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Repair and Removal of Asbestos Insulation

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1. Repair and Removal situations

1.1 Asbestos in varying proportions has been widely used in insulation materials, especially for the thermal insulation of steam-generating or process plants; for heating installations and services; as refractory linings in steel-making, metal and other industries; and in sites ranging from the smallest workshop to the largest industrial complexes such as oil refineries and power stations. At sea large quantities have been used both for thermal insulation and for the fire protection of crew, passengers and cargo. It has also been used widely in land transport, in railway locomotives and rolling stock. It has been a favoured material for the reduction of fire hazards in buildings, particularly those where large numbers of people assemble. In these buildings it is used in the form of cladding of the steel structures and the formation of fire breaks. It has also been widely used for thermal and acoustic insulation.

1.2 In the course of maintenance, repair, alteration, removal or demolition, many instances occur which necessitate the repair or removal of asbestos-containing materials. Since by the nature of their insulating properties such materials are usually of low density and often found in a very dry state, their disturbance is likely to result in high concentrations of dust unless suitable precautions are taken.

1.3 The amount of respirable asbestos dust generated will depend on the nature of the product and the operation to be performed. It is essential that steps are taken to reduce the level of dust to the lowest practicable level and to ensure the protection of all personnel from risk of inhalation of harmful quantities of asbestos or other dusts, although the measures to be adopted will vary according to the nature and extent of the work to be carried out. This document is designed to assist all those who may be concerned with the achievement of these aims.

2. Asbestos-containing products to which these procedures may apply

2.1 Compounds containing asbestos and applied by spray.

2.2 Compounds containing asbestos in the form of plastic self-setting mixes for covering pipes and equipment, often in conjunction with pre-formed insulation materials.

2.3 Pre-formed insulation in the form of pipes, lags or slabs (or fabrications thereof, such as valve and flange covers).

2.4 Mattresses consisting of asbestos or man-made cloth covers or envelopes filled with loose asbestos fibre.

2.5 Asbestos cloth, tape or paper, often as an outer covering of the above-mentioned forms of thermal insulation.

2.6 Asbestos rope lagging, usually applied spirally wound onto steam or hot-water lines.

2.7 Refractory blocks or linings.

3. Prevention of risk

3.1 Regulations in some countries restrict the use of certain of the above-mentioned products (e.g. by permitting their use for fire protection only). Even where certain uses no longer occur, installations and situations involving such materials will continue to exist for many years, so that the observance of suitable control procedures will be necessary for a long time in the future. Dust generated in demolition, whether or not the materials contain asbestos, is bound to be considerable so that measures for the protection of personnel and the prevention of public nuisance will be essential.

3.2 It should also be stressed that the removal of installed insulation for no other reason than that it contains asbestos may be ill-advised. In many cases the risk created by the removal would far exceed any which would arise if the insulation were left in place effectively sealed. It is not always possible completely to remove all sprayed asbestos; for example, where areas were sprayed during the construction process and subsequently have become inaccessible. Sometimes, as a result of impact or vermin attack, a portion of the surface may become opened up thus releasing fibrous material; in such situations it may well be more effective to repair the damage and seal the surface to prevent further release rather than to attempt removal.

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4. Recommended procedures for repair, encapsulation or cladding of asbestos insulation

4.1 Where, as described above, a portion of the surface of asbestos thermal insulation has become damaged so that there is a possibility of the release of fibres, various methods can be adopted to prevent such release. Whether the damage can be adequately and effectively encapsulated is a matter for judgement, taking into account the following:

4.1.1 The nature and condition of the insulation. For example, if the material is breaking away from its base complete removal will probably be unavoidable.

4.1.2 Whether the insulation is liable to further damage, e.g. in the course of ordinary work traffic.

4.1.3 Whether the insulation is accessible or if major structural work would be necessary to allow its removal.

4.1.4 What are comparative costs of removal or effective repair/sealing.

4.1.5 If the insulation has been provided for statutory fire protection, whether this requirement can be met by other means.

4.2 There are a number of products which may be used to seal, encapsulate or clad existing asbestos-containing insulation materials, provided they meet the basic requirement of a continuous impervious surface. The main classifications are as follows:

4.2.1 Flexible and semi-flexible polymeric or bituminous coatings. These are normally applied by spray as water-based emulsions but may be solvent-based. The finished surface has low to medium strength but polymeric coatings used in conjunction with glass fibre fabrics can provide good impact resistance.

4.2.2 Inorganic cementitious materials, normally in the form of fibrous or particulate-filled cements activated on site by water. These materials trowelled on to the surface of the insulation provide a rigid or semi-rigid hard-wearing surface which can be additionally strengthened with expanded metal mesh to give high impact resistance.

4.2.3 Pre-formed sheets, panels or boards of metal, plasterboard, etc. (e.g. for false ceilings and walls) assembled so that all joints are properly made and effectively sealed.

4.2.4 Cladding materials such as galvanised metal sheet or ribbed aluminium sheet, or wrapping materials such as polythene sheeting or reinforced aluminium foil of suitable gauge, again paying particular attention to the effective sealing of all joints.

4.2.5 Impermeable sealing tape (duct tape, fibre tape) can be used for sealing small damaged areas, particularly on pipes.

4.3 Selection of the sealing method and the material for a particular application will depend on the following factors:

4.3.1 The degree of protection required, e.g. is it an area vulnerable to impact or abrasion?

4.3.2 Conditions of wear; the surface toughness and flexibility required, e.g. does the surface require to be regularly decorated?

4.3.3 Type of surface. Certain treatments may impair sound absorption or anti-condensation characteristics or adversely affect the required 'spread of flame' properties.

4.4 Protective procedures

Specific precautions will depend upon local situations and the type, extent and condition of the surface to be repaired. Where the work is minor or the surface is not being disturbed, it is normally sufficient to erect physical barriers and warning notices ten metres from the work.

4.4.1 The area to be sealed should be vacuum cleaned (using an industrial cleaner approved for use with asbestos) to ensure the removal of all loose débris and dust particles to obtain good adhesion of the coating to be applied.

4.4.2 Damaged areas should be repaired before encapsulation to restore the required insulation properties, e.g. fire resistance, and to provide a suitable base for sealing.

4.4.3 If the condition of the damaged area is such that dust levels may exceed specified safety standards: (a) the area should be completely enclosed to prevent the escape of dust to adjacent areas; (b) workers should be provided with appropriate protective equipment and follow the work procedures described in subsequent sections of this guide.

5. Recommended procedures for the removal of asbestos insulation

5.1 Identification of materials

5.1.1 Under certain circumstances there may be a need for preliminary sampling of the material to be removed in order to establish precisely the asbestos content. This may not always be obvious by visual examination and in such cases scrutiny by sophisticated technical apparatus may be required in order to ascertain with certainty the nature of the fibrous content. If local regulations require this, expert advice can be sought from the AIA or from one of its Member Associations.

5.1.2 Generally, however, in view of the inevitable dustiness of such operations, full protective measures can and should be taken as a matter of course. Steps should be taken for the personal protection of workers involved and for the limitation of the contaminated area to safeguard other workers and to avoid a public nuisance, regardless of the type of insulation.

5.2 Selection of method

There are broadly three main methods for the controlled removal of asbestos insulation:

Dry stripping
Wet stripping
Stripping by high-pressure jets

In some cases circumstances may call for a combination of these techniques. The circumstances determining the selection of method and the factors to be considered are dealt with below.

5.3 Dry stripping

This method is essential where it is necessary to remove insulation near live electrical apparatus. It may also be desirable in other situations where the presence of large amounts of water would create difficulties or extra hazards.

5.3.1 Since no dust suppressant can be used, this method demands a very high standard of respiratory protection. (See RCP 9.)

5.3.2 Enclosure of the work area must be of a very high standard, with air locks for access, and maintained under negative pressure to prevent leakage of dust-laden air. (See 6.1.)

5.3.3 Surfaces from which insulation has been removed should be finished off by wire brushing under vacuum and in some cases it may be necessary to seal the exposed surface.

5.3.4 Thorough vacuum cleaning of the area on completion of the work, especially of the interior surfaces of the screening, is most important but should be easier than with other methods since the material remains dry. A final wet cleaning is also recommended. (See 10.4.)

5.4 Wet stripping

Control by suppression of dust with water is most general, but can only be used where there is no electrical apparatus, or where such equipment can be isolated. At the end of the work it is of vital importance that a competent person should ensure that it is safe to restore the electric supply.



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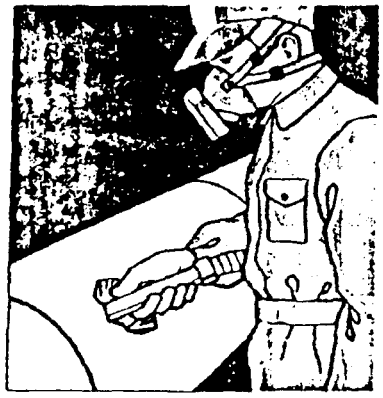
5.4.1 For adequate suppression of dust, the insulation material must be thoroughly wetted before stripping begins. The material needs to be saturated; to this end the lagging should be pierced at intervals, preferably with hollow probes which will carry the water into the interior of the insulation material. The addition of wetting agents to water greatly assists penetration.



5.4.2 Careful use of low-pressure sprays (or fine mist) at the point of operation will help to keep down the dust levels in the immediate working-area.

5.4.3 Care must be taken to avoid an accumulation of wet material and slurry on the floor of the working-area, since this will create a hazard from slipping as well as increasing the work of subsequent cleaning up.

5.4.4 If the floor consists of open-mesh gratings, they should be covered, but great care is necessary to avoid the risk of slipping. Floor surfaces which could be damaged by water (e.g. hardwood blocks, tiles) should be covered before operations commence.

5.4.5 Insulation should be removed by cutting or sawing rather than by breaking with axes or hammers. As far as possible material should not be allowed to fall, but should be placed directly into suitable plastic bags for ultimate disposal.

5.4.6 The wetted material should not be allowed to dry out, but should be removed while still wet and put into the plastic bags, re-wetting as necessary with the low-pressure sprays.

5.5 Stripping by high-pressure water jets

This is a highly specialised technique employing water jets normally operating at pressures above 750 psi (5.2 MN/m²) and usually restricted to fairly large-scale operations and to sites where access is difficult, e.g. where the asbestos has been applied by spraying, and where other techniques are unlikely to be satisfactory. However it should not be used where electrical apparatus is present which cannot be isolated.

5.5.1 This method should only be undertaken by properly trained personnel and under competent and expert supervision, since the use of such high-powered jets is capable of causing serious injury.

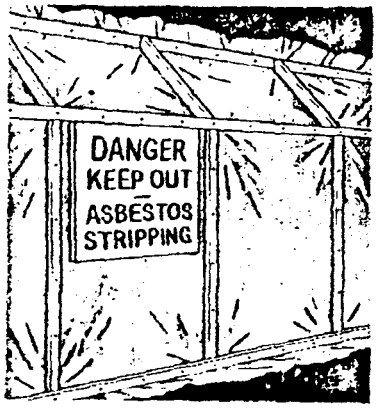
5.5.2 In addition to normal enclosure and warning notices, signs marked 'Danger: High-pressure Spraying' should be displayed.

5.5.3 The specialised equipment must be properly maintained and the jet controlled by a 'deadman's' control valve so that the high pressure is shut off on release.

5.5.4 The slurry produced will be collected by pump into specially designed containers for disposal and must be diverted from drain openings.

6. Isolation and enclosure of work areas

6.1 Whichever method of removal is employed, the area where the work is to be carried out should be isolated from other work areas, generally by enclosure within dust-impermeable screening. Strong plastic sheeting, with all joints carefully sealed, provides a most effective form of screening. Air locks must be provided for access and ventilation provided to ensure that the work area is maintained under negative pressure to prevent dust leakage.



6.2 Warning notices should be prominently displayed so that workers not directly involved with the removal are warned against, or prohibited from, entering the area as these workers will not be equipped with personal protective equipment and probably not trained in the procedures for the control of dust.

6.3 In some situations where the operation is limited and well controlled by wetting, and is not immediately adjacent to areas occupied by other workers, it may be sufficient and practical for the area of operation to be roped off. Generally, however (and always if dry stripping is to be carried out), it is preferable for the stripping-area to be screened off.

6.4 Access from the area of operations to the washing and changing facilities must also be isolated so that men who have been engaged in stripping do not spread dust from contaminated clothing. The most satisfactory arrangement is for a decontamination area to be sited immediately adjacent to the work area, so that workers pass through this before re-entering the unrestricted part of the location.

7. Dust extraction equipment

7.1 When dry stripping is the method employed, reliance must be placed upon a combination of:

(a) high-efficiency respiratory protection;
(b) comprehensive enclosure of the dusty area;
(c) dust-extraction equipment designed for use with asbestos dust and adapted for application to the point of dust generation. For stripping operations the equipment needs to be high efficiency filtered; transportable equipment will usually be required, although sometimes installed equipment may be adaptable for close application to the point of removal.

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7.2 Dust-extraction devices are most effective when they are coupled with adequate limitation of the area of application by a capture hood concentrating the suction airflow close to the point of dust generation



7.3 For some removal operations, for example where equipment of a similar type frequently requires stripping, it has been found practicable to develop a custom-built enclosure, coupled with extraction, within which the stripping can take place with no risk of escape of dust into the outside atmosphere.

8. Personal protective equipment

8.1 Experience indicates that even under wet conditions it is difficult to ensure that dust concentrations will at all times be successfully contained within the recommended levels. It is therefore advisable that personal protective equipment and clothing should always be provided and worn whenever and wherever such work is carried on.

8.2 Where small amounts of stripping are called for and water suppressing methods are used, cover-all protective clothing (such as a boiler suit) and asbestos-approved *on-nasal respirators* may be adequate. For all other situations full protective clothing, including hoods and boots, should be worn, together with positive pressure respirators. Where concentrations are expected to be heavy and sustained (certainly when dry stripping is being carried out) the most sophisticated equipment, such as direct air-line breathing-apparatus, will be required.

8.3 Accommodation must be provided for the storage of personal clothing so that it will not become dust contaminated. Separate storage must be provided for protective clothing and equipment when not in use; this clothing and equipment must be isolated from personal clothing by the personal cleansing area.

8.4 Facilities must be provided for de-dusting the protective clothing upon leaving the work site. Suitably adapted vacuuming equipment should be used for preliminary de-dusting before the protective clothing is removed. Washing facilities, including showers, should be provided for use after removal of the protective clothing and before moving into the personal clothing dressing-room.

8.5 Collection of protective clothing for cleaning must be strictly controlled. (See RCP 9.) In heavily contaminated conditions it may be necessary to change the clothing at the end of each work period. Certain kinds of disposable clothing may be suitable.

8.6 Detailed recommendations for use, selection, care and training in the use of personal protective clothing and equipment are contained in RCP 9.

9. Disposal of stripped material

9.1 As with other forms of asbestos waste, stripped material must be collected into receptacles from which dust cannot escape during transit from collecting-point to disposal site. Heavy-duty polythene bags are most convenient and suitable for stripped insulation. It is recommended that these bags carry a warning label — in some countries this is obligatory.



9.2 It is recommended that bags containing stripped asbestos material be collected into skips, kept separate from other wastes, and regularly cleared from the work site.

9.3 Detailed recommendations for the disposal of all types of asbestos waste, including control in transit and at tipping sites, are contained in RCP 3 and are applicable to the disposal of waste material from stripping operations.

9.4 When high pressure jet stripping is employed, resulting in large quantities of very liquid slurry, it will be necessary to pump the slurry from collecting-tanks into enclosed tanker-type vehicles for transit to approved locations for disposal in such a way that there is no risk of drying out.

10. General

10.1 Training and supervision. It will be apparent from the foregoing that stripping-crews must consist of personnel who have been selected and trained in the methods and hygiene disciplines required. Supervision of a high standard of integrity and competence is essential, with particular regard to the efficiency of the technical equipment and security of enclosures.

10.2 Maintenance. Routine inspection of all equipment, enclosures, accommodation and facilities should be scheduled and regularly reported and recorded. Plant so covered will include:

Extraction equipment
Vacuum cleaning equipment
Wetting appliances, including high-pressure jets
Enclosures and signs
Protective clothing and equipment
Hygiene facilities.

10.3 Cleaning. Whatever method of repair or removal is adopted, final cleansing of the site should be carefully carried out by wet cleaning, ideally in two stages with a 24-hour waiting-period in between to ensure that all dust is removed.

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