on Best Practice to Minimise Asbestos-Risks in Work that Involves (or May Involve) Asbestos"* is the result of the joint activity of the Senior Labour Inspectors Committee and employers' and employees' representatives in the EU Commission's Advisory Committee for Safety and Health taking a further step to dispose of asbestos from European work places. We hope that you will read it and keep it at hand.

The main target groups are the employers, the employees and the labour inspectors.

- For the employer, the guide provides information on the state of the art technical, organisational, and personal safety and health protection measures which he is obliged to apply.
- For the employee, the guide gives information about protective measures, focuses on key points that the worker should be trained on, and motivates to actively contribute to safe and healthy working conditions.
- For the inspector, the guide describes the key aspects which should be examined during an inspection visit.

The guide is supplemented by a special website of the **European Agency for Occupational Safety and Health at Work** where you will find additional information and special links to national websites on health and safety related to the risks of asbestos exposure.

http://osha.eu.int/OSHA

Beyond its use in the 2006 Asbestos Inspection Campaign, this Guide aims at providing all actors in the field of work under the risk of exposure to asbestos with a common European baseline for best practices.

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1 INTRODUCTION

This guide is issued by the Senior Labour Inspectors Committee (SLIC), working with the Social Partners (representatives of trades unions and employers) Advisory Committee on Safety and Health (ACSH). It is intended to provide a common and shared information resource for use by labour inspectors, employers and employees throughout Europe. The guide was prepared to support the 2006 campaign on asbestos, but with the intention that it should be useful after 2006 and therefore may be revised to cover advances in best practice during future years.

The scope of the guide is ambitious in that it presents information on three situations:

- work where there may be asbestos involved (e.g. in buildings where there is a risk of asbestos being found unexpectedly due to incomplete records or incomplete removal);
- work where the exposure to airborne asbestos is expected to be low;
- work which involves greater risk of exposure to airborne asbestos and is undertaken by specialist contractors.

Therefore, the guide comprises several chapters which are relevant to all three situations and some which focus on each in particular.

- Chapters 1 to 4 give the background, describing what asbestos is, its health effects, and the materials that contain asbestos and where they may be found.
- Chapters 5 to 7 describe the planning and preparations prior to undertaking work, i.e. a risk assessment, preparation of written instructions (or plan of work), the decision making process on the work to be undertaken and whether work has to be treated as notifiable and whether medical surveillance will be required, and the training that should be given to personnel.
- Chapters 8 to 12 describe the practical arrangements for undertaking work that involves (or may involve asbestos). Chapter 8 describes the equipment needed, Chapter 9 describes the general approach for controlling exposure, Chapter 10 describes procedures for maintenance work where there is a risk of encountering asbestos; Chapter 11 describes procedures for work that has been assessed as lower risk; and Chapter 12 describes procedures for notifiable asbestos work (e.g. asbestos removal work).
- Chapters 13 to 18 expand on particular aspects: demolition (Chapter 13), the worker and the work environment (Chapter 14), waste disposal (Chapter 15), monitoring and measurement (Chapter 16), the other persons with particular roles to play e.g. the client, architects and building facilities managers (Chapter 17), and asbestos in other situations e.g. in vehicles and machinery (Chapter 18).
- Chapter 19 describes the medical surveillance.

Work on asbestos can involve working at heights, in hot conditions, in restrictive and cumbersome protective equipment. Since this guide focuses on prevention of the asbestos-related risks to health, it is important to note that other risks (such as falls from heights, perhaps through a fragile asbestos cement roof) must not be forgotten.

There are some distinct differences in approach among member states in the regulations and practices for controlling and minimising risks from asbestos exposure. There are generally

advantages and disadvantages to each approach, and the guide offers commentary and explanation where there are alternative methods that are arguably "best practice" for the approach and the situation.

The criteria for selecting methods as qualifying for inclusion in the guide were that the practice should be either:

- a reliable and proven approach, that is understood to work well;
- a practice that combines features from separate sources of guidance, and therefore should be the best in theory;
- a practice that is arguably the best in the particular circumstances;
- a state of art advance in practice.

The intention is that the guide should be as concise and readable as possible, with avoidance of any repetition. Therefore, there is some cross referring between sections, for example to explain just once the considerations involved in selection and use of protective clothing.

In a concise guide covering a wide range of practical tasks, there may be occasional omissions of details. Omissions should therefore not be read as intentional exclusion of other actions.

The European Asbestos Worker Protection Directive 83/477/EEC as last amended by Directive 2003/18/EC is implemented within the Member States by national regulations that may differ in practical details. Therefore, this guide is deliberately presented as a non-binding guide so that it can offer the best practical advice without constraint as to whether that best practice is a binding requirement under each and every set of national regulations in the EU member states. Annex 1 contains a list of relevant national regulations, as supplied from each of the Member States.

As this guide focuses on the prevention of risks of exposure to asbestos, it does not attempt to cover the requirements of the Mobile Sites Directive (92/57/EEC). So, for example, the hygiene facilities for personal decontamination would need to be accompanied by adequate welfare facilities, as for any work on a mobile site. Where a health and Safety plan is required under the Mobile Sites Directive, then it should include safe procedures for work with asbestos. Where a health and safety file is required under that Directive, it should contain documentation of asbestos on site (e.g. clearance certificates).

This guide is written with remarks explicitly addressed to the employer, the worker and inspector. However, readers are likely to find the guidance aimed at others informative. A chapter is also included specifically to help the other people who are also connected with asbestos work, such as the client who commissions asbestos removal, or the persons who occupy a building after asbestos removal, or the occupational health and safety adviser.

The purpose of the guide is to provide practical advice on how to eliminate and minimise exposure to airborne asbestos. Most of the content is focussed on good and best practice to reduce exposure to asbestos.

2 ASBESTOS

Asbestos is the fibrous form of several naturally occurring minerals. The main forms are:

- Chrysotile (white asbestos);
- Crocidolite (blue asbestos);
- Asbestos gruenerite, (amosite, brown asbestos);
- Asbestos actinolite;
- Asbestos anthophyllite;
- Asbestos tremolite.

The first three have been the main commercially used varieties of asbestos. Although they are known by their colour, they cannot be reliably identified solely by colour; analysis in a laboratory is necessary.

Asbestos may be incorporated into a range of products (see Chapter 4). If the fibres can be released, then danger arises from inhalation of airborne fibres. The microscopic fibres can deposit in the lungs and remain there for many years, and may cause disease many years, usually several decades, later.

If the asbestos fibres are only weakly bound into the product or material, because of the friability or condition of the product/material, then that increases the risk of fibres being released. By contrast, if the fibres are tightly bound into a non-friable material, then the fibres are less likely to be released. Several member states have procedures that assign priority to removing the asbestos-containing materials that are considered more dangerous.

All varieties of asbestos are Class 1 carcinogens, that is they are known to cause cancers in humans. The European Asbestos Worker Protection Directive 83/477/EEC as last modified by Directive 2003/18/EC requires that worker's exposure be kept below 0.1 fibres/ml *for all types of asbestos*. Exposure to all types of asbestos must be reduced to a minimum and in any case below the limit value.

Some member states require that consideration also be given to the type of asbestos in decisions on the priority of a hazard. That is because the epidemiological evidence indicates that, for a given concentration of fibres (measured by the standard method for workplaces), crocidolite asbestos is more dangerous than amosite, which in turn is more dangerous than chrysotile. However, that does not change the practical requirement to use best practice to prevent exposure to any asbestos.

This guide sets out practical guidance on preventing or minimising exposure to any asbestos.

The annual consumption of asbestos in Europe has changed greatly over the 20th Century, as illustrated in Figure 2.1. The data (for consumption summed over 27 European nations, quoted from Virta (2003)) clearly show that consumption increased rapidly from about 1950 until about 1980, and then started to reduce as some member states introduced restrictions or bans on the use of asbestos. The decline became more rapid with the bans introduced by European Directives in the 1990s. A comprehensive ban on the use and marketing of products containing asbestos (following the European Commission Directive 1999/77/EC) came into force on the 1st January 2005. Bans on extraction of asbestos and on the manufacture and processing of products containing asbestos (following the Asbestos Worker Protection Directive 2003/18/EC) came into force in April 2006. Consequently, the asbestos problems remaining in Europe are due to the asbestos that has been installed in buildings, plant or equipment.

There were also important differences between EU member Sates, with some countries reducing asbestos consumption from about 1980 while others continued to use it until the end of the century.

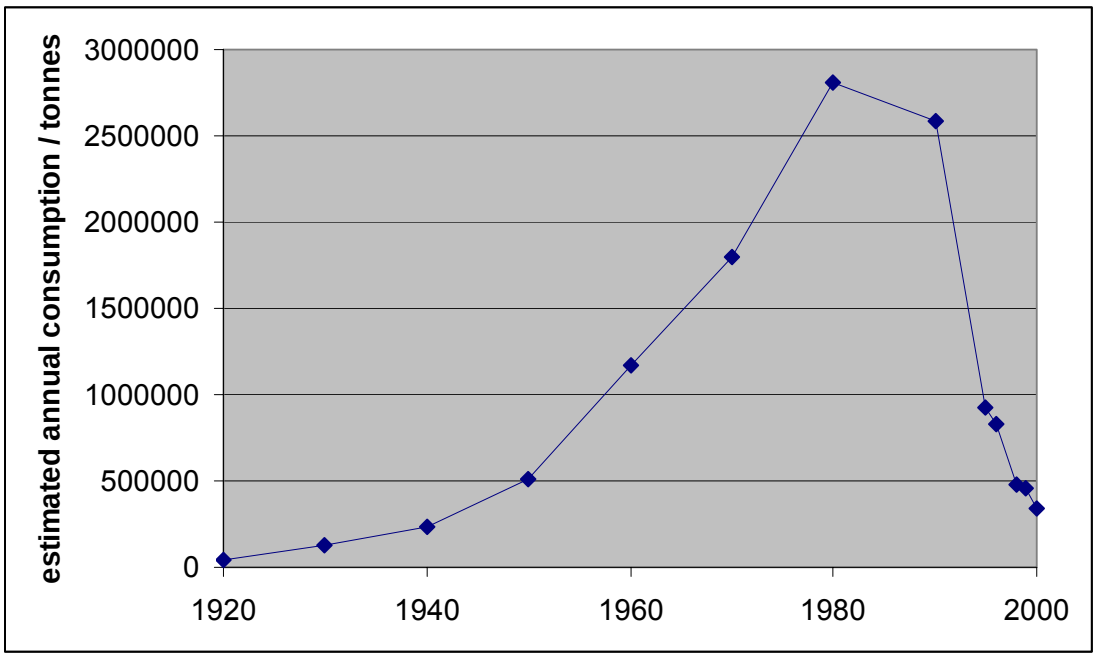


Figure 2.1 Estimated overall consumption of asbestos in Europe, from 1920 to 2000, (source of data Virta (2003)).

Figure 2.2 Scanning electron micrograph showing chrysotile asbestos fibres

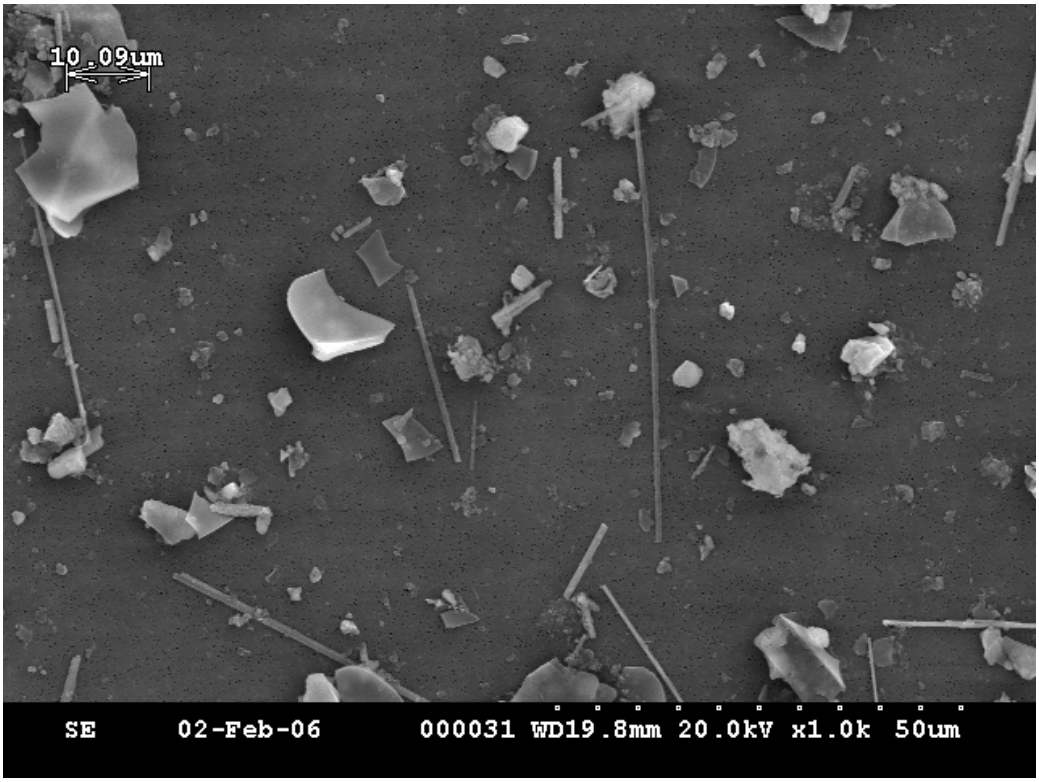


Figure 2.3 Scanning electron micrograph showing amosite asbestos fibres

3 HEALTH EFFECTS OF ASBESTOS

Asbestos is dangerous when it is dispersed into the air as very small fibres that are invisible to the naked eye. Breathing in those asbestos fibres can lead to one of three diseases:

- Asbestosis, a scarring of the lung tissue;
- Lung cancer;
- Mesothelioma, a cancer of the pleura (the smooth lubricated double membrane sacs containing the lungs) or of the peritoneum (the smooth double membrane lining the inside of the abdominal cavity).

Asbestosis severely hinders breathing and can be a contributory cause of death. Lung cancer is fatal in about 95% of cases. Lung cancer can also follow in cases of asbestosis. Mesothelioma is not curable, and usually leads to death within 12 to 18 months of diagnosis.

There have been suggestions that asbestos exposure may lead to cancer of the larynx or of the gastrointestinal tract. Ingestion of asbestos (e.g. in contaminated drinking water) has been suspected as a cause of gastrointestinal cancer and at least one study has shown an increased risk from unusually high concentrations of asbestos ingested in drinking water. However, these suggestions have not been consistently supported by the evidence from relevant studies.

Exposure to asbestos can also lead to pleural plaques. Pleural plaques are discrete fibrous or partially calcified thickened areas which arise from the surface of the pleura and can be detected in a chest X-ray or a Computer Tomogram (CT) examination. Pleural plaques do not become malignant and do not normally cause impaired lung function.

In Europe, there are many thousands of deaths annually from asbestos related diseases. At a conference on asbestos in 2003 (initiated by the Senior Labour Inspectors' Committee of the EC), the likely total deaths annually across 7 European countries (UK, Belgium, Germany, Switzerland, Norway, Poland, Estonia) was estimated to be about 15,000 http://www.hvbg.de/e/asbest/konfrep/konfrep/repbeitr/takala_en.pdf .

At the same conference, the relationship between asbestos consumption in Germany and the delayed incidence of new compensated asbestos-related disease was described by Woitowitz with the graph reproduced in Figure 2.1 below. The delayed incidence means that new cases of asbestos related disease will continue to occur due to exposure in the period when asbestos consumption was at its peak. Now that production of asbestos containing products or materials has ceased in the EU, there is still a risk of exposure to asbestos from the materials and products that are still in buildings and plant and equipment.

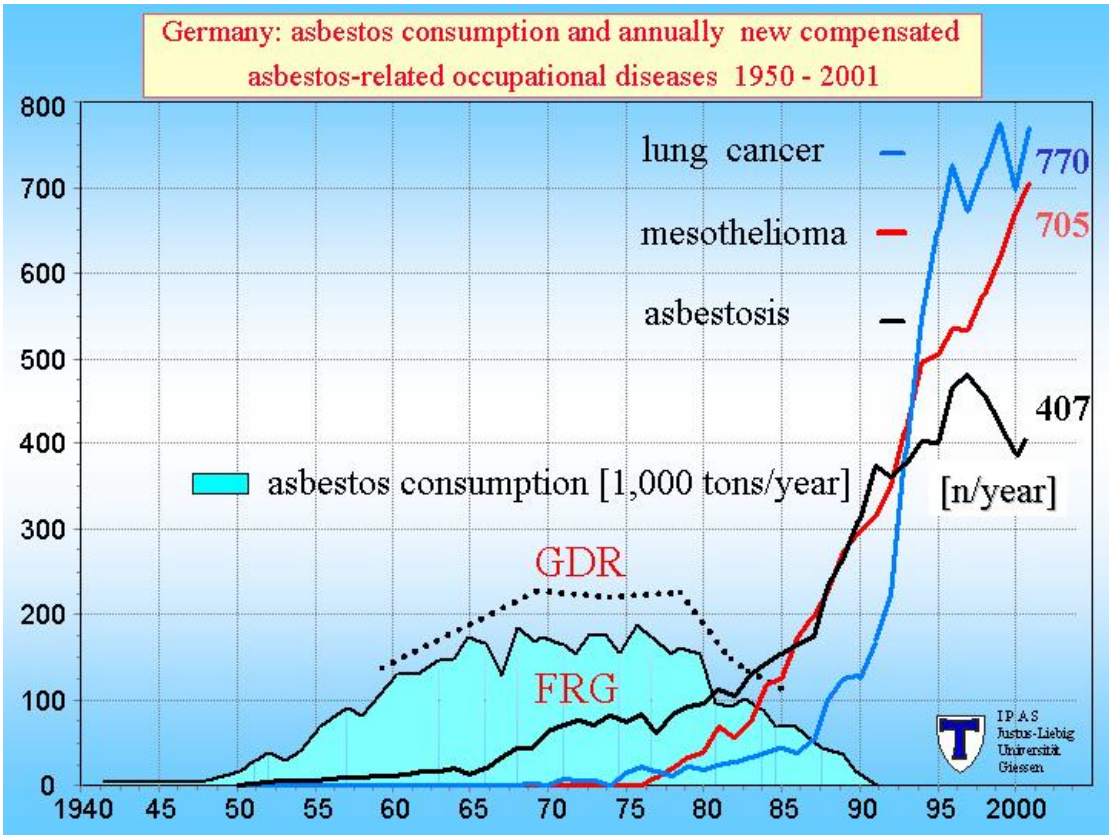


Figure 3.1 Annual asbestos consumption and annual incidence of disease in Germany (reproduced from Woitowitz (2003) http://www.hvbg.de/e/asbest/konfrep/konfrep/repbeitr/woitowitz_en.pdf .

In the UK, there were about 1900 deaths from mesothelioma annually in the years 2001, 2002 and 2003; and the incidence of mesothelioma is expected to peak at between 2000 to 2400 deaths annually between 2011 and 2015 (http://www.hse.gov.uk/statistics/tables/meso01.htm). Deaths from lung cancer due to exposure to asbestos are estimated to be about twice as many as the mesothelioma deaths. So the total number of deaths annually from asbestos related cancer is estimated to be about 5,500 to 6,000 currently in the UK alone.

Diagnosis and statistics for the cancers (especially mesothelioma, which is difficult to diagnose) may be less reliable in states where there has been less awareness of the asbestos risks.

These diseases generally take a long time to develop, and normally do not appear until at least 10 to 60 years or more after exposure started. The average latency time from first exposure for mesothelioma is approximately 35-40 years. The average latency period for lung cancer has been estimated to be of the order of 20 to 40 years. There is no immediate awareness of an adverse effect on inhaling asbestos fibres.

The risk of asbestosis arises from high exposure to asbestos over several years, and the disease generally occurs more than a decade after exposure started. The incidence of asbestosis still being reported in Western Europe almost certainly arises from high exposures decades ago.

The risks of asbestos-related lung cancer and mesothelioma increase with exposure. Keeping exposure to asbestos as low as possible reduces the risk of disease, however there is no known threshold below which there is absolutely no risk of these cancers. Therefore, it is important to use the *best practice* to remove or minimise the risk of exposure.

The lifetime risks of mesothelioma are believed to be higher for someone exposed at a young age than for someone exposed later in life.

It is widely recognised that lung cancer is much more common in smokers than non-smokers. The risk of asbestos-related lung cancer is also much greater for the smoker than for the non-smoker.

If you employ people whose work may involve exposure to asbestos, you should:

- follow best practice (as in this guide);
- ensure that they are adequately trained and informed of the risks;
- ensure that the communication is effective (e.g. that it is not impeded by language barriers);
- ensure that they understand the importance of minimising exposure;
- provide information about the increased risks from the combination of smoking and asbestos exposure to encourage smokers to stop smoking;
- comply with national regulations regarding work that may involve asbestos.

If your work involves possible exposure to asbestos, you should:

- be aware of the risks from asbestos exposure;
- understand the importance of keeping exposure as low as possible;
- if you smoke, consider stopping smoking; and
- follow best practice, as advised in this guide, for work with asbestos.

If you are the labour inspector, you should:

- look for availability of information and reminders (posters, leaflets etc.) about the health risks that arise from asbestos exposure;
- check that the workers have been informed adequately about the combined risks due to smoking and exposure to asbestos, e.g. by observing leaflets or posters, and by asking responses from those involved;
- check for compliance with national regulations on these issues.

4 ASBESTOS CONTAINING MATERIALS

4.1 INTRODUCTION

Asbestos has been widely used in many applications, as a strengthening component or as thermal, electrical or acoustic insulation. It has been used in friction products, gaskets, seals, glues. Its chemical resistance has led to use in some processes, such as filtration or electrolytic processes. It has been used in commercial, industrial and domestic buildings, as illustrated in Figure 4.1. It is also found as insulation in railway carriages and in ships and other vehicles including aircraft and some military vehicles.

The extent to which a material is liable to release asbestos fibres will depend on whether it is intact or damaged. The condition of asbestos-containing materials may change over time, for example due to damage, wear or weathering.

There are substantial differences between various materials in how friable they are and how easily fibres may be released. Table 4.1 gives examples of asbestos-containing materials and their typical use. These examples of asbestos-containing materials are listed in an order that is indicative of their potential for release of asbestos fibres. Materials likely to release fibres easily are at the top of the list. A few of the asbestos-containing materials (the bitumen compounds and rubber or polymer flooring materials) are combustible. These combustible materials must NOT be disposed of by burning, as that would release the asbestos fibres.

Table 4.1 Examples of materials containing asbestos, with an indication of asbestos content

Material containing asbestos	Typical use	Examples of where it is found
Sprayed coatings (may contain 85% asbestos)	Thermal and acoustic insulation, and fire and condensation protection.	On structural steel work in large or multi-storey buildings, as fire breaks in ceiling voids, and on swimming pool ceilings.
Loose-fill (may be 100% asbestos)	Thermal and acoustic insulation.	Loft insulation, cable holes.
Lagging and packings (from 1% to 100% asbestos)	Thermal insulation of pipes, boilers, pressure vessels, preformed pipe sections, slabs, tape, rope, corrugated paper, quilts, felts and blankets.	In public buildings, schools factories and hospitals on pipes and boilers. Asbestos quilts on industrial steam boilers, cord or rope wound around pipework sometimes covered with cement type coating.
Asbestos insulating boards (may contain 16 to 40% asbestos)	Fire protection, thermal and acoustic insulation, and in general building work.	In almost all types of buildings. In ducts and as fire breaks, infill panels, partitions, ceiling tiles, roof underlays, wall lining, bath panels. Domestic boiler casings, partition and ceiling panels, oven linings and suspended floor systems.

Material containing asbestos	Typical use	Examples of where it is found
Ropes, yarns (may be 100% asbestos)	Lagging, jointing and packing materials, heat/fire resistant gaskets and seals, caulking in brickwork, boiler and flue sealing, and plaited tubing for electric cable.	Central heating boilers, furnaces, incinerators, and other high temperature plant.
Cloth (may be 100% asbestos)	Jointing and packing, thermal insulation and lagging, (fire resistant blankets, mattresses and fire-protective curtains), gloves, aprons and overalls.	In foundries, laboratories and kitchens. Fire curtains in theatres.
Millboard, paper and paper products (90 to 100% asbestos)	General heat insulation and fire protection, electrical and heat insulation of electrical equipment.	Roofing felt and damp proof courses, steel composite, wall cladding and roofing, vinyl flooring, facing to combustible boards, flame resistant laminate, and corrugated pipe insulation.
Asbestos cement (may contain 10 to 15% asbestos)	Profiled sheets for roofing, wall cladding and weather boarding.	Partitioning in farm buildings and in housing, shuttering in industrial buildings, decorative panels, bath panels, soffits, linings to walls and ceilings, portable buildings, propagation beds in horticulture, fire surrounds, and composite panels for fire protection.
	Tiles and slates.	Cladding, decking, promenades tiles, and roofing.
	Preformed moulded products.	Cisterns and tanks, drains, sewer pipes, rainwater ducts and gutters, flue pipes, fencing, roofing components, cable troughs and conduits, ventilation ducts, and window boxes.
Asbestos bitumen products (may contain about 5% asbestos)	Roofing felts, damp-proof courses, semi-rigid roofing, gutter linings and flashings, and coatings on metal.	Flat roofs, down pipes.
Flooring material (may contain up to 25% asbestos)	Floor tiles (thermoplastic floor tiles containing typically 25% asbestos), asbestos-paper backed PVC flooring.	Schools, hospitals, housing.

Material containing asbestos	Typical use	Examples of where it is found
Textured coatings and paints (may contain 1 to 5% asbestos)	Coatings on walls and ceilings	Were fashionable and used in only some member states.
Mastics, sealants, and adhesives. (may contain about 5 to 10% asbestos)	May have been used wherever any such sealants used.	Window seal, flooring.
Reinforced plastics. (may contain about 5 to 10% asbestos)	Plastic coated panels, PVC panels and cladding, reinforcement of domestic goods.	Plastic coated panels (e.g. Marinite) in accommodation areas of ships, window sills.
Wall plugging compound.	Fixing screws for wall-mounted appliances.	Electrical boxes.

There are substantial differences between Member States in the extent to which the various types of asbestos-containing material have been used. In some, the great majority of asbestos usage has been in asbestos cement. While in other member states (e.g. the UK), the use of textured coatings (a coating a few mm thick and containing about 5% asbestos) to decorate ceilings or walls had a period of being in vogue.

Table 4.2 gives examples of the use of some of these asbestos-containing materials in domestic and industrial appliances.

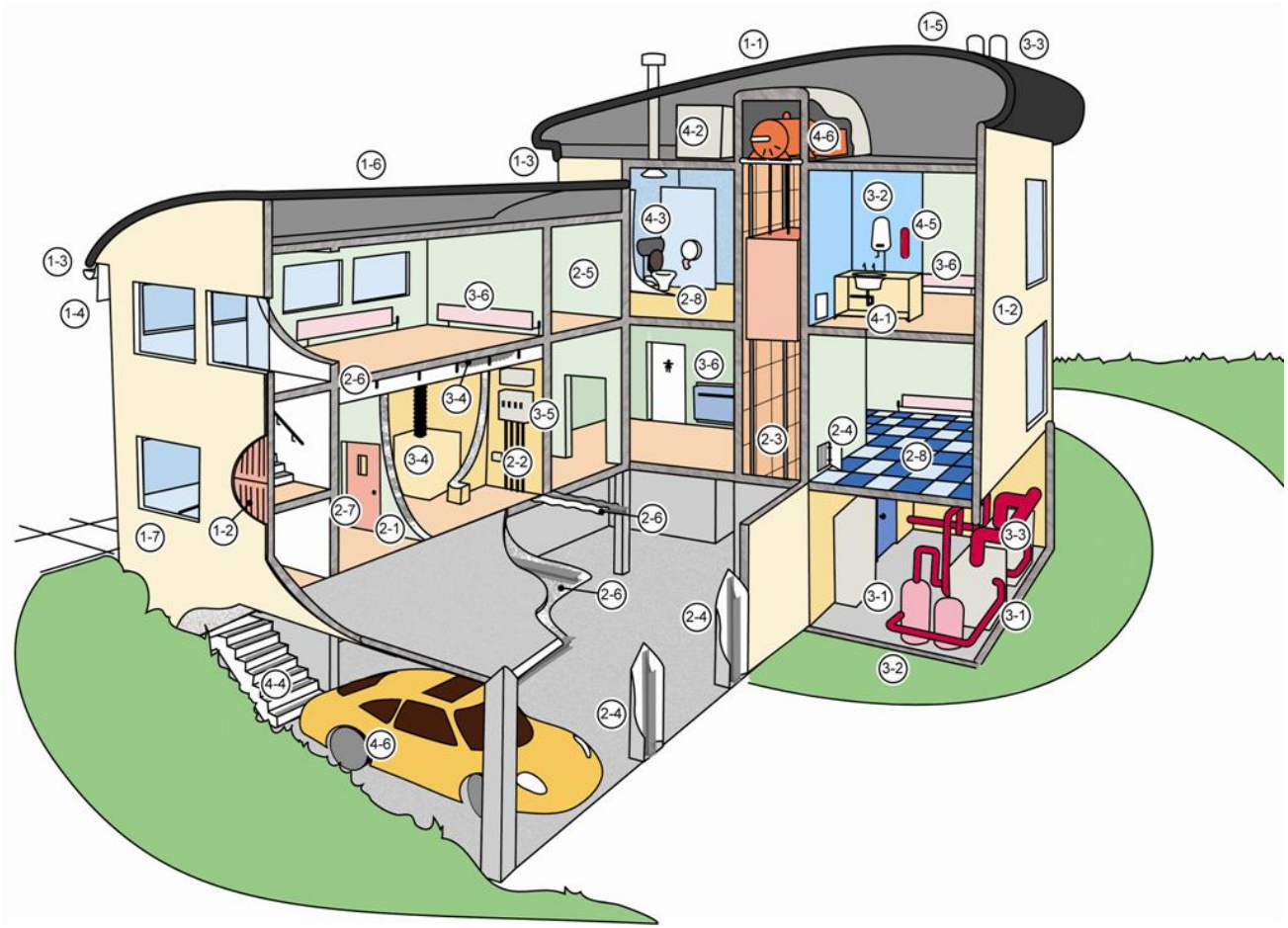


Figure 4.1 The asbestos building showing common locations of asbestos-containing materials.

Key to Figure 4.1

1 Roof/external construction
1-1 Roof sheets/tiles
1-2 Wall cladding/coating
1-3 Guttering/drain pipes
1-4 Soffit panels
1-5 Chimney cowls
1-6 Roofing felt
1-7 Under window panels

2 Internal construction
Walls/ceilings
2-1 Partitions
2-2 Panels to electrical equipment, heater units, cookers, baths, cupboards
2-3 Lining panels to lift shaft
2-4 Riser access panels, riser boxing
2-5 Textured coatings
2-6 Sprayed coating to structural elements, suspended ceiling tiles, firebreaks, loft/ceiling insulation
Door
2-7 Panels, cores, beading to vision panels
Floor
2-8 Tiles, linoleum, lining to raised floors

3 Heating, ventilation & electrical equipment
3-1 Boiler/calorifiers: External & internal insulation, gaskets
3-2 Pipework: Insulation, gaskets, paper lining
3-3 Flues & gaskets
3-4 Ductwork: Insulation, gaskets, internal lining, anti-vibration gaiters
3-5 Electrical switch gear: Internal elements, surround panels
3-6 Heater unit: Gaskets, surround panels

4 Other items
4-1 Bitumen sink pads
4-2 Water tanks
4-3 Toilet cisterns & seats
4-4 Stair nosing
4-5 Fire blankets
4-6 Brake/clutch lining (car in the garage and the lift motor)

Table 4.2 Examples of asbestos-containing materials or products used in domestic and other appliances.

Material containing asbestos	Domestic appliance
Thermal insulation and friction products, asbestos paper, element formers, brake pads, compressed fibre gaskets and seals, rubberised /polymer gaskets and seals.	Hairdryers, fan and radiant electric heaters, toasters , washing machines, tumble dryers, spin dryers, dish washers, refrigerators and freezers.
Insulating board, fire cement, compressed fibre seals, rubberised/polymer seals.	Cookers, fires.
Millboard.	Simmering mats.
Paper, millboard, asbestos cement.	Iron stands.
Asbestos textiles.	Oven gloves, fire blankets.
Fibre panels, sometimes with wire or glass fibre mesh covering.	Catalytic gas heaters.
Aluminium backed paper, cloth and insulating board.	Gas warm air heaters.
Asbestos plaster.	Boilers / pipework.
Insulating blocks, insulating board, paper, string compressed fibre washers, rubber /polymer-bonded washers.	Electric warm air storage heaters.
String washers.	Radiators.
	General appliances
Friction products	Brake pads, clutch pads in lorries and cars and other vehicles.

Products containing asbestos have been made by various manufacturers and marketed under various trade-names. In many cases, products that have in the past contained asbestos have subsequently been manufactured without asbestos. An extensive list of the details of trade-names, manufacturer, and dates defining when the manufactured product contained asbestos is available for products sold in France from the INRS website (INRS ED1475, http://www.inrs.fr/inrs-pub/inrs01.nsf/B20B5BF9E88608EDC1256CD900519F98/$File/ed1475.pdf).

4.2 WHAT YOU SHOULD DO

The possibility of encountering asbestos is likely to arise in general building maintenance or service work. If you are involved in the work in these sectors, then the guidance offered here will be relevant to you.

If you employ or control people whose work involves the possibility of encountering asbestos-containing materials (such as those as those described above), you should:

- provide adequate training so that they can recognise materials that may contain asbestos and understand what to do when and if they come across materials suspected to contain asbestos;
- obtain good and reliable information on the presence or absence of asbestos-containing materials, e.g. from building plans and/or the building architects, (some member states require the responsible person to produce an inventory of the asbestos-containing materials in a building);
- ensure that good records of the materials which are confirmed as containing or not containing asbestos are kept (e.g. within your organisation or by the building owner);
- provide written information on the site regarding the presence of known asbestos-containing materials, including an asbestos inventory and warning signs where appropriate;
- provide written instructions on the procedures to follow if asbestos-containing materials are encountered unexpectedly (in line with recommendations in Chapters 9 and 10).

If your work is likely to involve disturbing any of the above materials, you should:

- have been provided with information on whether they do or do not contain asbestos before starting work;
- know how to recognise the products that may contain asbestos;
- know what action to take if you encounter asbestos-containing materials (see Chapters 5 to 10).

If you are the labour inspector, you should:

- check that maintenance workers have been adequately trained to recognise which materials may contain asbestos;
- check that there is sufficient information available on which materials do or do not contain asbestos;

- check that there are arrangements for obtaining laboratory analysis of samples of materials suspected of containing asbestos;
- check that there is a person responsible for ordering the work to stop immediately if materials suspected of containing asbestos are encountered;
- check for compliance with national regulations on these issues.

Figure 4.2 Asbestos insulating board boxing partially removed to show asbestos cement flue pipe behind.

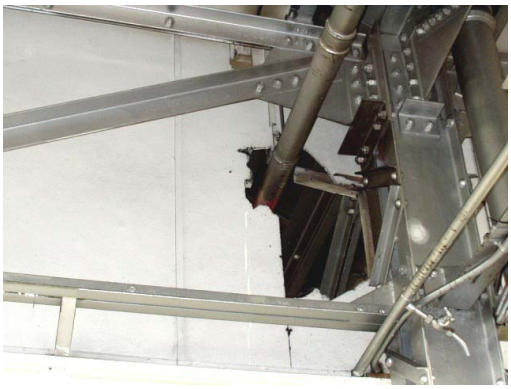


Figure 4.3 Asbestos insulating board partition wall. This example illustrates the practical difficulties in constructing a suitable enclosure and also shows the surfaces where asbestos dust may collect during the process of removal.

Figure 4.4. Penetration of a wall to show asbestos pipe insulation.

Figure 4.5 Asbestos cement flue with asbestos rope seals passing through asbestos infill panel.

Figure 4.6 Asbestos floor tiles

Figure 4.7 Asbestos roofing felt

Figure 4.8 Asbestos insulation on steam pipeworks

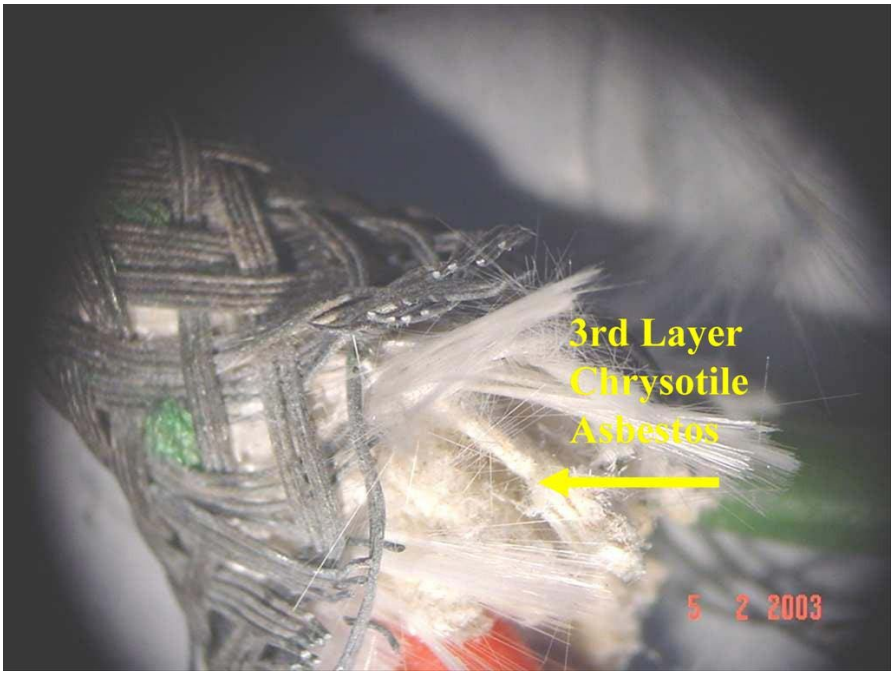


Figure 4.9 Insulated cables with an asbestos layer in the insulation.

Figure 4.10 Asbestos cement cladding on a factory

Figure 4.11 Asbestos insulation on structural steel.

Figure 4.12 Asbestos rope sealing on chimney door. The image on the right is a close up view of the rope.

5 RISK ASSESSMENT AND PLAN PRIOR TO WORK

5.1 INTRODUCTION

In producing a risk assessment and plan of work, it is always best practice to keep a written record of the information that was used to assess the risks involved.

Information about where asbestos is located may require a survey to be undertaken by competent experts. The procedures for undertaking such surveys are not included in this guide, but it is important that the responsible person (employer, manager, worker) knows that this information is required. The information should be provided in a format which is readily comprehensible.

Once that information is available, it is important that any limitations in the information be appreciated. For example, a survey may not have penetrated into wall cavities.

In some Member States, there may be a policy of removal of asbestos (especially weakly-bound asbestos) whenever possible. In that case, the confirmation of asbestos may lead to a legal requirement to organise safe removal.

In other Member States, a decision on whether to retain any asbestos containing material is based on an evaluation of the factors that affect the risk of release of asbestos fibres from the retained material. That decision making process is outlined in Section 6.2. Subject to that decision, materials containing asbestos can be kept in place and managed as a hazard that is safe as long as it is well maintained, well sealed, properly recorded (e.g. on building plans), and appropriately labelled.

The management of the retained asbestos needs to be regularly reviewed to check that the material is still in good condition and that the system of managing and controlling any work in that vicinity is effective. If the asbestos is not in a suitable condition or situation for it to be kept in a safe condition in place, then removal must be arranged.

Once a decision has been reached to undertake work that may encounter or disturb asbestos-containing materials, a written assessment of the hazard and the consequent risks shall be produced. The risk assessment should be specific to the site, i.e. take account of the details of that site, and it should include an evaluation of possible exposure with a summary of the experience of monitoring exposure in similar circumstances. The risk assessment should consider the risks of asbestos exposure for the workers and for others in the vicinity (e.g. occupants) who might be affected. This may be based on measurements for similar or previous work. Typical exposure concentrations, as measured by the UK Health and Safety Executive, for work involving asbestos lagging, coating and asbestos insulating board are shown in Appendix 1.

Written instructions (sometimes called a written plan of work) should be prepared specifically for each job.

The conditions under which work with asbestos is undertaken create certain practical difficulties in regard to emergencies such as suddenly incapacitating illness or injury. Access may be restricted (especially if the work is conducted in an enclosure, see Chapter 12); the wearing of respiratory protective equipment impedes communication. The emergency procedures need to cover the response to an accident or illness within the enclosure:

- the number and identity of first aiders;

- how to recognise first aiders (when everyone is wearing protective clothing and full face respiratory protection);
- how to communicate from inside an enclosure to outside (especially in emergencies);
- emergency rapid access points in an enclosure, and when and how they should be used;
- entry procedures for emergency personnel;
- the locations of emergency exits and emergency equipment;
- the detailed decontamination procedures to be used following urgent access in emergency case scenarios (e.g. urgent access to aid an injured and incapacitated worker in the enclosure).

Emergency procedures should also specify the actions to be taken in the event of an emergency evacuation of the building or site (e.g. fire or bomb alarm) by operatives in potentially asbestos-contaminated personal protective clothing.

The written risk assessment and written instructions (plan of work) should be readily available on site, and should take account of foreseeable emergencies specifying the procedures to be followed and persons who would be responsible should such an event arise.

5.2 WHAT YOU NEED TO DO

If you employ or control people whose work is likely to involve disturbing asbestos-containing materials, you should:

- have a written risk assessment and written plan of work prepared specifically for each job;
- ensure that the risk assessment takes account of the features of the particular site and the activities, and includes a sufficient basis for the estimate of possible exposure;
- ensure that the risk assessment considers exposure of all who may be affected (e.g. operatives, occupants, other contractors etc);
- ensure that the plan is sufficiently detailed and that it relates to the particular site and activities;
- include in the plan any preparatory work (e.g. prior to setting up an enclosure);
- include a clear site diagram in the plan, showing the location of the equipment (e.g. enclosure, airlocks, decontamination unit, negative pressure units, transit route for waste, and the secure waste container);
- consult with the workers who have the practical knowledge to ensure that the risk assessment and plan of work are realistic;
- ensure that copies of the risk assessment and plan of work are available on site and for those involved in doing the work;
- make sure that the risk assessment and plan of work are explained to the workforce and to anyone else affected by the work;
- ensure that copies of the risk assessment and plan of work have been supplied to the enforcement agency, if required by national legislation;
- include procedures for dealing with emergency situations (including those described in Section 5.1).

If you are about to undertake work that may involve disturbing asbestos-containing materials, you should:

- be consulted on the risk assessment and the plan of work;
- offer your suggestions on practical issues that affect the plan of work and risk assessment;
- have a copy of the risk assessment and plan of work available to you;
- make sure that you understand the written plan.

If you are the labour inspector, you should assess whether:

- there is an adequate and suitable risk assessment, for exposure of operatives and other persons, available on site;
- there are written instructions (plan of work), available on site, with site specific details;
- there is an emergency plan (e.g. within the plan of work);
- employees have an adequate understanding of the risk assessment and plan of work;
- the risk assessment and plan of work demonstrate that account has been taken of the input from employees.

5.3 EXAMPLE OF A CHECKLIST FOR A PLAN OF WORK

The national enforcing authority may provide guidance on the format for any plan of work (e.g. the "*Method statement aide memoire*" issued by the UK HSE Asbestos Licensing Unit. http://www.hse.gov.uk/aboutus/meetings/alg/policy/02-03.pdf). A plan of work may cross refer to generic information about methods of work, and then that information should be attached. The plan of work should always be comprehensive in describing any site specific and task specific features (e.g. a plan of the site and any departures from the generic methods).

This checklist for a plan of work is based on the guidance in INRS, 1998 ED 815, Annex 6, and the UK Health and Safety Executive *"method statement aide memoire"*.

The example given here is a non-exhaustive list of items to be included or considered in the plan of work. It is intended to cover the issues for notifiable work (described in Chapter 12). For lower risk work (as defined in Chapter 11), the plan of work may be less extensive but should include the sections or items marked with a *.

*** Title Page**

Under the banner of the organisation undertaking the works:

- date of issue;
- general title of project (Asbestos removal, encapsulation etc.);
- nature of the asbestos-containing material;
- national licences or permits to undertake the work (if required by national legislation), date and duration of the work;
- name of the person in charge of the works; and the name of the client;
- the exact address of the site;
- name of the medical doctor (in member states where a medical doctor is involved in the health and safety management);

- planned date of arrival of the contractor on site.

*** Administrative information**

- contractor or organisation undertaking the work on the asbestos-containing materials (name of legal Director, representative on site, with addresses, telephone and fax numbers);
- persons in charge of the works (telephone, fax);
- named consultant on site;
- laboratory charged with measurements on site (address, telephone, fax);
- subcontractors, especially for preparatory works;
- list of official organisations involved.

*** Information about the site**

- * situation (e.g. shop in shopping mall);
- * nature of the works;
  - planned treatment, removal and/or encapsulation;
  - type(s) of asbestos (crocidolite, chrysotile etc);
  - nature and condition of materials containing asbestos, their quantities and their extent across the site;
- * programme for the works, including when the work is going to take place (dates and times);
- personnel;
- daily routine schedule;
- designated areas;
- signage (types of signs, numbers, and locations);
- waste disposal route;
- location of the decontamination unit;
- welfare facilities;
- factors specific to the site (proximity to other activities; hot conditions; air conditioning or heating systems; working at heights etc.).

Factors which affect the plan for removal or encapsulation

- analysis of risk, due to asbestos and other factors, associated either with the workplace (e.g. with electricity, gas, steam, fire, machines, working at heights) or with the materials and equipment used;
- measurements of the fibre concentrations (or asbestos fibre concentrations) before the intervention;
- the likely asbestos exposure during removal or encapsulation.

Installation of the works (enclosure etc) on site

- personnel facilities (refreshment and sanitary);

- segregation and signage of the area;
- impact on other activities in the building or vicinity.

Preparatory Works

- removal of furniture and materials;
- creation of network of supplies and drainage (electricity, water, air ventilation);
- adapting building systems in the zone of works (fire alarms, electricity, gas, central heating, air conditioning etc.);
- materials and equipment needed for the work.

Preparation of the asbestos works area

- isolation and enclosure (see Chapter 12)
- achieving negative pressure;
- pre-cleaning of the work area and the fixtures and fittings, those to be removed and those to be left in place and covered;
- enclosure of the area (safe work procedures, materials, and emergency exits);
- negative pressure and air extraction characteristics;
- smoke tests, process and criteria for acceptability.

Removal or encapsulation of asbestos

- methods (injection, spraying,, manual scraping, etc), equipment (injection equipment, sprays,) and materials (wetting agents, cleaning materials etc),
- protection of operatives (respiratory protective equipment);
- quality control procedures (for work methods and efficacy of treatment).

Programme of Controls (monitoring and measurements)

- sampling plan for the period of the works, (see Chapter 16);
- systems for monitoring and controlling the effectiveness of the enclosure;
- plan of the intended sampling points.

Removal of Waste

- conditions of the waste materials (asbestos and non-asbestos), procedures for handling;
- disposal of waste, safe storage on site, and process of disposal to authorised sites.

Clean up of the work zone

- operational methods for removing surface covering and cleaning surfaces;
- methods for decontamination of materials and equipment used in the work;
- visual inspection and checks on cleanliness. System for maintaining negative pressure. Nominated person in charge of the control systems.

Restitution of area to normal use after the works

- sampling to test for airborne asbestos fibres, sampling plan and laboratory due to undertake the work;
- final clear up of equipment from the zone.

Description and characteristics of the materials and equipment used in the course of the work

- equipment for the personnel (including type of respiratory protective equipment);
- decontamination unit (and record of tests confirming that it is not contaminated from previous work);
- the enclosure and associated equipment;
    - size of the enclosure;
    - negative pressure units, (number and capacity, air change rate);
    - air locks, bag locks;
    - water heaters, water filters;
    - lighting;
    - injection equipment, and other dust suppression equipment;
    - emergency equipment;
- consumables (filters, etc.).

Emergency procedures

- first aiders; emergency procedures for situations of varying urgency and seriousness;
- procedures put in place for emergency help;
- communications (to summon help from within the enclosure);
- co-ordination with external emergency services.

Plans and diagrams of the site

- the location of site / enclosure relative to other activities and enterprises;
- the enclosure, its size and shape, and location of:
    - viewing panels and closed circuit TV (if needed),
    - negative pressure units and associated air discharge points,
    - asbestos rated (H-type) vacuum cleaners,
    - bag lock, waste transfer route, secure storage for waste (e.g. skip),
- location of the decontamination unit, and transit routes (if the decontamination unit does not connect directly to the enclosure) and air lock entry to the enclosure;
- the layout of the networks and facilities involved in the operation of the works (e.g. air intake points, supplies of water and electricity for the decontamination unit);
- the location of connection points *if* using a network of compressed air supply connection points to feed respiratory protective equipment.

6 DECISION PROCESS

6.1 DECISIONS TO BE MADE

This chapter outlines the logical decision making process involved in:

- determining whether it is more sensible to leave asbestos-containing materials in place (putting it into a sufficiently safe condition under suitable monitoring and management) or to arrange for removal of the asbestos;

- deciding whether certain maintenance works can be undertaken with sufficiently low risk of asbestos exposure that they fall within the "sporadic and low intensity exposure" tasks that can be undertaken without prior notification to the responsible authority.

6.2 GUIDANCE ON DECISIONS ON ASBESTOS CONTAINING MATERIALS IN BUILDINGS

Before undertaking work which may involve asbestos-containing materials, there are a series of key decisions to be made. These are closely linked to the risk assessment and planning process (Chapter 5). The risk assessments may determine the appropriate choice in your decision and the decisions will affect the purpose and content of the plans to be made.

Several factors are relevant to making decisions on the work that may be required. Some Member States have national regulations that call for asbestos-containing materials (especially materials with weakly bound fibres) to be removed where practicable. Other member states allow asbestos containing materials to be kept *in situ* dependent on certain criteria relating to the condition, location, ease of access and hence overall likelihood that the material may present a risk of fibres being released. A decision as to whether materials may be made safe (e.g. by sealing and/or enclosing) and kept in place must therefore also take account of national regulations.

Subject to national regulations, asbestos-containing materials that are in a safe state (that is in good repair or enclosed or encapsulated) may be left in place, provided that there is effective monitoring and management of the retained material. Wherever some asbestos-containing material is to be left in place, then it must be identified in the records and plans of the building so that its presence will be taken into account whenever any future works arise. There should also be a system in place to monitor its condition, and manage its presence (e.g. to maintain the material in good condition).

Figure 6.1 and 6.2 give logical flow charts that start from identifying whether a material is asbestos or not, and then provide a framework for reaching a decision on whether to remove it or not. Once the material is known to contain asbestos, the series of subsequent questions concern whether it is:

- in good condition; or
- not readily repairable;
- accessible (potentially making it prone to accidental or deliberate damage, whereas lack of access may hinder and restrict removal);
- damaged with more than minor and superficial damage (making repair unreliable);

- extensively damage (i.e. widespread damage making enclosure of damaged parts not feasible)
- not suitable for being sealed or enclosed (for any other reasons).

Not surprisingly, if material is not in good condition, is not readily repairable, is readily accessible (and therefore potentially vulnerable to further damage and disturbance), extensively damaged, and there is no practicable way to seal or enclose, then the material must be removed. This decision would hold for any type of asbestos-containing material.

The alternative outcome to removal is that the asbestos-containing materials could be made safe (by being kept in good repair, or being enclosed) and be monitored and managed in place.

Even if the asbestos-containing material can be made safe, monitored and managed in place, there is a need to consider the possible requirements of general building renovation work. If the materials will obstruct general building renovation work, then the correct decision may be to remove the asbestos-containing material.

For asbestos cement and other materials with tightly bound fibres, the decision making process may be more likely to lead to a decision to keep the material in place and record, monitor and manage.

Figure 6.1 Decision flow chart for materials suspected of containing asbestos

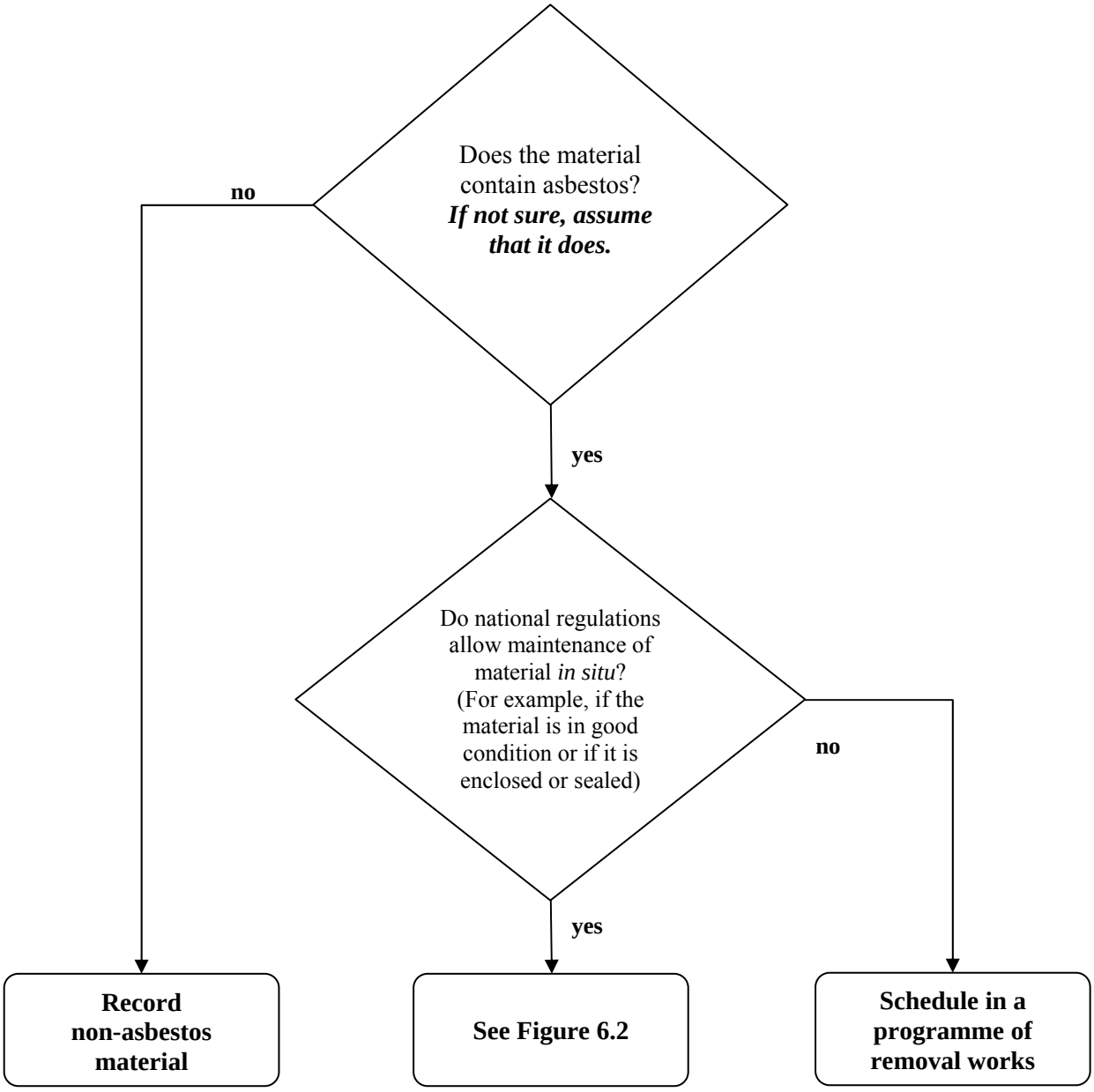
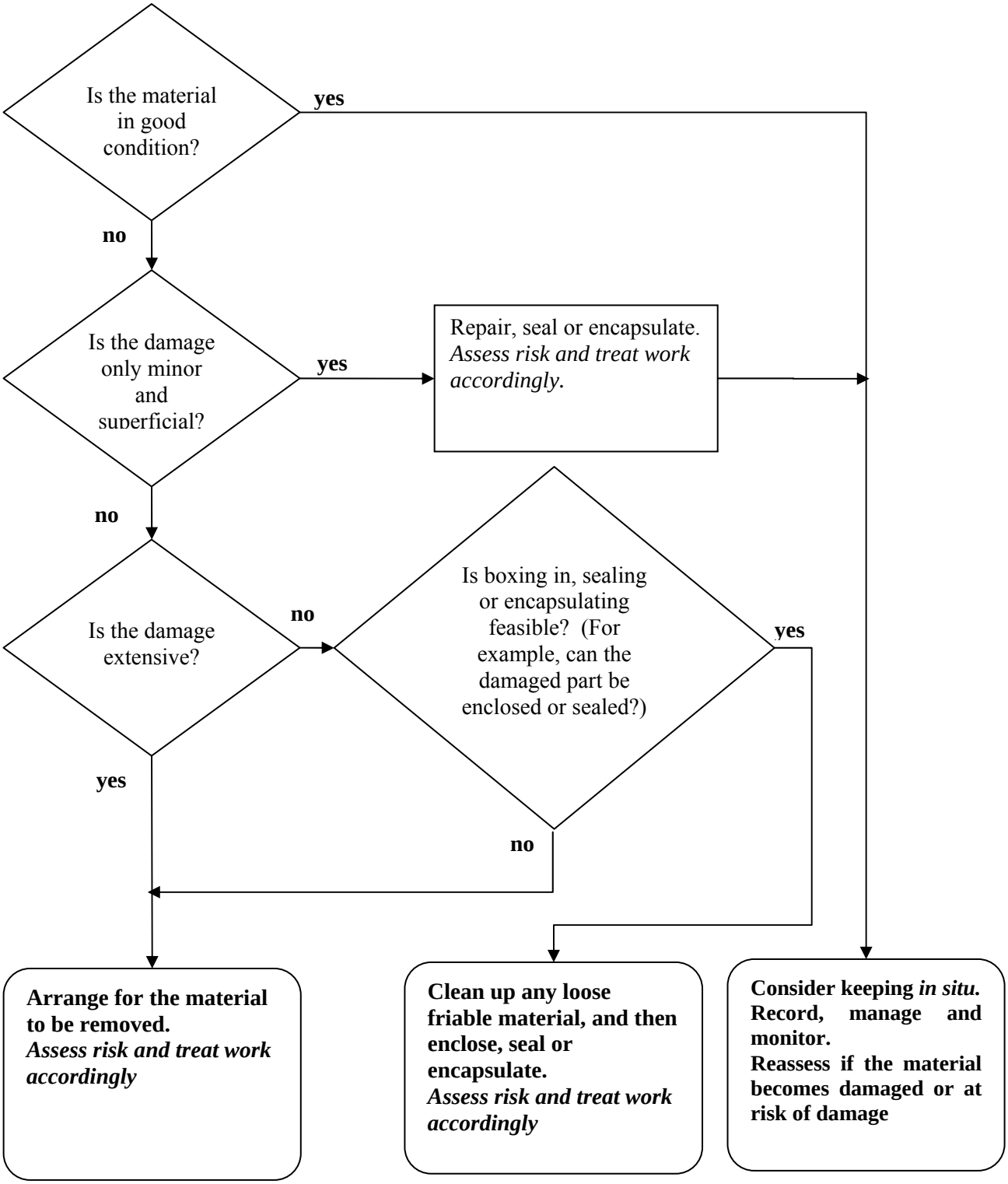


Figure 6.2 Decision flow chart for **asbestos-containing materials**



6.3 DECISIONS ON WHETHER WORK IS NOTIFIABLE

The risk assessment provides the basis for deciding whether work needs to be treated as notifiable asbestos work.

The amended Asbestos Worker Protection Directive 83/477/EEC as last amended by Directive 2003/18/EC applies to all workers who may be exposed to dust arising from asbestos containing materials.

Directive 2003/18/EC requires that the work be notified (to the Member State's enforcing authority) and that medical surveillance of the operatives be undertaken and kept on record. It also requires that the employer enters the workers "*in a register, indicating the nature and duration of the activity and the exposure to which they have been subjected.*" These requirements may be waived only in defined conditions. "*If the worker exposure is sporadic and of low intensity, and when it is clear from the results of the risk assessment that the exposure limit for asbestos will not be exceeded in the air of the work place,"* those provisions "*may be waived where work involves:*

- *short, non-continuous maintenance in which only non-friable materials are handled,*
- *removal without deterioration of non-degraded materials in which the fibres are firmly linked in a matrix,*
- *encapsulation or sealing of asbestos-containing materials which are in good condition,*"
- *air monitoring and control, and the collection of samples to ascertain whether a specific material contains asbestos."*.

A flow chart for the process of deciding whether work meets the criteria for the waiver is shown in Figure 6.3.

The Directive (2003/18/EC) defines the work place exposure limit for asbestos as 0.1 fibres/ml, (time-weighted average over 8-hours). Some Member States define the time weighted average over shorter periods (4 hours or 1 hour).

Member States national regulations may differ in regard as to whether, and to what extent, the possibility of waiving those provisions is applied.

Therefore, any work with friable materials (e.g. sprayed coatings, lagging, loose fill) needs to be treated as notifiable and requiring medical surveillance. Other materials need to be assessed for their condition and a risk assessment undertaken to provide the information to make a decision on the possibility of exemption from the requirements for notification.

Where the work involves materials with tightly bound fibres, e.g. asbestos cement, the risk assessment will need to take into account the nature of the work and its duration. Appendix 1 includes concentrations that have been reported as being typical for various activities with asbestos cement.

If you employ or control people whose work is likely to involve disturbing asbestos, you should:

- undertake the risk assessment for the specific work;
- follow through the decision making process to determine the appropriate course of action (i.e. to decide on either removal or putting the material into a safe condition and keeping and managing it in place; and on whether the work is notifiable);
- make and keep written records of the type of material (e.g. sprayed coating or insulating board or asbestos cement) and its condition (e.g. comments on type of damage and location, using photographs where possible);
- keep a record of the evidence used to estimate the likely concentration for the risk assessment;
- keep a record of the decision making process (e.g. how the questions in the relevant logical flow charts were answered);
- plan the work, arranging for air sampling if the evidence on likely concentrations from such work is not strong.

If your work is likely to involve disturbing asbestos-containing materials, you should:

- be consulted on the risk assessment that contributes to the above decision making process.

If you are the labour inspector, and you are inspecting a site where asbestos-containing materials are present, you should:

- look for evidence that the decisions to retain the material were soundly based;
- check that any materials that the risk assessment deemed suitable for work without notification do indeed meet the criteria described in Section 6.3 (e.g. non-friable, non-degraded, good condition);
- check that arrangements are in place to monitor and manage retained materials;
- check the adequacy of the information for estimating the likely exposure, especially if the risk assessment gave an estimate of low intensity exposure.

Figure 6.3 Decision flow chart for deciding whether the work is notifiable

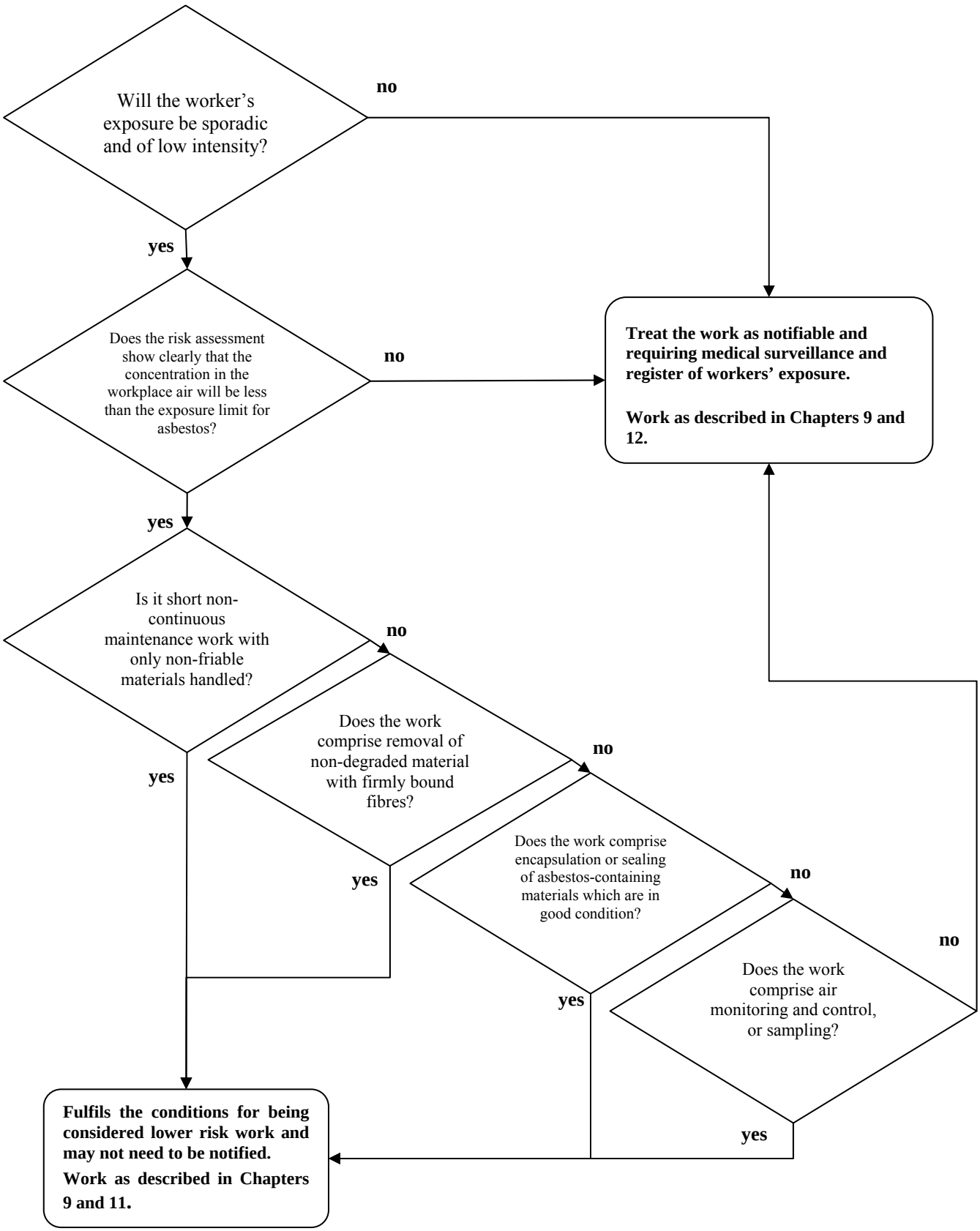


Figure 6.4 Asbestos insulating board; consideration should be given to removal as the board in this location is vulnerable to damage

7 TRAINING AND INFORMATION

7.1 INTRODUCTION

This chapter outlines the topics that should be covered within a training programme, and refers to other published information for more detail. In particular, the report by Bard *et al* (2001) setting out detailed recommendations on the structure and content of an asbestos training programme provides the full information for a training provider. The European Directive (2003/18/EC) states that: "*Employers shall provide appropriate training for all workers who are, or are likely to be, exposed to asbestos-containing dust. 1. Such training must be provided at regular intervals and at no cost to the workers. 2. The content of the training must be easily understandable for workers. It must enable them to acquire the necessary knowledge and skills in terms of prevention and safety*".

The recommendations of a SLIC working party are described in http://www.ilo.org/public/english/protection/safework/labinsp/asbestos_conf/inforen.pdf. Training recommendations from the UK are described at http://www.hse.gov.uk/aboutus/meetings/alg/licence/04-04.pdf.

The training should be presented in a style that is readily understandable for trainees (employer, supervisor, or workers), and it should include practical sessions on the use of all equipment. The training must be in a language that operatives (especially non-national operatives) know and understand.

This chapter also provides a brief guide to the training programme that is needed (initial training, refresher training, regular reviews of training needs, etc). Finally a few suggestions are offered on the supporting information that helps to reinforce the training.

The purpose is to let the employer know what training he needs to arrange, for the operatives, the supervisors and himself; and to let the worker know what training he should be provided with. The information is also intended to provide the inspector with a clear outline for checking the adequacy and effectiveness of training.

7.2 TRAINING CONTENT

7.2.1 Relevant to all work that may involve asbestos

The training for anyone involved (employer, supervisor, worker) in work that may involve (or does involve) asbestos, the training should cover:

- the properties of asbestos and its effects on health, including the synergistic effect of smoking;
- the types of materials or products that may contain asbestos and where they are likely to occur;
- how the condition of the material or products affects the ease of release of fibres;
- what to do if materials suspected of containing asbestos are encountered.

7.2.2 Relevant to general building work

Training needs to be provided for the worker who may encounter asbestos and for his supervisor and employer. That training should cover that listed above in Section 7.2.1 and:

- the information that may be available on locations of asbestos-containing materials (e.g. some member states require registers of the location of asbestos-containing materials in buildings);
- the need to stop immediately on encountering materials suspected of containing asbestos, and to report the finding to named supervisor;
- and what actions to take to reduce potential exposure if the suspected asbestos-containing material is in poor condition or has been accidentally damaged –e.g. vacate the immediate area, make secure and report to a named person; and
- - for the supervisor and employer - how the presence or absence of asbestos is to be confirmed by laboratory analysis of samples.

The training should cover the emergency situation where the suspicion about a material arises only after it has been disturbed. For that situation, the training should ensure that the situation is not made worse by inappropriate actions (such as trying to sweep up) or inaction letting exposures continue.

7.2.3 Relevant to lower risk work with asbestos

Where the training is for workers who undertake work that has been assessed as low risk, i.e. work that would meet the criteria outlined in Section 6.3, the training should cover the points in Section 7.2.1 and:

- the operations that could result in asbestos exposure;
- the importance of effective control measures to prevent or minimise exposure to airborne asbestos and to prevent spread of asbestos contamination;
- safe working practices that minimise exposure, including control techniques, personal protective equipment, risk assessments and written instructions (plan of work);
- the role of respiratory protective equipment, selection of the appropriate type of respiratory protective equipment, and its proper use;
- the proper care and maintenance of personal protective equipment and respiratory protective equipment;
- procedures for personal decontamination;
- emergency procedures, to cover situations such as: accidental damage to asbestos-containing materials, or personal injury or illness while engaged on the asbestos work;
- waste disposal, suitable containment (e.g. bagging or wrapping) all waste to prevent spread of contamination, labelling, and placing in a secure skip or container on site. Transport by an authorised asbestos-waste disposal contractor to an approved (or licensed) site.

For operatives and supervisors, the training must include practical work to ensure that they become familiar with examples of materials and accustomed to proper use and maintenance of equipment and techniques.

For supervisors and employers, the training should also cover legal responsibilities and monitoring of the work.

7.2.4 Relevant to asbestos removal work

Where the training is for workers who undertake work that is notifiable (i.e. the assessed risk does not meet the criteria outlined in Section 6.3 –low risk and restricted types of work), then more extensive training is needed. It should cover the topics listed in Section 7.2.3, but extend to cover the nature of the work, and should also cover the topics that are relevant to notifiable work.

The training of asbestos removal workers must include practical sessions so that trainees learn how to use and maintain equipment that affects safety (enclosures, personal protective equipment, respiratory protective equipment, and personal decontamination, and dust suppression equipment and controlled removal equipment).

The topics listed in Sections 7.2.1 and 7.2.3 would be extended, as outlined below:

- the effects of asbestos on health should cover the relationship between exposure and risk of disease to show the importance of preventing or minimising exposure;
- the types of products that may contain asbestos, should include more detail on the nature of the products in regard to how that may affect their removal;
- safe working practices would be extended to include:
    - good planning of the work including good site layout (positioning of equipment such as the airlocks, decontamination unit, shortest, safe route for carrying waste to a secure skip);
    - a suitable and sufficient risk assessment covering all aspects of the work and a plan of work detailing the job;
    - the preparation of a site prior to erecting an enclosure; including pre-cleaning if required;
    - practice in construction of an enclosure, extra protection of the floor and any weak spots. Ensuring all parts of the enclosure structure can be sufficiently cleaned i.e. no dust/debris traps. Waste locks, airlocks, viewing panels (and closed circuit TV where needed), negative pressure units including ease of changing pre-filters, leads to power supplies outside the enclosures to allow fuses etc to be changed;
    - maintenance of an enclosure in good order, (effectiveness of the ventilation system –negative pressure unit, integrity of the enclosure, regular inspections, etc); including the importance of smoke testing prior to commencement of work;
    - practical methods of removing asbestos with minimal release of dust, including dust suppression techniques such as wet stripping, prompt bagging of material to prevent spread (on feet, equipment or clothing), and – for the supervisors - how to monitor the effectiveness of techniques;
    - cleaning of the enclosure, air locks and hygiene facilities; fine cleaning (working from top to bottom);
    - Effective communication (including between inside and outside of enclosure);
    - re-cleaning in the event of an enclosure failing to pass clearance tests;
    - procedures for cleaning up and dismantling the enclosure;
- use of respiratory personal protective equipment would be extended to include:
    - positive pressure respiratory protective equipment and/or air fed respiratory protection;

- cleaning / maintaining respiratory equipment;
- the importance of face fit testing and factors that can affect or change the face-fit, how to inspect, test, and wear the respirator, and how to clean and maintain it;
- different types of respiratory protective equipment, and their advantages and limitations;
- emergency procedures in the eventuality of the supply (power or compressed air) to a respirator failing in a working situation;
- the possible restrictions (e.g. on visibility) and difficulties in using respiratory protective equipment;

- training for emergency procedures would cover procedures for:
  - aiding someone injured or taken ill in an asbestos enclosure;
  - emergency (e.g. fire) evacuation;
  - failures of electrical power or equipment (negative pressure, respirators etc);
  - leakage detected outside enclosure;
  - loss of water supply to the hygiene unit.

- Training for personal decontamination would include:
  - the use of airlocks, entry to / egress from the enclosure and to the decontamination unit, where the decontamination unit may be either directly linked to the enclosure or separate;
  - changing personal protective equipment, showering and disposal of overalls;
  - maintenance of a decontamination unit in good order;
  - personal decontamination in the eventuality of accident or evacuation.

- Correct use and maintenance of equipment associated with asbestos removal works;

- Other potential hazards, e.g. asbestos removal at high temperatures, working at heights, erection and use of access equipment for high surfaces;

- Waste disposal:
  - Procedures for bagging and wrapping waste;
  - secure containment (e.g. wrapping and /or bagging);
  - labelling;
  - safe transit via bag lock and designated route from enclosure to secure storage;
  - transport of waste from site by an authorised asbestos-waste contractor to an approved waste disposal site;
  - evidence of traceability of waste from site to disposal (e.g. consignment notes).

For these workers, for whom the Directive's requirement on medical surveillance cannot be waived, their training should cover:

- Medical examination requirements, including the purpose and importance of medical examination (as described later in Chapter 19), and the need to have certificates showing that medical examination has been completed;
- the information and advice that workers may be given after a medical examination.

For the supervisors and employers, the training should also cover:

- good planning;
- inspections and testing of equipment (e.g. decontamination unit, enclosure, suppression equipment etc) and how to recognise faults;
- auditing the work in progress;
- monitoring of effectiveness of fibre control techniques;
- reviewing competence and training needs;
- record keeping; and
- the need to closely supervise new operatives.

As well as the practical supervision, the supervisors' and employers training should cover the topics covered in Chapters 5 and 6, i.e.

- producing a risk assessment (for exposure of operatives and others) and a plan of work;
- relevant legislation and regulations;
- their roles and responsibilities.

For all the personnel involved in asbestos removal work, their training should provide an understanding of the air sampling and clearance testing that will be undertaken during and after the asbestos removal work (see Chapter 16).

Figure 7.1 Practical training in the use of Type-H vacuum cleaners to remove simulated contamination (talcum powder). Figure provided by the UK HSE.

7.3 TRAINING PROGRAMME – YOUR ROLE

If you employ or control people whose work involves a risk of exposure to asbestos, then you should:

- provide adequate initial training, as outlined above, before they undertake the work;
- assess their needs for refresher training at least annually, and in the event of changes in procedures or types of work, keeping a record of the assessment;
- arrange regular task specific instruction (sometimes known as tool box talks), particularly if there are unusual features associated with a particular job;
- arrange training through a competent training provider (i.e. an organisation or person with the knowledge of the proper procedures and good work practice and the skills in training);
- ensure that each trainee is given training in a language that he understands adequately:
- keep records of training successfully completed, available on site for each individual;
- ensure proper on site supervision, with close supervision for newly qualified operatives.

If your work involves a risk of exposure to asbestos, you should:

- be provided with the appropriate training prior to undertaking the work;
- have your needs for refresher training assessed regularly (at least annually) and when there are significant changes in the nature of the work;
- inform your employer if there is a language barrier that might hinder your understanding of the training (e.g. does your employer know what is your main language?).

If you are the labour inspector, you should:

- check that there are certificates for successfully completed training for each worker on site;
- check that there are records of regular assessments of each worker's need for refresher training;
- check that the training of any non-national operatives has been in a language (or languages) that they understood adequately;
- check that the training has been provided by a competent training organisation or person.

7.4 INFORMATION

For any work activities where workers are or maybe exposed to dust from asbestos-containing materials, the Asbestos Worker Protection Directive 83/477/EEC as last amended by Directive 2003/18/EC requires that the workers and their representatives receive adequate information on:

- the risks to health from exposure to dust from asbestos or materials containing asbestos;
- the statutory limit values and the need for monitoring for airborne asbestos;
- hygiene requirements, including the need to refrain from smoking;
- the precautions to be taken as regards the wearing and use of protective equipment and clothing;
- special precautions designed to minimise exposure to asbestos.

These issues are all included in the training content recommended above, but information on these issues should be readily available in the workplace, in appropriate forms (e.g. posters, notices, or leaflets).

8 EQUIPMENT

8.1 EQUIPMENT

Equipment suitable for the work needs to be available, and the essential equipment for most tasks is listed in this section. Equipment must be kept in good working order, and therefore must be maintained as described in Section 8.3.

8.1.1 For lower risk (non-notifiable) work

For low-risk (that is non-notifiable) work involving asbestos, the required equipment includes:

- materials to segregate and separate the work area (tapes, barriers, labels, warning signs);
- materials to protect against spread of contamination (durable 125 and 250 μm thick polythene [also known as 500 and 1000 gauge polythene], timber, plastic or metal frame materials);
- smoke tubes for checking the integrity of small enclosures;
- personal protective equipment (e.g. disposable overalls; washable boots) and respiratory protective equipment (e.g. asbestos rated disposable respiratory protection EN 149 Type FFP3, or EN405 half masks –with face-fit testing for suitability to the individual and regular replacement of soiled filters),
- H-type vacuum cleaner, i.e. a vacuum cleaner with High Efficiency Particulate Air (HEPA) filters manufactured to international specifications for use with asbestos;
- Dust suppression equipment, e.g. local exhaust ventilation connecting to the H-type vacuum cleaner for collecting dust from drilling holes etc.;
- suitable asbestos waste container (e.g. properly labelled plastic bags).
- cleaning equipment and consumables (wiping down wet rags, dust-adherent rags, fine airless water spray);
- secure storage for the relevant quantities of waste;
- hygiene facilities for personal decontamination (washing facilities, preferably a shower) and must include storage for work clothes and protective clothing separate from storage for street clothes (see Section 8.1.2 for personal decontamination facilities required for notifiable work with asbestos);
- consumables for personal decontamination (shower gel, nail brushes, towels);
- equipment for water filtration.

8.1.2 Additional equipment for notifiable work

For notifiable work involving asbestos, you will also need the following:

- full enclosure (durable polythene sheeting, framework, and negative pressure unit with pressure monitoring equipment; one member state specifies pressure monitoring equipment that produces a continuous record of the reading);

- the enclosure should have clear viewing panels or closed circuit television monitoring to enable the work and workers to be inspected without needing to enter the enclosure;
- good level of lighting (mobile, cleanable lights suitable for use in the enclosure);
- smoke generator for checking integrity of a large enclosure;
- high efficiency full face respirators (with staff having face-fit testing for that type of respiratory protective equipment); or air fed breathing apparatus;
- personal protective equipment (disposable overalls and washable boots);
- fully cleanable decontamination unit, with adjustable heated shower and separate areas for clean clothing and for discarding contaminated disposable work clothing. There must be a certificate confirming that the decontamination unit has been tested and found to be free of contamination prior to arrival on site. A minimum of one shower (decontamination unit) to be available for every four operatives involved in the asbestos work.
    - filtration of waste water prevents spread of asbestos;
    - the best practice (used in some member states) is to have a five compartment unit with two shower compartments (a diagram illustrating the arrangement and proper use of decontamination facilities is in Section 12.4). This five compartment system is for operatives wearing waterproof, sealed coveralls that are cleaned under a shower. After removal of the showered washable coveralls, which can be stored in the central compartment, the operative uses the next shower compartment. A widely used and acceptable alternative is a three stage unit with a shower between a "clean end" and a "dirty end"; that system is suitable for operatives using disposable coveralls.
    - An extract ventilation with a high-efficiency-particulate-air (HEPA) filter produces a flow of air (through grilles) from "clean end" to "dirty end" of the decontamination unit. Self-closing doors maintain the separation of the sections. In cold seasons, the clean end should be heated to provide an adequately warm environment for changing and showering.
- A negative pressure unit (exhaust fan with high-efficiency-particulate -air (HEPA) filter) to keep ventilation inwards into enclosures, with monitoring equipment to check that pressure is maintained. The best practice (specified in one member state) is to use continuous recording monitoring equipment (e.g. producing a paper record of the pressure difference). One member state requires that negative pressure units should comply with a national quality standard (British Standards Institution; PAS 60 Part 2).
- For notifiable work (Chapter 12), an emergency power generator to support the key electrical equipment (negative pressure ventilation, lighting etc in the enclosure, and adequate storage tanks to ensure water supplies for personal decontamination) is recommended by one member state, in particular for the removal of materials containing weakly-bound asbestos (The equipment must only be used by appropriately trained and competent persons.);
- dust suppression equipment, for injecting water into asbestos-containing insulation prior to removal, and for spraying surfaces of asbestos-containing material;
- secure storage for the relevant quantities of asbestos waste.

This list is not exhaustive but indicates the extent of equipment needed to ensure protection against the risk of asbestos exposure. Other equipment (such as fire extinguishers and first aid kits) will also be needed.

Figure 8.1 Water filtration for the discharge from the decontamination unit. Photograph provided by the UK HSE.

8.2 SELECTION AND USE OF RESPIRATORY PROTECTIVE

8.2.1 Selection of respiratory protective equipment

The European Directive (2003/18/EC) states that where activities (such as repair, maintenance, removal, demolition) are liable to give rise to concentrations of asbestos exceeding the exposure limit (value in Section 6.3) then the employer shall determine further measures to protect workers, including that: "*workers shall be issued with suitable respiratory and other personal protective equipment, which must be worn*". Therefore, based on the risk assessment (Chapter 5), suitable respiratory protective equipment should be selected. Guidance on the on selection, use and care of respiratory protective devices is available in EN 529.

The selection should be based on the following principles:

- the concentration inside the face-piece must be kept as low as possible, and in any case must not exceed the exposure limit; and
- the equipment must be suitable for the worker and the conditions in which he/she will be working;
    - the nature of the job, e.g. the range of movements that may be required, and any obstructions or restrictions;
    - the site conditions, e.g. suitability for access and movement within the work area;
    - the individual's facial characteristics;
    - his/her medical fitness;
    - the period of time that the wearer will have to use the equipment, and

- comfort, in the conditions of the particular site, such that people will wear it correctly for the required length of time.

One member state recommends that:

- disposable respiratory protective equipment (EN FFP3) should be limited to situations where concentrations will NOT exceed 10 times the exposure limit, and where the exposure is likely to be of relatively short duration. The suppleness of the mask is good for comfort, but is liable to let the mask deform – especially in demanding work – and that may lead to leakage where the mask should seal to the face.
- A half-mask equipped with a P3 filter gives a slightly better protection than the disposable respiratory protective equipment, due to a more reliable seal to the face.
- Battery powered respiratory protective equipment (hoods or blouses) with a P3 filter is more suitable for longer duration or harder work.
- Full face masks (or suits) supplied with compressed air (*known as compressed airline breathing apparatus*) should be used if concentrations are liable to exceed 50 times the exposure limit.

Another member state (UK) provides tables of protection factors that may be used in selecting the best protection that will suit each situation, see Tables 8.1 and 8.2 below. The protection factors in the table imply that EN FFP3 disposable respirators are unsuitable if concentrations in air are liable to exceed 20 times the exposure limit. Compressed airline breathing apparatus (or self contained breathing apparatus) should be used if concentrations are liable to exceed 40 times the exposure limit.

The performance of face-pieces (such as filtering face-pieces, full and half masks) depends greatly on a good seal being obtained between the wearer's skin and mask. Because the shape of the human face varies greatly between individuals, one particular size or type of respiratory protective equipment is unlikely to fit everyone. Therefore, it is important that:

- face-fit testing is part of the process of selection of suitable respiratory protective equipment;
- the wearers of respiratory protective equipment be consulted in the selection, as that helps to ensure that the chosen equipment is suited to them and that they will accept it and use it properly.

Face fit testing and consultation with wearers may be required under national regulations or guidance.

Beards, sideburns, or even visible stubble will affect the face seal of face-masks. For workers with these features, the respiratory protective equipment will need to be of a type that does not rely on a close face seal (e.g. powered /air supplied hoods or powered /air supplied blouses.

Wearing conventional glasses will also prevent a satisfactory face seal. There are, however, full face masks which allow the fixing of special frames inside the mask.

The European Directive (2003/18/EC) also specifies that where the wearing of respiratory protective equipment is necessary, "*this may 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 breaks appropriate to the physical and climatological conditions and, where relevant, in consultation with the workers and/or their representatives, in accordance with national laws and practice.*"

Table 8.1 Types of respiratory protective equipment that are available for protection against asbestos in air.

Protection Factor	Filtering half mask EN 149	Valved filtering half mask EN 405	Filtering half mask without inhalation valves EN 1827	Half mask EN 140 and filter EN 143	Full face mask EN 136 and filter EN 143	Powered hoods and filter EN 12941	Power assisted masks and filter EN 12942
20	FF P3	FF P3	FM P3	Mask + P3		TH2P	TM2P
40					Mask + P3	TH3P	TM3P

Table 8.2 Types of breathing apparatus that are available for protection against asbestos in air.

Protection factor	Fresh air hose breathing apparatus EN 138/269	Light duty compressed airline breathing apparatus masks EN 12419	Light duty compressed airline breathing apparatus hoods helmets, visors EN 1835	Constant flow compressed airline breathing apparatus hood EN 270/271 Mask EN 14593-1 EN 14593-2 EN 14594	Demand flow compressed airline breathing apparatus mask EN 14593-1 EN 14593-2 EN 14594	Self-contained breathing apparatus EN 137
20		LDM1 LDM2	LDH2	Half mask		
40	Full face mask		LDH3	Hood and blasting helmet	Negative demand full-face mask	Negative demand full-face mask
100		LDM3		Full face mask		
200				suit		
2000					Positive demand full face mask	Positive demand full face mask

8.2.2 Proper use of respiratory protective equipment

The European Directive (2003/18/EC states that workers must be given training that enables them to acquire the knowledge and skills in regard to "*the appropriate role, choice, selection, limitations and proper use of respiratory equipment;*

The respiratory protective equipment must be properly fitted and worn correctly to provide effective protection.

For disposable respirators, both head-straps should be fitted behind the head, and the nose clip pressed into fit to the bridge of the nose.

For face masks, the straps should be secure enough that the equipment is held in place, and generally the head harness should be worn under the hood of the coveralls.

Respiratory protection must never be removed in a contaminated area unless made necessary by an emergency (e.g. medical emergency).

8.2.3 Care of respiratory protective equipment

The respiratory protective equipment must be clean and in good order before being given to the wearer.

Before using respiratory protective equipment, the user should check that the equipment is in good working order, e.g.

- condition of the head-harness, face-piece including seal and visor;
- condition of the valves;
- condition of threaded connectors and seals;
- condition and type of filters and that they are within their use by date;
- air flow rate for powered and air fed equipment;
- completeness and correct assembly of the respiratory protective equipment;
- and any tests or checks recommended by the manufacturer.

After use, face masks must be cleaned and disinfected prior to next use. The respiratory protective equipment must be kept in a clean storage place that is designated specifically for that purpose.

(See also Section 8.3.2 on regular servicing.)

Figure 8.2 Respiratory protective equipment. Photograph provided by the UK HSE.

8.3 MAINTENANCE OF EQUIPMENT

8.3.1 Inspection and maintenance

Regular inspections of equipment should be made and recorded by a competent and responsible person. The maintenance and inspection schedule must include: the enclosure itself (each shift), the H-type vacuum cleaner(s), the hygiene facilities / decontamination unit (each shift), the dust suppression equipment (each shift).

The inspections should include checking for wear and tear on equipment, cleanliness and availability of supplies (soaps, towels, new filters for respirators, etc.) in the decontamination unit, adequacy of lighting (in the air locks, and in the enclosure), supplies of cleaning consumables, functioning of the smoke generator, the negative pressure unit (e.g. to check if the prefilter needs to be changed).

It is important that respirators are properly maintained, inspected and serviced regularly.

Air monitoring is a part of the inspection process, and is described in Chapter 16.

All portable electrical appliances need to be regularly inspected to check for damage to cables and connections, and tested for electrical safety. Where portable electrical tools are being used in a damp atmosphere, they must be suitable for working in such conditions.

8.3.2 Servicing

All equipment must be regularly serviced to make sure that it is fit for purpose.

The negative pressure units (for the enclosure and the decontamination unit) must be regularly serviced by persons competent to do that task. After replacement of the high efficiency filter,

the efficiency of the filtration should be tested with a safe substitute aerosol (e.g. Di-Octyl Phthalate [DOP]), by a person competent to do that test.

The filters for discharge water (from the decontamination unit, and from the enclosure) must be changed regularly. The used filters are to be disposed of as asbestos-contaminated waste.

Components of respirators can become worn and impair the level of protection. Therefore, respiratory protective equipment needs to be regularly serviced and a record kept of the servicing. National regulations may specify how long the records must be kept and be available for inspection.

The H-type vacuum cleaners must be regularly serviced.

8.4 YOUR ROLE

If you employ or control people whose work will involve using the equipment described here for work with asbestos, you should ensure that:

- adequate equipment in good condition is provided;
- the equipment is maintained in good order, i.e. inspected, maintained and regularly serviced;
- records are kept of inspections and servicing;
- workers are trained in the *appropriate role, choice, selection, limitations and proper use of respiratory equipment;*
- there is adequate supervision to checks that the equipment is used correctly;
- check that respiratory protective equipment is maintained and used properly.

If you are about to use some of the above equipment in work involving asbestos-containing materials, you should:

- have received training in how to use the equipment properly;
- always use the equipment properly (in accordance with training and manufacturer's instruction);
- have been consulted in the selection of respiratory protective equipment,
- have been face-fit tested for the respiratory protective equipment being provided for you, and have been trained in its proper use;
- always wear respiratory protective equipment properly, and never remove it in an area that is potentially contaminated with asbestos.

If you are the labour inspector, you should assess whether:

- equipment is in good operational condition, and properly maintained and serviced with proper records of servicing;
- respiratory protective equipment is used correctly;
- that each worker has had face fit testing for the type of respiratory protective equipment that he/she is using.

9 GENERAL PRINCIPLES OF MINIMISING EXPOSURE

9.1 GENERAL APPROACH

Prior to undertaking any work likely to involve a risk of exposure to dust arising from asbestos or asbestos-containing materials, there **must** be a risk assessment (undertaken as described in Chapter 5) to determine the nature and degree of the workers' exposure. The risk assessment provides the basis for decisions on the precautions that will be needed. The next three chapters deal with the precautions needed in the following situations:

- work where asbestos might be encountered (e.g. maintenance work in buildings of an age such that there might be some unrecorded asbestos-containing materials, Chapter 10);
- work where the levels of exposure are low enough that the work is not notifiable (as explained at the start of Chapter 11); and
- notifiable work (e.g. asbestos removal, Chapter 12).

However, exposure must be minimised in each case and there are some general principles of control relevant to all three situations:

- determine the extent and location of asbestos-containing materials;
- restrict access to the work area, appropriately (e.g. tape, barrier or full enclosure);
- erect clear and adequate signs (e.g. asbestos hazard, entry restricted to authorised personnel only);
- enclose or protect surroundings (e.g. with durable polythene), appropriately for the magnitude of the work (see later), to prevent contamination with airborne asbestos fibres;
- minimise the number of persons allowed into the area;
- use appropriate respiratory protective equipment and personnel protective equipment (e.g. disposable overalls and washable boots);
- use appropriate techniques to control release of fibres (e.g. damping down, wet stripping techniques, local exhaust ventilation, etc);
- minimise damage to asbestos-containing materials (e.g. remove and dispose of as whole pieces, e.g. remove and wrap whole boards);
- double bag or wrap and label (as asbestos) any possibly asbestos-containing waste before removal;
- clean up thoroughly (see Chapters 11 and 12);
- protect any transit routes to prevent spread of any asbestos contamination;
- ensure secure containment (e.g. wrapped or bagged) and storage (e.g. in a lockable skip) of any asbestos waste;
- ensure secure transport to an approved waste disposal facility;
- dispose of asbestos-containing waste only to waste disposal sites authorised to take asbestos (in accord with national regulations);
- ensure compliance with the required control regime to prevent exposure.

As part of the prevention of exposure to asbestos by either inhalation or ingestion,

- the areas where the activities involving asbestos take place must constitute areas where there should be no smoking; and
- areas must be set aside where workers can eat and drink without risking contamination by asbestos dust.

9.2 YOUR ROLE

Persons undertaking any task connected with work on asbestos must be competent for that task. A person is deemed competent if he/she person possesses sufficient training, experience and knowledge appropriate to the nature of the task to be undertaken. The nature of the task includes consideration of the complexity of the task and the hazards that would arise from the task being done incorrectly.

If you employ or control people whose work is likely to involve disturbing asbestos, you should:

- provide adequate training so that they can recognise the extent of work that they can properly undertake with their resources (see Chapter 7);
- provide equipment for the above steps, appropriate to the situation;
- arrange for, and ensure, proper maintenance and inspection of such equipment;
- provide written instructions specifying the procedures to be followed in the particular circumstances of the site.

If your work is likely to involve disturbing asbestos-containing materials, you should:

- know and understand the precautions that need to be taken, and the implications of not taking adequate precautions;
- know the level of work that can be undertaken with your own level of training, and equipment;
- comply with the required control regime to prevent exposure;
- be ready to call on more specialist help if you encounter more work on asbestos-containing materials than is covered by your plan of work, equipment or training.

If you are the labour inspector, you should check that:

- training certificates for named individuals show that they are trained for their assigned work;
- there is photographic identification for the operatives that ties in with the training records;
- appropriate equipment is being provided, maintained and regularly inspected;
- appropriate supervision and monitoring is being provided.

10 WORK THAT MIGHT INVOLVE ASBESTOS

Several trades are liable to disturb asbestos-containing materials unexpectedly. These include: carpenters, joiners, shop-fitters, plumbers, gas service engineers, electricians, computer cabling installers, janitors and handymen. There are also demolition workers, ship breakers and repairers, and vehicle and other mechanical engineers who may encounter asbestos.

These tradesmen should be supplied with information about the location of any asbestos-containing materials prior to starting work, and endeavour to avoid the hazard. However, there is a need to be prepared for the eventuality of encountering asbestos-containing materials unexpectedly as there is a risk that the information about the location of asbestos may, for whatever reason, be incomplete. Chapter 9 outlined the general approach to any work involving asbestos. This chapter adds more specific detail for the maintenance or service work where there is a risk of encountering asbestos. If asbestos-containing material is encountered unexpectedly, the priority is to stop work immediately, prevent others from becoming exposed, and prevent the spread of asbestos contamination.

If you employ or control people (such as the tradesmen listed above) who work on the fabric or equipment of a building that may contain asbestos-containing materials, then you should:

- ensure that they are adequately trained to be able to recognise possible asbestos-containing material;
- enquire thoroughly about the presence of asbestos before any work starts;
- assess the risk of exposure to asbestos;
- provide written instructions on what they should do if they unexpectedly encounter or damage material suspected of containing asbestos (stop work immediately, prevent others becoming exposed; prevent spread of contamination);
- if and when such an eventuality occurs, either arrange for a sample of the suspect material to be analysed or act on the presumption that it contains asbestos.

If the identification of asbestos is confirmed, then you should:

- assess whether the clean up work will involve worker exposure that is only sporadic and of low intensity (examples given in Section 11.1);
  - if so, then the work may be exempt from requirements to give notification to the responsible authority of the Member State (and the practice in Chapter 11 is relevant);
  - if not, then the work needs to be treated as notifiable works (Chapter 12);
  - whether or not the work is notifiable, a written risk assessment must be produced and be available;
- decide whether you need to employ a specialist contractor (Chapter 6), in accord with national regulations;
- report the incident to the enforcing authority (where appropriate);
- keep a record of the evidence (laboratory analysis of samples) and the reasons for your decisions;
- review the incident and put measures in place to prevent future occurrence of a similar event;
- where necessary, record the worker's exposure to asbestos and provide the individual with information for his medical records (see Chapter 19);
- best practice is to retain records (e.g. of training, risk assessments, written work instructions, any laboratory analyses, and notes on any incidents).

If you undertake work (in a building, or on equipment or on a vehicle) where there is a possibility of encountering asbestos, or damaging asbestos-containing materials, you should:

- know what to do if you either unexpectedly encounter materials suspected of containing asbestos or accidentally damage asbestos-containing materials in the course of your work;
- if you do encounter asbestos unexpectedly:
  - you should stop work immediately and report it to the person in charge;
  - arrange (or ask the person in charge to arrange) for a sample of suspect material to be taken for analysis or act on the resumption that it contains asbestos.

If you accidentally damage asbestos-containing materials, you should:

- stop work immediately;
- prevent anyone else entering the area;
- check for any dust and debris on your clothing and if so, remove the contaminated clothing and place them in a plastic bag; shower (if possible) or wash thoroughly, and rinse away any dust from the washing facilities.

If you are the labour inspector, you should:

- look for evidence that the above recommendations have been implemented, as reflected in the ready availability of written instructions, the content of those instructions, the employees' awareness of the content of those instructions, and examine whether the procedures have been implemented;
- check that the risk assessment adequately assesses the risk (to employees and others);
- check that adequate precautions have been defined (e.g. in the plan of work and work practice) and implemented;
- encourage critical review of management procedures for prevention of future incidents;
- where an incident has occurred:
  - check that actions taken were commensurate with risk to health;
  - give advice on risk to health factually and reassuringly;
  - ensure that records are kept on the incident (to enable improvements in general guidelines or for legal proceedings);
- check for compliance with national regulations on these issues.

Figure 10.1 Coverall and disposable respirator

11 LOWER-RISK WORK WITH ASBESTOS

11.1 DEFINITION OF LOWER RISK WORKS

The European Asbestos Worker Protection Directive (2003/18/EC), states that if the risk assessment shows that the risks of exposure are low then the work may not need to be notified to the responsible authority of the Member State. The criteria defined Article 3 of the European Directive (2003/18/EC) for deciding whether work meets the criteria for being lower risk is described in Section 6.3. However, the interpretation of Article 3 is (at the time of writing) under discussion in member states.

Essentially, the work falls within the scope of this chapter if the worker exposure is "*sporadic and low intensity*", and if the results of the risk assessment (undertaken as described in Chapter 5) show that the exposure is below the occupational exposure limit for asbestos (a time weighted average of 0.1 fibres/ml, over a period of 8 hours [or 1 hour or 4 hours in some Member States]). Possible examples of work that may be low risk (and may not be notifiable, depending on national regulations) include work on non-friable undamaged materials containing asbestos, removal of undamaged asbestos-containing materials intact; or encapsulation/sealing of some asbestos-containing materials in good condition. Handling non-friable intact asbestos-containing materials is likely to give rise to low exposure.

The following tasks, if undertaken with care to minimise release of dust into the air, may possibly be considered as examples of low risk work: removal of a single asbestos ceiling tile, removal of a single sheet of asbestos insulating board (AIB) intact, drilling up to 20 holes (less than 20mm diameter) through AIB (with proper precautions to prevent release of dust, including a simple local exhaust ventilation with an H-Type vacuum cleaner attached to a hood over the drill bit). Other possible examples of lower risk may be found in the UK Health and Safety Executive's "Asbestos Essentials" guidance (HSG 210 and HSG 213, HSE (2001)). The guide ED 809 published by INRS also contains examples of maintenance work, and some of those examples may be lower risk. However, the typical concentrations published in the guide ED 809 shows that concentrations for a wide range of simple maintenance tasks are liable to exceed 0.1 fibres/ml during the conduct of the task. Therefore, depending on the duration of the work, they are liable to lead to time weighted average concentrations that may exceed the exposure limit

If there is only limited information on which to make a risk assessment of likely exposure prior to the work, then measurements should be made to establish what actually occurs and hence to enable a more reliable risk assessment if similar further work has to be undertaken in the future. The control measures will need to be sufficient to cover any uncertainty in the risk assessment.

Information on published estimates of level of exposure to asbestos for various examples are available on a database (in France) called Evalutil (**http://etudes.isped.u-bordeaux2.fr/evalutil.**) and that data base is described in Appendix 1

11.2 GENERAL PROCEDURES FOR LOWER-RISK WORKS

11.2.1 General principles

Prior to any work on or near asbestos-containing materials, the risk assessment and planning (as outlined in Chapters 5 and 6) should have been completed. The personnel should have been adequately trained (Chapter 7) and the relevant equipment provided (Chapter 8). Provisions for segregation and separation of the work area, suitable respiratory protective

equipment and personal protective equipment, and personal washing facilities should have been provided as outlined in Chapter 9. Given that these preparations have been completed, this chapter addresses the practical methods of removing or minimising exposure.

11.2.2 Practical procedures

If you employ or control people who are going to undertake lower-risk work with asbestos-containing materials, you should make sure that the planning, preparation, training, etc. as outlined above and in previous chapters, has been completed.

In providing a risk assessment, you should ensure that it adequately covers the risks to employees and to others.

In providing written instructions, for the way the work is to be conducted on site, you should include the practical procedures described below with any details specific to the site (e.g. the route to be used for removing waste).

Restrict the number of people involved in the work.

You should also ensure that the equipment needed to implement these procedures is available and is in good operational condition.

You should ensure that there is suitable management and supervision to inspect and check that the instructions for safe working practices are followed.

Make and keep records of personnel, time spent and measured or estimated exposure to asbestos.

If you are about to undertake lower-risk works (as defined above) on asbestos-containing materials, you should check that the preparations mentioned above and referring to previous chapters are complete (e.g. that you have written instructions, defining and limiting the extent of the work and specifying the precautions to be taken (Chapter 5), the relevant training (Chapter 7), and the necessary equipment (Chapter 8). Then you should:

- segregate the area and protect the safety of others;
- plan the work to minimise or prevent disturbance of asbestos-containing materials;
- cover surfaces with 125 µm thick [500 gauge] or 250 µm thick polythene (which is to be disposed of as potentially asbestos-contaminated after the work);
- carry out the work with the minimum number of workers present;
- use methods which minimise the release of airborne asbestos fibres (e.g. shadow vacuuming, wet spraying);
- use appropriate asbestos-rated respiratory protection (e.g. EN 149 FFP3);
- avoid breaking asbestos-containing materials;

- avoid working on asbestos-containing materials directly overhead;
- use asbestos rated vacuum cleaner (H-type), and only dust-suppressant methods of cleaning such as damp rags, tacky cloths (to which dust adheres) – do **NOT** use sweeping or compressed air for cleaning;
- If the work involves overhead asbestos-containing materials, e.g. removal of a single ceiling tile, construct a simple enclosure about 1 m^2 (i.e. encompassing the area of that tile) to prevent any spread of airborne dust. This can be a simple wooden frame covered with durable (e.g. 125 µm thick [500 gauge]) polythene. Check the integrity of the enclosure using a smoke tube around the polythene especially at the joins. A colleague should look for any signs of leakage of smoke using a bright light or torch.
- Remove screws or nails carefully, suppressing dust release using either:
  - thick paste (wall paper paste) to coat the screw or nail prior to removal; or
  - a local exhaust ventilation fitting over the screw, and connecting to an asbestos rated vacuum cleaner (Type H vacuum cleaner);
  - then, treat the removed screws or nails as contaminated with asbestos dust.
- Remove asbestos-containing tiles or board intact, and avoid any breakage or damage.
- Place asbestos-containing materials carefully into labelled plastic bags directly (i.e. not letting unwrapped waste accumulate).
- Only partially fill waste bags, so that they close easily and properly.
- On closing bags, avoid propelling air out of the bag, as that air might carry dust and asbestos, but close carefully and place the closed and labelled bag in an outer transparent tough plastic bag.
- For larger items that do not fit into bags (e.g. whole asbestos insulating board), keep intact and wrap whole in two layers of polythene with an asbestos label clearly visible (e.g. securely attached inside the outer layer of transparent plastic).
- Minimise any risk of spread of contamination, by keeping to a pre-defined route and proceeding with care to prevent accidental damage to bags in the transit away from the work to a secure waste storage facility.
- Put the bagged or wrapped asbestos-containing material waste into secure storage (e.g. a lockable skip) prior to removal from site.
- Wash thoroughly whenever you leave the work area.

On completion of the work, ensure that the work area is restored to a clean state (using the H-type vacuum cleaner and / or wet paper towelling to clean up. Dispose of used towelling as asbestos contaminated.

Finally, follow the hygiene procedures in removing personal protective equipment and respiratory protective equipment, to ensure that you do not expose yourself or anyone else to asbestos that may be on your overalls. Use disposable overalls that are to be disposed of as asbestos contaminated waste after use, or use washable overalls that can be washed under a shower before removal. An H-type vacuum cleaner should be used to remove any dust from your overalls; colleagues may clean each other's overalls, enabling the back of the overalls to be reached. Keep your respiratory protective equipment in place until the last.

- wash boots;

- remove overalls, rolling disposable overalls inside out to trap any remaining dust;
- wipe (with damp towel) the exterior of your respirator;
- rinse and wash (showering if available), and only then remove respiratory personal protective equipment;
- do **NOT** take your working clothes home – they should be disposable coveralls or washed at a specialist laundry as asbestos contaminated.

If you are the labour inspector, you should:

- have a system to audit / visit a proportion of sites likely to be undertaking this work on an unannounced basis;
- check that the written instructions are available, are clear and cover the recommendations given here;
- check whether records of training, equipment, respiratory protective equipment and personal protective equipment are available, and are current and adequate;
- look for evidence that the above practical procedures to minimise release of dust, prevent exposure and spread of contamination have been implemented fully and consistently. For example, any asbestos insulating boarding that has been removed should be intact and any screw holes (visible through the wrapping) should be in a state consistent with careful removal of screws;
- check that the risk assessment was consistent with the work undertaken;
- check that the risk assessment gave adequate consideration to the safety of others;
- check that the work was correctly defined as non-notifiable;
- look for adequate monitoring to support the exposures estimated in the risk assessment, and good records of exposure measurements;
- check whether the results of the exposure monitoring indicate that the actual exposure was estimated adequately in the risk assessment;
- check that the organisation's record keeping is sufficiently thorough and traceable;
- check for compliance with national regulations on these issues.

These general principles cover most lower-risk works. The written instructions from the person employing or controlling those doing the works can identify which procedures apply in a specific task. However, in the next section, the principles are applied to a particular task as an example.

Figure 11.1 Use of warning tape and signs to segregate an area

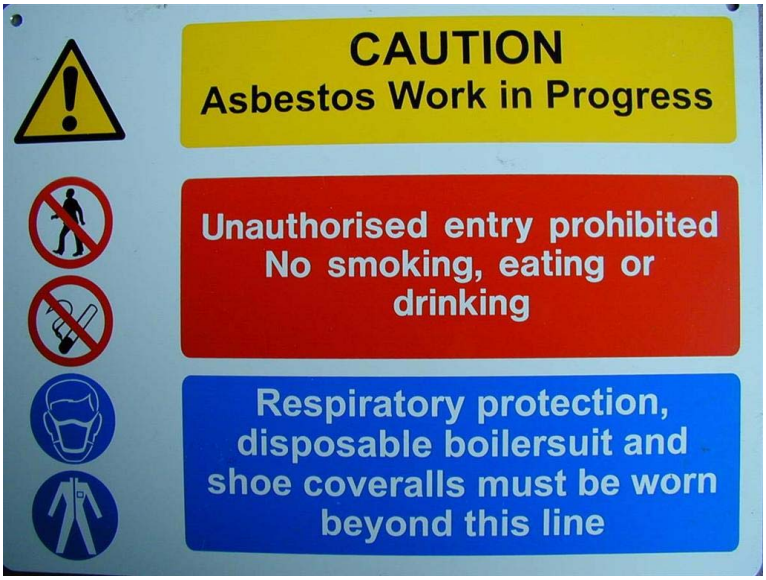


Figure 11.2 Warning signs to indicate hazards and precautions, in symbols and words.

11.3 EXAMPLES OF LOWER RISK WORK

11.3.1 Cleaning guttering of an asbestos cement roof

Debris in guttering on an asbestos cement roof may contain asbestos. Therefore, cleaning out the debris could create risks of asbestos exposure and spread of asbestos contamination. Therefore, a person doing this work needs to be appropriately trained.

The personal protective equipment that is needed includes:

- disposable overalls fitted with a hood;
- waterproof overalls may be needed (depending on weather conditions);
- boots that can be decontaminated (boots without laces);
- from the risk assessment, it may be clear that respiratory protective equipment is not necessary, but a disposable respirator (EN 149 FF P3) is advisable.

The tools that will be needed include:

- an access platform (e.g. scaffolding, or mobile elevating work platform);
- warning tapes and notices;
- bucket of water and detergent;
- watering can or garden type spray;
- scoop or trowel;
- rags;
- a suitable asbestos waste container (e.g. a labelled and colour coded polythene sack).

The preparation of the work area includes:

- if the work is at a height, then the appropriate precautions to prevent the risk of falls must be taken;
- access to the work area must be restricted (e.g. using the warning tape and notices).
- the work should be undertaken with the minimum number of people necessary present.
- the safe means of access should be erected.

The process of cleaning the gutter involves:

- mixing water and detergent;
- pouring or spraying water with detergent into the gutter, but not using so much water as to create a slurry;
- removing the debris with the trowel or scoop and putting directly into the waste container;
- wetting the debris again if dry material is uncovered.

The cleaning up afterwards involves:

- using wet rags to clean the equipment;
- using wet rags to clean the access equipment;

- placing the debris, used rags and any other potentially asbestos-contaminated waste in the asbestos-waste container.

Personal decontamination should involve:

- disposing of the coveralls as potentially contaminated;
- cleaning boots of any signs of debris;
- personal washing/showering.

Inspection procedure on completion of the work should involve a thorough visual inspection of the platform and surrounding area to make sure that it has been properly cleaned.

If you employ or control people who are about to clean debris from guttering on an asbestos cement roof, you should assume that the debris contains asbestos. Therefore, you should arrange and ensure that:

- The risk assessment considers the risks from asbestos and the risks of falls form heights, and that it covers the risks to others (from asbestos and from materials falling from height);
- there are written plans of work to operate as above that also cover safe working at heights;
- only the minimum number of people are present;
- they are trained appropriately, for the asbestos risks and for working at heights;
- the right protective and safety equipment is available;
- that there are arrangements for proper waste disposal (see Chapter 15);
- that the visual checks on completion are rigorous.

If you are about to undertake this task,

- restrict access to others (e.g. with warning tape and signs);
- keep the debris damp but avoid excessive water use which might make controlling spread of contamination more difficult;
- place the debris in a suitable waste container (e.g. labelled polythene sack).
- be alert to windy conditions that may increase risk of spread of contamination and endanger those on the roof;
- clean up carefully afterwards.

In regard to the whole task, comply with the written plan of work from the employer. Use safe procedures for working at heights.

If you are the labour inspector, you should:

- look for evidence that the above recommendations have been implemented, as reflected in work plans, training;
- check that adequate precautions have been taken for working at heights;
- undertake the checks listed for low-risk works generally.

11.3.2 Removal of an asbestos insulating board wall panel

Removal of a single screwed-in asbestos insulating board wall panels, under 1 m^2 in area. This task comes within the non-notifiable work provided that the asbestos insulating board does not have more than minor damage, is not heavily painted (so that removal could damage adjacent panels), and it is not in the form of ceiling slats.

Protective equipment needed for this task comprises:

- disposable coveralls with a hood;
- boots that can be decontaminated (boots without laces);
- disposable respiratory protection (EN 149 FF P3).

The equipment that will be needed includes:

- heavy duty polythene (250 µm) thick polythene and duct tape;
- warning tape and notices;
- Type H (asbestos rated) vacuum cleaner;
- magnet and screwdriver;
- sealant, e.g. polyvinyl acetate (PVA);
- bucket of water, garden type spray and rags;
- asbestos warning stickers;
- suitable asbestos waste container (e.g. a labelled polythene sack);
- appropriate lighting.

The work area should be prepared by:

- if the work is at height, providing safe access and preventing risks of falls;
- restricting access (close door, use warning tape and notices);
- erect safe access platform, if at height;
- inspect the boards. If they are in good condition, proceed as described below. If not in good condition or likely to be damaged in removal, treat as notifiable work (see Chapter 12);

- use the 250 µm thick polythene sheeting to cover surfaces that could become contaminated;
- ensure adequate lighting.

For the removal of the panel:

- use the magnet to locate steel screws;
- or, for brass screws, locate by carefully scraping the paint using shadow vacuuming;
- unscrew using shadow vacuuming;
- carefully ease back one end of the panel and vacuum the back surface;
- spray the back surface with the sealant;
- remove all remaining screw in the same way;
- lower the board and place in the waste container, or double wrap in 250 µm thick polythene sheeting and attach asbestos warning labels.

Clean up the area and equipment:

- use the Type H vacuum cleaner to clean the frame work;
- use a screw driver and Type H vacuum cleaner to clean the screw holes;
- use the Type H vacuum cleaner and wet rags to clean the equipment;
- place debris, used rags, polythene sheeting and other waste in the waste container.

Follow the personal decontamination procedures as in the previous example.

Visually inspect the area to make sure that it has been properly cleaned.

11.3.3 Maintenance or removal of asbestos cement materials

Provided that asbestos cement materials are dealt with properly, the risk assessment is likely to show clearly that their removal can be treated as lower risk work. However, the risk assessment may lead to a different conclusion if power tools are needed. (Typical concentrations for work on asbestos cement are shown in Appendix 1.) The risk assessment should also specify suitable respiratory protective equipment and other personal protective equipment.

For **maintenance work** that may involve contact with asbestos cement materials, the practice should be to follow the general procedures in Section 11.2.2, and:

- where practicable, avoid the need to either:
  - attach items to asbestos cement; or
  - route wiring or cables through it;
- protect any adjacent surfaces from contamination;
- keep the material wet when moving it or working on it;
- avoid breaking asbestos cement;
- use hand tools in preference to abrasive tools (such as sanders) or pneumatic impacting tools;

- where abrasive or impacting power tools are used, set them to their lowest speed and operate with local exhaust ventilation, which may be either;
    - a cowl, connected to local exhaust ventilation, fitted around the drill bit (and with a spring loaded fitting so that the cowl remains in contact with the material as the drill bit penetrates);
    - shadow vacuuming, with the nozzle of an asbestos-rated Type H vacuum cleaner;
- cleaning up the work area (with a Type H vacuum cleaner) and disposing of any debris as asbestos containing waste.

For **removal** of asbestos cement materials **(in demolition or renovation)** the practice should be to follow the general procedures in Section 11.2.2, and:

- remove the asbestos cement prior to demolition;
- in renovation, protect other surfaces from contamination;
- avoid breaking asbestos cement materials – remove whole;
- keep the material wet when working on it, but avoid excess water that would create a slurry;
- if removing asbestos cement from a height, lower the material onto a clean hard surface;
- (use safe methods of access for removing asbestos cement materials from high places;)
- remove asbestos-containing waste and debris as soon as possible, to prevent it being crushed underfoot or by vehicles;
- do NOT bulldoze asbestos cement into piles;
- do NOT sweep asbestos cement debris;
- dispose of the asbestos cement waste and debris as asbestos-contaminated waste.

Large pieces of asbestos cement should be disposed of whole. They should either be placed in a covered skip or covered lorry, or should be wrapped in polythene before disposal.

Small debris and dust deposits should be cleaned up with an asbestos-rated Type H vacuum cleaner. Debris that is too large for vacuuming should be collected and bagged as asbestos containing waste.

Figure 11.3 Use of tape and polythene sheeting to protect a work area before cleaning asbestos gaskets from a valve

Figure 11.4 Damping the asbestos gasket on a valve

Figure 11.5 Use of hand tools only to clean asbestos gaskets and residue from a valve.

Figure 11.6 Use of shadow vacuuming to capture dust released in cleaning asbestos from a valve.

Figure 11.7 Cleaning up the work area carefully, with H-Type vacuum cleaner and wet waste rags.

12 NOTIFIABLE WORKS WITH ASBESTOS

12.1 INTRODUCTION

12.1.1 Definition of notifiable works

Section 6.3 described the criteria set by the Asbestos Worker Protection Directive 83/477/EEC as last amended by Directive 2003/18/EC for deciding whether the Directive's provisions requiring notification and medical surveillance may be waived. For example, unless the worker exposure is only "*sporadic and of low intensity*" and the risk assessment shows clearly that concentration in the workplace air will not exceed the exposure limit for asbestos (0.1 fibres/ml, time-weighted average concentration over 8 hours (or in some member states over 1 hour or 4 hours)), and unless the work falls within limited types (defined in Section 6.3), then the work should be treated as notifiable, medical surveillance should be arranged (see Chapter 19), and the practical precautions described in this chapter should be followed.

Asbestos removal works will clearly be notifiable works. The European Directive (2003/18/EC) states that "*Before carrying out asbestos demolition or removal work, firms must provide evidence of their ability in this field. The evidence shall be established in accordance with national laws and/or practice.*

12.2 GENERAL PROCEDURES FOR NOTIFIABLE WORKS

12.2.1 Summary of preparations

Previous chapters have described the preparations needed before notifiable work is undertaken:

- risk assessment and written plan of work (Chapter 5);
- decisions on how to do the work, including considering any options that do not involve disturbing the asbestos (Chapter 6);
- training for the worker, the supervisor / manager/ employer (Chapter 7);
- equipment (Chapter 8).

The general approach to preventing the risk of exposure in undertaking asbestos work has been outlined in Chapter 9, e.g. segregation and separation of the work area, respiratory protective equipment and personal protective equipment, and personal washing facilities.

The need for medical surveillance for all asbestos workers has been noted (Chapter 6); the requirements on the employer to arrange medical surveillance, and the purpose and benefits of the medical surveillance are described in Chapter 19.

The planning may involve decisions as to whether asbestos-containing material at each location is to be removed or be retained, monitored and managed. The guidance on this decision varies between member states. In Germany, the guidance is to remove all asbestos (if possible); in the UK, the guidance is that asbestos materials in good condition may be left in place. The alternative approaches have their own advantages: removal is a direct solution, but the process of removal may cause some immediate exposure which might have been avoided. Keeping asbestos-containing materials in place (in good condition) is a safe

procedure, provided that effective monitoring and management ensures that any future renovation works follow the necessary precautions with regard to that asbestos.

As described in the previous chapters, if you employ or control people who are going to undertake notifiable work with asbestos-containing materials, you should have:

- ensured that the planning (risk assessment and plan of work), preparation, training, etc. have been completed and that the necessary records are available on site and understood by operatives (Chapters 5 to 7);
- ensured that the safety of others has been addressed and protected;
- consulted with building managers and any other persons who may have an interest to ensure that the plan of work is appropriate for the purpose and that no other health and safety risk is posed by its implementation;
- ensured that **emergency procedures in the plan of work** take account of the emergency procedures for the overall site, and that key personnel understand all the relevant emergency procedures;
- ensured that the **detailed, site-specific, plan of work** (drawn up by a competent person) fully covers practical information specific to the site (e.g. the route to be used for removing waste, any other health and safety hazards in the proximity of the site or arising from the asbestos disturbance) (Chapter 5);
- ensured that the equipment (including personal protective equipment and respiratory protective equipment) needed to implement these procedures is available and is in good operational condition with easily traceable records of regular inspection by competent person(s) (Chapter 8);
- ensured that all the asbestos workers can be readily identified for comparison with records (Chapter 7).

As the employer of worker exposed to asbestos, you should:

- maintain adequate levels of insurance;
- provide asbestos medical examinations for all employees prior to exposure to asbestos, and at least once every 3 years thereafter (Chapter 19);
- ensure that health records and exposure records are kept for a minimum of 40 years;
- ensure that all other records are maintained in good order and retained for at least 10 years.

Before the work commences, Directive 2003/18/EC requires you to submit "*notification to the responsible authority (of the member state) in accordance with national laws, regulations and administrative procedures"* (which may specify how far in advance notification must be given – e.g. 14 or 28 days). "*The notification must include at least a brief description of the:*

- *location of the work site;*
- *type and quantities of asbestos containing materials used or handled;*
- *activities and processes involved;*
- *number of workers involved;*
- *starting date and duration of the work;*
- *measures taken to limit the exposure of workers to asbestos".*

The notification may also include:

- the plan of works;
- contact telephone numbers; and
- expected dates of other key elements of the work (e.g. smoke test of the integrity of the enclosure, and clearance testing).

"Each time a change in working conditions is likely to result in a significant increase in exposure to dust from asbestos or materials containing asbestos, a new notification must be submitted." You should also notify the national authority of any changes to the work schedule or significant changes to work methods.

If you are employed to undertake notifiable work (as defined in Section 12.1.1) on asbestos-containing materials, then the preparations mentioned in previous chapters should have been completed. Check that you have been provided with:

- the relevant training (Chapter 6), (and you hold currently valid certificates of training);
- face fit testing for the respiratory protective equipment that you will be using; and
- have had an asbestos medical examination (Chapter 19) within the previous two years.

If you are the labour inspector, you should:

- be proactive in large or complex projects, and scrutinise and question the plan of work before such projects start;
- be available for consultation with those either designing large projects or encountering difficulties with achieving best practice;
- check that the notification includes the information specified above (especially types and quantities of asbestos, number of workers involved, start date, measures taken to limit the exposure of workers);
- ensure that your own training and equipment are adequate to protect you from the risk of exposure when attending sites.

12.2.2 Summary of site management requirements

The practical arrangements for managing the asbestos removal work are an important part of ensuring that the work is done safely.

If the site involves work at heights, then safe procedures for work at heights must be specified in the plan of work (including protection from falls (see for example UK Health and Safety Executive publication MISC614). The procedures may involve the use of towers, scaffolding or mobile elevating work platforms. The procedures should include protecting the equipment from contamination (e.g. by wrapping or covering with polythene), erecting the tower or scaffolding (e.g. using appropriate protective equipment), dismantling safely, and decontamination of the equipment prior to dismantling the enclosure, and inspection / testing (for contamination).

If you employ or control people who are going to undertake notifiable work with asbestos-containing materials, as part of your preparations you should:

- appoint a competent manager to oversee the execution of the works.

Your management of the site should ensure that the work area is properly controlled, with:

- the working area segregated and enclosed adequately;
- warning notices and barriers maintained at all times;
- the safety of workers and others adequately protected;
- adequate air monitoring around the enclosure during works (see Chapter 16), and results of this communicated promptly to site supervisors;
- the decontamination facility in good working order from first start on site through to after dismantling of the enclosure;
- an emergency plan that contains adequate information specifically for the site, e.g. the contact details for the local hospital.

You should also commission an independent clearance test by a competent person.

If you are about to undertake notifiable work (as defined in Section 12.1.1) on asbestos-containing materials, then the preparations mentioned in previous chapters should have been completed. Check that you have been provided with:

- a written plan of work defining and limiting the extent of the work and specifying the precautions to be taken (Chapter 5); and
- the necessary equipment (Chapter 8).

You should :

- make sure that you understand and follow the plan of work;
- do NOT use methods that are not in the plan of work without the plan of work being amended first;
- communicate with your supervisor/manager/employer. In particular,
  - if you anticipate or encounter any unforeseen difficulties, then work should be stopped until the risk assessment and/or plan of work have been reviewed by a competent person.
  - If you encounter any problems with respiratory protective equipment, personal protective equipment, or control measures, stop work immediately;
- provide adequate evidence of your identity when required.

If you are the labour inspector, you should:

- check that there is effective segregation of the working area, with barriers, signs and controls;
- check that the decontamination facility is in good order and on site from the start;
- check that the emergency plan is readily available and that it contains adequate site specific information;
- check that the equipment on site is consistent with the methods described in the plan of work (e.g. dust suppression equipment, vacuum cleaners).

12.3 ENCLOSURE FOR ASBESTOS REMOVAL WORK

12.3.1 Purpose and exceptions

Purpose

The purpose of an enclosure is to prevent the spread of asbestos contamination, and to prevent the exposure of other people. Regulated access through airlocks and decontamination of personnel and equipment on leaving keeps the asbestos contamination within the enclosure.

Exceptions

An enclosure is necessary for all asbestos removal work, unless the airborne asbestos concentration is likely to be very low, the location is remote (so that other people are not affected), or an enclosure is not practical e.g. high level pipework in the open air, or soffits (boards under overhanging rafters) around building roofs. In these cases, other means must be used to prevent spread of contamination or exposure of other people.

12.3.2 Preparation and description

Preparation

Before setting up an enclosure, the site should be prepared using appropriate precautions (which should have been specified in the risk assessment [Chapter 5]) to protect against exposure to asbestos, e.g. personal protective clothing, respirators and vacuum cleaners rated for use with asbestos (Type H vacuum cleaners). Asbestos-containing materials may be disturbed in the process of setting up the enclosure or erecting access equipment (e.g. scaffolding).

The preparations should include:

- disposing of any non-asbestos waste in the area (where the enclosure, transit routes, and waste skip will be), as non-asbestos waste;
- removing or covering items that would be difficult to clean if they became contaminated, checking that such items are not already contaminated;
- cleaning up loose debris from asbestos containing materials and disposing of as asbestos waste, to prevent such material being trapped under the enclosure;
- securing any other potential hazards (e.g. sources of water leakage, gas flues);

- blocking openings (such as air conditioning systems, ventilation systems, etc) to prevent spread of any airborne asbestos out of the enclosure;
- ensuring provision of suitable power and water supplies;
- one member state requires electrical mains power supplies to be disconnected and electrical power to be supplied from an independent generator (INRS Guide 815), to provide a safer electrical system for wet removal work;
- arranging access for equipment;
- ensuring that the enclosure does not obstruct emergency (fire) escape routes (e.g. for others in the building), or that adequate alternative routes are signposted;
- ensuring that smoke alarms in the enclosure are deactivated for smoke testing of the enclosure;
- ensuring that electrical equipment within the work area has been switched off and made safe;
- ensured that there are emergency back up arrangements for power and water supplies.

Description

An enclosure may make use of existing building structure or may be an entirely free standing temporary structure. Existing surfaces must be smooth and impervious or else covered with polythene. An enclosure is generally constructed of durable (250 µm thick) polythene which will be disposed of as asbestos contaminated waste after the work is completed. In one member state (France), two layers of durable polythene are recommended. The enclosure should have:

- a sacrificial floor covering (to contain spread of contamination), or a smooth impermeable floor that can be cleaned;
- an airlock for personnel entering and leaving the enclosure;
- a separate air lock (sometimes called a bag lock) for passing properly contained (e.g. bagged and/or wrapped) waste out of the enclosure;
- exhaust ventilation (known as a negative pressure unit), with high efficiency filtration, to produce a slight negative pressure (20 Pascals recommended with a minimum of 10 Pascals required in one member state; in another member state, 5 Pascals minimum) within the enclosure and to provide a constant flow of fresh air throughout the enclosure;
- the rate of air changes in the enclosure should be at least 8 per hour;
- viewing panels (each at least 600 mm by 300 mm), giving views into all key areas (or closed circuit TV if necessary);
- direct connection to the decontamination unit, where possible, through air locks;
- where direct connection to the decontamination unit is not possible, additional airlocks to provide separation in changing from contaminated coveralls to intermediate coveralls worn solely for the transit to the decontamination unit.

The enclosure needs to be as air tight as possible, to prevent release in the eventuality of the negative pressure unit failing.

It may need to be:

- weatherproof, (if exposed), and/or
- constructed from orange fire retardant polythene (if there is an ignition hazard and/or restricted access).

These aspects (weather proofing, fire proofing) of the enclosure should be clearly stated in the plan of work.

Only authorised personnel, wearing personal protective equipment and appropriate respiratory protective equipment, are to be allowed to enter the enclosure.

There must be signs indicating the danger of asbestos exposure, designating the restricted access and the requirement to use protective equipment. These signs should comply with national regulations.

If you employ or control people who are going to undertake notifiable work with asbestos-containing materials, as part of your preparations you should ensure that:

- the site preparations and erection of the enclosure are undertaken by adequately trained and competent operatives;
- the site preparation is covered in the risk assessment and the plan of work;
- the preparation work is adequately supervised and inspected;
- effective systems are in place to monitor, inspect and maintain the enclosure (see Section 12.7).

If you are involved in asbestos removal, you should use personal protective equipment and respiratory protective equipment in the manner for which they were designed, and in accordance with your training. Check your personal protective equipment and respiratory protective equipment for suitability (for the specific job) and for correct functioning (each time you use it). Co-operate with your employer in keeping appropriate records of such checks.

Figure 12.1 Entry to an enclosure, with arrowed from top in clockwise rotation, the baglock, the waste container, the viewing panel, the negative pressure meter, the negative pressure unit, the electrical power supply, the stock of wetting agent and the decontamination unit.

Figure 12.2 Negative pressure units and air discharge ducts, viewing panels and warning signs.

12.3.3 Operation of an enclosure

The operatives within the enclosure will need to use the full decontamination procedure each time they leave the enclosure. Therefore it is important that there is someone outside the enclosure who:

- provides communication between those inside and those outside;
- controls the entry of persons though the airlock, checks that personnel are authorised, records who has entered and exited from the enclosure;
- organises the supply of equipment to the enclosure, and removal of bagged (or wrapped) waste from the bag lock;
- checks the good order of equipment and plant associated with the work.

This person (sometimes known as the "outside man") may not need the same degree of respiratory protective equipment as the operatives inside the enclosure. However, he should use at least disposable respiratory protection (rated for use against asbestos, e.g. EN FFP3)

and coveralls to protect against exposure if any bag is accidentally punctured. He should routinely use personal decontamination procedures at the end of the shift.

Any equipment taken into the enclosure should be prepared to make the eventual task of decontaminating that equipment easier, for example, capping the ends of scaffold tubes, and wrapping scaffold boards with polythene. However, boards wrapped in polythene, if wet, make a slippery walking surface. In that situation, additional thin boarding (plywood) may be needed as the walking surface. That wood would have to be treated as contaminated waste and not be re-used.

If you are the labour inspector, you should:

- look for records of inspection and checks on the enclosure (visual inspection, negative pressure, extract ventilation servicing, smoke tests);
- check that there is an outside man removing waste (etc), and that he is using suitable respiratory protective equipment and protective clothing;
- check that there is adequate provision of viewing panels;
- look through the viewing panels and closed circuit television, to check (for example) that the span of view is complete, that the work is being done according to the work plan, and that the waste is being cleared as material is removed;
- check that the transit routes (between the enclosure and the decontamination unit and between the enclosure and the secure waste storage facility) use the shortest suitable route;
- examine the transit routes, to check that they are kept clear, that they are as specified on the plan, and that no waste is left unattended on the transit route.

Figure 12.3 Enclosure for removal of lagging from a flue gas duct

12.4 PERSONAL DECONTAMINATION

12.4.1 The decontamination unit

The decontamination unit should be the first piece of equipment set up on site, and should be the last to leave the site.

The decontamination unit is essentially a "clean changing room" (often called clean end) separated by a self-closing door from a shower which in turn is connected via another self-closing door to a "dirty changing room" ("dirty end"). The principle of its operation is that the personnel take off their street clothes in the clean end, and don clean respirators and clean coveralls before moving through the shower compartment to the dirty end. If possible, the "dirty end" should connect directly to the stripping enclosure via airlocks.

There should be mirrors in both ends of the decontamination unit to enable operatives to check that their own respiratory protective equipment and coveralls are correctly in place.

After being in the enclosure (i.e. becoming potentially contaminated with asbestos), the personnel return to the dirty end, clean their coveralls with an asbestos rated (H-type) vacuum cleaner but keep their respiratory personal protection on until they have showered and cleaned

the external surfaces of the respirator. In some member states (e.g. the UK), the workers clean their overalls with vacuum H-type vacuum cleaners at the exit from the enclosure (or in the compartment of the airlock nearest the enclosure), rather than in the dirty end of the decontamination unit.

Any potentially contaminated materials that have been either discarded (coveralls in the dirty end of the decontamination unit) or used (towels or filters in the shower) must be bagged and disposed of as asbestos-contaminated waste.

In common practice, there is one shower section between the "dirty-end" and the "clean end".

In a more advanced practice, there is an additional intermediate room and a second shower room. This gives scope for a progressive decontamination and discarding of protective equipment, and allows the "clean end" to be best protected from contamination. The provision of the two separated showers also makes it feasible to use the first shower for washing down waterproof coveralls before they are taken off, and then the second shower for the final washing after discarding the protective clothing. The respiratory protective equipment is kept on until it has been further washed in the second shower. Disposable undergarments worn under the washable overalls are binned for disposable as contaminated waste; the washed washable overalls are stored in the central compartment.

In one member state (France), the five compartment decontamination unit is recommended even when disposable overalls are used, unless it is not possible to set it up on the site.

As the decontamination units are often mobile units, the facilities are often quite compact. However, it is important that there is adequate space for the number of personnel and adequate facilities such as benches to encourage proper use.

The decontamination unit should be provided with negative pressure ventilation, with a ventilation pressure gradient from the "clean end" to the "dirty end". An air change rate of 30 per hour for the shower and the dirty end is recommended but some national guidance accepts less; the greater the air change rate, the more dilution there will be of any asbestos released.

12.4.2 Use of the decontamination unit

The correct use of the decontamination unit is essential to prevent risk of exposure. It is important that individuals are shown the correct use and practice physical decontamination in training (Chapter 7.2.4). Figure 12.4 illustrates the use of decontamination units, both five-compartment and three-compartment units.

If you employ or control people who undertake asbestos removal, you should ensure that:

- they are properly trained in the use of the decontamination unit;
- contaminated disposable coveralls, towels and filters are bagged as asbestos contaminated waste in the dirty end;
- the unit is kept in good order, with the necessary supplies (hot water, shower gel, nail brushes, towels etc.) and protection against weather extremes (e.g. freezing of water supplies).

If you undertake asbestos removal work, you should:

- have been trained in the use of the decontamination unit;
- know how to prevent any contamination being carried from the enclosure to the clean end of the decontamination unit, and know how to correctly follow the decontamination procedures thereby preventing your own exposure to any asbestos in the process of personal decontamination;
- inform a supervisor immediately in the event of a unit malfunction (e.g. lack of pressure for the shower, lack of heated water, ventilation failure).

Figure 12.4. Illustration of personal decontamination in a five-compartment decontamination unit and in a three-compartment unit.

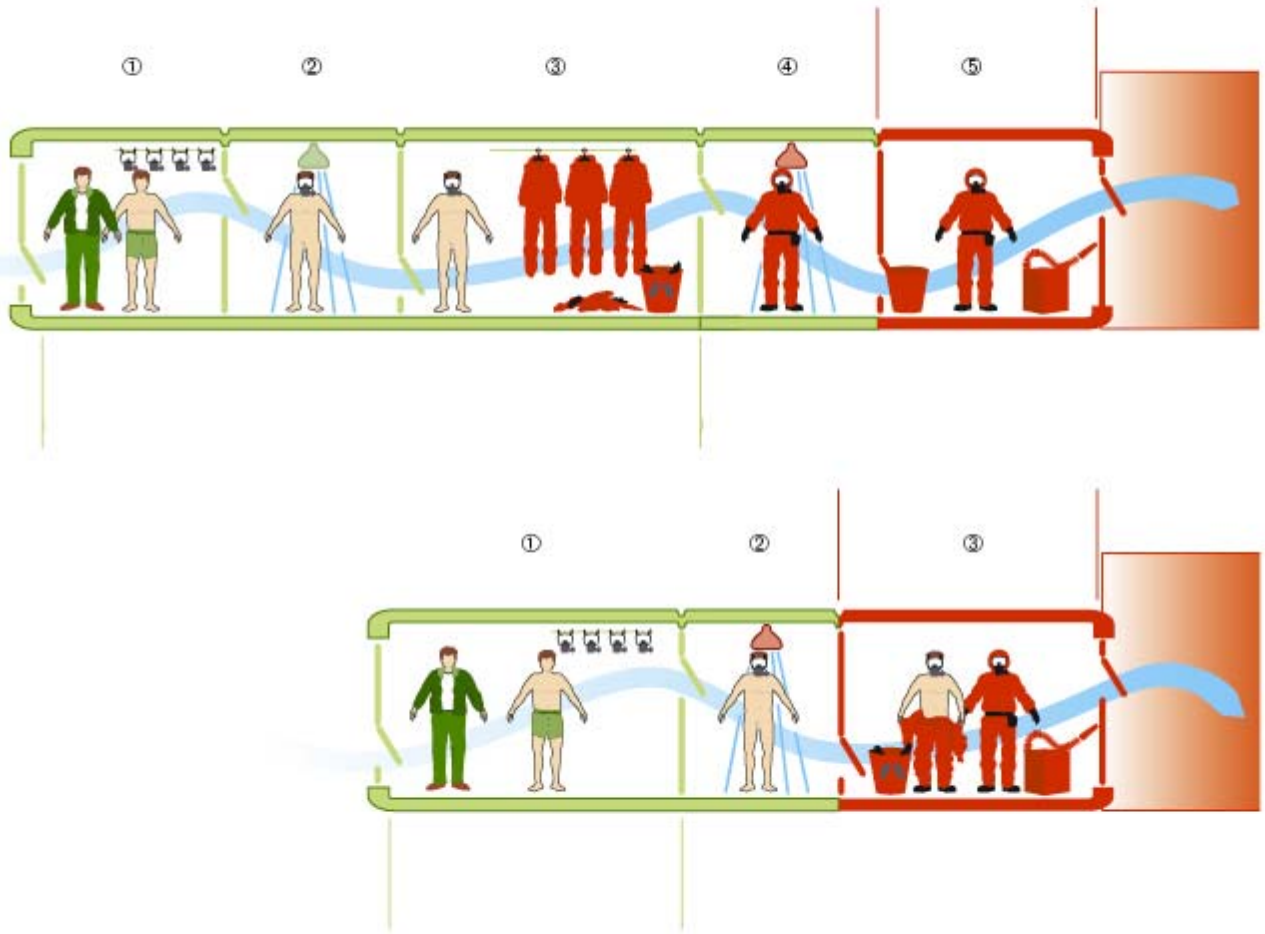


Figure 12.5 Decontamination with H-Type vacuum cleaner, in the shower with waterproof coveralls, and then showering before removal of the respiratory protective equipment. (Photographs provided by INRS; copyright INRS).

12.4.3 Maintenance of the decontamination unit

The decontamination unit should have a clearance certificate (confirming that it is not contaminated from previous work) before it is commissioned for use on site.

Cleaning of the decontamination unit should be undertaken by a competent person wearing clean coveralls and a clean respirator. Contaminated materials (towels, filters, coveralls, etc) should be bagged and collected up starting from the clean end so that contaminated material is taken out from the dirty end.

There should be regular monitoring of airborne fibre concentrations in the compartment where operatives doff their respiratory protective equipment (Chapter 16).

After completion of each shift, the decontamination unit should be thoroughly cleaned. It should be routinely tested for airborne fibre contamination in the "dirty end" and on completion of all works prior to leaving site or being dismantled should undergo a full clearance test (similar to that undertaken within an asbestos enclosure).

12.4.4 Transit between a remote decontamination unit and the enclosure

Where the decontamination unit cannot be linked directly to the enclosure, there is a need to ensure that the transit of operatives between the enclosure and the decontamination unit does not spread asbestos contamination out of the enclosure. The procedure for making this transit is suited to the use of disposable coveralls rather than washable coveralls.

To enter the enclosure, you should:

- use the decontamination unit (as described above) to change from street clothes into a set of disposable coveralls (for use in the enclosure) underneath transit coveralls, differently coloured from those worn in the enclosure to enable easy identification by others. Don clean footwear for transit to the enclosure. Inspect and check the respiratory protective equipment, and fit correctly using the mirror;
- move to the enclosure;
- remove clean footwear and transit coveralls in the outer compartment of the airlock to the enclosure. Hang the coverall on hooks or place in containers provided in the first compartment. (Do not leave on the floor.)
- pass into the second compartment of the airlock, and don footwear for use in the enclosure;
- pass though the inner compartment of the air lock and into the enclosure.

To leave the enclosure, you should:

- vacuum all visible dust from your personal protective equipment, respiratory protective equipment and footwear;
- from the enclosure, enter the inner compartment of airlock. Brush footwear in footbath. Sponge down or wet wipe respiratory protective equipment using separate water- bath;
- pass into middle stage of airlock. Remove coverall and footwear worn in the enclosure. Place coverall in waste bag as potentially asbestos-contaminated waste. (Or store for re-use, if taking a break during the shift (e.g. in hot work)). Do not remove respiratory protective equipment;
- pass into outer stage, and don transit overalls and footwear, keeping respiratory protective equipment on;

- move to the decontamination unit via a designated transit route (this should be identified at an early stage and should be a short, direct rote with the minimum of hazards e.g. stairs);
- enter the dirty end of the decontamination unit; take off footwear, all personal protective equipment and underwear worn in the enclosure; keep the respiratory protective equipment on with the motor running;
- move to the shower area, with the respiratory protective equipment still on. Shower and use a sponge to wipe the respiratory protective equipment without letting water into the filter ports;
- once the respiratory protective equipment has been cleaned, remove it and shower thoroughly. Remove the filter from the respiratory protective equipment, and bag for disposal as asbestos-contaminated waste;
- dry yourself with a towel; any towel used before leaving the shower compartment should not be taken into the clean end (it should be left in the shower compartment or discarded as potentially contaminated); all towels used should be treated as potentially contaminated and should be disposed of or cleaned accordingly;
- complete drying with a different towel in the clean end;
- dress in transit overalls (e.g. for a break) or in street clothes;
- leave via the clean end external door.

Figure 12.6 A mobile decontamination unit

12.5 DUST SUPPRESSION TECHNIQUES

12.5.1 Principles of dust suppression techniques

Where asbestos containing materials are to be removed, then dust suppression techniques must be used to prevent asbestos fibres becoming airborne. The choice of the removal technique needs to be carefully considered to take account of its suitability for the particular job. For example, wet stripping techniques are generally a preferred approach but may not be suitable if there is live electrical or mechanical equipment present. One member state recommends switching off all mains electrical supplies and providing an independent

generator. If there are any chemicals present, the possible hazards from reaction with water need to be considered. Wetting agents combined with water may make surfaces slippery increasing the risk for slips and falls particularly if working at a height. Freezing conditions may require use of antifreeze wetting agent.

The equipment (used for dust suppression and control) must be of adequate quality (e.g. meet quality standards such as the PAS quality standard in the UK (British Standards Institution)), be in proper working order and be properly maintained.

12.5.2 Wet stripping

Asbestos containing materials can be wetted by alternative application techniques: airless spray (to wet the surface or for thin and porous materials), and by injection needles for thicker materials or materials with an impervious surface. A wetting agent has to be added to the water, in order to wet the asbestos effectively.

The injection method is suitable for materials such as lagging and sprayed coatings, and can be suitable for other asbestos containing materials with impervious surfaces (e.g. painted asbestos insulating board). The injection needles may be mounted on a rigid board (for flat surfaces), or on a flexible supply pipe (for curved or uneven surfaces). A single point injection (on a rod) may be needed for inaccessible places).

Injection should be at low pressure (3.5 bar) so that the asbestos–containing material is wetted under capillary action without unnecessary spread of water. It is important that sufficient time is allowed to achieve adequate wetting throughout the material. ***If the material has dry patches, then that can lead to much higher concentrations of asbestos fibres in the air of the work place.***

The size and design of the needles should be selected to suit the shape of the asbestos-containing material, e.g. long needles with holes along their length for coatings/insulation more than 1 cm thick.

The needles need to be located appropriately to ensure good coverage. Close enough spacing to ensure that dry patches are not left, and positioned such that gravity assists the spread of water (e.g. needles along the top of horizontal pipes; needles in horizontal rings around vertical pipes, at intervals of about every metre for vertical pipes).

If the coating/insulation is covered with a hard surface that needs to be drilled to enable injection needles to be inserted, then dust suppression techniques must be used for the drilling. This can include wetting with the airless spray, and wetting in advance may allow the water to soak in.

Figure 12.7 Asbestos pipe insulation showing multiple layers and penetration of wetting agent

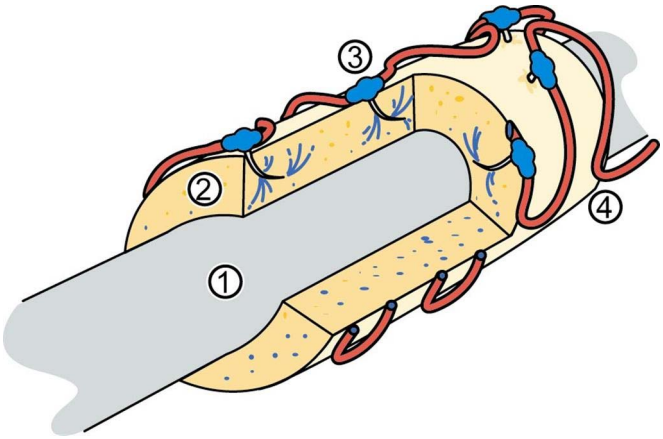


Figure 12.8 Diagram of injection system. (1) pipe, (2) lagging (3), injection needle supplied via (4) flexible piping.

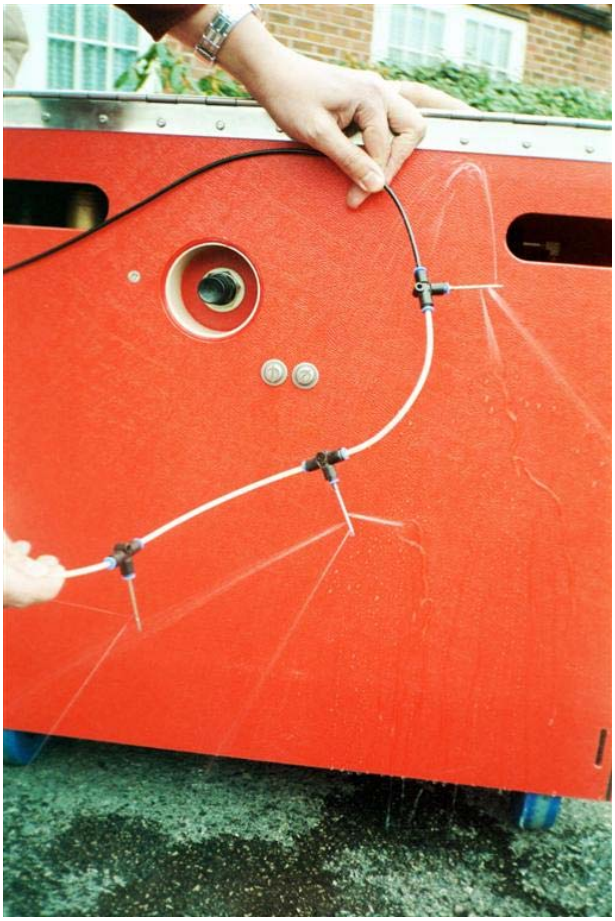


Figure 12.9 The injection system with water flow from several orifices along each needle. Figure provided by the UK HSE, from HSG 247. © Crown copyright material is reproduced with the permission of the controller of HMSO and Queen's Printer for Scotland.

Figure 12.10 Example of multi-point injection used in wetting sprayed asbestos insulation.

Airless spray (i.e. a spray which does not use air or gas to propel the water) can be used to wet the surface of porous material (for example insulating blanket, ropes, gaskets), and to prepare any material before drilling to allow insertion of needles for injection. Wetting with an airless spray can also be used on asbestos insulating board (for removal under local exhaust ventilation), and also on small debris during cleaning.

Damaged coating / lagging may be prone to break off in undertaking injection. Such damaged section can be wrapped in polythene (or cling film and tape) to prevent spread of debris.

Metal cladding, around the asbestos-containing lagging, may need to be removed to expose the lagging for injection. If the metal cladding can be drilled, then the lagging should be injected in that way. If the cladding can be removed without damaging the lagging, then that may be an easier way to gain access for inserting injection needles, and in that case airless spraying and shadow vacuuming should be used to control the release of dust.

Problems in uniformity of wetting can arise if the material is damaged with internal cracking, or where there is non-uniformity in the porosity of the material. Where cracks are apparent, needles should be placed carefully to maximise the effectiveness of wetting. Where there is varying porosity, then adjusting the flow rate can help. Wrapping of the asbestos containing material may be necessary to retain water and ensure wetting throughout.

Large scale, heavy duty industrial heating may involve the problems of:

- extensive and complex pipework, making full sealing of the enclosure difficult or impossible to achieve;
- large amounts of very thick (e.g. around 1 m) asbestos lagging;
- large quantities of asbestos-waste and slurry.

Properly wetted asbestos containing materials have a dough like consistency, and are ready to remove.

Removing the wetted asbestos-containing materials is best achieved with manual tools (e.g. scrapers, chisels, screwdrivers). Power tools (such as disc cutters and sanders) should never be used to cut through asbestos-containing materials.

The work should be organised methodically, with removed material being immediately bagged, or wrapped, and working progressively from top to bottom to prevent recontamination of cleaned surfaces (e.g. ceilings/beams first, then walls, and finally floor).

Once the majority of the material has been removed, there may be smaller amounts remaining on the surfaces. Sometimes the residual adheres strongly (e.g. on pitted pipe surface). Preference should be given to manual tools for removing residual asbestos, but power tools may be necessary for some strongly adhering residual material. In these cases, the tools should be used at the lowest power setting and with dust suppression (foams, airless sprays, or local exhaust ventilation).

Figure 12.11 Bagging waste close to the point of removal to prevent spread and minimise exposure.

If you employ people in removing materials containing asbestos, you should provide effective supervision to ensure that:

- the safety procedures are followed; and
- only the removal methods specified in the plan of work are used;
- any alteration in methods of work must NOT happen without prior revision of the risk assessment and plan of work;
- asbestos-removal works follow best practice (as in this guide);

If you are removing asbestos:

- decide on an order of works that minimises the possibility of recontamination of cleaned surfaces, e.g. ceilings/beams first, then walls, and finally floor.
- ensure that filters do not get wet as that damages their filtration efficiency.
- good housekeeping is essential. Clean up waste as soon it is produced. Timber supports for asbestos ceilings are likely to have nails in them, ensure these are not left protruding for someone to stand on.
- Remove asbestos-containing materials with minimal breakage. For example, if an AIB tile has 4 nails then it should be removed intact apart from damage only to nailed corners. Nails should be removed individually (with dust suppression as in Chapter 11);

- do NOT use methods other than those specified in the plan of work, and
- do NOT use power tools on asbestos-containing materials (except for specific and limited applications if those applications have been included in the risk assessment and the plan of work).

If you are the labour inspector, you should check that the work is being implemented in accord with the plan of work, for example, by:

- viewing the work thorough viewing panels;
- checking that the tools on site or in the enclosure are consistent with the methods in the plan of work;
- checking that power tools are NOT being used.

12.5.3 Controlled dry removal

Wet stripping is the best method, and it should always be used except in very special circumstances. However, in those special circumstances where wet stripping is not possible, the alternative is *controlled* dry removal – which means removal with other methods to control the release of dust such as local exhaust ventilation or wrapping the insulated components and cutting and removing an entire section (known as "wrap and cut ").

Wrapping and cutting sections of lagged pipe is suitable where the pipe together with the lagging are to be disposed of as asbestos waste. The lagged pipe is wrapped in polythene. Small localised sections of lagging may need to be removed to give access for cutting the pipe. The removal of this section of lagging means that there is a risk of asbestos exposure and the overall work should therefore be conducted in an enclosure (see Section 12.3.1 for those exceptional cases where enclosures may not be needed). This technique is suitable only if the sections of pipe are of a manageable size, and if the contents of the pipes /vessels have been drained.

Glovebags, made of strong clear plastic, have integral long sleeved plastic gloves that enable an external operator to manipulate items within. After fitting the glovebag around the item to be stripped, the operator can use tools via the gloves to remove the asbestos. The material stripped from the item is collected in the lower part of the glove bag. The bag should have a zip seal to enclose the waste in the lower part of the bag when the work is complete. The bag is used once only and then disposed of with the waste. Where practicable, the glovebag should be used under slight negative pressure.

A system of work for withdrawing tools (e.g. on completion) from the glovebag needs to be specified. This may involve drawing the tools into one of the gloves, then pulling the glove outwards so that the tools are contained in the protruding plastic glove. Knotting the glove

can then leave the tools in a kind of plastic pouch, a second knot in the glove creates a section which can be cut with minimal risk of release of asbestos. The tool pouch may be opened ether in the next glovebag, or in a bucket of water for cleaning.

The glovebag protects the operator, but the bag is not adequate to replace the need for personal protective equipment and respiratory protective equipment nor the need for an enclosure because asbestos could be spilt by a bag being punctured.

Several varieties of glovebag are available commercially.

Figure 12.12 Glovebags used for controlled removal of asbestos lagging (photographs provided courtesy of INRS; copyright INRS)

Direct removal by vacuum systems is a suitable and efficient method of removing loose asbestos (e.g. thermal or noise insulation). The waste asbestos is drawn to a remote collection unit by means of a vacuum transport duct, with the vacuum generated by equipment designed for the purpose.

If this duct connects to a bagging unit which is placed outside the removal enclosure, then that bagging unit needs to be given its own enclosure and operatives of the bagging unit need to use full respiratory protective equipment, personal protective equipment and decontamination procedures (as if working on removal).

If this type of equipment is used, then the plan of work should clearly specify how blockages of the vacuum transport duct would be cleared. For example, the duct would have to be carefully capped at both ends and drawn into the removal enclosure for clearing.

12.6 ENCAPSULATION AND ENCLOSURE

Where it has been decided that some or all of the asbestos-containing materials can be made safe by either encapsulation or enclosure, the process may involve risk of disturbance of the asbestos-containing material. Encapsulation may be achieved either by applying a thin sealant coating, a thick sealant coating, or impregnating the asbestos-containing material with a liquid that will harden. However, the initial wetting may add enough weight to cause the asbestos containing material to detach and fall, releasing dust. Generally, the same precautions as for asbestos removal are needed when encapsulating asbestos-containing materials.

Enclosure can mean encasing the asbestos-containing material in a structure that may stand away from the asbestos containing material. The risk assessment for this task should assess whether the work is likely to avoid disturbance of the asbestos-containing material. This will affect the decision as to whether the work needs to be notified and undertaken with the precaution described in this chapter, or whether precautions outlined Chapter 11 will suffice.

Figure 12.13 Careful removal of an asbestos tile

12.7 INSPECTION, MONITORING AND MAINTENANCE OF THE ENCLOSURE

12.7.1 Systematic inspection and monitoring

There needs to be a system in place to provide regular monitoring and maintenance of the enclosure. A trained and competent person can be nominated to be responsible for this. A defined system should be in place setting out the monitoring procedures and defining the frequency. The records of the monitoring should be checked frequently by management.

The monitoring should include:

- **Visual inspection** of the integrity of the enclosure.
    - **Before work starts**, the checks should cover the correct construction, seals, air locks, joints, and effectiveness sealing around obstacles such as pipes, ducts and cables.
    - **Daily inspections, prior to shifts**, should look for any damage or failure of seals of seals or joints, and for indications of satisfactory negative pressure in

the inward tension on the enclosure's polythene walls. Regular visual inspection is the primary prevention of any leakages.

- **Smoke testing to detect potential leaks** should be undertaken with the extract ventilation switched off. The purpose is to detect places where leakage could occur (especially if the air extract ventilation were to fail).

- **Differential pressure** of about 5 Pascals is usually sufficient to prevent outward leakage, but this is a small negative pressure and the readings can be affected by external conditions (e.g. strong winds affecting the pressures around and within the building). One member state requires a minimum pressure of 10 Pascals, and recommends a pressure difference of 20 Pascals.

- **Airborne concentration measurements** in the vicinity of the enclosure should be undertaken at the start of the work to confirm that no asbestos is detected outside the enclosure. These should be repeated at intervals, with the intervals being dependent on how critical any slight leakage would be. For example, if the enclosure is in an occupied building with nearby areas in use, then daily monitoring would be appropriate. If the enclosure is in an unoccupied building, much less frequent monitoring would suffice. The risk assessment should consider how much exposure could arise if there were a leakage, and set the frequency of monitoring accordingly. In many situations weekly monitoring may be appropriate. Regular monitoring is a confirmation and reassurance that leakage has not occurred, and can be important especially in sensitive situations (e.g. enclosure near a school).

- **Air extraction system**, should be checked by a competent person, prior to use and at regular intervals. The pre-filter can be replaced if it becomes clogged, but a clogged pre-filter suggests that dust suppression techniques are not working as well as they should. It is important to ensure that the filter is correctly installed. The air extraction system should be regularly serviced (6-monthly) by a competent person. If the high **e**fficiency filter is properly installed and working to its specification, then there should be no asbestos in the air discharged; however, occasional air sampling near the discharge is a useful check (e.g. when the high efficiency filter has just been replaced). Immediately after the high efficiency filter has been changed, the filtration efficiency of the extract ventilation should be tested to make sure that the filter has been correctly installed with effective seals. (Filter efficiency may be tested with a safe substitute aerosol e.g. di-octyl phthalate (DOP), normally done by the sub contractors servicing this equipment.)

12.8 WASTE REMOVAL

12.8.1 Bringing packaged waste out of the enclosure

Bags that are colour coded for asbestos waste and labelled as asbestos waste, in accordance with national regulations, should be used for the asbestos-containing waste. Bags of waste should be NOT more than partially filled, to and the contents should be damp. The bags should be carefully closed to exclude excess air, and sealed.

Bagged or wrapped waste is brought out of the enclosure through a separate airlock from that used for personnel entering and leaving. The air lock for waste is often called a "bag lock"; and the usual practice is a three compartment bag lock.

The sealed waste bags (or wrapped items) are sprayed (with a hand spray) and wet wiped in the inner compartment of the three stage bag lock. The cleaned bags are placed in the central airlock, and put inside an outer, transparent bag which is then sealed. The double bagged waste is then placed in the outer compartment of the bag lock. The waste is collected from the outer compartment by the outside operative(s) using appropriate (asbestos rated) respirators and transferred directly to the secure waste storage (e.g. lockable skip).

Care should be taken to ensure that the frame of the bag lock does not present any sharp corner or points, as sharp edges might tear a bag (or wrapping) containing waste.

12.8.2 Prevention of spillage

The packaged waste that is brought out of the enclosure needs to be kept securely to prevent spillage from either accidental damage or vandalism. Once outside the bag lock, the packaged waste should:

- never be left unattended until in secure containment;
- be transported by the shortest practicable route to a secure storage (e.g. lockable skip or vehicle), and the route should be clearly defined (so that it can be inspected at the end of the work).

There must be care to prevent bags splitting or being damaged:

- bags not overfilled;
- no sharp objects in the skip;
- no rough handling of the packaged waste (e.g. no throwing bags into the skip).

12.8.3 Personal Protection during removal

As described in Section 12.3.3, an operative stationed outside the enclosure can take the wrapped waste from bag lock to secure store. That operative should wear appropriate personal protective equipment and respiratory protective equipment, as defined in the risk assessment and plan of work.

12.9 CLEAN UP AND COMPLETION

During the course of the work, all equipment and the entire area of the work should be kept clean, with asbestos-containing waste being bagged as it is produced. Work areas should be cleaned and tidied up at the end of each shift. Cleaning methods must not create dust. Type H (i.e. rated for asbestos) vacuum cleaners should be used to vacuum up dust, using appropriate attachments for the various surfaces.

Debris should be damped down before collection. Shovels and rakes can be used for pieces of debris (brushes are not suitable). Wet cloths or rags can be used to clean surfaces, with the washing water being regularly changed to prevent cross contamination of surfaces. Where surfaces have been wet wiped, they must be allowed to dry before final inspection.

The Type H vacuum cleaner should not be used to collect wet material as the moisture will damage the high efficiency filter that prevents release of fibres.

After removal of all asbestos, and after all the asbestos waste and various tools and equipment have been taken out of the enclosure, a final clean of the enclosed area should be undertaken.

Surfaces should be vacuum cleaned initially with a Type H vacuum cleaner, and then with wet cloths and wipes.

Then any sheeting or boarding used as sacrificial covering of plant, equipment, floors or other surfaces, can be cleared. These sheets and boards (but only these sheets and boards) should be sprayed with sealant to prevent dust being released when they are moved.

All equipment used in the asbestos removal work needs to be cleaned prior to being taken out of the enclosure. Where possible, equipment such as scaffold boards of mobile elevating work platforms should have been protected (e.g. with sacrificial thin boarding, polythene sheeting) prior to being taken into the enclosure. Such boarding / sheeting can be sprayed with sealant and then must be disposed of as asbestos contaminated. Any surfaces that have not been fully protected must be cleaned, with an H-type vacuum cleaner and clean water. Contaminated water must be disposed of through a water filtration system.

Finally the contractor should thoroughly inspect to ensure that all asbestos-containing materials due for removal have been removed, and that the work area is cleaned of visible debris and fine settled dust. The only equipment remaining at this stage in the enclosure should be any wrapped waste that could not be extracted through the bag air lock, a type H vacuum cleaner, a means of safe access to any high surfaces within the enclosure, and wipes and waste bags for any additional cleaning that may be directed by the independent analyst undertaking a clearance test (see Chapter 16).

In some member states (UK and Ireland), the independent analyst will undertake a 4-stage procedure to assess whether the asbestos work has been satisfactorily completed making the premises fit for reoccupation.

1. a preliminary check of site conditions and job completeness, comparing what has been done with what was stated in the plan of work and assessing the conditions on transit routes and areas around the enclosure for signs of contamination with debris;

2. a thorough visual inspection inside the enclosure to ensure that the asbestos-containing materials have been removed, that surfaces are clean, and that any asbestos-materials retained *in situ* are in accord with the plan of work;

3. air monitoring, within the enclosure, to establish that air concentrations are less than a set indication level (of 0.01 fibres/ml as measured by phase contrast optical microscopy);

4. a final assessment, involving a thorough visual inspection after the enclosure has been dismantled and removed. This final assessment is to ensure that any debris revealed in the course of dismantling the enclosure has been properly cleared up.

National procedures may involve the analyst issuing a document or certificate setting out the outcome of each of the above four stages. The contractor may need to counter sign the document.

Once the above procedure has been satisfactorily completed, the analyst will also undertake an inspection of the decontamination unit before that is taken off site. The inspection will comprise visual inspection in all compartment, and air monitoring in the shower and dirty compartment.

Detailed guidance for analysts undertaken this procedure is published by the UK Health and Safety Executive (2005) in Guide HSG248.

In some member states, air monitoring by electron microscopy is required after completion of asbestos removal work (see Section 16.2 for a description of the significance of different measurement methods).

If you are the labour inspector, you should check that:

- the work has been notified in accordance with statutory requirements;
- the plan of work is available, that it is clear and covers the recommendations given here;
- training and refresher training is being implemented;
- good working practice is encouraged;
- the scope of the works complies with that defined in the plan of work;
- photographic identification of operatives ties in with medical and training records;
- good site management and supervision processes and procedures are being used.

You should also check that:

- everyone on site has a correct version of the plans that they can understand, (e.g. if any of the workers does not speak the national language, then you should find out whether he has been provided with a copy in a language that he does understand. He should also have a means of communication with his supervisor sufficient to cover enquiries regarding his tasks within the plan).
- practical procedures to minimise release of dust, prevent exposure and spread of contamination are being used. For example, any AIB boarding that has been removed should be intact and any screw holes (visible through the wrapping) should be in a state consistent with careful removal of screws.

Consider also the practical checks described in Section 11.2.2 (e.g. on asbestos-containing materials being removed intact as far as possible).

Where best practice is not being achieved in a project or site, give clear instructions regarding required actions and recommendations. If the failure to meet best practice creates a significant exposure to asbestos for workers or others, then cessation of works is the safest course.

13 DEMOLITION

Demolition works come under the EC Directive on safety and health requirements at mobile construction sites EC Directive 92/57/EEC). That Directive requires that health, safety and welfare be adequately catered for when setting up a site.

This guide is focussed on the prevention of risks of exposure to asbestos, and therefore does not attempt to cover the requirements that arise from the general requirements of the mobile sites directive. However, those involved in managing demolition works should have a working knowledge of the requirements that arise from the mobile sites directive.

The European Directive 83/477/EEC as last amended by Directive 2003/18/EC states that: "*Before carrying out asbestos demolition or removal work, firms must provide evidence of their ability in this field. The evidence shall be established in accordance with national laws and/or practice*."

The Directive also requires that before beginning demolition work, *"employers shall take, if appropriate by obtaining information from the owners of the premises, all necessary steps to identify presumed asbestos-containing materials." If there is any doubt about the presence of asbestos in a material or construction, the applicable provisions of this Directive shall be observed"*. Those provisions include that: "*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*".

When undertaking demolition work which may involve asbestos-containing materials, the key points to consider are:

- who may be affected by the work?
- how are we going to segregate the work?
- what control measures will we use?
- can asbestos removal work take place side by side with demolition work?
- how will the asbestos removal contractor's operatives be protected from the demolition works?
- how will the demolition contractor's operatives be protected from the asbestos removal works?

The process of undertaking demolition should involve the following steps.

- Identify where asbestos-containing materials are present on demolition site via asbestos surveys, inspections and/or reviewing existing information regarding the site.
- Remove all accessible asbestos prior to commencement of any demolition work.
- Allow preliminary demolition works to proceed in areas where no asbestos-containing materials were located i.e. removal of non-structural non-asbestos elements, suspended ceilings, partition walls, flooring etc.
    - During this work, voids will be uncovered e.g. mechanical and electrical routes. These networks should be traced to ensure that any connections to other structures not included in the demolition have been severed e.g. a pipe

run covering a number of buildings on a site where not all the buildings are due for demolition.

- Re-inspect those areas now revealed for asbestos-containing materials not previously identified. If asbestos-containing materials are discovered, demolition should stop and then these materials should be removed by the asbestos contractor.

- Identify locations of inaccessible asbestos-containing materials or those that cannot be safely removed prior to demolition e.g. asbestos-containing materials that either form or insulate structural elements.
- Develop a strategy regarding how and when to remove those asbestos materials e.g. removal of shuttering containing asbestos may require removal of concrete slabs. This could be done within a contained work zone with appropriate trained personnel wearing appropriate respiratory protective equipment. It may not always be practicable in these instances to construct an enclosure.
- Provide asbestos-awareness training to those involved in demolition, so that if asbestos-containing materials are encountered unexpectedly then a safe system of work will be implemented to enable removal of the asbestos containing materials with minimal exposure to those working adjacently.

Demolition can involve several techniques:

- Dismantling – this should consist of taking the structure down in the reverse sequence to that in which it was constructed. The non-structural material (e.g. asbestos cement wall cladding and roof sheets) would normally be removed first. Then the structural frame would be dismantled either by unbolting by hand or by flame cutting, and using lifting equipment and access equipment (e.g. scaffolding or mobile elevating work platforms).
- By machine – large machines fitted with various specialised attachments can undertake a range of demolition activities. Machines fitted with hydraulic shears can carefully cut out previously inaccessible structural beams. Such machines can lower structural beams coated with asbestos insulation to the ground where removal of the asbestos insulation can take place under controlled conditions. Demolition by machine is often the preferred method as this can be carried out remotely and those involved are at a safe distance from building structure during the work. Large brick and/or stone buildings can be simply pushed over by specialised machines. Asbestos containing waste can be dealt with in a controlled manner on the ground, thus preventing the danger of work at heights.
- Remote demolition by 'ball & chain' or similar equipment

  These methods have their use when demolishing unsafe structures as they are remote methods so protect the safety of those undertaking the work, however risk assessments should show the asbestos exposure levels expected and how to control and minimise these.

- Remote demolition by explosive methods

  Explosive methods may be less controllable (for spread of contamination), and are therefore a last resort for demolition of unsafe structures. However, the use of explosives in the demolition of buildings is becoming increasingly common and it has the advantages that al personnel are remote from the building when the explosives are detonated. However, large amounts of dust are generated and therefore all asbestos

remaining materials should be removed first, unless the risk assessment has clearly shown that some materials should be left in place.

For fire-damaged structures, any of the above techniques can be employed.

All asbestos remediation works within the scope of a demolition project should be dealt with as either lower risk or notifiable works, as appropriate, and with appropriate precautions. **There is no 'lower' standard for demolition sites.**

In some instances, the demolition of a building will include the removal of electrical switchgear, transformers, etc. Because of their valuable scrap metals, these pieces of equipment are likely to be removed intact and transported to other premises for further processing. Components of electrical switchgear may be asbestos-containing materials. Therefore, those involved in dismantling such equipment should be aware of the possible presence of asbestos-containing materials, be able to recognise them, and should adopt best practice to minimise exposure to asbestos dust.

If you employ people in demolition work involving materials containing asbestos, you should ensure that:

- there is effective co-ordination between the various activities on site, and in particular that demolition works do not endanger asbestos-removal workers, and vice versa,
- asbestos-removal works follow best practice (as in this guide);
- all operatives have appropriate training (e.g. so that demolition workers can recognise materials that may contain asbestos and know what to do when they uncover such materials);
- that asbestos-containing materials revealed in the course of demolition works are removed and disposed of as asbestos-contaminated waste.

If you work on a demolition site where there are asbestos-containing materials, you should:

- be aware of the risks from asbestos exposure;
- know how to recognise materials that may contain asbestos;
- understand the procedures that prevent you being endangered by demolition activities; and
- follow best practice, as advised in this guide, for work with asbestos.

If you are the labour inspector, you should:

- check that there is an effective systems for co-ordinating demolition and asbestos removal activities;
- check that demolition workers:
  - have been informed about, and understand, the risks from asbestos, and
  - have been trained in, and know, how to recognise asbestos-containing materials;
- check that the asbestos-removal work follows best practice (as in Chapter 12);
- check for compliance with national regulations on these issues.

14 THE WORKER AND WORKING ENVIRONMENT

14.1 INTRODUCTION

The difficulties of protecting operatives from the risk of asbestos exposure can be made more complicated when the working conditions also involve other factors, such as extreme temperatures. High temperatures may arise in working on hot plant or in enclosures heated by direct sunlight; low temperatures arise in working in unheated areas in cold weather or cold climates.

In addition, the use of sealed or non-permeable coveralls can reduce routes for heat loss from the body and, in combination with high work loads, can result in heat related illness even in relatively temperate climates. Furthermore, where the use of water for wet stripping creates a humid atmosphere, that can restrict the normal loss of body heat through evaporation of sweat. Hot conditions might tempt operatives to loosen clothing thereby reducing the effectiveness of protection against contamination with asbestos.

The disposable overalls used in asbestos stripping may provide relatively little protection against cold conditions. Physically arduous clearance activities may generate significant metabolic heat, but the more delicate final cleaning tasks generate relatively little metabolic heat and cold related problems become a greater issue.

14.2 THE WORKER

The worker's physical condition can also affect their capability to work safely within these environments.

The worker's ability to wear and use respiratory protective equipment may be affected by changes in their personal condition. A beard stubble, or loss of weight may affect the face-fit of a respirator.

For a pregnant worker, it is also important to consider how that condition affects these issues: face-fit of the respiratory protective equipment and the physical capacity to deal with thermal extremes.

14.3 THE TYPE OF WORK

Musculoskeletal disorders are the largest single cause of work-related ill health and sickness absence across the EU. Manual handling is a major cause of work-related back pain. Compliance with the provisions of the EC Directive on Manual Handling (90/269/EEC) should help to minimise this risk in asbestos work. Working in awkward postures (e.g. stooping or twisting) may provoke back pain; and this might be a particular problem in working in cold environments.

Three factors: force, posture and repetition can contribute to upper limb symptoms and injury. The practical issues that can affect the risk include: poorly designed hand tools; repeated work with wrist flexion and extension; and extensive work with elevated arms.

Musculo-skeletal symptoms or problems may be a factor that distracts an operative from ensuring that he is keeping respiratory protective equipment properly fitted to his face.

14.4 THE WORK ENVIRONMENT

14.4.1 Hot condition

The adverse health effects from working at high temperatures may include:

- burns, from contact with hot surfaces or radiant heat;
- superficial effects: swelling of feet and ankles, heat rash;
- fainting, due to a reduction of blood pressure to the brain (which can become serious if the person is held upright), and bringing obvious dangers of injury in falls and the difficulties of aiding an unconscious operative in a respirator;
- muscle cramps, nausea, vomiting, due to salt depletion caused by excessive sweating;
- heat exhaustion, caused by dehydration caused by excessive loss of sweat. symptoms include: fatigue, giddiness, nausea, headache, breathing difficulties, extreme thirst, muscle cramps;
- heat stroke, an acute and potentially fatal condition caused by the rise in body core temperature to above 40 °C. This condition may occur suddenly with no warning or may be preceded by headache, dizziness, confusion, faintness, restlessness or vomiting.

The actions that should be taken to minimise the risks from hot working include:

- minimising heat sources (e.g. switching off hot plant as far as possible);
- restricting conduction and radiation of heat (e.g. sacrificial lagging over hot surfaces, radiant heat shields to deflect heat);
- higher air change rates (e.g. greater general or local exhaust ventilation);
- cooling (e.g. with make up air from outside, compressed air fed suits, or air conditioning plant);
- localised cooling with free standing fans (taking care to avoid dust disturbance);
- job rotation and periodic breaks in a cooler area;
- preventing dehydration, by supply of regular drinks of water before work, during breaks and after work;
- training in heat stress awareness, symptoms, safe practices and emergency procedures;
- monitoring thermal conditions and the health state of the workers (e.g. measuring core body temperature) with input from health professionals.

Two European Standards (EN 27243 and EN ISO 7933) can help carry out a risk assessment for the effects of hot conditions. EN 27243 is the simpler to apply but does not include any provision to allow for clothing or personal protective equipment or respiratory protective equipment. EN ISO 7933 allows for skin coverage effects but not clothing permeability. A UK standard (BS 7963) provides some guidance on adjustments to be made to allow for the thermal impact of personal protective equipment.

14.4.2 Cold conditions

For work in cold conditions, ISO/TR 11079 provides guidance on required clothing insulation and ISO 9920 covers estimating the thermal characteristics of the clothing ensemble. Notifiable work on asbestos-containing materials in cold conditions may require the provision of disposable undergarments to be worn under the disposable or washable coveralls.

Exposure to low temperatures, without adequate protection, can lead to hypothermia. Hypothermia is a decrease in the body's core temperature to a level at which the functions of the muscles and the brain are impaired. Mild hypothermia (core body temperature between 37 °C and 35 °C) causes mild shivering which is not under voluntary control, impairs complex motor actions (but not walking or talking), and (by causing vasoconstriction) reduces blood flow to the surface of the body. Moderate hypothermia (core body temperature 35 to 34 °C) causes dazed consciousness, loss of fine motor control (particularly in the hands), slurred speech, irrational behaviour, and an attitude of not caring what happens. These symptoms are obviously likely to increase the risk of incorrect use of tools or protective equipment and so increase the risk of exposure when working with asbestos.

Severe hypothermia can lead quickly to death.

If you employ people whose work may involve exposure to asbestos under conditions such as described in this chapter, you should:

- monitor the condition of operatives and have a system for ensuring that their safety is not compromised (e.g. by respiratory protective equipment becoming less effective due to operatives having beard stubble, or reassess the choice of respiratory protective equipment if an operative has a significant change in physical condition);
- take into account the practical difficulties to minimise the risks of the work causing musculoskeletal disorders, or impeding proper use of respiratory protective equipment;
- set up effective systems to achieve tolerable thermal conditions in the work place, such as:
    - cooling/ heating;
    - sacrificial lagging of hot elements;
    - appropriate protective clothing;
    - additional ventilation;
    - a work schedule with adequate breaks;
- arrange adequate monitoring to check on operatives well being.

If your work involves possible exposure to asbestos and physically difficult work conditions (due to temperature, or to the physical nature of the work), you should:

- be aware of the importance of maintaining protection against asbestos exposure;
- be alert to the effects of hot conditions, and use the equipment provided to protect against the conditions (sacrificial insulation, protective clothing, additional ventilation, regular breaks, drinking water at breaks at before work);
- use protection provided to protect against cold conditions (heaters – where appropriate, thermal protective clothing, breaks if needed, etc);
- always follow best practice, as advised in this guide, to protect against the risks of asbestos exposure.

If you are the labour inspector, you should:

- look for effective action to alleviate thermal stress;
- check whether work conditions are likely to impede the effective use of respiratory protective equipment;
- check for compliance with national regulations on these issues.

15 WASTE DISPOSAL

15.1 INTRODUCTION

The Asbestos Worker Protection Directive 83/477/EEC as last amended by Directive 2003/18/EC, requires that (Article 6) "*...the exposure of workers to dust arising from asbestos or materials containing asbestos at the place of work must be reduced to a minimum … through the following measures" (*regarding transport and disposal of waste)*:*

- *"asbestos or dust-generating asbestos-containing materials must be stored and transported in suitable sealed packing;*
- *waste must be collected and removed from the place of work as soon as possible in suitable sealed packing with labels indicating that it contains asbestos……Such waste shall then be dealt with in accordance with Council Directive 91/689/EEC of 12 December 1991 on hazardous waste."*

Under the Framework Directive on Waste, EU Member States must encourage the prevention or reduction of waste and its harmfulness by encouraging the development of clean technologies, technical product improvements and disposal techniques. In addition, they must prohibit uncontrolled dumping. An adequate network of disposal installations must be established in co-operation with other Member States, using the best available technology which does not entail excessive costs.

15.2 ISSUES

The packaged waste containing asbestos shall be labelled, in accordance with European Directive 1983/478/EEC of 19th September 1983, as asbestos containing waste..

Once the packaged waste has been collected in secure storage (e.g. a lockable skip) on site, it will need to be transported safely to an authorised disposal site. The transport must be arranged in accordance with national regulations on the transport of dangerous goods, which may include requirements on securing the load, labelling the vehicle, prior written arrangement with the authorised disposal site, emergency procedures for dealing with any spillages (e.g. of wrapped waste within the skip); training of the driver; a competent advisor on transport of dangerous goods.

Currently within the EU the sites for disposal of asbestos are landfill sites or vitrification plants. In some member states, underground mines can be used for disposal of asbestos waste.

Controlled landfill/mine sites

The asbestos waste is buried in these sites. The records (kept by the site) enable the material to be traced from source to location within site. In some member states the waste is sealed e.g. with concrete.

A risk assessment of the likely exposure of operatives on the site, engaged in the transfer or burial of bagged waste needs to be undertaken and regularly checked by personal sampling. Employees should be protected against the risk of exposure (e.g. due to damage to bagged or wrapped waste during transfer or burial) by use of suitable protection (e.g. provision of high efficiency particulate filtration on the air conditioning of vehicle cabs, and use of adequate asbestos rated respiratory protection, protective clothing and changing facilities or decontamination facilities).

Vitrification

This involves a processing plant where asbestos waste is treated at high temperatures and enables transformation by chemical alteration to a vitrified inert end-product which may be suitable for use as road aggregate and possible other uses. The process is believed to be a completely effective means of eliminating the risk of exposure from the final product. However, vitrification uses considerably more energy than the other processes.

15.3 RECORDING THE TRANSPORT

Directive 84/631/EEC requires the use of a detailed consignment note detailing the source and composition of the waste, the routes by which it will be transported, measures undertaken to ensure safe transportation and the existence of a formal agreement with the consignee of the waste.

15.4 WHAT YOU SHOULD DO

If you employ people whose work involves dealing with disposal of asbestos-containing waste, you should:

- undertake a risk assessment (as in Chapter 5) to assess their likely exposure, and the potential exposure of others from the work;
- provide written instructions for methods of work that minimise the worker exposure to airborne asbestos;
- follow best practice (as in this guide);
- ensure that they are adequately trained and informed of the risks;
- arrange for adequate monitoring of airborne asbestos fibre concentrations to determine the exposure of operatives and others;
- keep records of the asbestos disposed of (e.g. the location of batches of waste on landfill sites);
- ensure that operatives are provided with, and use properly, adequate personal protective equipment (e.g. respiratory protective equipment and coveralls, where indicated by the results of the risk assessment).
- comply with national regulations regarding work that involves asbestos.

If your work involves dealing with asbestos-containing waste, you should:

- from your training, be aware of the risks from asbestos exposure;
- understand the importance of keeping exposure as low as possible;
- adhere to written instructions that minimise the risk of asbestos exposure; and
- follow best practice, as advised in this guide, for work with asbestos.

If you are the labour inspector, you should:

- look for an adequate risk assessment;
- suitable written methods of work for preventing or minimise the risk of asbestos exposure;
- look for records of results of monitoring of worker exposure to asbestos;
- check for compliance with national regulations on these issues.

16 MONITORING AND MEASUREMENT

16.1 INTRODUCTION

This chapter explains the monitoring and measurements of air concentrations that should be undertaken by a competent person or organisation. The explanation is intended to:

- help the employer arrange appropriate air monitoring;
- aid the employer, worker and inspector understand the several purposes of air monitoring;
- help to explain what the results may mean;
- outline what is involved in air sampling and measurement of concentrations of airborne fibres;
- show how different techniques (in the determination of numbers of fibres on the sample) affect the information reported.

16.2 AIR SAMPLING AND SAMPLE ANALYSIS METHODS

During air sampling, a measured volume of air is drawn through a filter capturing airborne fibres on the filter. Subsequently, the filter is examined under a microscope to produce a count of the number of fibres, and hence a measurement of the concentration of fibres in the sampled air.

The EU Asbestos Worker Protection Directive 83/477/EEC as last amended by Directive 2003/18/EC specifies that the sampling shall be carried out by suitably qualified personnel, and the samples analysed in laboratories equipped for fibre counting. It also specifies that the filter shall be subsequently analysed using a method published by the World Health Organisation (1997) i.e. by counting fibres under a phase contrast optical microscope, or by any other method giving equivalent results. The phase contrast optical microscope method is the method used in most EU member states.

Other types of microscope may be used to analyse the filters. Electron microscopes provide higher magnification (which reveals more fibres with very thin diameter than detectable under an optical microscope), and they can distinguish asbestos fibres from other fibres (e.g. organic fibres or man made mineral fibres). Therefore counts by different types of microscope are likely to produce different estimates of concentration. There are two types of electron microscope: the scanning electron microscope and the transmission electron microscope.

Each microscope method has its own advantages. The optical microscope can be readily transported and used on site to give rapid results, which is important when results are needed promptly e.g. when testing for leaks from an enclosure. The limitation of the phase contrast optical microscope method is that it produces a count of all fibres, including non-asbestos fibres and hence a concentration of all types of fibre (not just asbestos fibres).

The electron microscopes provide higher magnification and greater resolution and hence detect thinner fibres that would not have been seen under the phase contrast optical microscope. Concentrations measured by electron microscopes can therefore be higher than those measured by the optical microscope method.

The scanning electron microscope distinguishes asbestos fibres from non-asbestos fibres, by determining the chemical composition of the fibres. This can help demonstrate lower

concentrations after completion of asbestos removal work, if there are other types of fibre (e.g. organic fibres) present in the air.

The transmission electron microscope can determine which type of asbestos a fibre is (amosite, crocidolite, chrysotile, etc) by determining the fibre's chemical composition and crystalline structure. The transmission electron microscope has the highest magnification for observing the very smallest of fibres. However, the analysis by this method is the most costly and time consuming. It also involves a delicate and time-consuming sample preparation technique.

One member state requires measurements by transmission electron microscopy to confirm that concentrations are below 0.005 fibres/ml as part of the tests to establish that a building is fit for reoccupation (INRS ED815). Another member state requires measurements by scanning electron microscopy. In several member states, measurements by phase contrast optical microscopy (e.g. to demonstrate concentrations below 0.01 fibres/ml) are used as part of the procedures for establishing that asbestos removal has been satisfactorily completed.

16.3 PURPOSES OF AIR MONITORING

Background Sampling may be used to establish the ambient fibre-level where there is no active asbestos disturbance, e.g. prior to work starting. It is also used in the management of asbestos-containing materials that remain in place.

Personal Monitoring measures the concentration of fibres in the operative's breathing zone. This measurement provides a basis for checking if the protection factor of the personal respiratory protective equipment is adequate.

The Asbestos Worker Protection Directive 83/477/EEC as last amended by Directive 2003/18/EC states that

1. "*The employer must enter the workers responsible for carrying out the activities*" (notifiable work as defined in Section 6.3) "*in a register, indicating 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. Each worker shall have access to the results in the register which relate to him personally. The workers and/or their representatives shall have access to anonymous, collective information in the register.*
2. *The register referred to in point 1 and the medical records referred to in Article 15(1)"* (see Chapter 19) *"shall be kept for at least 40 years following the end of exposure, in accordance with national laws and/or practice.*
3. *The documents referred to in point 2 shall be made available to the responsible authority in cases where the undertaking ceases trading, in accordance with national laws and/or practice."*

Regular monitoring may also identify any operative whose work practice produces unusual concentrations, and hence help identify where work practices need to be improved.

Samples are also sometimes collected in the general area of the work. These samples, in conjunction with the personal monitoring, help establish the concentration of asbestos fibres in the air where the work is being done.

Environmental Monitoring should include measuring the concentration of airborne fibres in areas where there is a possibility of operatives being exposed when they are not using personal respiratory protection. One member state specifies measuring twice weekly in the

compartment of the decontamination unit where operatives remove their respirators (INRS ED815).

Leak Testing may be carried out during asbestos works, where there is an enclosure. It is a secondary measure to visual inspection and smoke testing of the enclosure. This test is used where there are suspected 'weak spots' in the enclosure, or where there are sensitive areas nearby (e.g. occupied areas). The monitoring tests for an elevated fibre concentration that may be associated with a release of asbestos from the enclosure. A background test prior to work starting is useful, as it can help determine if a leak test measurement reflects a release or just background concentrations

Leak testing may be necessary especially where there are obstacles (cables, pipes, risers etc.) that cross the enclosure. The planning should provide a "buffer zone" between those involved in the asbestos works and other occupiers of the building. Leak testing should be done within this 'buffer zone'.

Leak tests should be carried out at a greater frequency at the 'higher risk' times of the contract (e.g. at the start, times of greatest asbestos disturbance, and times of disturbance around the enclosure 'weak spots'). Where sufficient monitoring indicates a well sealed and managed enclosure, then such tests may be reduced or stopped as appropriate.

Clearance Monitoring is carried out in association with a visual assessment of the cleanliness and the integrity of containment systems. National regulations and practice may require clearance monitoring after asbestos removal works before the site is either returned to normal use or made available for demolition or building renovation.

16.4 SELECTION OF A MONITORING ORGANISATION

Laboratories that are accredited to ISO/IEC 17025 will have the necessary quality systems in place. The laboratories should also participate in an external fibre proficiency testing scheme (such as the national schemes in the UK (RICE), Spain (PICC-FA), Belgium, France) or an international scheme (such as AFRICA).

16.5 WHAT YOU SHOULD DO

If you employ or control people who remove asbestos, you should:

- ensure that the tests (personal exposure monitoring, clearance testing, etc) are carried out by a competent, accredited, person or organization;
- ensure that airborne fibre monitoring, where necessary, is carried out by a person or organization independent of the asbestos contractor;
- provide the monitoring organization with the plan of work prior to their attendance on site;
- have a monitoring strategy implemented which is appropriate to the nature, extent, location and complexity of the asbestos works;
- maintain a register of the employees (undertaking notifiable work), which records their activities, the exposures they have been subjected to, and keep for a minimum of 40 years, and make it accessible as below:
  - to the responsible national authority and to the doctor responsible for medical surveillance;
  - to individuals, for access to the records of their own exposure;
  - to workers' representatives, for collective information in the register;
- ensure that personal exposure monitoring is carried out on a regular basis, to national requirements, and that records are retained for a minimum of 40 years;
- act promptly on results received from the monitoring organization.

If you undertake work on asbestos removal, you should:

- co-operate with you employer and the chosen monitoring organization in wearing a personal monitoring device and ensuring that it is not impeded and your working practices remain normal during the sampling period;
- provide accurate information on your work and methods during personal sampling;
- aid the monitoring organization in determining expected 'weak spots' in the enclosure for leak testing;
- aid the monitoring organization to achieve a thorough visual examination of the enclosure during clearance testing, e.g. by assistance in use of access equipment etc.;
- not move, adjust or otherwise tamper with any of the air monitoring equipment;
- acting on your employer/manager's instructions, take immediate remedial action where the monitoring organization identifies elevated fibre concentrations in or around the work area.

If you are the labour inspector, you should:

- look for evidence that the monitoring is appropriate to the nature, extent , location and complexity of asbestos works;
- ensure that mandatory tests are carried out by a competent and where necessary, independent organization or person;
- establish that regular personal monitoring is undertaken and that the records are stored for a minimum of 40 years;
- inspect the register of workers' activities and their exposures (e.g. to make sure that it is realistic and adequate);
- review results of air monitoring tests to establish that action has been taken in instances where elevated fibre concentrations have been reported.

16.6 INFORMATION

The Asbestos Worker Protection Directive 83/477/EEC as last amended by Directive 2003/18/EC requires that:

- there should be arrangements for workers and/or their representatives to have access to the results of measurements of concentrations asbestos in the air, and to have explanation of the significance of the results;
- if the results of the measurements of air concentrations exceed the specified limit value (0.1 fibres/ml as an 8-hour time weighted average), then:
    - the worker(s) affected must be informed as quickly as possible of the fact and the reasons for it;
    - the workers and/or their representatives in the organisation are consulted on the measures to be taken, or in an emergency must be informed of the measures taken.

17 OTHER PERSONS INVOLVED

17.1 WHO ELSE IS INVOLVED

Most chapters of this guide are intended for those persons directly involved in work that may, or does, involve a risk of exposure to asbestos. There are however several other persons who have an important involvement. These include:

- the client (who commissions the work);
- the people involved in building design and services (architects, civil engineers, building facilities managers);
- the people who undertake subcontract work in preparation for the asbestos removal or encapsulation work;
- the people who work or live in a building where asbestos work is undertaken;
- anyone who might be affected by the work e.g. passers by, members of the public.

17.2 INVOLVEMENT IN PLANNING ASBESTOS WORKS

17.2.1 Selection of a contractor

For the client who is seeking a contractor, it is important to consider the technical standards of contractors' proposals for preventing the risks of:

- spread of asbestos contamination;
- exposure to others during the course of the works;
- providing adequate records to enable subsequent monitoring and maintenance of any encapsulated or enclosed materials to be efficient and effective.

The upheaval involved in asbestos encapsulation or removal is clearly substantial. Therefore, it is important that the area should be thoroughly surveyed so that all asbestos-containing materials can be dealt with at the same time.

For the people involved in the building design and services (architects, civil engineers, building facilities managers), the planning of the asbestos work may involve taking account of all services that might need to be re-routed or provided:

- water, gas, electricity, central heating, air conditioning, ventilation, fire alarms – may need to be altered so that the building as a whole can function safely during the asbestos works;
- water, gas, electricity, drainage, telephone, may need to be provided for the asbestos works.

17.3 RETAINED ASBESTOS-CONTAINING MATERIALS

Where some or all of the asbestos containing materials are retained in place (either in good original condition, or encapsulated, or impregnated, or enclosed), then:

- the retained materials will need to be inspected, at a frequency to be decided by a risk assessment but at least annually, to make sure that it is still in safe condition, and the inspections must be documented;

- its presence will have to be taken into account in any future building refurbishment or installation that might disturb it. This will involve a management system so that it is taken into account whenever any contractor or employee does some work that touches on the building fabric;

- a system should be put in place for reporting any accidental damage to the material.

17.4 RE-OCCUPATION

After removal of materials, the completion of the work has to be confirmed by clearance tests undertaken by an independent organisation. This involves the independent person making a visual inspection and taking air samples to determine the concentration of fibres in air. In most member states, the air samples are analysed by phase contrast optical microscopy and concentrations must be below 0.01 fibres/ml for re-occupation (see description of methods in Chapter 16).

One Member State also requires that, after removal of friable asbestos, the client has to arrange for a further air test to measure the concentration of asbestos fibres. In that Member State, confirmation of satisfactory conditions is obtained if the measured concentration of asbestos fibres is below 0.005 fibres/ml with the sample being analysed by transmission electron microscopy.

17.5 WHAT YOU SHOULD DO

If you employ or control people who are involved in some capacity with work on materials that contain asbestos, you should:

- ensure that they understand their role with respect to preventing and minimising exposure for themselves and/or for others;
- ensure that any retained asbestos-containing materials are monitored, managed and properly maintained;
- ensure that any potential contractors' technical proposals demonstrate high standards in controlling and preventing asbestos exposure;
- ensure that you fulfil requirements under national regulations and legislation, e.g. sub-contractors may need to hold licences in some member states.

If you undertake work that is connected with work on asbestos, then you should:

- understand your role in preventing and minimising exposure for yourself and/or for others;
- follow best practice, as in this guide, if your own work involves any contact with asbestos containing materials.

If you are the labour inspector, you should:

- look for evidence that all parties involved have undertaken their roles in respect of preventing and reducing exposure to asbestos (e.g. specifications in sub-contracts, arrangements for re-routing supplies, inspection records and schedules, availability of records on asbestos-containing materials, etc.)
- check that all parties have licences or certificates as may be required under national legislation and regulation.

18 ASBESTOS IN OTHER PLACES (VEHICLES, MACHINERY ETC.)

18.1 INTRODUCTION

Asbestos-containing materials have been used in a wide variety of applications and places (as described in Chapter 4), and consequently some situations may involve additional considerations. However, the general approach of a risk assessment and written plan of work (Chapter 5), a decision on what needs to be done and whether the work needs to be notified to the responsible authority (Chapter 6), adequate training (Chapter 7), and containment and prevention of exposure (Chapters 9, and 11 or 12) still applies.

18.2 DIVERSITY OF APPLICATIONS

The other applications of asbestos which may involve some special issues include:

- in vehicles (trains, ships, military vehicles such as tanks);
- in plant and equipment;
- in decorative coatings (which may as yet be uncertain as to whether they come within notifiable work).

18.3 PRINCIPLES OF PREVENTION OF ASBESTOS EXPOSURE

Whatever the asbestos work, the same principles apply, i.e.:

- preventing exposure by containment of dust released (e.g. with an enclosure with airlocks);
- suppression of dust at source (e.g. thoroughly wetting the material throughout);
- local exhaust ventilation (e.g. using fans with high efficiency particulate filtration, or shadowing the movement of the tool with an H-type vacuum cleaner [known as shadow vacuuming]);
- personal protective equipment and appropriate respiratory protective equipment; and
- appropriate personal decontamination;
- appropriate waste removal.

18.4 ISSUES FOR SPECIAL CASES

The issues that need to be considered for work on some of these special cases include:

- constraints of space and access within vehicles generally (e.g. asbestos in ships engine rooms, or in the confined spaces within military vehicles), for achieving effective enclosure, bringing in equipment, removing bagged or wrapped waste;
- the need to gain access (to asbestos containing materials) through steel structures in ships or vehicles;
- the difficulties of dismantling some products, and the need to burn or cut to reach the asbestos containing material.

Asbestos has been used in decorative coating applied to ceilings and walls in some member states. The most recent evaluations of the risk arising from such work suggest that if the work is done with appropriate techniques, then the likely asbestos exposure is low enough that the work could be regarded as low risk and may not need to be notified to the responsible authority. Exposure to asbestos is prevented, or minimised, by:

- removal of coated panels whole, cutting the coating with a sharp knife if necessary to release the panel;
- sprayed application of a wetting agent, followed by gentle (manual) scraping with shadow vacuuming;
- if wall papered, using a steaming appliance to soften and release the material;
- NO dry sanding or powered abrasive tools;
- Wet blast techniques are NOT suitable for first cleaning, but may be used for final removal of residues.

If you employ people whose work involves exposure to asbestos, you should:

- follow best practice (as in this guide);
- ensure that they are adequately trained and informed of the risks;
- ensure that they understand the importance of minimising exposure;
- undertake a risk assessment to determine the likely exposure to asbestos;
- provide written instructions (method of work) that prevents or minimises exposure;
- provide adequate and suitable equipment (dust control and personal protection, as in Chapter 12);
- arrange adequate monitoring by an independent analyst to determine the actual exposures;
- comply with national regulations regarding work that may involve asbestos.

If your work involves potential exposure to asbestos, you should have received adequate training so that you will:

- be aware of the risks from asbestos exposure;
- understand the importance of keeping exposure as low as possible;
- follow written instructions to prevent or minimise exposure;
- follow best practice, as advised in this guide, for work with asbestos.

If you are the labour inspector, you should:

- look for an adequate and appropriate risk assessment;
- check that written instructions provide an effective method of preventing or minimising exposure;
- check that there is adequate equipment (e.g. for dust suppression and personal protection) for following the written method of work;
- check that equipment is being inspected and maintained at sufficiently frequent intervals to ensure that remains in good working order;
- check for compliance with national regulations on these issues.

Figure 18.1 Asbestos in brake shoes on a truck

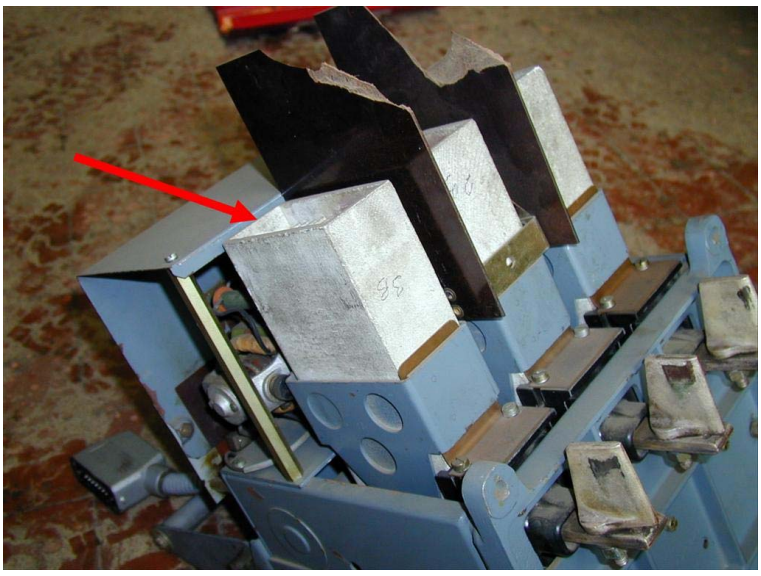


Figure 18.2 Asbestos containing components in high voltage electrical switch gear.

19 MEDICAL SURVEILLANCE

19.1 THE SURVEILLANCE

The Asbestos Worker Protection Directive 83/477/EEC as last amended by Directive 2003/18/EC states, in Article 15, that for workers engaged in notifiable work (as defined in Section 6.3):

"*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. This assessment must include a specific examination of the chest."*

"A new assessment must be available at least once every three years for as long as exposure continues.

An individual health record shall be established in accordance with national laws and practices for each worker referred to in the first subparagraph."

Medical surveillance will involve seeing a specialist doctor (generally appointed under national regulations) with knowledge of the medical issues arising from work with asbestos.

Some medical conditions are indications that the employee may not be fit enough to work safely in the conditions associated with asbestos related work. In particular, diseases which could be suddenly incapacitating may affect fitness for work in enclosures with respiratory protective equipment. Respiratory conditions or impaired cardiopulmonary status could also affect fitness for strenuous work while wearing respiratory protective equipment and in hot conditions.

In some member states (e.g. the UK), the certificate of an asbestos medical examination certifies only that examination has taken place. If the risk assessment indicates specific risks such as strenuous work and hot conditions, the employer may need to arrange for a "fitness for work examination" beyond the asbestos medical examination.

The medical surveillance may involve X-ray chest examination, either by conventional X-ray examination or by Computer Tomography (CT) scan. The computer tomography obtains X-ray information data from different angles around the body and then uses computer processing to construct cross-section images of the body. Conventional X-ray involves radiation exposure equivalent to that from about 10 days of natural background radiation (from cosmic radiation and naturally occurring radioactive materials). The CT scan involves greater radiation exposure than conventional X-ray examination, equivalent to about three years of natural radiation exposure (see for example http://www.radiologyinfo.org/content/safety/xray_safety.htm#measuring_dosage).
Unnecessary radiation exposure should be avoided, and the Doctor will consider the patient's best interests in deciding on when, and whether, such examination is useful.

The European Directive 83/477/EEC as last amended by Directive 2003/18/EC states that "*Information and advice must be given to workers regarding any assessment of their health which they may undergo following the end of exposure".*

In summary, the medical surveillance contributes to making sure that the employee is fit enough to work without jeopardising the effectiveness of procedures that protect against the risk of exposure to asbestos. Asbestos related disease is unlikely to manifest until many years after exposure; that is when the medical examination may recognise the signs of asbestos related disease and would arrange for the patient to be informed in a suitable manner.

19.2 WHAT YOU SHOULD DO

If you employ or control people whose work is likely to involve exposure to asbestos, you should:

- for employees whose work involves asbestos, arrange for a medical examination prior to starting work with asbestos, and at least once every three years (or more frequently in accordance with national regulations) thereafter for as long as exposure to asbestos continues;
- for other employees with a risk of possible exposure to asbestos, assess whether medical surveillance is advisable or required (by national regulations), based on the risk assessment (see Chapter 5 and Section 6.3);
- report notifiable diseases (such as asbestosis, lung cancer or mesothelioma) in employees exposed to asbestos, in compliance with national regulations;
- keep records of the health and medical examinations. National regulations may stipulate the information to be recorded (e.g. the completion of an asbestos medical examination) and the minimum time for the records to be retained. Keep records for at least 40 years. If your organisation ceases trading, then you should arrange for the medical records to be passed to an appropriate place of safe keeping (which may be specified in national regulations);
- ensure that all workers can be readily identified for comparison with such records.

If your work is likely to involve regular exposure to asbestos, you should:

- expect medical surveillance, and ask your employer if it is not in place;
- recognise that the health checks are important to ensure that you are fit enough to work safely in the conditions that are often associated with asbestos work e.g. respiratory protective equipment worn in hot conditions;
- ask the doctor if you want clarification about the risks to health from exposure to asbestos;
- realise that a clear X-ray does not necessarily mean that work practices are safe, as the effects of asbestos take more than 10 or 15 years to cause any indication that may be detected by X-ray;
- appreciate that the doctor provides you with advice which is in the best interests of your health.

You may have an option to allow non-medical data to be collected for epidemiological studies. We recommend that you do allow such data to be collected as it enables checks on the effectiveness of health protection programmes.

If you are the labour inspector, you should:

- look for evidence that the above recommendations have been implemented, as reflected in the employees understanding of the health effects, the employers and employees' awareness of fitness standards needed, and the completeness and clarity of health records;

- check for compliance with national regulations on these issues.

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21 APPENDIX 1

Typical exposures during work with asbestos lagging, coating and asbestos insulating board (UK Health and Safety Executive 1999, HSG 189/1; and UK HSE (2003) INDG 288(rev1)) and asbestos cement (UK HSE HSG 189/2). *See notes at the foot of the page*.

Technique	Comments	Typical Exposure (fibres/ml)
Well-controlled wet stripping of lagging and sprayed coatings, using manual tools	**Thorough soaking of the lagging with a wetting agent followed by careful removal**	**Up to 1**
Well-controlled wet stripping of lagging and sprayed coatings, using power tools	***As above but using power tools (which is NOT to be done)***	**Up to 10**
Stripping of lagging **where dry patches** are encountered	***Demonstrates need to allow thorough wetting***	**Around 100**
Stripping of sprayed coatings **where dry patches** are encountered	***Demonstrates need to allow thorough wetting***	**Around 1000**
Careful removal of whole asbestos insulating board.	**Unscrewing (with shadow vacuuming) with the spray application of a wetting agent on unsealed surfaces**	**Up to 3**
Breaking and ripping out asbestos insulating board. Carried out dry with no unscrewing	***Bad practice***	**5-20**
Machine drilling asbestos cement	**With local exhaust ventilation, or shadow vacuuming**	**Up to 1**
Drilling asbestos insulating board overhead, with no local exhaust ventilation	***Bad practice***	**5-10**
Drilling vertical columns. No local exhaust ventilation	***Bad practice***	**2-5**
Use of a jig saw on asbestos insulating board. No local exhaust ventilation	***Bad practice***	**5-20**
Hand sawing asbestos insulating board. No local exhaust ventilation	***Bad practice***	5-10

Notes:

1 Some of the results indicate the consequences of unacceptable bad practice. **Where controlled stripping techniques are used but not applied correctly, they can lead to high airborne fibre concentrations. Poor wetting is often little better than uncontrolled dry stripping**

2 The exposures quoted are typical values. The same process in different locations may result in higher or lower concentrations.

3 The exposures relate to the work period and are not calculated as time-weighted averages.

Typical exposures during work with asbestos cement (UK HSE HSG 189/2). ***See notes at the foot of the first table in Appendix 1.***

Technique	Comments	Typical Exposure (fibres/ml)
Machine drilling asbestos cement	**With local exhaust ventilation, or shadow vacuuming**	**Up to 1**
Machine cutting without exhaust ventilation		
Abrasive disc cutting	***Bad Practice***	15-25
Circular saw	***Bad Practice***	10-20
Jig saw	***Bad Practice***	2-10
Hand sawing		Up to 1
Removal of asbestos cement sheeting		Up to 0.5
Stacking of asbestos cement sheets		Up to 0.5
Remote demolition of asbestos cement structures dry		Up to 0.1
Sweeping up after remote demolition of asbestos cement structures	***Bad Practice***	Greater than 1
Remote demolition of asbestos cement structures wet		Up to 0.01
Cleaning asbestos cement vertical cladding by wet brushing		1 to 2
Cleaning asbestos cement vertical cladding by dry brushing	***Bad Practice***	5 to 8

The above exposure concentrations relate to the work period and are not calculated as time-weighted averages. However, it is clear that an extended duration of work may lead to time-weighted average concentrations greater than 0.1 fibres/ml.

Further data on occupational exposures to asbestos available from an online database Evalutil.

"*Evalutil is a database of occupational exposures to asbestos and man-made mineral fibres (MMMFs) that can be accessed directly from Internet. It is intended to provide assistance to those involved in public health and prevention: occupational physicians, safety engineers, company occupational safety committee members, researchers, and others.*

Evalutil is made of three databases: two factual databases, one about asbestos fibres and the other MMMFs, and a job-exposure matrix (JEM) for asbestos only. The metrological and descriptive data in the factual databases come from the scientific literature and technical reports of prevention and industry bodies. The asbestos JEM furnishes information about asbestos exposure, assessed by experts for a large number of jobs. However, in its current state, simple interrogation does not produce a synthesis of available information.

Although the information provided by the document databases concern specific situations, they furnish very useful indications about risks associated with some work situations. This information cannot, however, substitute for a careful analysis and risk assessment of each particular situation by professionals, because a given set of measurements may be associated with several operations or a work area covering several activities.

The form and content of Evalutil has undergone constant revision and improvement since 1992. The development of Evalutil will continue in the years to come, through the updating of the existing databases and the improvement of the web interface to facilitate broader use."

The internet address of the database is: http://etudes.isped.u-bordeaux2.fr/evalutil.