

MIDHS

*Methods for the Determination of
Hazardous Substances*
Health and Safety Laboratory



100

Surveying, sampling and assessment of asbestos-containing materials

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INTRODUCTION

1 This MDHS sets out how to survey workplace premises for asbestos-containing materials (ACMs) and how to record the results in a usable form. It also gives advice on how to recognise and sample suspected ACMs. The MDHS has been produced as part of guidance issued by the Health and Safety Executive for people carrying out surveys. It will also be of interest to those who commission surveys.

Regulations

2 The Health and Safety at Work etc Act 1974¹ requires an employer to provide a safe workplace. Work with asbestos is covered by its own set of regulations – the Control of Asbestos at Work Regulations (CAWR).² There are duties to prepare a risk assessment and to make written arrangements to protect those at risk in the Management of Health and Safety at Work Regulations 1999,³ and to maintain workplace buildings/premises to protect occupants and workers under the Workplace (Health, Safety and Welfare) Regulations 1992.⁴ Arrangements to deal with asbestos during refurbishment may also be required by the Construction (Design and Management) Regulations 1994.⁵ It is intended that CAWR⁶ be amended by introducing a specific duty to manage the risk from asbestos-containing materials in premises. This specific duty will be supported by an approved code of practice (ACOP) and associated guidance.

Managing asbestos

3 The new regulation will create an explicit duty to assess and manage the risks from asbestos in premises. The risks will vary with circumstances, ranging from normal occupation of a building to the repair, refurbishment and demolition of the premises, and they will each need to be assessed. This assessment will be used to produce a management plan which details and records the actions to be undertaken to manage and reduce the risks from asbestos. The broad requirements on employers are to:

- take reasonable steps to determine the location of materials likely to contain asbestos;
- presume materials to contain asbestos, unless there are good reasons not to do so;
- make and maintain a written record of the location of the asbestos and presumed asbestos materials;

- monitor the condition of asbestos and presumed asbestos materials;
- assess the risk of exposure from the asbestos and presumed asbestos materials and document the actions necessary to manage the risk; and
- take steps to see that the actions above are carried out.

To manage the risk from asbestos-containing materials you will need to:

- keep and maintain an up-to-date record of the location, condition, maintenance and removal of all asbestos-containing materials on the premises;
- repair, seal or remove, if there is a risk of exposure due to its condition or location;
- maintain it in a good state of repair and regularly monitor the condition;
- inform anyone who is likely to disturb it about the location and condition of the material;
- have arrangements and procedures in place, so that work which may disturb the materials complies with CAWR; and
- review the plan at regular intervals and make changes to the plan and arrangements if circumstances change.

Health and safety issues

4 Surveying and sampling ACMs can give rise to exposure to asbestos and is covered by CAWR, which require an assessment and plan of work to be made, setting out the control measures and personal protective equipment (PPE) to be used. It also requires that adequate information, training and refresher training have been given to the sampling personnel. Sampling ACMs is, however, exempt from the Asbestos (Licensing) Regulations (1983) as amended,⁷ but is covered by the CAWR ACOP on unlicensed work.⁸ As other hazards may be present, such as working at heights and electrical hazards, a risk assessment will need to be carried out before commencing work on site (see paragraph 25). It should include any safety aspects and record any safety protocol to be observed on site. Fire alarm/evacuation procedures should be included.

OVERVIEW OF REQUIREMENTS FOR SURVEYING AND SAMPLING

5 Anyone undertaking surveys or sampling should:

- have appropriate training and experience;
- be able to demonstrate independence, impartiality and integrity; and
- have an adequate quality assurance procedure (see paragraphs 67-69).

Appropriate training, for example, is provided by courses organised through the British Institute of Occupational Hygiene (BIOH) (see paragraph 67 for contact information).

Asbestos management programmes

6 In order to have an effective asbestos management programme, it is necessary to establish clear lines of responsibility for the programme's management and implementation. A survey of the premises must be undertaken to locate and assess the ACMs. The results of the survey must be recorded in an easily retrievable form, which can then be used to make a risk assessment and draw up a management plan. The management plan may include some or all of the following options:

- clean up debris;
- repair;
- encapsulate (paint or seal);
- enclose;
- remove;
- maintain and update log of ACMs;
- monitor condition (applies to all presumed or identified ACMs);
- restrict access/isolate;
- label or colour code;
- inform;
- train;
- define and use safe systems of work;
- operate a permit-to-work system.

Several of the management options apply to all ACMs and are required by CAWR. Others are appropriate for ACMs which have a high material or risk assessment score. Guidance on risk assessment and the management of asbestos will be available from HSE. Advice from the Department of the Environment, Transport and the Regions (DETR) is also available.⁹

Asbestos surveys

7 An asbestos survey has three main elements:

- firstly, it must as far as reasonably practicable **locate and record** the *location, extent* and *product type* of any presumed or known ACMs;
- secondly, it must **inspect and record** information on the *accessibility, condition* and *surface treatment* of any presumed or known ACMs;
- thirdly, it should **determine and record** the *asbestos type*, either by collecting representative samples of suspect materials for laboratory identification, or by making a presumption based on the product type and its appearance etc.

This information must be held in a suitable (upgradable) form and should be accessible to and understandable by all relevant personnel.

Material assessment

8 The purpose of the material assessment is to establish the relative ability of various types of ACMs to release fibres into the air, should they be disturbed. The type of fibre is also taken into account. This assessment can be carried out as an integral part of the survey, as it requires no knowledge about the building use etc. A simple four parameter additive algorithm is used to assess the likely magnitude of release from the material, given a standard disturbance. This is evaluated using four categories: high, medium, low and very low.

AIM, PURPOSE AND TYPE OF SURVEY

Aim and purpose

9 The type of survey undertaken may vary, depending on the aim and purpose for which it is to be used. Surveys before demolition and refurbishment will continue to be required under CAWR and the CDM regulations.⁵ However, it is anticipated that most surveys will be undertaken initially to comply with the duty to manage asbestos

in premises. In these cases, the aim of an asbestos survey is, as far as reasonably practicable, to locate and assess all the ACMs present in the building and its purpose is to present the information collected in a way which allows the employer to manage the risk. In situations where a surveyor is used, the aim, purpose, type of survey and report format required should be clearly established in the original invitation to tender, or agreed with the client at a preliminary meeting or site visit before starting the survey. One of the main issues is to decide when samples should be taken to prove that ACMs are not present.

Presumption or identification of ACMs

10 An experienced, well-trained surveyor, familiar with the range of asbestos products, can usually, by inspection alone, say that a material can be 'presumed' to contain asbestos. This presumption can only be tested by laboratory analysis of representative samples of the material. A low-magnification stereo microscope examination of the sample followed by polarised light microscopy (PLM) of selected fibres, as outlined in MDHS 77,¹⁰ is the most widely used and cost-effective method in current use. In the absence of analytical evidence, many non-asbestos materials will also be presumed to contain asbestos, *unless there is other strong evidence to support a reasoned argument that they are highly unlikely to contain asbestos.*

11 This therefore creates two levels of presumption: one where there is a '**strong presumption**' that the material does contain asbestos but a laboratory identification has not been undertaken to confirm this; and a default situation where it must be '**presumed**' to contain asbestos because there is insufficient evidence to suggest that it is not an ACM. An example of a 'strong presumption' would be thermal insulation on a pipe where fibres are clearly visible and have the appearance of asbestos but no sample analysis has been undertaken. Where similar construction exists and laboratory analysis of one of the materials has confirmed the presence of asbestos, there is a strong presumption that the other similar materials also contain asbestos. Materials where no asbestos fibres are visible but asbestos is known to have been commonly used in the manufactured product at the time of installation (eg floor tiles, ceiling tiles and insulating boards) will be presumed to contain asbestos. A reasoned argument to suggest that a material does not contain asbestos would be:

- non-asbestos substitute materials were specified in the original architect's/quantity surveyor's plans or in subsequent refurbishments;
- the product was very unlikely to contain asbestos or have asbestos added (eg wallpaper, plasterboard etc);
- post-1985 construction (for amphibole asbestos-containing materials such as asbestos insulation board, see Table 1);
- post-1999 construction (some chrysotile products were prohibited in 1993 and nearly all were prohibited in 1999).

12 The conclusion that ACMs are not present cannot always be easily reached. The regulations require that **reasonable** steps are taken. It may in some circumstances not be reasonable to decide wholly on age and/or original specifications, which may have been circumvented during the construction of the building. There are also examples of poor removal practice leaving asbestos-containing debris and residues, and areas where asbestos has been removed previously will need to be inspected.

Type of survey

There are three types of survey referred to in this MDHS.

Type 1: Location and assessment survey (presumptive survey)

13 The purpose of the survey is to locate, as far as reasonably practicable, the presence and extent of any suspect ACMs in the building and assess their condition. This survey essentially defers the need to sample and analyse for asbestos (or the absence thereof) until a later time (eg prior to demolition or major refurbishment). The duty holder bears potential additional costs of management for some non-asbestos-containing materials. All areas should be accessed and inspected as far as reasonably practicable (eg above false ceilings and inside risers, service ducts, lift shafts, etc) or must be **presumed** to contain asbestos. Any material which can reasonably be expected to contain asbestos must be presumed to contain asbestos, and where it appears highly likely to contain asbestos, there should be a **strong presumption** that it does. All materials which are presumed to contain asbestos must be assessed.

Type 2: Standard sampling, identification and assessment survey (sampling survey)

14 The purpose and procedures used in this survey are the same as for Type 1, except that representative samples are collected and analysed for the presence of asbestos. Samples from each type of suspect ACM found are collected and analysed to confirm or refute the surveyor's judgement. If the material sampled is found to contain asbestos, other similar homogeneous materials used in the same way in the building can be strongly presumed to contain asbestos. Less homogeneous materials will require a greater number of samples. The number should be sufficient for the surveyor to make an assessment of whether asbestos is or is not present. Sampling may take place simultaneously with the survey, or as in the case of some larger surveys, can be carried out as a separate exercise, after the Type 1 survey is complete.

Type 3: Full access sampling and identification survey (pre-demolition/major refurbishment surveys)

15 This type of survey is used to locate and describe, as far as reasonably practicable, all ACMs in the building and may involve destructive inspection, as necessary, to gain access to all areas, including those that may be difficult to reach. A full sampling programme is undertaken to identify possible ACMs and estimates of the volume and surface area of ACMs made. The survey is designed to be used as a basis for tendering the removal of ACMs from the building prior to demolition or major refurbishment *so the survey does not assess the condition of the asbestos*, other than to note areas of damage or where additional asbestos debris may be expected to be present.

16 Although different types of survey can be specified and used depending on the circumstances, it is important that the building owner, employer and the surveyor know exactly what type of survey is to be carried out, what the specifications for each type are, and in which areas they are to be used. It is recommended that the type of survey used conforms to a standard (eg this MDHS), otherwise interpretation of the survey reports will be difficult and the management plan produced may not adequately minimise the risks involved. It is possible that at larger premises a mixture of survey types will be appropriate – eg a boiler house due for demolition will require a Type 3 pre-demolition survey, while offices at the site may only have a Type 1 presumptive survey. Similarly, a system-built property may start with several Type 2 surveys, but other similar premises may be evaluated using a

Type 1 survey. Therefore it is important that there is a clear statement and record of the type of surveys that are to be carried out, including the reasons for type selected, where they are to be carried out, and an estimate of the number of samples to be collected.

SURVEY PLANNING

Procedure

17 Once the type of survey has been established, it is important to gather information and plan the survey. Survey planning should include the following five steps:

- preliminary site meeting and walk-through;
- desk-top study to plan survey;
- survey plan (including details of sampling strategy, if appropriate);
- risk assessment for the conduct of the survey; and
- specification of the method for recording and presenting data.

At some sites it may not be necessary or possible to include all of these steps (eg small premises, fire damaged premises and pre-purchase surveys etc).

Preliminary site meeting and walk-through

18 If a third party is carrying out a survey for the employer, a preliminary meeting is important to establish how to record and use the results of the survey, so the employer can manage the risk. It is also an opportunity to explain further the type of survey and assessments which will be undertaken. Every site will have its own specific problems relating to safety issues and hazards, the availability of original and up-to-date plans, entry limitations to certain areas etc. Whenever possible, current accurate plans of the building and the floor layout should be made available at an early stage. If current or older plans are not available, a sketch plan will need to be made. All plans should be checked for accuracy. These plans will be used to refer to and record the whereabouts of any suspect material and the location of any samples taken for identification. They should also be used to locate and record any sensitive or restricted areas and hazards.

19 A walk through the site should be made with a person who knows the premises which are to be surveyed. The purpose is to get a better overall

picture of the site and the problems involved. The walk-through can be used to check that any site plans are up-to-date and room numbering/coding is adequate. It also allows any specific hazards which the survey personnel may encounter to be recognised and discussed to minimise any risks. Potential problems for access to ceiling voids and crawl spaces can also be assessed, along with other potential sampling problems (eg sampling only when the area is otherwise unoccupied, materials or decorations which cannot be disturbed, labelling of sample locations, future placement of asbestos warning labels, measures used to reduce dust release and clean-up, etc).

Desk-top study to plan survey

20 The aim of the desk-top study is to gather information on the types, construction and ages of premises to be surveyed and current or former equipment and types of processes carried out in them (eg buildings constructed after 1974 are unlikely to contain sprayed asbestos fireproofing). Architects' original plans and specifications and subsequent plans for major changes or refurbishment should also record where ACMs were installed for fire protection, heat insulation or decorative purposes. Previous plans, as well as current plans, should be obtained where possible.

21 However, low density insulating board and other asbestos-containing products are often used to give increased fire protection to structural beams and pillars, fire doors, risers, service ducts, stairwells, ceilings, lift shafts and also around heaters. These boards may not be readily observable as they may be concealed or over-clad with other materials. Any equipment requiring heat insulation such as boilers, furnaces, ovens, fires, storage radiators, heat exchangers, calorifiers as well as any connecting pipes, are the obvious places where asbestos insulation is likely to have been used. Also, large machinery may have asbestos-containing friction components such as clutches and brakes. Some of the products and product names of ACMs are listed in Table 1.

22 The current plans can be used to refer to and record the whereabouts of any suspect material and the location of any samples taken for identification. The plans should also be used to locate and record any sensitive or restricted areas. If no plans are available, additional work will be necessary to record the survey information accurately. There will also be a need for information on any previous asbestos removal.

Survey plan and sampling strategy

23 After the preliminary site visit and desk study have been completed, a written plan for the main survey can be produced. The plan will normally specify the following:

- the buildings and areas to be included in the survey and any areas to be excluded;
- the type of survey to be used (and where other types may be applicable);
- any possible or known ACMs not to be included in the survey;
- the survey procedure;
- the assessment method and the parameters to be assessed (eg product type, location, extent, condition and accessibility of ACMs);
- the information to be recorded and the method and format to be used;
- the quality assurance checks and procedures to be undertaken;
- any area where access was not possible; and
- sampling method, number of samples and agreed arrangements for making good.

Specification of the method for recording and presenting data

24 Both the form of the survey records and final report format should be documented and agreed with the client before starting the survey. Consideration should be given to:

- what data will be reported;
- how they will be presented;
- the way the survey data will be stored, accessed and updated (eg a paper copy in the site manager's office or a computer database accessible on a network or the Internet);
- the way photographic or video records and marked-up plans will be stored and reported;
- whether each room/area inspected should be individually recorded; and
- whether asbestos lookalike materials should be recorded.

The survey report or abstracts from it should be presented in a form that can be used as the basis for an updatable register or log of ACMs. This log will need to be readily accessible (eg in the estates or building manager's office) so it can be consulted prior to the authorisation of maintenance or remedial work. A register or log can be more easily accessed and updated if it is stored electronically.

HEALTH AND SAFETY RISKS

Risk assessment for conduct of survey

25 Before carrying out a site survey, it is important that an assessment of the risks to the health and safety of surveyors, sampling personnel and other occupants is carried out. Risk assessments should be documented and must be available to the site surveyors. Often surveyors will be seeing the site for the first time so will have little chance to evaluate the site-specific hazards that are involved and will rely on the risk assessment made based on information gathered during the preliminary site meeting and walk-through. The client should be asked to provide information relating to any hazards specific to the site. In addition to the hazards of asbestos, hazards which may be associated with asbestos surveying include:

- working at heights, in ceiling voids or on fragile roofs;^{11, 12}
- working on operable machinery or plant;
- working in confined spaces;¹³
- chemical hazards;¹⁴
- electrical hazards;
- biological hazards;¹⁴
- noise hazards;¹⁵ and
- lone working.

The risks to surveyors, sampling personnel and other occupants should be reduced to as low as reasonably practicable. In assessing the risks, the appropriate HSE guidance should be consulted.

Safe work procedures

26 Ideally a survey should be conducted with team(s) of two persons. This has a number of advantages, for example, in assisting with carrying equipment such as step ladders, labelling of sample bags and documentation. In cases of remote or

dangerous locations (eg derelict buildings or items identified in paragraph 25), a team of two should be specified as a safety requirement. Teamworking also allows field training of new surveyors to be carried out in a supervised practical environment and gives a better chance of finding ACMs. Further information on safe working procedures can be found in paragraphs 44-45.

Personal protective equipment

27 Disposable overalls, overshoes and gloves should be worn when there is a likelihood of asbestos contaminating the surveyor's clothing and during bulk sampling. The overalls should be of the type normally used for asbestos work and should have a hood and elasticated cuffs and ankles. They can be worn over normal clothing but should be carefully removed after use by turning inside out, and be disposed of as asbestos waste. Care should be taken to prevent the spread of asbestos. For some dirty or contaminated sites, Wellington boots will be required, and these should be wiped or washed clean if they become contaminated and/or after sampling is completed. For some sites, more stringent decontamination procedures may be necessary (see paragraph 29).

28 Appropriate respiratory protective equipment (RPE) should be worn during sampling or when surveying areas where the asbestos is likely to be disturbed during the inspection (eg crawl tunnels and above false ceilings). The survey and sampling personnel must have been properly trained in the selection, use and maintenance of respiratory protective equipment and follow the guidance given in INDG288.¹¹

Decontamination and disposal arrangements

29 If the surveyor has to enter areas where there is a lot of contamination (eg thermal insulation in crawl tunnels, spray insulation in ceiling voids), clothing is likely to be particularly contaminated, so additional safety precautions and decontamination procedures will be necessary. This may involve the use of positive pressure respirators, transit procedures and a hygiene facility, and these requirements should be identified in the initial walk-round of the site. Alternatively, the area should be presumed to be heavily contaminated with asbestos.

SURVEYING

Requirements

30 The success and usefulness of a survey is **dependent on the specification and planning**

carried out and the training, experience and diligence of the surveyor. When an area is not inspected, this must be recorded and presumed to contain asbestos until it can be proven that ACMs are not present. It is important that the surveyor has a good understanding of which products and materials are likely to contain asbestos and where ACMs are likely to be located. Experienced surveyors may discriminate between potential asbestos and non-asbestos-containing materials in situ. This initial judgement will be tested by sampling and analysis in a Type 2 survey, but previous experience is used to make a presumption in a Type 1 survey. **The surveyor should have strong evidence to support a reasoned argument for presuming a material does not contain asbestos.** The surveyor must also look out for evidence of asbestos debris released by previous work, or even during installation or removal work (eg over-spray from sprayed asbestos applications).

31 The survey will need to be carried out in a methodical and systematic way to ensure that all visible or accessible areas are inspected. This will usually involve using either a top-down or bottom-up approach for surveying the building and each individual area or room for ACMs. The outside of the building should also be inspected. Larger premises will require more detailed survey procedures, particularly if there are several surveyors at work. It may also be appropriate to carry out a separate survey on the building services, machinery and any large floor and ceiling voids.

Types, location and appearance of asbestos-containing building products

32 Table 1 and Figure 1 summarise the main types and uses of ACMs in the fabric of a building and in fixed installations such as heating, water and electrical systems. The table lists the main product types, their location and use, asbestos content, date last used and common trade or product names. The product types are listed approximately in order of their ability to release fibres assuming no surface treatments have been applied. The appearance of these products and where and how they are likely to appear in situ in buildings have been given in an illustrated annex (Annex 1) as an aid to identifying potential asbestos-containing materials.

Other products containing asbestos

33 Older consumer electrical products may also contain some ACMs (eg hairdryers, irons, toasters, washing machines, dishwashers, tumble dryers), but the asbestos is not readily accessible and it is not practical to inspect or sample for such asbestos which would constitute a very low risk. However,

products which are used for or require significant heat insulation should be considered during the survey. This will include simmering mats, iron stands, fire curtains and blankets, catalytic gas heaters, gas coal or log effect fires, all types of warm air, storage or radiant heaters, and cooker door seals. Older industrial machines and plant are more likely to contain asbestos owing to their age or higher performance requirements and are more likely to be serviced and subject to maintenance. Therefore, parts of machinery or plant which provide heat and electrical insulation, high performance seals and frictional performance (driving belts, clutches, brakes and bearings) should be inspected if readily accessible. It is not recommended that the surveyor should sample or work on any machinery, unless qualified to do so. If sampling is not carried out, they should be presumed to contain asbestos unless there is evidence to suggest they are non-asbestos materials.

What to assess and record

34 A Type 1 and 2 survey must assess and record the following, for each suspect or presumed asbestos material found:

- product type;
- location;
- extent (or quantity);
- asbestos type;
- accessibility;
- amount of damage or deterioration; and
- surface treatment (if any).

The last three will not usually be required for a Type 3 pre-demolition survey.

Presumed ACMs

35 If a sample is not taken, there must also be a presumption made whether the material is asbestos or non-asbestos. Surveyors may visually assess the edges and damaged areas of suspect materials and record the following:

- whether visible fibres are present on close inspection (see MDHS 77¹⁰);
- the colour of the fibres, if visible; and
- whether fibres are visually consistent with asbestos (eg form bundles with splayed ends).

Some materials like textured plasters, paints and vinyl floor tiles may contain very fine dispersed chrysotile asbestos which may not be seen by eye or with a magnifying glass, and these materials (if old) will have to be presumed to contain asbestos unless they are sampled and carefully analysed by a competent laboratory. As imported materials may have contained chrysotile asbestos until 1999 and laboratories often miss the fine asbestos, some additional checks may be necessary with these types of materials. Other useful characteristics (eg surface texture, sound when knocked, warmth to touch, surface hardness/deformation with a probe) may also be used by experienced surveyors to help compare the material to other materials they have previously encountered and had samples identified. Unless the surveyor is **convinced that there is adequate evidence to support a reasoned argument** that the material is non-asbestos-containing (eg plaster, plasterboard, wood etc), a presumption or strong presumption is made that it is an ACM.

Asbestos type

36 It is also necessary to decide which types of asbestos are present for the material assessment. If a material is not sampled and a similar product has not been identified in the survey, the most likely asbestos type must be allocated based on the product types and age in Table 1. Close inspection of the fibres, if visible in the product, will give some additional clues to the type of asbestos (see MDHS 77¹⁰). In general, there should be a reasoned argument for it not being crocidolite or another amphibole asbestos.

BULK SAMPLING STRATEGY

37 Bulk sampling may be carried out simultaneously with the survey or carried out later as a separate sampling exercise. Often for small surveys it is convenient to take samples while surveying, while for larger buildings sampling may be carried out as a separate exercise when the building is empty. After a visual examination to assess any apparent areas of different material, samples of about 3-5 cm² area and through the entire depth of the ACM should normally be taken with the aim of collecting one or more samples which are representative of the whole material. Sampling should not be carried out where there is an electrical hazard or if it will damage the critical integrity of a roof, gutter, pipe etc. An equipment list is given in Annex 2.

38 The sampling strategy (see paragraphs 39-43) will be based on the types of ACMs present, and for

larger premises there is often an advantage in sampling after a Type 1 survey has been completed, so the numbers and locations of the samples required can be specified. In general, for homogeneous manufactured products containing asbestos, it can be assumed that the asbestos is uniformly distributed throughout the material, and one or two samples will suffice, eg boards, sheets, cement pipes, textiles, ropes, friction products, plastics and vinyls, mastics, sealant, bitumen roofing felt and gaskets. Insulation materials are generally less homogeneous as they were applied on site and their composition depended on the availability of supply. Subsequent repairs and patching may add to this variability and increase the number of samples required. In addition, substantial over-spray contamination and debris may have been produced. Often a single sample may be all that is required to confirm the suspicion that a homogeneous material is asbestos and to make a presumption that it applies to other material of the same type. However, for non-homogeneous materials and for some presumed non-asbestos materials, additional sampling may often be needed, to reduce the possibility of false negatives which may lead to uncontrolled exposures. The following sample numbers are suggested, but may be adapted depending on the site and the circumstances prevailing.

Spray coatings, encapsulated sprays and bulk materials

39 These are usually, but not always, homogeneous (under any encapsulate) and usually two samples should be sufficient if taken at either end of the sprayed surface, unless the installation is particularly large or there are areas of repairs or alterations.

Pipe/thermal insulation

40 Pipe insulation is often highly variable in composition, especially where there is a change in colour, size and texture or there is evidence of repairs or modifications. The number of samples collected will be dictated by the planned and subsequent activities. If a plant room is due for complete refurbishment, a few samples of proven asbestos materials may be sufficient to condemn the entire plant room to be stripped as asbestos. If, however, most of the insulation is apparently non-asbestos, it may require more than a few samples to 'prove' that all the insulation is asbestos-free. For individual pipe runs or boilers needing repair or replacement, two samples may be sufficient, provided that there is no sign of earlier repairs or changes to the insulation.

Table 1: Asbestos-containing materials in buildings (listed in approximate order of ease of fibre release)

Asbestos product	Location/use	Asbestos content and type/date last used	Ease of fibre release and product names
<p>Loose insulation Bulk loose fill, bulk fibre-filled mattresses, quilts and blankets. Also 'jiffy bag'-type products used for sound insulation</p>	<p>Bulk loose fill insulation is now rarely found but may be encountered unexpectedly, eg DIY loft insulation and fire-stop packing around cables between floors. Mattresses and quilts used for thermal insulation of industrial boilers were filled with loose asbestos. Paper bags/sacks were also loose-filled and used for sound insulation under floors and in walls.</p>	<p>Usually pure asbestos except for lining/bag. Mattresses and quilts were usually filled crocidolite or chrysotile. Acoustic insulation may contain crocidolite or chrysotile.</p>	<p>Loose asbestos may readily become airborne if disturbed. If dry, these materials can give rise to high exposures.</p> <p>Covers may deteriorate or be easily damaged by repair work or accidental contact.</p>
<p>Sprayed coatings Dry applied, wet applied and trowelled finish</p>	<p>Thermal and anti-condensation insulation on underside of roofs and sometimes sides of industrial buildings and warehouses.</p> <p>Acoustic insulation in theatres, halls etc. Fire protection on steel and reinforced concrete beams/columns and on underside of floors. Over-spray of target areas is common.</p>	<p>Sprayed coatings usually 55%-85% asbestos with a Portland cement binder. Crocidolite was the major type until 1962. Mixture of types including crocidolite until mid-1971. Asbestos spray applications were used up to 1974.</p>	<p>The surface hardness, texture and ease of fibre release will vary significantly depending on a number of factors. Sprays have a high potential for fibre release if unsealed, particularly if knocked or the surface is abraded or delaminates from the underlying surface. Dust released may then accumulate on false ceilings, wiring and ventilation systems.</p>
<p>Thermal insulation Hand-applied thermal lagging, pipe and boiler lagging, pre-formed pipe sections, slabs, blocks. Also tape, rope, corrugated paper, quilts, felts, and blankets</p>	<p>Thermal insulation of pipes, boilers, pressure vessels, calorifiers etc.</p>	<p>All types of asbestos have been used. Crocidolite used in lagging until 1970. Amosite was phased out by the manufacturers during the 1970s. Content varies 6-85%. Various ad hoc mixtures were hand-applied on joints and bends and pipe runs. Pre-formed sections were widely used, eg '85% magnesia' contained 15% amosite, 'Caposil' calcium silicate slabs and blocks contained 8-30% amosite while 'Caposite' sections contained ~85% amosite. Blankets, felts, papers, tapes and ropes were usually ~100% chrysotile.</p>	<p>'Limpet' (also used for non-asbestos sprays).</p> <p>The ease of fibre release often depends on the type of lagging used and the surface treatment. Often will be encapsulated with calico and painted (eg PVA, EVA, Latex, bitumen or proprietary polymer emulsions or PVC, Neoprene solutions), eg 'Decadex' finish is a proprietary polymer emulsion. A harder chemical-/weather-resistant finish is known as 'Bulldog'.</p>

Asbestos boards

<p>'Millboard'</p>	<p>'Millboard' was used for general heat insulation and fire protection. Also used for insulation of electrical equipment and plant.</p>	<p>Crocidolite was used in some millboard manufacture between 1896 and 1965; usually chrysotile. Millboards may contain 37-97% asbestos, with a matrix of clay and starch.</p>	<p>Asbestos 'Millboard' has a high asbestos content and low density so is quite easy to break and the surface is subject to abrasion and wear.</p>
<p>Insulating board</p>	<p>Used for fire protection, thermal and acoustic insulation, resistance to moisture movement and general building board. Found in service ducts, firebreaks, infill panels, partitions and ceilings (including ceiling tiles), roof underlay, wall linings, external canopies and porch linings.</p>	<p>Crocidolite used for some boards up to 1965, amosite up to 1980, when manufacture ceased. Usually 15-25% amosite or a mixture of amosite and chrysotile in calcium silicate. Older boards and some marine boards contain up to 40% asbestos.</p>	<p>AlB can be readily broken, giving significant fibre release. Also significant surface release is possible by abrasion, but surface is usually painted or plastered. Sawing and drilling will also give significant releases. 'Asbestolux', 'Turnasbestos', 'LDR', 'asbestos wallboard', 'insulation board'. Marine boards known as 'Marinite' or 'Shipboard'.</p>
<p>Insulating board in cores and linings of composite products</p>	<p>Found in fire doors, cladding infill panels, domestic boiler casings, partition and ceiling panels, oven linings and suspended floor systems. Used as thermal insulation and sometimes as acoustic attenuators.</p>	<p>Crocidolite used for some boards up to 1965, amosite up to 1980, when manufacture ceased. 16-40% amosite or a mixture of amosite and chrysotile.</p>	<p>Can be broken by impact; significant surface release possible by abrasion, but usually painted or plastered. Sawing and drilling will also give significant releases. 'Asbestolux'.</p>
<p>Paper, felt and cardboard</p>	<p>Used for electrical/heat insulation of electrical equipment, wiring and plant. Also used in some air conditioning systems as insulation and acoustic lining. Asbestos paper has also been used to reinforce bitumen and other products and as a facing/lining to flooring products, combustible boards, flame-resistant laminate. Corrugated cardboard has been used for duct and pipe insulation.</p>	<p>Asbestos paper can contain ~100% chrysotile asbestos but may be incorporated as a lining, facing or reinforcement for other products, eg roofing felt and damp-proof courses, steel composite wall cladding and roofing (see asbestos bitumen products below), vinyl flooring. Asbestos paper is also sometimes found under MMMF insulation on steam pipes.</p>	<p>Paper materials, if not encapsulated/combined within vinyl, bitumen, or bonded in some way, can easily be damaged and release fibres when subject to abrasion or wear (eg worn flooring surface with paper backing). Asbestos paper, asbestos felt, 'Novilon' flooring, Durasteel laminates, vinyl asbestos tile, roofing felt and damp-proof course etc. 'Pax felt'. 'Viceroy' (foil-coated paper). 'Serval'.</p>

Asbestos product	Location/use	Asbestos content and type/date last used	Ease of fibre release and product names
Textiles			
Ropes and yarns	Used as lagging on pipes (see above), jointing and packing materials and as heat-/fire-resistant boiler, oven and flue sealing. Caulking in brickwork. Plaited asbestos tubing in electric cable.	Crocidolite and chrysotile were widely used due to length and flexibility of fibres. Other types of asbestos have occasionally been used in the past. Chrysotile alone since at least 1970. Asbestos content approaching 100% unless combined with other fibres.	Weaving reduces fibre release from products, but abrading or cutting the materials will release fibres, likely to degrade if exposed, becoming more friable with age. If used with caulking, fibres will be encapsulated and less likely to be released.
Cloth	Thermal insulation and lagging (see above), including fire-resisting blankets, mattresses, and protective curtains, gloves, aprons, overalls etc. Curtains, gloves, etc were sometimes aluminised to reflect heat.	All types of asbestos have been used in the past. Since the mid-1960s the vast majority has been chrysotile. Asbestos content approaching 100%.	Fibres may be released if material is abraded.
Gaskets and washers	Used in domestic hot water boilers to industrial power and chemical plant.	Variable but usually around 90% asbestos, crocidolite used for acid resistance and chrysotile for chlor-alkali. Some gasket materials will continue to be used after asbestos prohibition takes effect.	May be dry and damage easily when removed. Mainly a problem for maintenance workers.
Strings	Used for sealing hot water radiators.	Strings have asbestos contents approaching 100%.	'Klingerit', 'Lion jointing', 'Permanite', 'CAF' - compressed asbestos fibre or 'It' in German gaskets.
Friction products			
Resin-based materials	Transport, machinery and lifts, used for brakes and clutch plates.	30-70% chrysotile asbestos bound in phenolic resins. Used up to November 1999.	Low friability, dust may build up with friction debris.
Drive belts/conveyor belts	Engines, conveyors.	Chrysotile textiles encapsulated in rubber.	Low friability, except when worn to expose textile.

Cement products

Profiled sheets	Roofing, wall cladding. Permanent shuttering, cooling tower elements.	10-15% asbestos (some flexible sheets contain a proportion of cellulose). Crocidolite (1950-1969) and amosite (1945-1980) have been used in the manufacture of asbestos cement, although chrysotile (used until November 1999) is by far the most common type found.	Likely to release increasing levels of fibres if abraded, hand sawn or worked on with power tools. Exposed surfaces and acid conditions will remove cement matrix and concentrate unbound fibres on surface and sheet laps. Cleaning asbestos-containing roofs may also release fibres.
Semi-compressed flat sheet and partition board	Partitioning in farm buildings and infill panels for housing, shuttering in industrial buildings, decorative panels for facings, bath panels, soffits, linings to walls and ceilings, portable buildings, propagation beds in horticulture, domestic structural uses, fire surrounds, composite panels for fire protection, weather boarding.	As for profiled sheets. Also 10-25% chrysotile and some amosite for asbestos wood used for firedoors etc. Composite panels contained ~4% chrysotile or crocidolite.	Asbestos cement, Trafford tile, 'Bigsix', 'Doublesix', 'Supersix', 'Twin twelve', 'Combined sheet', 'Glen six', '3" & 6" corrugated', 'Fort', 'Monad', 'Troughsec', 'Major tile and Canada tile', 'Panel sheet', 'Cavity decking'.
Fully compressed flat sheet used for tiles, slates, board	As above but where stronger materials are required and as cladding, decking and roof slates (eg roller-skating rinks, laboratory worktops).	As for profiled sheets.	Release as for profiled sheets. Flat building sheets, partition board, 'Pollite'.
Pre-formed moulded products and extruded products	Cable troughs and conduits. Cisterns and tanks. Drains and sewer pressure pipes. Fencing. Flue pipes. Rainwater goods. Roofing components (fascias, soffits, etc). Ventilators and ducts. Weather boarding. Windowsills and boxes, bath panels, draining boards, extraction hoods, copings, promenade tiles etc.	As for profiled sheets.	Release as for profiled sheets. Asbestos-containing roofing slate (eg 'Eternit', 'Turners', 'Speakers'), 'Everite', 'Turnall', 'Diamond AC', 'JM slate', 'Glasal AC', 'Emalie, Eflex', 'Colourglaze', 'Thrutone', 'Weatherall'.

Asbestos product	Location/use	Asbestos content and type/date last used	Ease of fibre release and product names
Other encapsulated materials			
Textured coatings	Decorative/flexible coatings on walls and ceilings.	3-5% chrysotile asbestos. Chrysotile added up to 1984 but non-asbestos versions were available from the mid-1970s.	Generally fibres are well contained in the matrix but may be released when old coating is sanded down or scraped off. 'Artex', 'Wondertex', 'Suretex', 'Newtex', 'Pebblecoat', 'Marblecoat'.
Bitumen products	Roofing felts and shingles, semi-rigid asbestos bitumen roofing. Gutter linings and flashings. Bitumen damp-proof courses (dpc). Asbestos/bitumen coatings on metals. [Car body underseals.]	Chrysotile fibre or asbestos paper (approximately 100% asbestos) in bitumen matrix, usually 8% chrysotile. Used up to 1992.	Fibre release unlikely during normal use. Roofing felts, dpc and bitumen-based sealants must not be burnt after removal. See felts and papers.
Flooring	Bitumen mastics and adhesives (used for floor tiles and wall coverings). Thermoplastic floor tiles. PVC vinyl floor tiles and unbacked PVC flooring. Asbestos paper-backed PVC floors.	Adhesives may contain up to a few per cent chrysotile asbestos. Used up to 1992. Up to 25% asbestos. Normally 7% chrysotile. Paper backing approximately 100% chrysotile asbestos. Used up to 1992.	Fibre release is unlikely to be a hazard under normal service conditions. Fibre may be released when material is cut, and there may be substantial release where flooring residue, particularly paper backing, is power-sanded. 'Novilon', 'Serval asbestos'.
Reinforced PVC	Magnesium oxychloride flooring used in WCs, staircases and industrial flooring. Panels and cladding.	About 2% asbestos. 1-10% chrysotile asbestos.	Very hard, fibre release unlikely. Fibre release is unlikely.
Reinforced plastic and resin composites	Used for toilet cisterns, seats, banisters, window seals, lab bench tops. Brakes and clutches in machines.	Plastics usually contain 1-10% chrysotile asbestos. Some amphiboles were used to give improved acid resistance, eg car batteries. Resins were reinforced with woven chrysotile cloth, usually contain 20-50% asbestos.	Fibres unlikely to be released, limited emissions during cutting. 'Sindanyo', 'Siluminite', 'Feroasbestos'. Minor emissions when braking, most asbestos degrades with frictional heat.

Insulating board/ceiling tiles

41 Insulating board is usually homogeneous, but repairs and replacement boards and tiles may have been fitted. One sample per room or every 25 m² is usually adequate. If there is evidently more than one type of panel, then representative samples of each should be taken. Larger installations completed at the same time may require only a few tile samples to be taken. Some replacement panels may look the same. Inspection of the hidden side of the board or tile may, where access permits, reveal the trade name of the materials and/or differences in colour which indicate variations in the material.

Asbestos cement materials

42 These are homogeneous materials which are commonly encountered as corrugated and flat sheets or as various moulded products. In older buildings, most pre-formed exterior cement sheets can be strongly presumed to be asbestos, and only limited sampling is needed to confirm the presumption. The risk from falls through asbestos cement roofs usually means that sampling is restricted. If sampling is required, one sample of each type of sheet or product (eg gutters, down-pipes, etc) should be taken. Repeated sampling is not usually necessary unless areas of replaced sheets are found. Asbestos cement (A/C) sheets are visually very similar to their non-asbestos (fibre-cement) replacement. Fibre-cement replacement sheets are identifiable by a code 'NT' placed near the edge of the sheet, where they overlap. Some newer asbestos sheets have the code 'AT' in a similar position.

Other materials

43 Where there are distinct types of materials, then one or two samples from each separate source will usually be adequate. Two samples are recommended if there is more than a few square metres of material.

BULK SAMPLING PROCEDURES

Safe systems of work

44 All work to be carried out must have an adequate risk assessment of the survey site (see paragraph 25) and the work must be carried out according to the procedures defined in the risk assessment. The work should minimise the disruption to the client's operations and must protect the health and safety of all persons who may be at risk (see CAWR). Sampling personnel must wear adequate personal protective equipment (PPE), as

determined by the risk assessment under CAWR (eg disposable overalls, overshoes/Wellington boots and a suitable respirator). The type of material sampled and the amount of disturbance of asbestos material will dictate the type of respirator. Airborne emissions should normally be controlled by pre-wetting the material to be sampled, with water and/or a suitable wetting agent. This may involve spraying the surface (eg boards and sheets) or injecting (eg lagging and sprays). Shadow vacuuming (holding the suction inlet close to the area where dust is being produced) with a Type H (BS 5415) vacuum cleaner should be used if wetting is likely to be incomplete (eg A/C, AIB boards, ropes and gaskets) or if it is not safe to do so (eg it may drip into electrical installations). Special sampling precautions are used for pipe lagging (see below).

45 The areas to be sampled inside buildings should as far as possible be unoccupied. Sampling should not be undertaken in normally occupied areas, but if in constant use, periods of minimal occupation should be chosen. The nature of the area, the likely release of dust and the proximity and nature of future work will dictate the precautions required to prevent the spread of asbestos. Entry of other people to any sampling area should be restricted or suitable warnings posted (eg a notice with wording such as '**Asbestos sampling in progress – keep out**'). Care should be taken to minimise the disturbance to the ACMs and any dust or debris that might be present. Surfaces onto which asbestos debris may fall should be protected with a sheet of impervious material such as polythene which can be easily cleaned by wet-wiping or using a suitable type 'H' vacuum cleaner. All samples must be individually sealed in their own container or a sealable polythene bag which is then sealed in a second container or polythene bag. The sample area should be left clean with no evidence of debris from the sampling operation and any sampling points sealed to prevent the release of fibres. A variety of methods are used to reseal the sampling point (eg tapes and fillers).

Sample and site labelling

46 Whenever a sample is collected, it should be labelled with a unique identifier that is also recorded in the survey documentation, records and site plans so that the sample origin can be traced at a later date. The sampling position at the site may also be labelled with the same identifier. Visual records such as marked-up plans and/or photographic records showing the location and extent of the sample are also effective ways of recording the sampling position and the location of the ACMs.

Bulk sampling

Spray coatings and bulk materials

47 If the coating is encapsulated, it can be pre-injected with liquid around the sampling area then carefully cut with a sharp knife or scalpel in order to lift a small flap to retrieve a sample. If the spray is uncovered, both wetting (spraying surface and injection) and shadow vacuuming may be necessary to reduce airborne emissions. As sprays are generally homogeneous, a surface sample which will cause only a small disturbance should suffice.

Pipe insulation

48 The area to be sampled should be fully wetted first; injection techniques are recommended. Samples are taken with a core sampler which should penetrate to the full depth of the pipe insulation. Proprietary types are available, but laboratory cork borers are also suitable. It should include a plunger to remove the sample from the borer. The sample point hole should be made safe after sampling (eg covered with tape or filled with a suitable inert filler), if the pipe is to remain in place and the surface was originally intact. This helps to keep the insulation in good condition and to prevent dispersal of asbestos. The borer should have a 'wet-wipe' pushed down to form a plug inside the borer and another wrapped around the outside. The borer is then used to take a full-depth sample of the insulation. The inner wet-wipe is used to seal the surface of the insulation where the borer enters and disturbs the insulation. The outer wet-wipe is used to clean the outside of the borer as it is withdrawn, and the contaminated wet-wipe can be placed in the sample bag. The sample is removed by using a plunger to push the sample out into the polythene bag, complete with the wet-wipe. Further cleaning will be required to completely clean the sampling equipment between sampling.

49 An alternative approach is to use core sampling tubes in which the sample is retained. Again the core tube can be withdrawn through a wet-wipe and then capped both ends and placed in a bag until it reaches the laboratory. Chicken-wire was often included within pipe insulation. This may hamper sampling, and a thin core sample may need to be taken. Where there is pipe insulation which is obviously new and non-asbestos, the possibility of debris from an earlier asbestos strip beneath the new insulation should be investigated.

Insulating board

50 Materials such as ceiling tiles or wall panels

should be inspected for areas of existing damage, where a sample can be collected more easily. Otherwise, a small sample should be taken from a discrete location at the corner or edge of the panel, with a sharp knife or chisel blade to lever off a sample.

Asbestos cement

51 Asbestos cement is usually very hard and it is preferable to seek a damaged portion where it will be easier to remove a small sample. The sample size should be about 5 cm² as it will be necessary to search for traces of amphibole asbestos such as crocidolite. The sample should be obtained using the pliers or a screwdriver blade to remove a small section from an edge or corner. (**Samples should not be collected from roofs without special safety precautions to prevent falls through the fragile sheets.**)

Gaskets, rope, seals, paper, felts and textiles

52 Samples can be taken using a sharp knife to cut a representative portion from the material.

Floor and wall coverings

53 Samples should be cut out with a sharp knife, usually taking one sample from tiles of each type or colour present. The area should be cleaned after sampling but the fibre release is likely to be very low, unless the asbestos is present as a lining or backing material.

Textured coatings

54 Samples should be obtained by carefully scraping the coating with a screwdriver, directing the material into the sample container held below the sampling point.

Air sampling

55 Personal air sampling can be carried out to measure the exposures of survey and sampling personnel. Occasionally there may be a request for air sampling if the ACMs are a matter of sensitivity to the occupants. Such requests need careful appraisal, as the area may already be contaminated, even before the bulk sampling is carried out. The procedures for reassurance air sampling as described in MDHS 39/4¹⁷ should be used.

Sample analysis and reporting

56 Analysis of the samples collected should be carried out and reported in accordance with the

method given in MDHS 77¹⁰ or an equivalent method. The laboratory report should for each sample give a clear statement of whether asbestos was found and the types of asbestos identified.

Survey report format

57 There are a number of ways the survey results may be reported and presented. However, the report must clearly identify the:

- location (eg building identifier, floor number or level, room identifier and position);
- extent (area, length, thickness and volume, as appropriate);
- product type (see Table 1);
- level of identification (presumed, strongly presumed or identified); and
- asbestos type (chrysotile, amosite, crocidolite etc).

If an assessment is carried out for a Type 1 or Type 2 survey, the following will also be recorded:

- accessibility;
- amount of damage or deterioration; and
- surface treatment (if any).

Laboratory results should be appended. Materials which have been sampled and found not to contain asbestos after analysis also need recording as 'ASBESTOS NOT DETECTED', as the asbestos content of these materials may be questioned in future and it will save a great deal of time and cost if this has been clearly recorded in the first instance. The survey report or abstracts from it should be presented in a form that can be used as the basis of a register or log of ACMs and therefore should be both accessible and updatable.

ASSESSMENT

58 The new duty to manage under CAWR will require a written plan to be produced, specifying the measures to be taken to control and manage the risk from identified and presumed ACMs. An important stage of this process is to assess the potential for fibre release of each ACM found. To help make the assessment, in a structured and recordable way, various tools have been developed. Algorithms and decision diagrams (decision trees/flow charts) have been widely used with various degrees of success. A standardised

assessment approach suitable for a Type 1 or Type 2 survey is given below, based on a simplified additive algorithm. For pre-demolition Type 3 surveys, no assessment is necessary.

Material assessment algorithm

59 The four main parameters which will determine the amount of fibre release from an ACM when subject to a standard disturbance are:

- product type;
- extent of damage or deterioration;
- surface treatment; and
- asbestos type.

Each parameter is scored as: high = 3, medium = 2 or low = 1; two categories also allow a nil score. The value assigned to each of the four parameters is added together to give a total score of between 2 and 12. Presumed or strongly presumed asbestos-containing materials are scored as crocidolite (3), unless analysis of similar samples from the building shows a different asbestos type, or if there is a reasoned argument that another type of asbestos was almost always used (see paragraph 30 and Table 1). Examples of scoring for each parameter are given in Table 2.

60 Materials with assessment scores of 10 or more are regarded as having a high potential to release fibres, if disturbed. Scores of between 7 and 9 are regarded as having a medium potential, and between 5 and 6 a low potential. Scores of 4 or less have a very low potential to release fibres. Non-asbestos materials are not scored. **The material assessment score should be calculated and recorded as part of the survey.**

Risk assessment and management plans

61 The material assessment identifies the high-risk materials, that is, those which will most readily release airborne fibres if disturbed. It does not automatically follow that those materials assigned the highest score in the material assessment will be the materials that should be given priority for a remedial action. Management priority must be determined by carrying out a risk assessment which will take into account factors such as:

- the location of the material;
- its extent;
- the use to which the location is put;

Table 2: Material assessment algorithm

Sample variable	Score	Examples of scores (see notes for more detail)
Product type (or debris from product)	1	Asbestos-reinforced composites (plastics, resins, mastics, roofing felts, vinyl floor tiles, semi-rigid paints or decorative finishes, asbestos cement etc).
	2	Asbestos insulating board, mill boards, other low density insulation boards, asbestos textiles, gaskets, ropes and woven textiles, asbestos paper and felt.
	3	Thermal insulation (eg pipe and boiler lagging), sprayed asbestos, loose asbestos, asbestos mattresses and packing.
Extent of damage/deterioration	0	Good condition: no visible damage.
	1	Low damage: a few scratches or surface marks; broken edges on boards, tiles etc.
	2	Medium damage: significant breakage of materials or several small areas where material has been damaged revealing loose asbestos fibres.
	3	High damage or delamination of materials, sprays and thermal insulation. Visible asbestos debris.
Surface treatment	0	Composite materials containing asbestos: reinforced plastics, resins, vinyl tiles.
	1	Enclosed sprays and lagging, AIB (with exposed face painted or encapsulated), asbestos cement sheets etc.
	2	Unsealed AIB, or encapsulated lagging and sprays.
	3	Unsealed lagging and sprays.
Asbestos type	1	Chrysotile.
	2	Amphibole asbestos excluding crocidolite.
	3	Crocidolite.
Total		

- the occupancy of the area;
- the activities carried on in the area; and
- the likelihood/frequency with which maintenance activities are likely to take place.

62 The risk assessment can only be carried out with the detailed knowledge of all the above. Although a surveyor may have some of the information which will contribute to the risk assessment and may be part of an assessment team, the duty holder under CAWR is required to make the risk assessment, using the information given in the survey and their detailed knowledge of the activities carried out within the premises. The risk assessment will form the basis of the management plan (see paragraph 6). Further information on risk assessments and management of asbestos will be available as separate HSE guidance.

DOCUMENTATION

Presentation of results

63 The results must be recorded in a clear, comprehensible, readily accessible and usable form. For all but the simplest survey, a computer database of suitable form is useful, as it enables the records to be kept up-to-date and to be readily accessible by various means (eg intranets, the Internet and other data transfer technologies). A database can be used to record all the remedial work carried out and to prompt the building manager to carry out and record any further inspections which are required. Some databases can also link digital picture images of a sample and CAD plans.

Reporting requirements

64 The final report, depending on the type of survey undertaken, may contain the following sections:

- general site and survey information;
- survey report;
- bulk analysis report;
- material assessment/report.

If it is to be used as an integral part of the management plan, it will also require sections for review and update.

65 General site and survey information should include:

- the name and address of the organisation carrying out the survey;
- the names of the surveyors;
- the name and address of the person who commissioned the survey;
- the name and address of the premises surveyed;
- the date of the report;
- the date of the survey;
- the purpose, aims and objective of the survey;
- a description of the areas included in the survey;
- a description of any areas excluded from the survey;
- the survey method used (this MDHS and/or other documented procedures);
- the type of survey undertaken (Type 1, Type 2 or Type 3) and, if more than one type is used, where they apply within the premises;
- any variations or deviations from the method; and
- agreed exclusions and inaccessible areas.

66 The survey report should include a set of marked-up plans (quality will depend on what was available) and a table, spreadsheet or database containing the following descriptors:

- location (eg building identifier, floor number or level, room identifier and position);
- extent (area, length, thickness and volume, as appropriate);
- product type (see Table 1);
- level of identification (presumed, strongly presumed or identified); and
- asbestos type (chrysotile, amosite, crocidolite etc).

For a Type 1 or Type 2 survey, the following descriptors should also be used:

- accessibility;

- amount of damage or deterioration; and
- surface treatment (if any);

and the material assessment score or category (high, medium, low or very low) given.

For Type 2 and 3 surveys, a bulk analysis report should also be attached and include:

- the name and address of the laboratory carrying out the bulk identification;
- a reference to the method used;
- the laboratory's current United Kingdom Accreditation Service (UKAS) accreditation for bulk asbestos analysis/sampling and accreditation number;
- a table or appendix summarising the results of the bulk analysis, including asbestos found or not found and types identified, by sample identifier;
- dates the bulk analysis was carried out and reported by the laboratory; and
- the names and signatures of the analyst and any countersigning person.

QUALITY ASSURANCE PROCEDURES

67 The person or persons responsible for surveying the premises have to use a high level of subjective assessment, and need adequate training, experience and time to carry out the survey. It is important that procedures used for conducting the survey, assessing and documenting the findings are clearly recorded. Organisations offering an asbestos survey service should be able to comply with the standard set out in EN 45004 (*General criteria for the operation of various types of bodies performing inspection*). Accreditation to EN 45004 for organisations undertaking asbestos surveys will be available from UKAS. Accreditation to ISO 17025 for organisations sampling and/or analysing asbestos-containing materials is currently available from UKAS. Please address enquiries to UKAS, 21-47 High Street, Feltham, Middlesex TW13 4UN (tel: 020 8917 8555). An individual proficiency module (P402) on building surveys and bulk sampling is currently offered through the British Institute of Occupational Hygiene (BIOH), Suite 2, Georgian House, Great Northern Road, Derby DE1 1LT (tel: 01332 298087). Individuals can seek personal certification to undertake asbestos surveys from certification bodies accredited to EN45013 by UKAS.

68 All surveying organisations should have and implement policies for quality control and quality assurance procedures. Quality control checks, such as re-inspection (and, if necessary, corrective action) should be carried out on work in progress. The numbers of repeat samples should be adequate to detect errors and will vary with the complexity and variety of the materials being surveyed. All the procedures of a surveying organisation should be quality assured by carrying out audits of completed surveys.

69 The laboratory should be able to demonstrate its competence to carry out bulk asbestos analysis (eg staff training records, certificates from external training providers, testing programmes, participation in quality assurance schemes, satisfactory performance in national proficiency testing programmes, accreditation to ISO 17025 or be able to demonstrate equivalence). The Asbestos in Materials Scheme (AIMS) is the UK national proficiency testing programme for bulk asbestos analysis. Individual analysts can also demonstrate competency through training records and satisfactory performance in a quality assurance scheme. It is recommended that samples or representative sub-samples are kept after analysis for at least six months to allow checks to be made.

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Figure 1 Asbestos building
Typical locations for the most common asbestos-containing materials

KEY

ROOF AND EXTERIOR WALLS

- 1 Roof sheets, slates and tiles
- 2 Guttering and drainpipe
- 3 Wall cladding
- 4 Soffit boards
- 5 Panel beneath window
- 6 Roofing felt and coating to metal wall cladding

BOILER, VESSELS AND PIPEWORK

- 7 Lagging on boiler, pipework, calorifier etc.
- 8 Damaged lagging and associated debris
- 9 Paper lining under non-asbestos pipe lagging
- 10 Gasket in pipe and vessel joints
- 11 Rope seal on boiler access hatch and between cast iron boiler sections
- 12 Paper lining inside steel boiler casing
- 13 Boiler flue

CEILINGS

- 14 Spray coating to ceiling, walls, beams/columns
- 15 Loose asbestos in ceiling/floor cavity
- 16 Tiles, slats, canopies and firebreaks above ceilings
- 17 Textured coatings and paints

INTERIOR WALLS/PANELS

- 18 Loose asbestos inside partition walls
- 19 Partition walls
- 20 Panel beneath window
- 21 Panel lining to lift shaft
- 22 Panelling to vertical and horizontal beams
- 23 Panel behind electrical equipment
- 24 Panel on access hatch to service riser
- 25 Panel lining service riser and floor
- 26 Heater cupboard around domestic boiler
- 27 Panel behind/under heater
- 28 Panel on, or inside, fire door
- 29 Bath panel

FLOORING MATERIALS

- 30 Floor tiles, linoleum and paper backing, lining to suspended floor

AIR HANDLING SYSTEMS

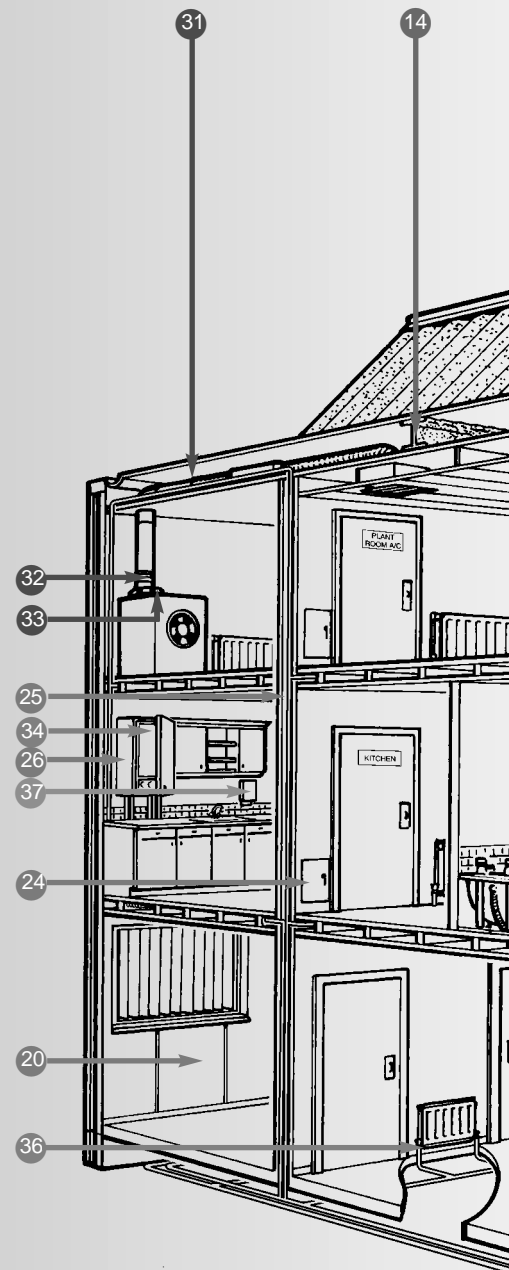
- 31 Lagging
- 32 Gaskets
- 33 Anti-vibration gaiter

DOMESTIC APPLIANCES

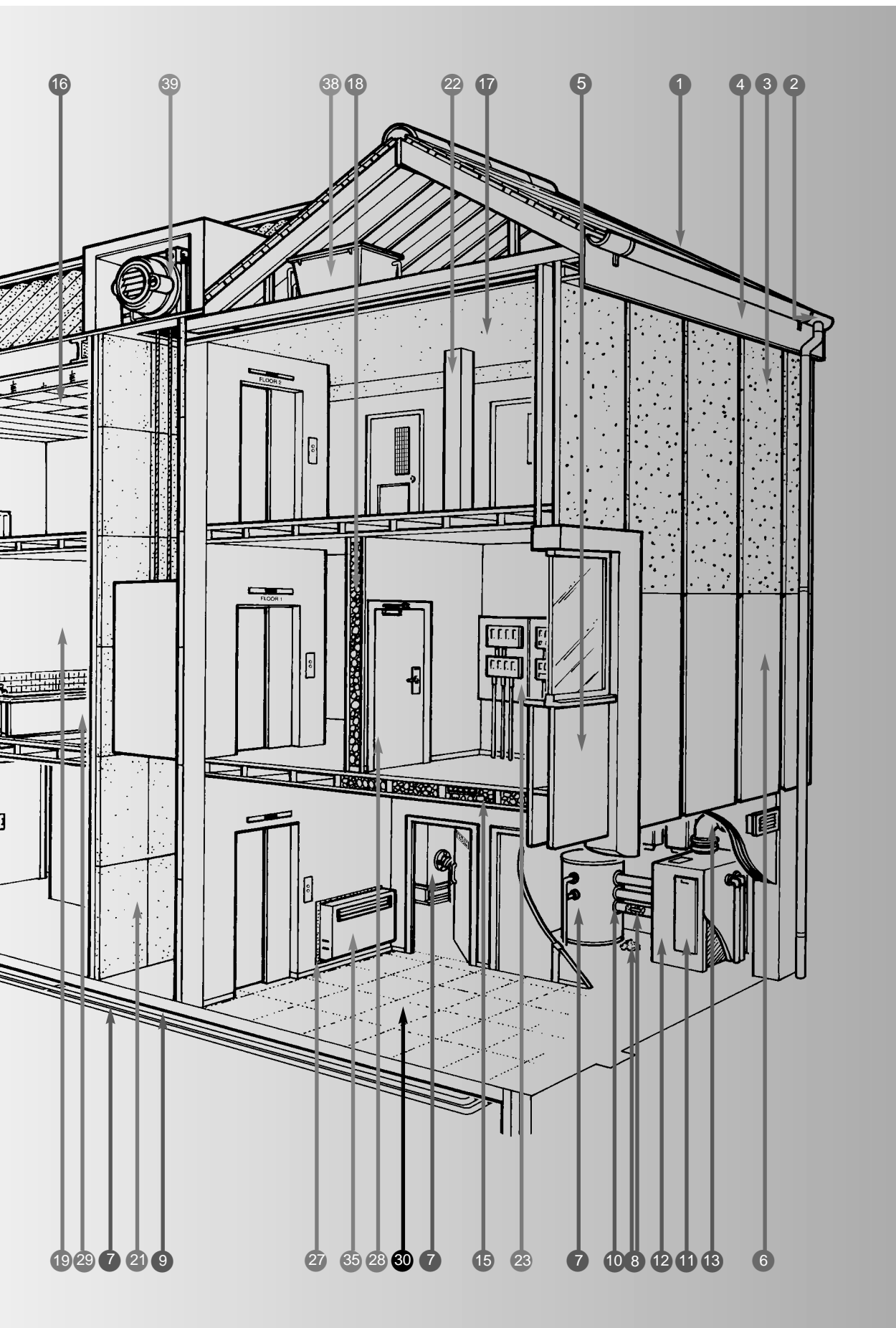
- 34 Gaskets, rope seals and panels in domestic boilers
- 35 'Caposil' insulating blocks, panels, paper, string etc in domestic heater
- 36 String seals on radiators

OTHER

- 37 Fire blanket
- 38 Water tank
- 39 Brake/clutch lining



Note: This diagram does not show all possible uses and locations of asbestos-containing materials. A detailed survey will be required to identify all asbestos-containing materials present in a building.



ANNEX 1: WHAT ACMs LOOK LIKE AND WHERE TO FIND THEM

Examples of the main types, locations and uses of ACMs in premises are given below to help people recognise materials which may contain asbestos. This is only a small selection of the range of asbestos-containing materials used, but should cover many of the main uses of asbestos in premises.

Product types

1 Loose asbestos insulation

Some fire doors contained loose asbestos insulation sandwiched between the wooden or metal facings to give them the appropriate fire rating. Loose asbestos was also packed around electrical cables, sometimes using chicken wire to contain it. Mattresses containing loose asbestos were widely manufactured for thermal insulation. Acoustic insulation has been provided between floors by the use of loose asbestos in paper bags, and in some areas near asbestos works it is not unknown for loose asbestos to have been used as a readily available form of loft insulation.



1a Acoustic insulation in a ceiling void with a 'Jiffy bag'-type construction, with paper container punctured for electrical wiring.



1b Loose insulation with paper cover degraded under a dance floor.

2 Sprayed asbestos coatings

These are normally homogeneous coatings sprayed or trowelled onto reinforced concrete or steel columns or beams as fireproofing. Sprays were also commonly used on the underside of ceilings for fireproofing and sound and thermal insulation in many high-rise premises. Warehouses and factories commonly had sprayed asbestos applied to walls, ceilings and metal support structures for fireproofing and thermal/anti-condensation insulation purposes. In some larger spaces, sprays were also applied to walls and ceilings for acoustic and decorative purposes (theatres, cinemas, studios, halls etc). The depth of the spray depended on the fire rating and substrate, and may vary from 10 to 150 mm thick. The dry sprayed coatings may have a candyfloss appearance if left untamped (rarely found in the UK). The wet sprayed/trowelled coatings are usually denser, and those with higher proportions of Portland cement that have been well tamped can be quite hard. Surfaces may be sealed with an elasticised paint or proprietary encapsulant, sometimes reinforced with calico or man-made fibre mesh, or left completely unsealed. Spray coatings are vulnerable to accidental damage and also to delamination due to water leakage releasing debris onto the floor and other horizontal surfaces. Overspray onto areas and recesses surrounding the object that was being coated is common. Spray coatings may have deteriorated significantly since installation and must be treated with caution.



2a Cementitious sprayed chrysotile asbestos on a ceiling for decorative and fireproofing purposes, showing evidence of previous damage and repair.



2c Sprayed amosite fireproofing on steel roof support beams in a return air plenum showing signs of damage and wear at the bottom caused by access for maintenance.



2b Poorly tamped sprayed chrysotile fireproofing on a structural steel beam holding up a concrete floor showing some overspray onto the concrete and damage by electrical work.



2d Sprayed crocidolite asbestos (100 mm thick) applied as thermal insulation to the underside of an asbestos cement roof. From top to bottom, the encapsulated spray, the spray without encapsulant and removed spray from the A/C cement sheets.



2e Close-up of the surface of sprayed amosite insulation (~40 mm thick) on the underside of an asbestos cement roof.

instead of the pre-formed sections. For bends, joins, small sections of pipe and repairs, an asbestos-containing plaster was wet-mixed on-site and hand-applied to the areas. Larger installations were also insulated with asbestos-containing plaster which was marketed as 'plastic', but various local names were used for this hand-applied insulation (eg 'muck'). Larger thicknesses of insulation would use pre-formed blocks (eg 'Caposil') which would be wired in place and various other coatings or layers applied, depending on the insulation required. Very hard-wearing coatings were known as 'Bulldog' finishes and may contain metal sheets and/or chicken wire reinforcement beneath a hard plaster finish. External pipes may also be clad with sheet metal or painted with bitumen to give additional weatherproofing. As installers would often use whatever materials were available to hand or in stock, it is very common to find variations on the same pipe or boiler. Particular attention must be paid to bends and valves, or where it is evident that repairs have been made.



2f Sprayed crocidolite thermal insulation applied to external wall cladding and enclosed behind non-asbestos wallboard.



3a Asbestos-insulated water pipes in a loft, sealed and in good condition.

3 Thermal insulation

Asbestos was widely used for thermal insulation of pipes, boilers and heat exchangers. There are a number of different types and forms of insulation, often with multi-layer construction. The simplest form to apply was pre-formed sections of asbestos insulation made to fit the diameter of the pipe. These would be strapped on and calico-wrapped and sometimes painted (eg 'Decadex' finish), or sealed with a hard plaster (often asbestos-containing) to give protection against knocks and abrasion. Other types of asbestos-containing felts, blankets, tapes, ropes and corrugated papers were also used



3b Asbestos-insulated water pipes in a loft, showing evidence of maintenance work damage, with detached pre-formed sections and calico wrapping.



3d Asbestos pipe lagging on central heating pipes at the entrance of an underground crawl tunnel to adjacent premises.



3c Asbestos pipe lagging in a service riser, with calico wrapping and straps.



3e Asbestos-lagged pipe with a polymeric encapsulant 'Decadex' finish.



3f Asbestos-lagged boiler with a hard plaster coating.



3h Badly degraded external asbestos-lagged pipe in an industrial plant, with asbestos rope wound around the bends.



3g High-pressure steam pipes in a power station with a 'Bulldog' finish over 'Caposil' insulation blocks.



3i Example of hand-applied 'hard set' insulation, partially removed from a pipe.

4 Millboard

Millboard was used when a low-cost, relatively soft low-density board with modest mechanical properties but with good fire, insulation, thermal and electrical properties could be specified. Generally found in industrial premises, but has been used as exterior lining to ventilation ducts and was commonly used inside fire doors.



4a Removal of a piece of low density millboard from an electrical cable box.

5 Asbestos insulating board (AIB)

Widely used in premises for internal partition walls and linings and for fire protection, acoustic and thermal insulation. Suspended ceiling tiles were often made from AIB. Insulating boards come in a range of densities and can be subject to damage by the use of moderate force (eg kicking). There may be variations due to later construction of partition walls as part of a redevelopment or refurbishment. All kinds of combinations may be found and surveyors must be alert for all possibilities. Areas around lift shafts, stairwells and service risers in multi-storey buildings were commonly lined or faced with AIB or composites. Similarly, areas around gas fires and central heating boilers were also constructed from AIB. Fire doors were also faced with AIB to achieve the appropriate fire rating. AIB is usually found inside premises, but weather-protected exterior areas such as porches and soffits may contain AIB.



5a Typical use of AIB in system-built flats. The internal AIB panel is visible behind a broken flat sheet (possibly asbestos cement) with textured coating (possibly chrysotile asbestos-containing) with MMMF insulation in between.



5b Painted AIB on ceiling.



5c Painted AIB partition wall in a factory.



5e Painted AIB fire surround.



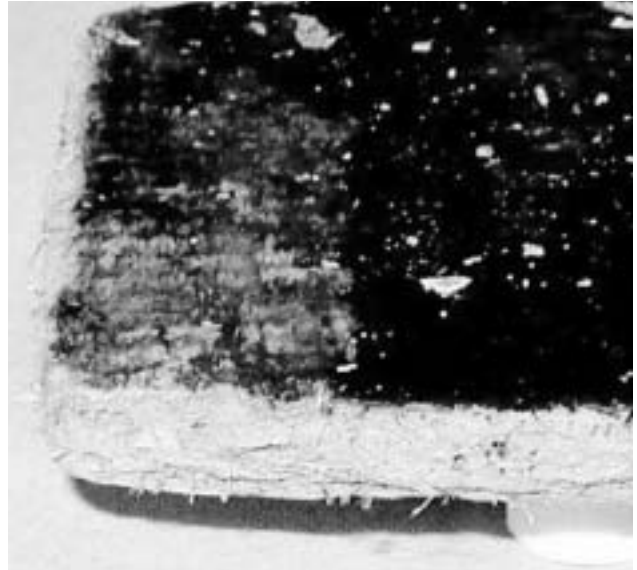
5d AIB around a service riser shaft (showing cut and uncut edges).



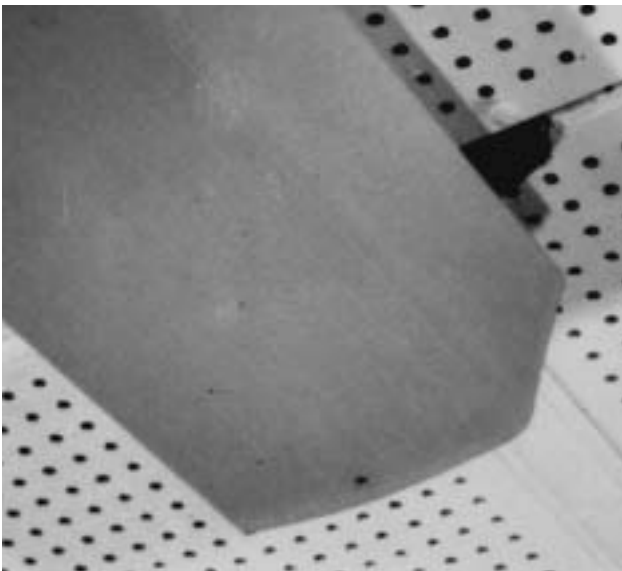
5f Painted AIB soffits.



5g Painted AIB facing to a fire door with some damage around the door furniture.



5i Close-up of AIB with adhesive coating the top surface, showing the fibrous nature of the material.



5h Perforated AIB ceiling tiles, showing a small area of damage around a light fitting.

6 Asbestos insulating board (AIB) in composite materials

Asbestos insulating board was used in composite materials and may be sandwiched between or surfaced with non-asbestos products such as straw board, plywood, metal mesh, sheet metal and plasterboard.



6a AIB inside an interior wall faced with plasterboard.

7 Asbestos papers, felts and cardboard

Air conditioning trunking may be insulated internally with 'Paxfelt' or externally with other asbestos-containing felt, cardboard and paper for acoustic and heat insulation. Asbestos papers were widely used to line the surfaces of other boards, ceiling tiles and sheet materials.



7a Example of the use of asbestos cardboard.



7c Chrysotile paper-lined strawboard.

8 Asbestos textiles

Asbestos textiles were manufactured for primary heat (eg insulation tapes and ropes) or fire protection uses (eg fire blankets, fire curtains, fire-resistant clothing). Textiles were also used widely as a reinforcing material in friction products/composites (see section 15).



7b Foil-backed asbestos cardboard insulation inside a warm air heater.



8a Example of asbestos tape on a domestic water heater.



8b Asbestos gaiter between pipe flanges.



8d Asbestos rope seal in a domestic gas boiler.



8c Asbestos fire blanket.



8e Asbestos rope used as packing/seal where pipe passes through a wall.

9 Asbestos gaskets, washers and strings

A wide range of asbestos gaskets have been produced and used for sealing pipe and valve joints in industrial plant, but they may also be found in some older domestic boilers etc. Asbestos string was widely used in the past by plumbers for sealing various screw thread joints.



9a Asbestos tape, string, rope and gasket in a maintenance repair cabinet (note also the shiny vitreous appearance of a non-asbestos MMMF replacement tape to the left).



9b Asbestos string.



9c Gasket material adhering to a pipe flange.

10 Asbestos cement sheets and tiles used for roofing and cladding

Asbestos cement (A/C) has been extensively used for roofing and exterior cladding on industrial, public and some domestic premises. Corrugated/profile sheets are commonly found, but flat sheets have also been widely used for exterior and some interior cladding (eg panels below windows and on walls in older prefabricated housing).



10a Asbestos cement roof (seen from inside).



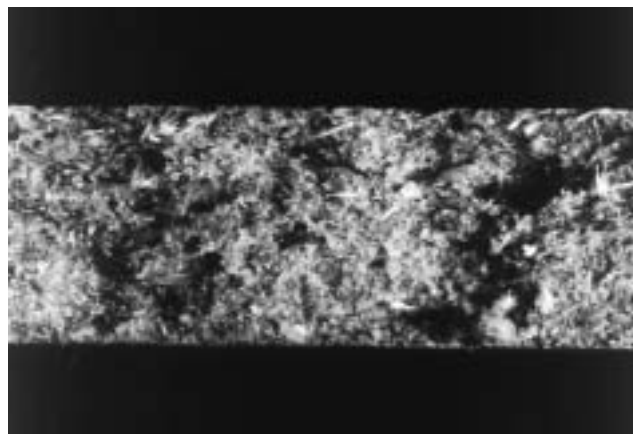
10b Asbestos cement roof (weathered exterior).



10d Asbestos cement roofing slate.



10c Asbestos cement vertical cladding.



10e View of the broken edge of an asbestos cement slate showing chrysotile asbestos fibres embedded in the cement matrix.

11 Moulded asbestos cement products

A wide range of moulded compressed A/C products have been used inside premises (eg waste pipes, cold water tanks, flues etc) and outside premises (eg gutters, downpipes, flues, cowls, etc). Many other items have been moulded from asbestos cement. Asbestos cement pipes are also used underground (eg from local drainage to regional water supply systems).



11a Asbestos cement water tank.



11b Asbestos cement flue from a domestic boiler.



11c Asbestos cement external flue, rain water gutter and profile roofing sheet.



11d Asbestos cement downpipe, hopper and profile sheet.



11e Asbestos cement pipes.

12 Textured coatings, paints and plasters used for decorative effects

These were often manufactured containing up to a few per cent of asbestos. 'Artex', 'Wondertex', 'Suretex', 'Newtex', 'Pebblecoat' and 'Marblecoat' are examples of typical trade products, which usually contained a few per cent of chrysotile asbestos.



12a Example of painted chrysotile textured coating on a ceiling.

13 Bitumen products

Bitumen-based roofing felts and damp-proof courses have been widely reinforced by the addition of asbestos, usually in the form of chrysotile paper. Bitumen-based wall and floor coverings were also produced. Some mastics used to stick the bitumen products commonly had asbestos added to them to provide flexibility. Other sealants also had asbestos added to improve the performance of the product.



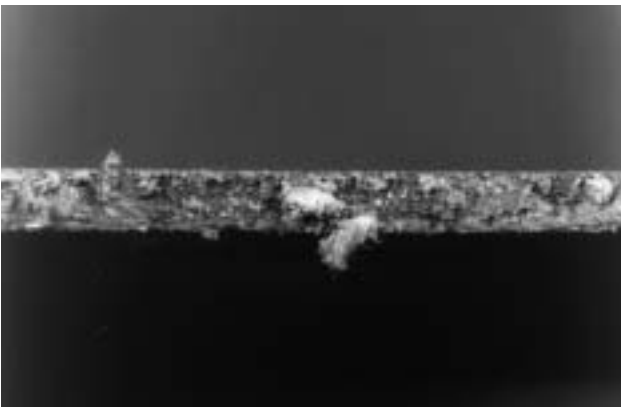
13a Weathered asbestos-containing roofing felt (less weathered material is black).

14 Flooring products

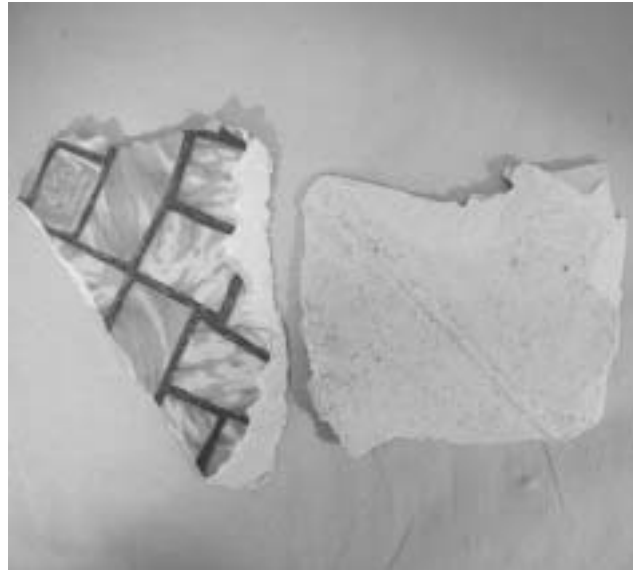
Polyvinyl chloride (PVC or vinyl) tiles were manufactured with added asbestos to meet a British Standard and often contain a few per cent (5-7%) of very fine chrysotile. Black and brown thermoplastic tiles containing larger amounts and often visible clumps of chrysotile were also produced. Sheet floor coverings were sometimes backed with a thin layer of chrysotile paper (eg 'Novilon', a vinyl flooring, which was more common in Europe). Some underfelts for carpets and linoleum were also manufactured containing asbestos. The mastics which were used to bond the floor covering to the surface could also contain asbestos. Some hard-wearing composite floors (eg magnesium oxychloride) also contain about 2% of mineral fibres which could be asbestos.



14a Asbestos-containing vinyl floor tiles.



14b Cross-section of a broken thermoplastic floor tile showing significant chrysotile asbestos bundles. PVC/vinyl asbestos tiles contain short grades of finely divided chrysotile which may be difficult to detect.



14c Asbestos paper-backed vinyl floor covering.

15 Asbestos-reinforced plastic/resin composites and friction products

Asbestos-reinforced plastics and resin composite material were used for windowsills, capping for banisters, school and laboratory worktops, toilet cisterns etc. The material is often black and has a high density and scratch resistance. Asbestos textiles were widely used as a reinforcing material in friction products (eg conveyor and fan belts, brake and clutch linings). Older asbestos-containing components may still be in use or present in vehicle repair and maintenance workshops and stores.



15a Asbestos-reinforced plastic toilet cistern.



15b Asbestos-reinforced windowsill.

16 Metal-asbestos composites

Flues for wood-burning stoves were commonly constructed from a metal-asbestos where the asbestos was added as insulation between the inner and outer layers of stainless steel to give a high degree of insulation when passing through floors and on the outside to prevent sudden cooling of the flue gases. 'Durasteel' metal panels were used to provide a strong construction with a certain degree of insulation, by incorporating a layer of asbestos paper.



16a Metal-clad asbestos flue pipe.



16b A 'Durasteel' panel.

17 Wall jointing tapes and fillers

Chrysotile textile tapes and webbing were used to reinforce wall joints before plastering. Several types of wall plugs and some wall repair fillers had asbestos added to give additional strength and flexibility. These are very difficult to locate as they are integrated into the plaster finish.



17a Examples of chrysotile 'scrim' tapes.

18 Domestic appliances and products

Many domestic appliances and products contain asbestos insulation materials for thermal or electrical insulation, including ironing boards, hairdryers, oven seals, simmering plates etc. Some older electric fires and storage radiators and old gas fires with catalytic elements or coal or log effect gas fires also contained ACMs.



18a Ironing board with asbestos cement sheet for iron rest.



18b 'Caposil' insulation from inside an old electric storage radiator.



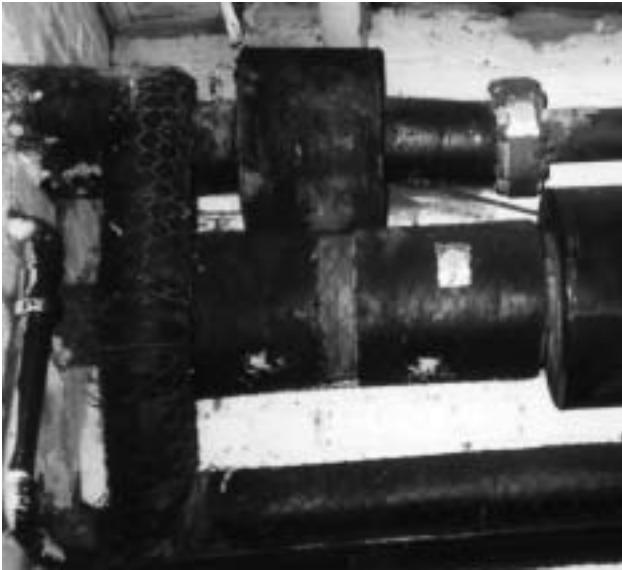
18c Asbestos tape flash guards in a fuse box.

19 Industrial sites, factories and plant

Industrial sites (eg refineries, power stations, warehouses and factories) often contain substantial amounts of asbestos. Many of the examples given for spray, thermal insulation and pipe lagging come from industry. Higher-performance ACMs were usually specified to cope with the higher temperatures and pressures prevalent at industrial sites. Some machinery may also incorporate asbestos gaskets and friction products (eg clutches, brake pads, drive belts and conveyor belts). The higher power requirements of industry also saw increased use of asbestos insulation in electrical cables and switchgear.



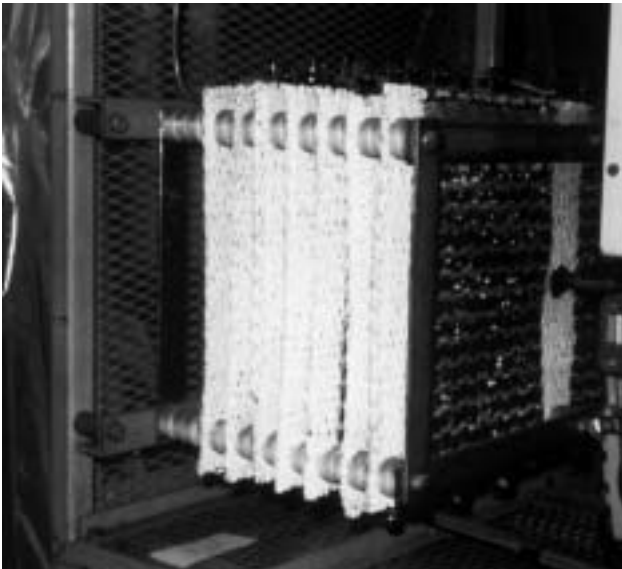
19a Asbestos-insulated vessel and supply pipes in a factory.



19b Asbestos gasket in an industrial pipe join.



20a Asbestos debris in the bottom of a service riser.



19c Asbestos cloth and tape used as electrical insulation.



20b Asbestos debris left on a walkway.

20 Dust and debris

Damaged materials will release asbestos dust and debris. Often the source of the debris is obvious, but if poor removal and/or a poor level of clean-up has taken place, only asbestos dust and debris will be left. This will have accumulated on horizontal surfaces and in difficult-to-clean areas. Poor removal will also leave debris, either remaining in situ from where it should have been removed, or as scattered debris often in difficult-to-reach or clean areas.



20c Fibrous debris in a cable tray.



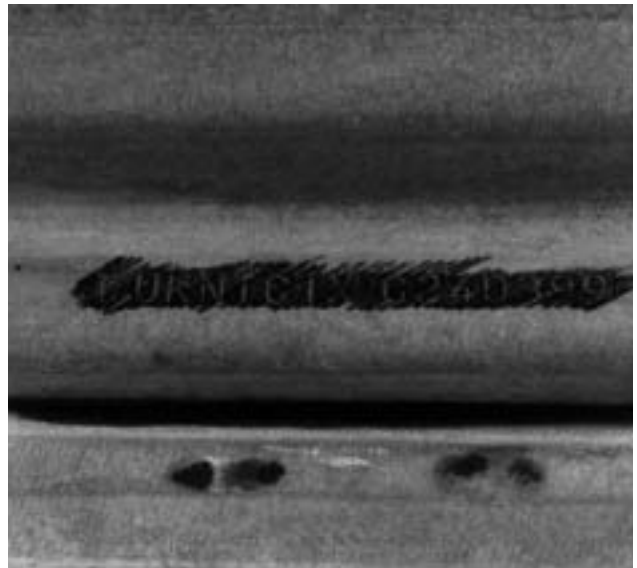
20d Sprayed asbestos debris released onto a suspended ceiling from cable installation work.

21 Non-asbestos replacement materials

Many materials in a building will be non-asbestos, and many of these can be readily recognised as such. Later premises will often contain substitute non-asbestos materials, which cannot be differentiated without analysis. Some examples are given below.



21a Glasswool insulation usually has a distinctive yellow colour, even after many years of gathering dust in lofts and roof spaces. A black layer of asbestos-containing roofing felt is, however, visible where the insulation has been removed and the wooden roof purling is encased in AIB. Rockwool and slagwool are also widely used and their darker brownish or grey colour may possibly be confused with amosite, although the texture and fibre size is very different from asbestos. These wools may occur in blanket form, pre-formed bats and blown as loose insulation in cavities. MMMF textiles have a vitreous shiny appearance (see 9a) compared to asbestos textiles.



21b Fibre cement sheets are now widely produced as a replacement for asbestos cement sheets and are visually similar. However, each non-asbestos will be marked with a code containing the letters EUR NT (new technology). Some of the newer A/C sheets are also marked with AT (asbestos technology).

ANNEX 2: EXAMPLE OF A SURVEY AND SAMPLING EQUIPMENT CHECKLIST

Survey equipment

- Site plan
- Log book, organiser, computer
- Step ladder
- Camera (film or digital) with flash and preferably with a date and number facility
- Torch
- Access keys to rooms and covers
- Screwdrivers

Bulk sampling equipment

- Pliers
- Screwdrivers
- Core samplers or cork borers
- Aluminium foil or cloth tape
- Stanley knife with spare blades
- Hand-spray with diluted PVA or surfactant
- Sample bags (polythene self-seal bags)
- Sample point labels
- Type H vacuum
- Asbestos waste bags of the approved type
- Warning signs: 'Asbestos Sampling - Keep Clear'
- Wet-wipes and tissues
- Polythene sheeting

PPE for sampling

- Disposable overalls (hooded)
- Disposable booties or Wellington boots
- Disposable gloves
- Respiratory protective equipment (as per assessment)

ANNEX 3: ASBESTOS WARNING LABEL



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