ASBESTOS

CODE OF PRACTICE FOR
THE SAFE REMOVAL OF ASBESTOS
[NOHSC:2002(1988)]

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INTRODUCTION

This Code of Practice outlines the basic principles which should be followed in selecting the most suitable technique for the safe removal of asbestos-based thermal or acoustic insulation including friable asbestos boards, and is aimed at minimising the concentration of airborne asbestos fibre.

This Code is directed at specific removal jobs such as those involving the removal of the sprayed asbestos coatings used for thermal and acoustic insulation in buildings and the extensive asbestos-based lagging on boilers and other industrial plant. It is not intended that procedures outlined in the main body of the Code should cover work involving asbestos-cement (fibro) products and floor tiles containing asbestos.

The work practices and precautions to be adopted in the safe removal of asbestos-based products vary considerably with the type of product, amount of asbestos, its condition and location. The objective of this Code is to provide a guide to good current practice which may be adapted to the particular circumstances of the removal job. Because the work practices for the handling of asbestos-cement (fibro) products differ from those applicable to thermal insulating, the safe working practices for these materials have been presented in a separate section of this Code.

This Code has been compiled with reference to the current NH&MRC[(1)], OSHA[(2)] and HSC[(3)] codes of practice for the removal of asbestos and is designed to be read in conjunction with the attached *Guide to the Control of Asbestos Hazards in Buildings and Structures*, where the more general aspects of asbestos and its potential hazards are outlined.

1. PLANNING AND PROGRAMMING CONSIDERATIONS

As removal of asbestos-containing insulating material by an approved removalist is often done by contract or tender, it is essential that the precise nature of the work to be done is understood by both contractor and client. Any misunderstanding may lead to the contractor utilising removal procedures which endanger the health of his/her employees, neighbouring workers and local residents and may jeopardise his/her removal licence.

1.1 INFORMATION TO BE SUPPLIED BY CLIENT

The client must supply precise details of the removal requirements to the asbestos removalist prior to commencement of any removal work; however, it is recognised that in some cases the full extent of the asbestos material is not always known until after the removal is under way. Some materials may be inaccessible, or concealed in such a way that some removal has to be carried out before the asbestos is detected.

In the preparation of job specifications the following considerations should be addressed:

(a) Location -

- indoors
- outdoors but protected
- outdoors exposed to weather
- enclosed in ducts or trenches below ground level
- difficult or unusual site conditions which will influence the selection or application of removal methods, particularly in regard to transport, scaffolding or weather protection

(b) Technical description of material to be removed, with details of type of asbestos present and any special or unusual materials.

(c) Dimensions of surfaces. Where these are adequately detailed on drawings, preferably coloured to indicate areas for removal, provision of copies of the drawings may be sufficient. Otherwise, information of the following nature will be required:

- surface dimensions of flat or large curved areas, and thickness of insulation
- external diameters of pipes
- length of each size pipe
- number and type of pipe fittings, for example, flanged joints, valves, tees, expansion bends
- particular detail is to be provided if asbestos is to be removed from any part of the building's air conditioning system

(d) Details of any pipework sections that are steam or electrically heated and the arrangement of its insulation.

(e) Details of any section or materials to be left in place.

(f) Confirmation and details of residual heat that will remain in pipework, boilers, turbines or refinery equipment.

(g) Any unusual or specific hazards associated with the removal job.

(h) Temperature considerations [4] -

- normal working temperature for each portion of the plant concerned
- ambient temperature at the removal area

(i) Conditions of substrate surfaces - special requirements, such as the removal or otherwise of protective paint or lacquer from pipework or for the application of paint or other protective coatings to the substrate from which the asbestos-based material has been removed.

(j) Types of fittings and supports and whether or not these may be removed or disposed of with the waste.

(k) Type of finish required.

(l) Special service requirements; for example, where there is any potential hazard from contact with live electrical equipment in use in the removal area, attention should be drawn to this fact.

(m) Where electrical switch gear or panels are to be sealed, consideration should be given to the provision of supplementary ventilation to dispose of potential heat build-up and consequent fire risk.

(n) Site occupancy restrictions and conditions.

(o) Adjacent area cleaning (adjacent areas which are to be cleaned or are to be protected from airborne dust and are to be cleaned on completion).

(p) Safety practices to be followed under relevant legislation.

(q) Location of any relevant electrical cables.

1.2 INFORMATION TO BE SUPPLIED BY THE APPROVED REMOVALIST

Information pertaining to the relevant sections of 1.1, and how the removalist proposes to undertake the removal program.

If required, the approved removalist should provide specifications or drawings showing details as follows:

(a) Type and extent of isolation required at the asbestos removal area and location of restricted access barriers.

(b) Particular methods to be adopted when removing material, including detail of the contamination control program, for example -

- provision of negative air pressure and the location of the exhaust unit
- location of decontamination unit

(c) Waste disposal program -

- storage on-site

- storage in bin on-site
- removal from building (using an isolated lift)

(d) Waste disposal site and approval from relevant local disposal authority.

(e) Shapes and sizes of temporary buildings required by the removalist, together with particulars of water, light and power requirements.

1.3 GUIDELINES FOR PLANNING AND PROGRAMMING

Frequently, the approved removalist's operations are dependent upon progress of other contractors at the site. It is therefore recommended that the asbestos removalist be provided with details of planning schedules which will control his/her work and allow him/her to effect removal without other personnel being present in the asbestos removal area. Conversely the work of other contractors needs to be scheduled to preclude them working near to, or accidentally breaking into, the asbestos removal area.

The following are the major points to which early consideration should be given:

(a) Safety of personnel.

(b) Identification of types of asbestos involved.

(c) Program of commencement and completion dates. However, it should be recognised that unforeseen problems with removal or the extent of the asbestos cannot always be ascertained prior to removal work commencing.

(d) Responsibility for the supply and application of isolating materials; for example, ropes, barriers, plastic screens, waste containers and warning signs.

(e) Preparation of surfaces (pre-removal) cleaning.

(f) Areas to be left free of insulant on a temporary or permanent basis.

(g) Precise information on extent of work covered by contract.

(h) Limitations of access to removal area.

(i) Conditions of employment on the site, including the labour and supervision required and agreed working hours.

(j) Transport facilities.

(k) Protected storage area pending the removal of asbestos-based materials.

(l) Availability of water, power, heat, light and drainage.

(m) Accommodation, decontamination and canteen facilities.

(n) Provision of access equipment, such as scaffolding or ladders.

(o) Protection of adjacent plant and machinery.

(p) Waste disposal responsibilities and clean-up requirements.

(q) Temporary sealing of asbestos where necessary.

(r) Notification to, and approval from, regulating authorities where necessary.

(s) Responsibility for air monitoring.

(t) Cleanliness standards which must be achieved to fulfil the contract.

1.4 TRAINING

Prior to engagement in the work, all asbestos removal workers shall be instructed in the relevant aspects of asbestos health hazards, safe working procedures, and the wearing and maintenance of protective clothing and equipment. The quality of this training could be assessed as one of the stages in determining whether an asbestos removalist is sufficiently experienced to undertake the removal.

The degree of training should be appropriate to the trade and function of the individual within the organisation and should be sufficiently detailed to ensure that the individual understands not only the procedural and safety requirements, but also the reasons for these requirements.

1.5 SUPERVISORY PERSONNEL

Supervisory personnel shall have a detailed knowledge of the precautions and procedures outlined in this Code and, in the light of this knowledge and personal experience, shall assume the following responsibilities:

- to plan the total removal procedure; the pre-removal setting up, the actual removal and final cleaning operation
- to select the most appropriate technique for removal of asbestos
- to ensure that all necessary measures are taken to reduce the airborne concentration of asbestos dust, and that in any case, workers are not exposed to levels exceeding the recommended exposure standard
- to arrange for, and assess results of, air monitoring where appropriate
- to ensure that all workers under his/her supervision are adequately trained in the safe working practices outlined in this Code
- to ensure that the removal is continually supervised and that the operation is carried out in a safe and proper manner, in accordance with the precautions listed in this Code
- to ensure that personal protective equipment is maintained in good condition
- to ensure that the removal site is maintained in a clean condition, that waste is quickly and properly disposed of, and that the personal hygiene procedures are continually observed

2. PREPARATION OF THE REMOVAL SITE FOR A MAJOR REMOVAL PROGRAM

In preparing the removal site, a number of considerations must be addressed. These include the method of containment of the removal area and whether complete enclosure is possible, the provision and location of decontamination and changing facilities, and the precautions which must be implemented to prevent the spread of asbestos contamination away from the removal area. Each of these aspects is discussed in turn in the following sections.

2.1 DETERMINATION OF ASBESTOS REMOVAL AREA WHERE TOTAL ENCLOSURE IS NOT POSSIBLE

In some instances such as in large power stations or other industrial plant, it may not be possible to provide an enclosure around the asbestos removal area. In these circumstances the boundaries of the asbestos removal area shall be determined by assessment of supervisory staff; however, the boundary would not normally be less than ten metres from the asbestos workface unless an existing barrier is already in place. This distance may be decreased or increased on the basis of air monitoring results for asbestos dust.

The boundary of the removal area shall be defined by barrier, rope or rail and by appropriately placed signs indicating that it is an asbestos removal area. The signs shall be state:

ASBESTOS WORKING AREA - NO UNAUTHORISED ENTRY

RESPIRATORY PROTECTION ESSENTIAL

Static air sampling may be necessary to confirm the suitability of the selected boundaries. Experience will generally enable supervisory staff to quickly determine and set boundaries for most types of removal.

Entry to the removal area shall be restricted to personnel directly engaged in the asbestos removal. Other persons entering the area will be required to observe the appropriate safety precautions for that area. All dirty work clothing, tools, equipment and bagged waste materials should be properly decontaminated before being removed. Those items that cannot be decontaminated through a decontamination unit should be plastic wrapped and sealed and only opened in another removal area.

2.2 SITE PREPARATION FOR ASBESTOS REMOVAL FROM BUILDINGS AND OTHER STRUCTURES

Where total enclosure of the removal area is possible, isolation of the area can be achieved by the installation of plastic sheeting (approximately 0.2mm thick) on the floor and walls of the structure. It may be necessary to erect a temporary timber or metal frame to which the plastic barrier can be attached. All joints shall be overlapped (by approximately 200mm) and double taped to ensure the area is completely sealed off. In some circumstances the use of adhesives may supplement the use of tape.

Existing floor coverings should be removed where practicable. A double layer of plastic sheeting, (suitably fixed by double-sided tape or adhesive to prevent movement between layers), should be used on the floor of the containment area, and a turn-up of 300mm should be used where the floor joins the sidewalls. Extra strength in the containment floor can be achieved by running the double layers of plastic

at 90° to each other. `Duct tape' or `plastic wrapping tape' is preferable to `masking tape' when sealing plastic sheeting.

Where asbestos is removed from an entire floor of a multi-storey building, all passenger elevators shall be prevented from stopping at the floor from which asbestos is being removed. Removal workers may gain access to the floor via the fire stairs or from an elevator dedicated for this purpose.

All movable furniture, plant and fittings should be removed from the asbestos removal area. The immovable items should be fully wrapped and sealed in suitable plastic sheeting so that they are effectively isolated from the removal area. In regions of heavy traffic or high wear, additional masking or barricading may be necessary.

Where masking operations may liberate asbestos fibres, all persons in the removal area shall wear respiratory protective equipment approved for asbestos. This precaution is particularly applicable when removing existing barriers or partitions such as false ceiling tiles. Where asbestos materials have fallen on to a false ceiling, the ceiling should only be removed under full removal conditions. Any utility or service line which penetrates into the ceiling space should be sealed up when it is located if it cannot be sealed from outside the removal area.

Aside from specific asbestos extraction units, all ventilation and air-conditioning networks servicing the removal area must be closed down for the duration of the removal job. All vents must be thoroughly masked to prevent the ingress of asbestos dust into the duct network. Upon completion, and after final cleaning of the removal area, all mechanical ventilation filters for recirculated air should be replaced if possible.

Additional care should be taken to ensure that asbestos dust cannot escape at points where pipes and conduits pass out of the removal area. Greater attention to masking and compliance testing is required in these regions, particularly if service riser-shafts pass through the removal area.

To prevent the escape of airborne asbestos dust from the removal area enclosure, an exhaust extraction fan shall be installed in a position so as to create a negative air pressure of approximately 12Pa (water gauge) within the removal area. In this arrangement, the major and usually only route of air into the removal area would be through the decontamination unit.

The air extracted by this system must pass through an appropriate High Efficiency Particulate Air (HEPA) filter to remove any asbestos dust. Ideally, air extraction units should be so situated that access to the filters can be gained from the removal area; however, the unit is kept outside the removal area. This expedites the otherwise difficult decontamination of these units and allows another unit to be brought into service in the event of a breakdown. Where it is not possible to change the filter within the removal area, a temporary enclosure should be constructed around the unit during the filter replacement.

The HEPA filter must comply with the minimum 99.97 per cent efficiency requirement detailed in Australian Standard 1324.[5] A coarse pre-filter should be installed prior to the HEPA filter to prolong the useful life of the high efficiency filter. Where practicable, the discharge point for this extraction unit should be to the outside air, distant from other working areas, air-conditioning inlets or breathing air compressors.

EXTRACTION EQUIPMENT SHALL BE OPERATED CONTINUOUSLY WHILST THE REMOVAL ENCLOSURE IS IN PLACE.

The most satisfactory method for assessing the integrity of the filter and seal fittings is by regular inspection, in conjuction with a static pressure alarm which indicates a failure in the system.

Air monitoring of the exhaust from the extraction unit is a specialised procedure for which the Membrane Filter Method [6] is unsuitable because the results obtained may not truly reflect the actual fibre concentration in the exhaust air. Non-isokinetic sampling may give false negative results which may lead to unwarranted confidence in the filter integrity.

WHEN INSTALLING THE ASBESTOS REMOVAL AREA CONTAINMENT, EXTRA CONSIDERATION MUST BE GIVEN TO THE ALTERATION OF THE FIRE RATING OF THE BUILDING AND TO THE PROVISION OF FIRE FIGHTING FACILITIES, EMERGENCY EXITS AND EMERGENCY LIGHTING.

2.2.1 **Compliance testing of removal area containment prior to commencement of work**

Before any asbestos removal begins in an enclosure, a non-toxic smoke generator should be used to test the integrity of the removal area enclosure, prior to the operation of the extraction unit.

A visual inspection of the enclosure shall also be carried out at the beginning of each working period. Any defect revealed during inspection shall be remedied immediately. Where necessary, provision for air monitoring shall be made.

2.3 DECONTAMINATION FACILITIES

In many instances, the only satisfactory method of providing appropriate changing facilities is by the provision of a mobile or specially constructed on-site unit. The decontamination facility should be sited immediately adjacent to, and joined to, the enclosed asbestos removal area. This unit can be divided into three distinct regions, namely:

(a) *DIRTY DECONTAMINATION AREA*

(b) *CLEAN DECONTAMINATION AREA*

(c) *CLEAN CHANGING AREA*

These areas should be separated by means of a suitable airlock or buffer zone. Normally this airlock would consist of spring loaded doors or two or more overlapping sheets of plastic sheet positioned so as to define the boundary between each segment of the decontamination facility, whilst allowing personnel access and airflow towards the removal area. To ensure a good airflow through the unit where doors are used to segment the decontamination unit, large openings with a hinged flap to operate as a one-way valve should be provided.

Generally no more than six persons should use the one decontamination facility. A diagrammatic view showing an example of the arrangement of this facility is presented in Figure 2.

The *DIRTY DECONTAMINATION AREA* should have provision for:

- vacuum cleaning or hosing down of contaminated clothing and footwear
- storage of contaminated clothing and footwear
- airflow towards the removal area
- a shower area with an adequate supply of warm water

The *CLEAN DECONTAMINATION AREA* should have provision for:

- storage of individual respirators in containers or lockers
- airflow towards the dirty decontamination area
- a shower area with an adequate supply of warm water

The *CLEAN CHANGING AREA* should have provision for:

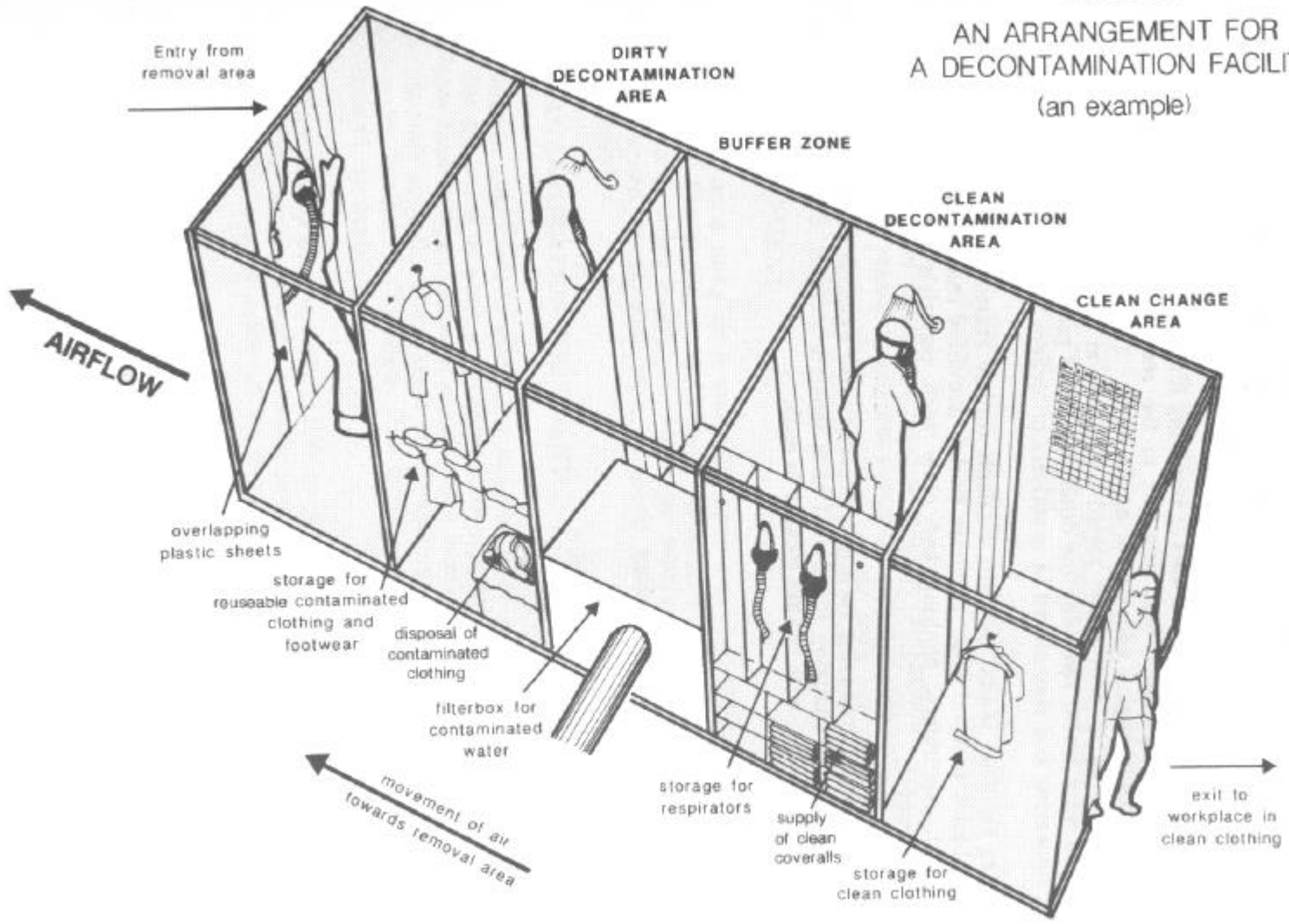
- storage of clean clothing
- separate storage of clean and dirty towels
- airflow towards the clean decontamination area

All water from the decontamination facility should pass through a suitable filter or other trap before it passes into sewer mains.

PROCEDURES FOR THE USE OF DECONTAMINATION FACILITIES ARE DETAILED IN SECTION 5.1.1 OF THIS CODE.

FIGURE 2

AN ARRANGEMENT FOR
A DECONTAMINATION FACILITY
(an example)



2.4 CHANGING FACILITIES WHERE A DECONTAMINATION UNIT IS INAPPROPRIATE

For operations involving the removal of small amounts of asbestos and where the decontamination facilities described earlier are inappropriate, an arrangement shall be adopted to ensure that protective clothing used for asbestos work shall not be worn away from the immediate vicinity of the asbestos removal area.

Normally this would entail the worker removing his/her outer protective garments and overshoes in a designated area attached to the removal area, and then proceeding directly to the changing and showering facilities. The discarded protective clothing should be stored in appropriate sealed containers at the removal area. Respirators should be worn whilst removing the outer protective garments and must be worn until after showering and then stored in containers or lockers.

Changing facilities should be made available for the exclusive use of persons working in an asbestos removal area. Separate storage provision should be made for portable equipment, respirators, clothing and other such materials used in the course of asbestos removal.

Where a permanent changing facility is necessary (for example in larger power stations or dockyards), the changing room shall have separate sections, designated as dirty or clean as appropriate, with clothes lockers in each.

3. EQUIPMENT FOR ASBESTOS REMOVAL

3.1 CUTTING TOOLS

Breaking through the finishing compound and cutting the reinforcing wire in the lagging are operations which can liberate considerable quantities of dust. Care should therefore be taken in the selection of tools and in keeping the insulation wet. Tools should allow cutting of the insulation into small sections while keeping dust levels in the removal area to a minimum.

Power, telephone and fire alarm cables may lie underneath asbestos insulation. These cables must be clearly identified prior to the commencement of any cutting, as severe damage and/or hazard to the worker could result.

Service lines under insulation, particularly on turbines, are vulnerable to damage from cutting tools. Alternate routing, cabling or deactivation of such lines suggested.

The use of any power tool in asbestos removal requires caution since not all types are suitable, particularly in regard to internal dust collection and electrical safety in wet conditions. In general, compressed air driven power tools are preferable. Where doubt exists, reference should be made to the State regulatory authority.

3.2 SPRAY EQUIPMENT

Surface soaking from a spray jet is useful for small areas and where total saturation is not practicable. The spray could be from an adjustable, pistol-grip, garden hose spray, fed from a mains supply or, where no supply is readily available, from a portable pressurised vessel, such as a pump-up garden sprayer. A constant water pressure is desirable.

3.3 TOTAL SATURATION EQUIPMENT

Total saturation equipment is useful for large areas of insulation where time can be allowed for the water to soak in. The equipment consists of an injection harness of light rubber hose with a number of outlets, each terminating in an injection head with its own shut-off control. These heads have numerous side holes through which water is fed into the insulation. The water flow is stopped during transfer of the head from one position to the next.

The heads are moved progressively at 200 to 300mm intervals as the insulation soaks, until the asbestos matrix is wet. A water pressure of approximately 170 kPa (25 psi) is desirable. This can be achieved by tapping a higher pressure source through a reducing valve.

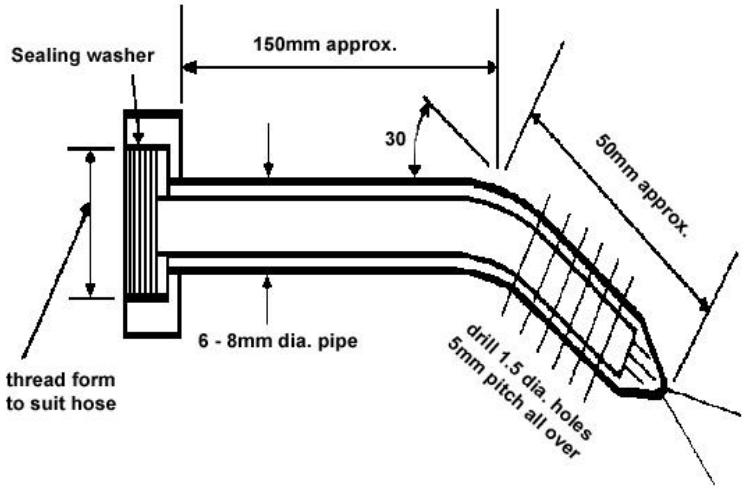


FIGURE 3 TOTAL SATURATION INJECTION HEAD

3.4 VACUUM CLEANING EQUIPMENT

All vacuum cleaning equipment used in association with asbestos removal shall conform with the requirements of the appropriate Australian Standard[7] and shall be approved for this purpose by the relevant State authority. In particular, all extracted air must pass through a HEPA filter before discharge into the atmosphere.

3.5 WASTE DISPOSAL EQUIPMENT

The selection of appropriate containers for the removal of asbestos waste, and its subsequent disposal, is detailed in section 13 of the attached Guide.

3.6 INSPECTION OF EQUIPMENT

All equipment used for the removal of asbestos-based material shall be inspected before commencement of the removal job, after repair and at least once in every seven days where continually used.

A register containing details of the examination, state of equipment and repair (if any) is to be maintained by a designated person.

4. REMOVAL TECHNIQUES FOR BUILDINGS AND STRUCTURES

The removal of asbestos-based materials from buildings and other structures shall be carried out by methods which will minimise the release of asbestos dust into the atmosphere, both during and after the removal operation. The choice of method is determined by the nature of the asbestos material, the quantity of insulant and its location.

As the techniques used for the removal of sprayed thermal insulation from buildings are not dissimilar from those used for removal from steampipe and boilers, the following removal methods may equally be adapted to the removal of asbestos from industrial plant and machinery.

4.1 SPRAY METHOD

This method shall be used only where relatively small quantities of asbestos-based materials are to be removed and where the following conditions apply to the material:

- the asbestos-based material is not covered with other materials such as calico or metal cladding which require prior removal
- there is no reinforcing wire or other similar restrictions to removal
- the asbestos-based material is not coated with paint or mastic
- where rapid temperature drop due to excessive water could cause damage to heated metal components
- where no live electrical conductors are present and where no damage to electrical equipment can arise from the ingress of water

The spray shall be applied in such a manner as to ensure that the entire surface of asbestos-based materials is wet, but minimal run-off occurs.

In many instances, it will be helpful if a wetting agent (surfactant) is added to the water to facilitate more rapid wetting of the insulation material.

It is desirable for the asbestos-based material to be wetted through its full depth and maintained in a wet condition. It is recommended that a manually controlled, consistent low pressure, coarse spray such as from an adjustable, pistol-grip garden hose be used for this purpose (see section 3.2). The design of the spraying equipment will be dependent on availability of water supply and access to the area to be sprayed.

It is important that the spray should be copious, but not such that the water droplets generate dust from impact with the surface of the insulation. When using cutting equipment to remove asbestos, the water spray should be directed at the site of the cut and the wetted material removed as the cut progresses.

The wetted asbestos-based material should be removed in sections and immediately placed in suitably labelled containers and properly sealed. Any small sections which may be dislodged should be collected and properly disposed of.

Dust is significantly suppressed, although not entirely eliminated by this technique; therefore appropriate respiratory protection must be used.

4.2 REMOVAL BY SOAKING OR TOTAL SATURATION

The quantity of asbestos-containing insulation to be removed from pipes or ducts is often so extensive, or the material so thick, that the spray method will not suppress the dust sufficiently. An alternative is to soak the insulation by the introduction of water through appropriate applicators. The design and usage of these water injection devices is detailed in section 3.3 of this Code.

The soaking of the asbestos-based materials may start as soon as metal temperatures permit; however, where metal cracking could occur, the metal must be allowed to cool to a suitable temperature.

The following steps are recommended for the soaking procedure:

- where the asbestos-based material is covered by cloth, mastic or other such materials, loose asbestos-based dust or other nuisance dust shall be removed by vacuum cleaning with approved equipment or by wiping with a damp cloth.
- where cladding has to be removed before access is obtained to the asbestos-based material, the cladding shall be removed carefully and surfaces vacuum cleaned continually or, where practicable, sprayed with water.
- holes or cuts must be made in the outer covering to enable water to be injected in such a manner and quantity as to ensure that asbestos-based material is wetted but not washed out by the passage of water. It has been found that slow saturation from the metal interface outwards is quite successful.
- the quantity of water and the time to soak will be dependent on factors such as thickness of insulation, access, location of holes.
- the saturated asbestos-based material shall be removed in sections and immediately placed in properly labelled containers and suitably sealed. During this process, it may be necessary to carefully cut reinforcing wire or similar restraints. The asbestos-based material shall be properly soaked, and small sections which may be dislodged shall be properly disposed of.
- although sufficient water is needed to saturate the asbestos material, excess water may create contamination and waste disposal problems. All waste water must be filtered to remove dust prior to discharge into sewer mains.

4.3 DRY REMOVAL

THIS METHOD IS CONSIDERED TO BE THE LEAST DESIRABLE REMOVAL TECHNIQUE AND SHALL ONLY BE USED WITH PRIOR APPROVAL FROM THE RELEVANT STATUTORY AUTHORITY AND WHERE THE SPRAY AND SOAKING METHODS CANNOT BE USED. Such may be the case where there are live electrical conductors or where major electrical equipment could be permanently damaged or made dangerous by contact with water.

Notwithstanding the general guidance given earlier in this Code, the greater potential for the generation of airborne asbestos dust in dry removal techniques demands that particular attention be given to the following points:

- the work area shall be fully isolated with impermeable sheeting and the interior maintained at a slight negative pressure, using approved exhaust equipment.
- all personnel involved in the removal operation must wear full-face, positive pressure, supplied air respirators.

- asbestos-based material shall be removed in small pre-cut sections with minimum disturbance in order to reduce the generation of dust. Waste material shall be immediately placed in appropriate wetted containers.
- in some cases it may be possible to use local exhaust extraction to minimise airborne dust concentrations. In order to achieve the required efficiency, a minimum air velocity at the extraction point of 1 m/s is recommended and the area of the nozzle should be large enough and placed close enough (not greater than diameter of nozzle) to ensure efficient dust collection.[8] Filtration must be sufficiently complete to permit the return of air to the workplace (see section 3.4).

4.4 REMOVAL FROM HOT METAL

Removal of asbestos from hot metal presents one of the worst conditions of removal due to the spread of dust on convection currents of air. Wherever possible, sufficient time should be given to allow the machinery to cool to below 100°C before removal is attempted. However, if this is not possible owing to system requirements, then extreme care is essential.

In using the dry removal method on hot surfaces, particular care shall be taken in the selection of dust extraction equipment to cope with the convection currents involved. The selection of appropriate personal protective clothing also becomes more important.

4.5 TECHNIQUES FOR SMALL REMOVAL JOBS

4.5.1 **Use of glovebags**

Glovebags are single use bags constructed from transparent, heavy duty polyethylene, with built-in arms and access ports. Generally these glovebags are approximately 1 metre wide by 1.5 metres deep and are designed to completely isolate small removal jobs from the general working environment. As such, glovebags provide a flexible, easily installed and quickly dismantled, temporary enclosure for small asbestos removal jobs.

THIS TECHNIQUE IS THEREFORE PARTICULARLY SUITED TO THE REMOVAL OF ASBESTOS LAGGING FROM INDIVIDUAL VALVES OR JOINTS IN STEAMPIPE OR OTHER SIMILAR LOCATIONS. THERE ARE A VARIETY OF COMMERCIAL BAGS WHICH ARE SUITABLE FOR THIS PURPOSE.

The major advantage of these glovebags is that they contain all waste and contamination within the bag, thereby eliminating the need for extensive personal protective equipment and decontamination. The only significant limitation to the use of glovebags is the volume of waste material that they may contain. As such, care needs to be exercised to prevent overfilling with water or waste.

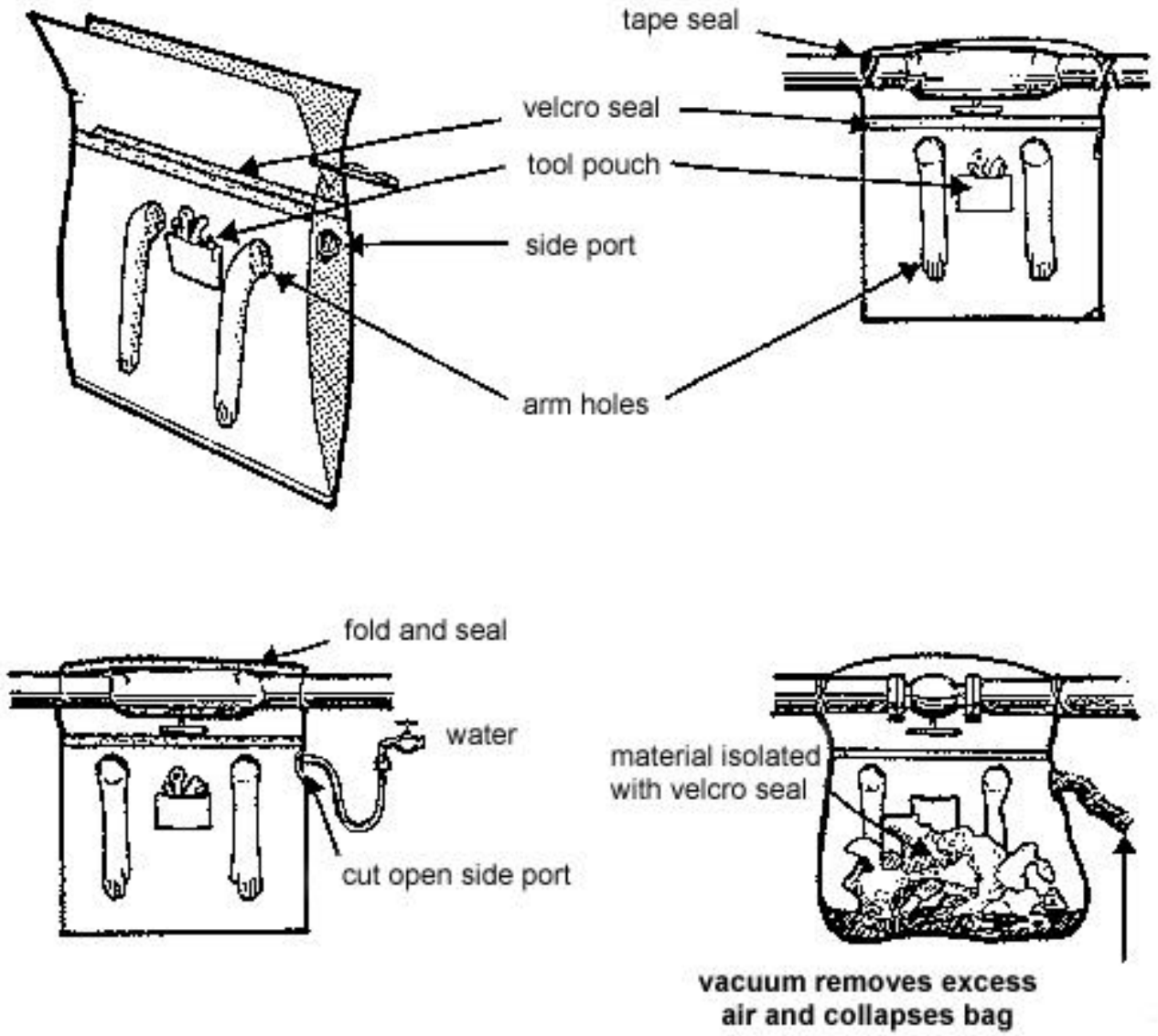
The correct technique for the use of glovebags is as follows:

- the glovebag shall be installed so that it completely covers the pipe or other structure where asbestos work is to be done. The pipe lagging on either side of the bag must be sufficiently sound to support the weight of the bag and its wet contents. Glovebags are installed by cutting the sides of the glovebag to fit the size of the pipe from which asbestos is to be removed. The glovebag is attached to the pipe by folding the open edges together and securely sealing them with tape. All openings in the glovebag must be sealed with duct tape or equivalent material. The bottom seam of the glovebag must also be sealed with duct tape or equivalent to prevent any leakage from the bag that may result from a defect in the bottom seam.

- employees using glovebags must as a minimum, wear a half-face respirator fitted with particulate cartridges approved for asbestos. This precaution is taken in case the bag is punctured or a leak develops from a poor seal.
- the asbestos material from the pipe or other surface that has fallen into the enclosed bag must be thoroughly wetted with a wetting agent (applied with an airless sprayer through the pre-cut port provided in most glovebags, or applied through a small hole cut in the bag).
- once the asbestos material has been thoroughly wetted, it can be removed from the pipe, beam or other surface. The choice of tool used to remove the asbestos material depends on the nature of the material to be removed. Asbestos-containing materials are generally covered with painted canvas and/or wire mesh. Canvas may be cut and peeled away from the asbestos-containing material underneath. Where the asbestos-containing material is dry, it should be re-sprayed with a wetting agent to ensure that it generates as little dust as possible when removed.
- after removal of the asbestos-containing material, the pipe or surface from which asbestos has been removed must be thoroughly cleaned with a wire brush and wet-wiped until no traces of the asbestos-containing material can be seen. In addition, the upper section of the bag should be washed down to remove any adhering asbestos materials.
- any edges of asbestos-containing insulation that have been exposed as a result of the removal or maintenance activity must be encapsulated with a sealing compound to ensure that these edges do not release asbestos dust to the atmosphere after the glovebag has been removed.
- once the asbestos removal and encapsulation have been completed, a vacuum hose from an approved vacuum cleaner should be inserted into the glovebag through the access port to remove any air in the bag that may contain asbestos dust. Once the bag has been evacuated, it should be squeezed tightly (as close to the top as possible), twisted, and sealed with tape, keeping the asbestos materials safely in the bottom of the bag.
- the vacuum line can then be removed from the bag and the glovebag itself removed from the workplace to be disposed of properly.

FIGURE 4

USE OF GLOVE BAGS



4.5.2 **Mini-enclosures**

In some instances, such as removal of asbestos from a small ventilation system or from a short length of duct, a glovebag may not be either large enough or of proper shape to enclose the item. In such cases, a mini-enclosure can be built around the area where small-scale, short-duration asbestos maintenance or removal work is to be performed.

The mini-enclosure should be constructed from polyethylene sheeting (approximately 0.2mm thick) and can be small enough to restrict entry to the asbestos removal area to one worker. The plastic sheeting shall be affixed to the walls of the room or other existing or temporary supports, and a double layer of plastic shall be laid on the floor. As with the larger structures discussed earlier, adequate overlap should be given where the walls and floor are joined. The two layers on the floor should be secured to minimise movement between layers. Care must also be taken to ensure that any penetrations such as pipes or conduits are properly sealed.

Constructed as part of the mini-enclosure are two small, approximately 1 metre square changing rooms. The changing area should be separated from the removal area by double, overlapping layers of plastic. A similar arrangement should also separate the dirty changing area from the clean changing area outside the enclosure. This arrangement is presented diagrammatically in Figure 5 on the following page.

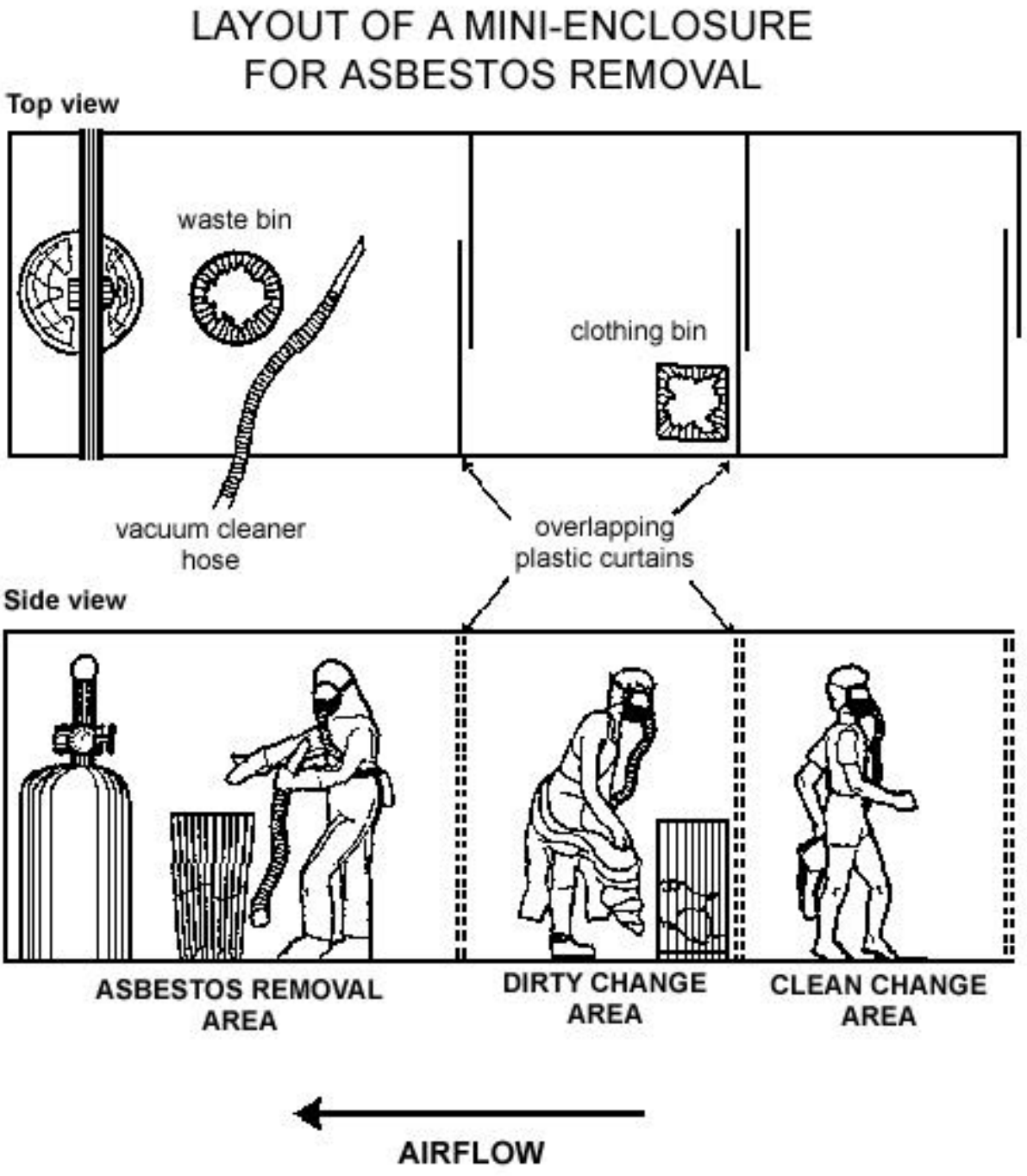
While inside the mini-enclosure, the worker should wear disposable coveralls, overshoes and appropriate respiratory protection. Upon leaving the removal area part of the enclosure, the worker should vacuum down his/her coveralls, removing them in the dirty changing area section of the enclosure. After leaving the enclosure, the worker should shower and then remove respiratory equipment before changing into fresh clothing.

In this application, an airline respirator would be inappropriate, as the worker must wear his/her respirator on the journey from the removal area to the shower.

The advantages of mini-enclosures are that they limit the spread of asbestos contamination, reduce the potential exposure of bystanders and other workers who may be working in adjacent areas, and are quick and easy to install. The disadvantage of mini-enclosures is that they may be too small to contain the equipment necessary to create a negative pressure within the enclosure; however, the double layer of plastic sheeting separating the removal and changing areas will serve to restrict the release of asbestos dust from the enclosure.

The procedures to be followed in dismantling the mini-enclosure are the same as those outlined for larger enclosures in section 8 of this Code.

FIGURE 5


LAYOUT OF A MINI-ENCLOSURE
FOR ASBESTOS REMOVAL
Top view
waste bin
clothing bin
vacuum cleaner
hose
overlapping
plastic curtains
Side view
ASBESTOS REMOVAL
AREA
DIRTY CHANGE
AREA
CLEAN CHANGE
AREA
AIRFLOW

5. GENERAL HYGIENE REQUIREMENTS

Persons working with asbestos materials shall observe a high standard of hygiene and good housekeeping to ensure that asbestos dust is not taken from the asbestos removal area to other environments.

Persons leaving a removal area shall first go through the decontamination procedures appropriate for that site. The more detailed procedures for decontamination are detailed in the following sub-section of this Code.

In general, persons involved in asbestos removal shall be provided with changing facilities separate from those used by other groups of workers. Clean overalls, outer clothing and dirty overalls shall be segregated.

WORK CLOTHING SHALL NOT BE TAKEN HOME AND UNDER NO CIRCUMSTANCES SHOULD OUTER CLOTHING WORN IN THE REMOVAL AREA BE WORN AWAY FROM THE REMOVAL AREA.

PERSONS SHALL NOT EAT, DRINK OR SMOKE IN THE ASBESTOS REMOVAL AREA as this would require the removal of respirators, potentially exposing workers to high concentrations of asbestos dust.

5.1 DECONTAMINATION PROCEDURES

In circumstances where the decontamination unit cannot be located adjacent to, and joined to, the removal area enclosure, procedures to minimise asbestos contamination shall be implemented. Usually this would require workers to discard their coveralls and overshoes or other outer garments in an isolated changing area attached to the removal area enclosure, and thereafter change into fresh outer clothing for the journey to the decontamination facility.

Where use is made of these temporary changing facilities at the removal area, de-dusting must be carried out before the protective equipment is placed in the dust-proof accommodation provided.

5.1.1 **Personnel**

Persons leaving an asbestos removal area shall first ensure that protective clothing and footwear are thoroughly cleaned of adhering gross contamination by vacuuming with an approved vacuum cleaner, or by hosing down with water, prior to entering the decontamination unit. *REMOVING DUST FROM CLOTHING BY SHAKING OR BLOWING OFF WITH COMPRESSED AIR IS FORBIDDEN.*

Following this initial cleaning, the worker must shower fully clothed in the *DIRTY DECONTAMINATION AREA*, with respirator worn and operating. After showering, the wet clothing is removed and placed in the storage provided.

The worker then passes through the buffer zone or airlock and removes his/her respirator whilst showering in the *CLEAN DECONTAMINATION AREA*. The discarded respiratory equipment is then stored in a locker or other appropriate enclosure. Where airlines are brought through the decontamination facility, provision should be made to wash the airline and enclose the end in plastic once it is disconnected from the respirator mask.

During the final shower, the worker must pay particular attention to washing of hair, face and fingernails.

Following this final shower, the worker passes through the second airlock or buffer zone into the *CLEAN CHANGING AREA*. Here the worker changes back into his/her conventional work clothing stored in the lockers provided.

Personnel must not smoke, eat or drink in any part of the decontamination facility.

Part of the responsibility of the removal supervisor is to ensure that provision is made for routine cleaning of the decontamination facility, disposal of discarded coveralls and overshoes, and the laundering of wet garments and towels.

5.1.2 **Equipment**

All tools and electrical equipment such as vacuum cleaners and power tools should be left in the removal area until the completion of the removal job. When the equipment is removed it should be vacuumed thoroughly and all accessible surfaces wiped over with a damp cloth. Where decontamination is not possible, the item should be plastic wrapped and sealed, and only opened in another removal area.

6. PROTECTIVE CLOTHING AND EQUIPMENT

When the use of respiratory equipment and protective clothing is required, adequate rest breaks should be provided for, taking into account the physical strain caused by the use of such equipment.

Accordingly, consultation between employers and employees should establish a normal work/rest regime to be followed in the particular circumstances depending on factors such as the type of protective equipment and method of work.

6.1 RESPIRATORY PROTECTION

The degree of respiratory protection required is determined by the nature of the removal job, the type of asbestos and the potential for exposure to dust.

A DETAILED GUIDE TO THE SELECTION OF APPROPRIATE RESPIRATORY PROTECTION FOR VARIOUS OPERATIONS INVOLVING ASBESTOS IS PRESENTED IN APPENDIX B OF THIS CODE.

For minor removal jobs, especially when removing asbestos-cement (fibro) sheets or using glovebags, an *approved* disposable respirator or half-face respirator fitted with particulate cartridges should be worn. Alternatively, *approved* air-purifying ventilated helmet or visor respirators can be used.

During masking of a removal area or during final cleaning where there is potential for exposure to airborne asbestos, the use of an *approved* disposable particulate respirator would suffice. These conditions would NOT apply inside the removal area during other asbestos removal operations.

In general, positive pressure, hood or full-facepiece powered air-purifying respirators with Class M filters or positive pressure demand compressed airline respirators shall be worn by all personnel directly engaged in asbestos removal operations inside a removal area enclosure. Inspection and supervisory personnel, not physically engaged in the removal operation, may use powered air-purifying respirators fitted with appropriate particulate filters when working in the removal area.

The air supply equipment for airline respirators shall be located outside and distant from the work area and must be maintained in good order to avoid interruption in the air supply or deterioration in the quality of the breathing air.

Audible and visual warning of compressor failure shall be provided to warn operators of any system malfunction. The air supply equipment shall be of sufficient capacity to allow time for personnel to clear the removal area if a supply failure occurs.

Powered, air-purifying respirators must be designed, or shielded, so that their operation is not degraded by water from showering.

ALL RESPIRATORY PROTECTIVE EQUIPMENT USED IN ASBESTOS REMOVAL WORK MUST CONFORM TO THE REQUIREMENTS OF AUSTRALIAN STANDARDS[9,10] AND BE APPROVED BY THE RELEVANT STATE OR TERRITORY AUTHORITY FOR THIS PURPOSE.

The asbestos removalists and/or supervisor must be familiar with the aforementioned Australian Standards and shall ensure the provisions contained therein are adhered to at all times. Arrangements shall be made for regular inspections and servicing of non-disposable respirators.

Respirators shall be issued on a personal basis. Users shall receive instructions on the correct method of using respirators and the importance of good facial fit. The user's name shall be clearly marked on all non-disposable respirators.

It is the employer's responsibility to ensure that all protective equipment is maintained in a clean and safe working condition. Where a number of different respirator types are suitable and available, individual operators may express a preference for a particular type.

6.1.1 **Faceseal**

Persons wearing spectacles or persons with beards, sideburns or even a visible growth of stubble, may not be afforded adequate protection from asbestos dust where the respirator worn relies on a good faceseal, that is, a close contact between face and seal.

A complete solution to the problem of facial hair, or the wearing of spectacles involves the use of equipment which does not require a faceseal, for example, ventilated helmet respirators, or positive pressure powered respirators with blouses.

If there is any doubt as to the adequacy of protection, individuals concerned should not be permitted to work in asbestos removal areas.

6.2 PROTECTIVE CLOTHING

Asbestos does not enter the body through the skin, and has no harmful effect on the skin. Thus removal of asbestos itself does not call for the wearing of any special skin covering, although any asbestos deposited on the skin and in the hair must be scrubbed off before leaving the decontamination area.

The selection of protective clothing is therefore determined not by asbestos exposure but by climate, degree of physical exertion required, the other hazards involved in the work, and ease of decontamination.

Closely woven, disposable or washable coveralls without pockets or cuffs, but including an integral head covering, in combination with disposable overshoes, greatly assist in personal decontamination; however, these synthetic garments may make a substantial contribution to the heat stress of the individual in some environments. Trousers and coverall cuffs should be worn outside of boots and gloves. Where specific decontamination facilities are not available, the use of disposable coveralls is recommended.

As several variables influence the type and amount of clothing worn in asbestos removal, decisions on what is appropriate in the particular circumstances should always be based on consultation between employers and employees.

6.2.1 **Laundering of protective clothing**

All clothing worn in an asbestos removal area shall be regarded as potentially contaminated with asbestos. As such, it is important that care is taken to ensure that the contractor, or other persons handling the clothing, fully understand the precautions necessary for handling asbestos-contaminated clothing. It is generally considered preferable that, where possible, all laundering be done on-site or in a facility provided and operated by the asbestos removalist.

Contaminated clothing may be safely laundered in a conventional washing machine separate from other laundry, provided the clothing is thoroughly wetted when discarded by the worker and not allowed to dry out until it is washed. Contaminated clothing to be laundered by a commercial laundry shall be despatched in a thoroughly wetted state in an impermeable container clearly marked *ASBESTOS CONTAMINATED CLOTHING*.

Where clothes dryers are used to dry work clothes and/or overalls, the exhaust air from the unit should either pass through a filter or be discharged to the outside atmosphere. Random air monitoring may be carried out in the laundering facility to ensure laundry workers are not being exposed to asbestos dust.

THE LAUNDERING OF PROTECTIVE OR WORK'S CLOTHING IN WORKERS' HOMES SHALL BE STRICTLY PROHIBITED.

7. ENVIRONMENTAL MONITORING OF REMOVAL SITE

An airborne asbestos monitoring program is necessary in order to determine whether the precautions and work procedures described in this Code are being applied in a satisfactory manner, and that permitted asbestos exposure levels are not exceeded.

Air monitoring is not intended to be used as a preventive or control measure, but as a check at intervals, which may be random, in order to ensure that control procedures are operating satisfactorily and that workers are not being exposed to harmful environments.

The location and frequency of air monitoring is very much dependent upon the method of removal, the quality of the removal area containment, the monitoring history at the particular site and the possible consequences of fugitive releases. For larger removal areas or on dry removal jobs, a fairly extensive monitoring program should be implemented at the start of the removal program to check the integrity of the containment and decontamination facilities.

The need for further monitoring and its frequency should be determined on the basis of the results obtained. Problem areas, or neighbouring regions with a high occupancy of unprotected persons, should be monitored routinely every shift, while consistently clear areas may only require a random sample.

The recommended exposure standard for asbestos and its basis is outlined in section 6.2 of the attached Guide.

During asbestos removal operations, where complete containment of the removal area is not possible (section 2.1), asbestos fibre concentrations in the air shall be measured at a number of positions outside the barriers which contain the removal area. Such data are important in determining the positions of barriers and the effectiveness of the control procedures. Air monitoring shall also be done in decontamination areas. Generally, it will not be necessary to monitor each individual job where asbestos material is being removed by the same procedure and where the monitoring history has indicated that there has been no problem with asbestos contamination.

7.1 AIR MONITORING TECHNIQUE

The determination of airborne asbestos concentrations shall be made in accordance with the detailed method set out in the NOHSC *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust*.[6]

Briefly, this determination is achieved by drawing an accurately measured volume of air through a specially prepared membrane filter, and thereafter counting the number of asbestos fibres collected on this filter, using an optical microscope. This data can then be used to calculate a result which may be compared to the recommended exposure standard detailed in section 6.2 of the attached Guide. *COMPARISON WITH THIS EXPOSURE STANDARD IS ONLY VALID IF THE DETAIL OF THIS METHOD IS OBSERVED.*

`Static' air samples taken over a short period at a fixed location can only serve as an indicator of the effectiveness of contamination control. Comparisons between samples taken for engineering control and the recommended exposure standard are not valid. True worker exposure can only be estimated from personal samples attached to, and taken within, the breathing zone of the individual. These personal samples should preferably extend over an entire shift.

Since the measurement of airborne asbestos concentration is an important and highly skilled process, the monitoring shall only be carried out by suitably trained personnel who have been instructed in the sampling techniques and analytical procedures.

It should be noted that the Membrane Filter Method is the only technique which can be used to determine compliance with the asbestos exposure standard, and where monitoring is undertaken to this end, it must be done by that method and should be performed by National Association of Testing Authorities, Australia (NATA) registered or government accredited personnel, when available. However, because of the four-hour sampling period required, and the subsequent time needed for sample preparation and counting, it may not be of sufficiently informative value during the course of, for example, short-term asbestos disturbance, control, or removal operations. In such circumstances more reliance should be placed upon frequent visual inspection of the containment area.

The results of air monitoring shall be made available to workers in the area, and the site supervisor notified immediately if the fibre count exceeds the recommended level.

8. DISMANTLING OF ASBESTOS REMOVAL AREA

On completion of the asbestos removal job, all tools and equipment not used for cleaning should be removed from the removal area so that efficient vacuuming of the inside of the removal area enclosure can be undertaken. In taking these tools and equipment from the removal area, appropriate decontamination procedures must be observed (section 5.1.2).

By spraying the internal surfaces of the plastic containment around the removal area with polyvinyl acetate (PVA) or similar water based paint, any asbestos dust adhering by electrostatic attraction is effectively encapsulated. Personnel involved in this spraying operation should wear an airline respirator or a half-face respirator fitted with combined organic vapour/dust cartridges. Plastic surfaces may become very slippery while the paint is wet, so unnecessary movement within the enclosure should be avoided until the paint has dried.

The plastic enclosure surrounding the removal area may only be dismantled if a thorough inspection reveals no visible traces of asbestos contamination and air samples taken within the enclosure indicate a result below the level specified by the relevant statutory authority. The visual assessment may, in some circumstances, include analysis of settled dust within the enclosure by optical microscopy. Air monitoring should only be undertaken once the PVA has dried, as the airborne mist will adversely affect the ability to detect fibres in the sample.

It should be stressed that visual inspection and air monitoring are complementary techniques and dismantling may only proceed after both techniques give clearances.

The sealing plastic may then be dismantled, folded and placed in appropriate disposal bags and sealed. The sealing plastic should not be re-used, but treated as asbestos waste, [see section 12 of the attached Guide]. Safety barricades and warning signs should not be removed until the complete area has been thoroughly cleaned.

Prior to resumption of normal work in the area by unprotected personnel, a comprehensive visual inspection shall be undertaken to ensure removal has been satisfactorily completed and that no source of asbestos dust remains in the area. Particular attention should be paid to examination of ledges, tops of air conditioning ducts, cracks in the floor, folds in plastic sheeting and crevices or areas which may have been overlooked during the initial clean-up.

The asbestos removal job shall only be considered to have been completed when a visual inspection reveals no further evidence of asbestos contamination and static air samples give a clear result.

9. HANDLING OF ASBESTOS-CEMENT (FIBRO) PRODUCTS[11]

A large number of building products used in the building and construction industry in Australia have been compounded from asbestos-cement. These products include, but are not limited to:

- flat or corrugated, compressed asbestos-cement sheeting (fibro)
- fibro pipes - water, drainage and flue
- roofing shingles
- flexible building boards (for example, Villaboard, Hardiflex, Wundaboard, Flexiboard)

While new fibrous-cement products no longer contain asbestos, prior to 1970 crocidolite was used in many products. Provided these products are maintained in good order, they present no health risk; however, precautions must be observed during structural alteration or demolition involving asbestos-cement materials.

9.1 PRECAUTIONS TO BE OBSERVED WHEN WORKING WITH ASBESTOS-CEMENT PRODUCTS

In general, work procedures should be designed to minimise the generation of dust and, where possible, action should be taken to avoid the spread of any asbestos dust contamination. In particular, the following practices should be adopted:

- use non-powered hand tools such as hand-saws, as these generate a smaller quantity of predominantly coarser dust or waste chips.
- wetting down the material further reduces the release of dust when cutting. High pressure water jets shall not be used.
- *POWER TOOLS UNLESS APPROVED BY THE RELEVANT STATUTORY AUTHORITY FOR ASBESTOS WORK, AND ABRASIVE CUTTING OR SANDING DISCS, IN PARTICULAR, SHALL <u>NOT</u> BE USED ON ASBESTOS-CEMENT PRODUCTS*.
- work with asbestos-cement products in well-ventilated areas, and where possible, in the open air.
- good work hygiene principles should be observed. This may entail the use of plastic drop sheets to collect off-cuts and coarse dust or the use of approved vacuum cleaning equipment. Where it is necessary to sweep floors, the area involved should be wetted to suppress dust.
- all off-cuts and collected dust should be disposed of as asbestos waste.
- approved respiratory protection should be used when appropriate, particularly in confined spaces.

9.2 REMOVAL OF ASBESTOS-CEMENT (FIBRO) SHEETING

The following precautions should be observed when removing asbestos-cement roofing, wall sheeting or other fibro products from buildings or other structures:

- all windows and doors on the building should be closed, or in factory-type buildings where there is no ceiling, the area below or adjacent to the work should be roped off.
- the asbestos-cement sheets should be sealed or wetted with water, but not with high pressure water jets. The sheets should not be wetted if this creates a high risk of a worker slipping from a roof.
- workers should wear disposable coveralls and either an approved disposable respirator or an approved half-face respirator mask fitted with dust cartridges approved for asbestos.
- only power tools approved by the appropriate statutory authority for asbestos work may be used for removal.
- asbestos-cement sheets should be removed with minimal breakage and should be lowered to the ground, **not dropped**.
- the removed sheets should be stacked on a ground sheet and not allowed to lie about the site where they may be further broken or crushed by machinery or site traffic.
- all asbestos-containing waste should be kept wet, wrapped in plastic or otherwise sealed and removed from the site as soon as practicable, using covered bins or on a covered truck.
- the asbestos-containing waste should be disposed of in a manner, and at a site, approved by the appropriate disposal authority. Asbestos-cement sheets should not be re-used.
- any asbestos-cement residues remaining in the roof space or around the removal area should be cleaned up, using an approved vacuum cleaner if necessary.

APPENDIX A

RELATED DOCUMENTATION

REFERENCES

1. National Health and Medical Research Council (NH&MRC): *Code for the Safe Removal of Asbestos-based Thermal/Acoustic Insulating Materials*, NH&MRC, Canberra, 1979, (amended 1981).

2. US Department of Labour, Occupational Safety and Health Administration (OSHA*): Work Practices and Engineering Controls for Major Asbestos Removal, Renovation and Demolition Operations - Non Mandatory*, Appendix F, Section 1926.58, 1986

3. Health and Safety Commission (UK): *Work with Asbestos Insulation and Asbestos Coating - Approved Code and Guidance Note*, HMSO, London, 1985.

4. National Health and Medical Research Council (NH&MRC): *Effects of Heat on Health, Comfort and Performance*, NH&MRC, Canberra, 1979. (available from NOHSC)

5. Standards Association of Australia, AS 1324-1973, *Air Filters for Use in Air Conditioning and General Ventilation*, section 4.3.1., Sydney.

6. National Occupational Health and Safety Commission: *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust* Part 2 - Air sampling for paraoccupational situations, NOHSC, Sydney, 1988 (attached).

7. Standards Association of Australia, AS 3544-1988 *Industrial Vacuum Cleaners for Particulates Hazardous to Health*, Sydney.

8. American Conference of Governmental *Industrial Hygienists, Industrial Ventilation - a Manual of Recommended Practice*, 18th Edition, Michigan, ACGIH, 1984.

9. Standards Association of Australia, AS 1715-1982 Selection, *Use and Maintenance of Respiratory Protective Devices*, Sydney.

10. Standards Association of Australia, AS 1716-1984 *Respiratory Protective Devices*, Sydney.

11. National Health and Medical Research Council (NH&MRC): *Code of Practice - Working with Asbestos Cement (Fibrocement) Building Materials*, NH&MRC, Canberra, 1981.

12. Health and Safety Executive (UK): *Respiratory Protective Equipment for Use Against Asbestos*, Guidance Note EH 41, HMSO, London, 1985.

13. Health and Safety Executive (UK*): Probable Asbestos Dust Concentrations at Construction Processes*, Guidance Note EH 35, HMSO, London, 1984.

LEGISLATION

Legislation relevant to asbestos has been introduced, or is being introduced, in all States and Territories. Other legislation relates to clean air, waste disposal and so on.

At the time of publications the relevant Acts and regulations are:

NEW SOUTH WALES

Factories, Shops and Industries Act 1962

Factories (Health and Safety - Asbestos Processes) Regulations (1984)

Occupational Health and Safety Act 1983

Occupational Health and Safety (Asbestos Dust) Regulation 1984

Occupational Health and Safety (Asbestos Removal Contractors) Regulation 1988.

Construction Safety Act 1912

Regulation 84 a-j, Construction Work Involving Asbestos or Asbestos Cement 1983, (Amended March 1984 and August 1986).

Environmentally Hazardous Chemicals Act 1985

Chemical Control Order - Asbestos Waste Chemical Control Order 1987 (Packaging, Disposal as Landfill).

Mines Inspection Act 1975

General Rules 65b. Section 56, July 1984 (Reprinted March 1985).

Poisons Act 1966 (Amended July 1985).

Clean Air Act 1961

Dangerous Goods Act 1975

Waste Disposal Act 1970

VICTORIA

Labour and Industry Act 1958

Labour and Industry (Asbestos) Regulations 1978

Labour and Industry (Asbestos)(Amendment) Regulations 1979

Occupational Health and Safety Act 1985

Environment Protection Act 1970

Health Act 1958

QUEENSLAND

Factories and Shops Act of 1960

Asbestos Rule (Rule 9), 1977, as amended on 20 December 1980, 30 January 1982, and 11 June 1983.

Construction Safety Act 1971

Regulation: Division V.A. Subsection 57.E. Licences for demolition, involving asbestos.

Building Act 1975

Clean Air Act of 1963

Health Act of 1937

WESTERN AUSTRALIA

Factories and Shops Act 1963#

Asbestos Regulations 1978

Factories and Shops (Asbestos) Regulations, 1985.

Construction Safety Act 1972#

Construction Safety Regulations 1973 Part VII (A)

Asbestos Removal Regulation, 1984.

Health Act 1911

Health (Disposal of Asbestos Waste) Regulations, 1984.

Occupational Health, Safety and Welfare Act 1984

*Occupational Health, Safety and Welfare Amendment Act 1987**

Occupational Health, Safety and Welfare (Workplace) Regulations 1988

*Acts Amendment (Occupational Health, Safety and Welfare) Act 1987**

* awaiting proclamation 1988, repealing those indicated thus#

SOUTH AUSTRALIA

Occupational Health Safety and Welfare Act, 1986

(Industrial Safety) Regulations, 1987.

Regulation 39 - Asbestos Work.

(Construction Safety) Regulations, 1987.

Regulation 161.1	-	Control of Spraying of Asbestos
Regulation 161.2	-	Construction Work in the Vicinity of Asbestos
Regulation 161.3	-	Sealing, Encapsualting or Enclosing Asbestos
Regulation 222	-	Licence for Asbestos Removal Work

Dangerous Substances Act 1979

Health Act 1935

Waste Management Commission Act 1979

TASMANIA

Industrial Safety, Health and Welfare Act 1977

Administrative and General Regulations, Part VI.,

Division 2 - Asbestos.

Health and Welfare Provisions, Regulations 228-246.

Dangerous Goods Act 1976

NORTHERN TERRITORY

Construction Safety Act 1975

AUSTRALIAN CAPITAL TERRITORY

ACT Building Ordinance 1972, as amended 1984

ACT Asbestos Removal Manual

ACT Dangerous Goods Ordinance 1984

ACT Building Regulations

COMMONWEALTH

Quarantine Act 1956

Custom (Prohibited Imports) Regulation No. 90

AUSTRALIAN STANDARDS

Issued by Standards Association of Australia, Sydney

AS 1216	*Classification, Hazard Identification and Information Systems for Dangerous Goods.*
Part 1 - 1984	*Classification and Class Labels for Dangerous Goods.*
AS 1318 - 1985	*Rules for Use of Colour for the Marking of Physical Hazards and the Identification of Certain Equipment in Industry (SAA Industrial Safety Colour Code).*
AS 1319 - 1983	*Safety Signs for the Occupational Environment.*
AS 1530	*Methods for Fire Tests on Building Materials, Components and Structures.*
Part 3 - 1982	*Test for Early Fire Hazard Properties of Materials.*
AS 1715 - 1982	*Selection, Use and Maintenance of Respiratory Protective Devices.*
AS 1716 - 1984	*Respiratory Protective Devices.*
AS 2342	*The Design and Use of Graphic Symbols and Public Information Symbol Signs.*
Part 6 - 1985	*Guidelines for the Implementation of Symbol Sign Systems.*
AS 2601 - 1983	*The Demolition of Structures (known as the SAA Demolition Code.)*

APPENDIX B

GUIDE TO THE SELECTION OF APPROPRIATE RESPIRATORY PROTECTION

APPROPRIATE RESPIRATORS

There is a wide range of respiratory protection available for protection from airborne asbestos dust. In general, the selection of a particular respirator is determined by the nature of the asbestos work and the probable maximum concentrations of dust that would be encountered in this work. Another consideration would be the personal characteristics of the wearer that may affect the facial fit of the respirator; for example, amount of facial hair, or whether glasses are worn.

Table 2 below provides, in approximate order of increasing efficency, an indication of some respirators which may be used for protection against asbestos dust. The protection afforded by each device depends not only upon the design and fit of the respirator, but also upon the efficency of the filters (L,M,or H) where applicable.

Australian Standards AS-1715[9] and AS-1716[10] provide detailed advice on the selection, use and maintenance of respiratory protective equipment and should be consulted for more detailed advice on *Nominal Protection Factors* and other relevant matters.

TABLE 2

FIGURE	TYPE OF RESPIRATOR
6	· disposable, half-face particulate respirators
7	· half-face, particulate filter (cartridge) respirator
8	· powered, air-purifying, ventilated helmet or hood respirator
9	· full-face, particulate, filter (cartridge) respirator
10	· full-face, powered air-purifying particulate respirator
11	· full-face, positive pressure demand respirator
12	· full suit or hood, continuous flow, airline respirator

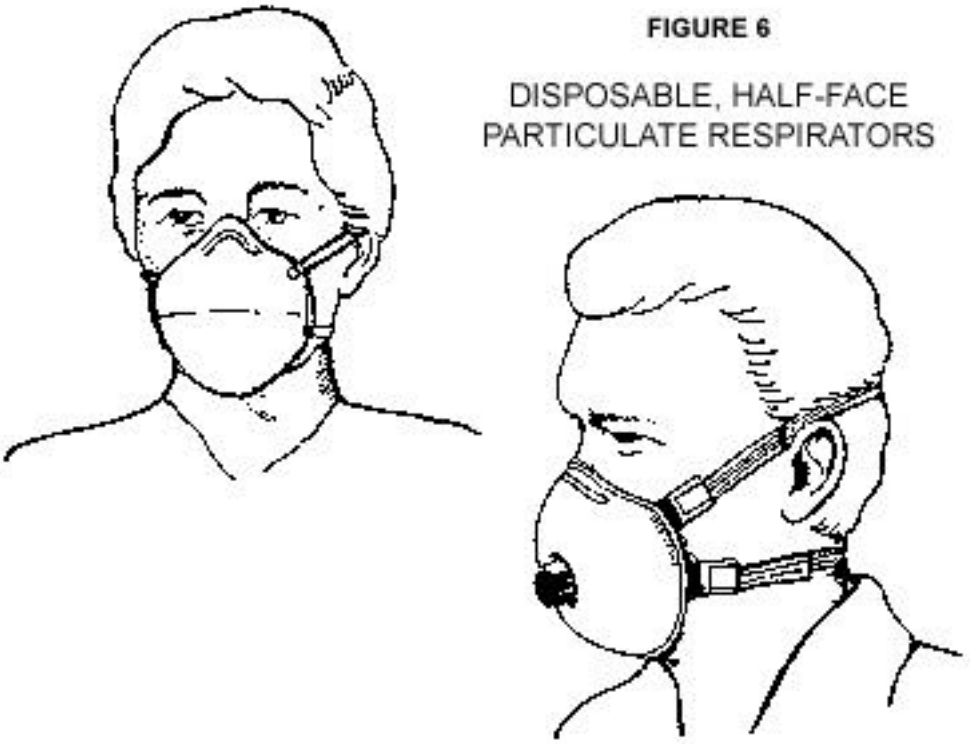


FIGURE 6

DISPOSABLE, HALF-FACE
PARTICULATE RESPIRATORS

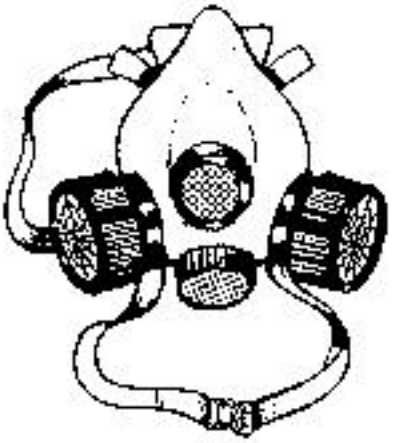
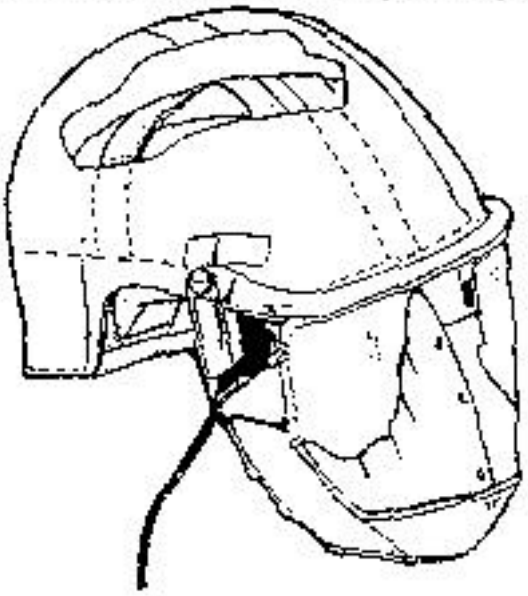


FIGURE 7

HALF-FACE PARTICULATE
FILTER (CARTRIDGE)
RESPIRATOR

FIGURE 8

POWERED, AIR-PURIFYING,
VENTILATED HELMET RESPIRATOR



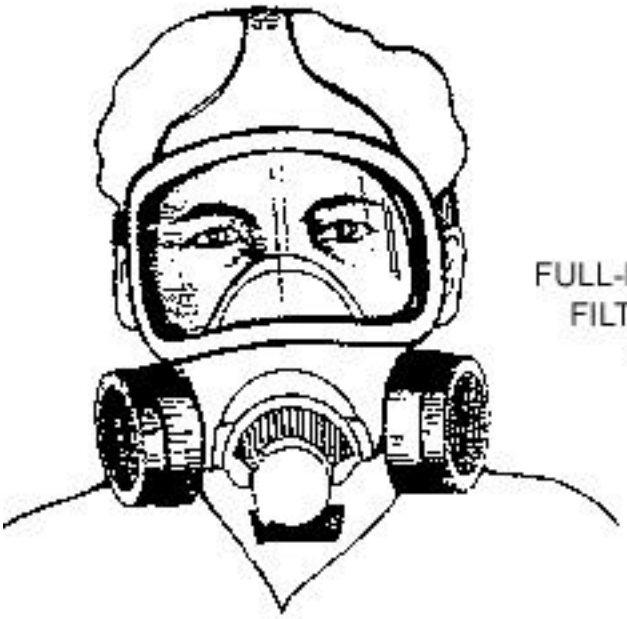
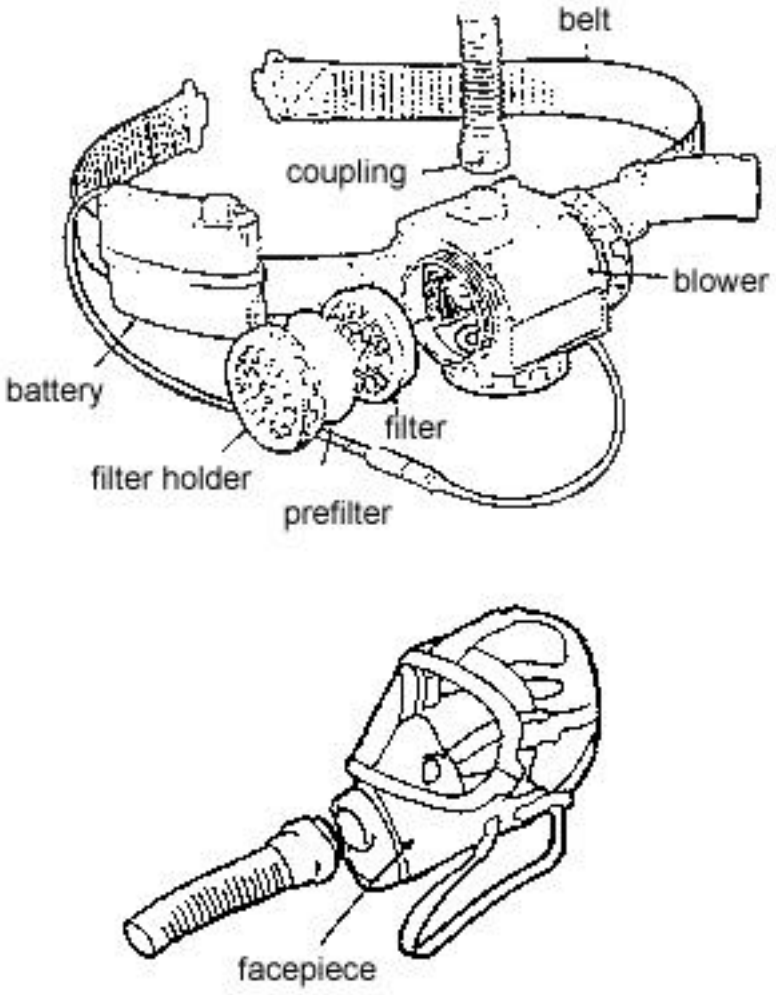


FIGURE 9

FULL-FACE PARTICULATE
FILTER (CARTRIDGE)
RESPIRATOR

FIGURE 10

FULL-FACE, POWERED
AIR-PURIFYING
PARTICULATE RESPIRATOR



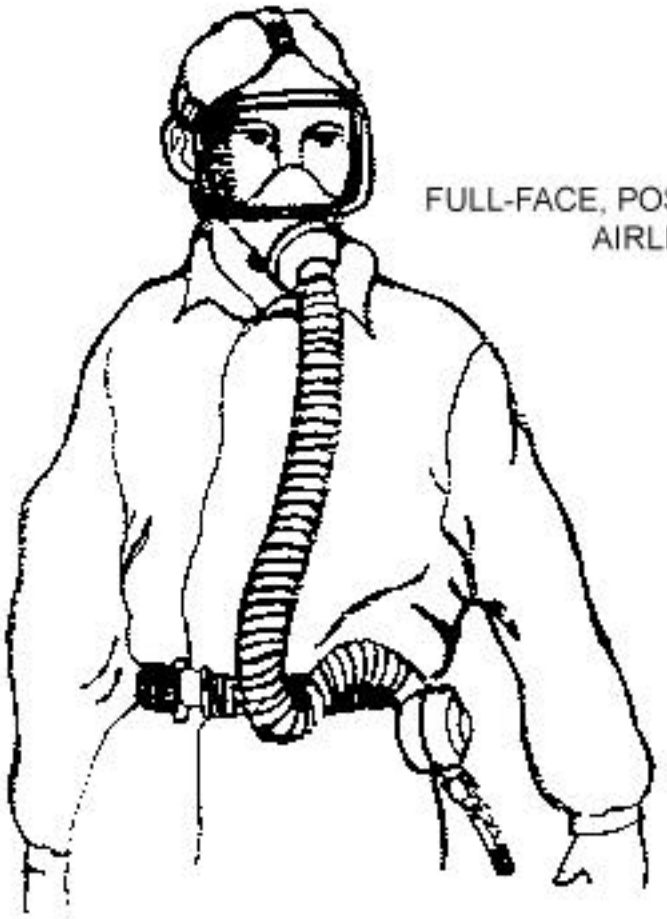


FIGURE 11

FULL-FACE, POSITIVE PRESSURE DEMAND
AIRLINE RESPIRATOR

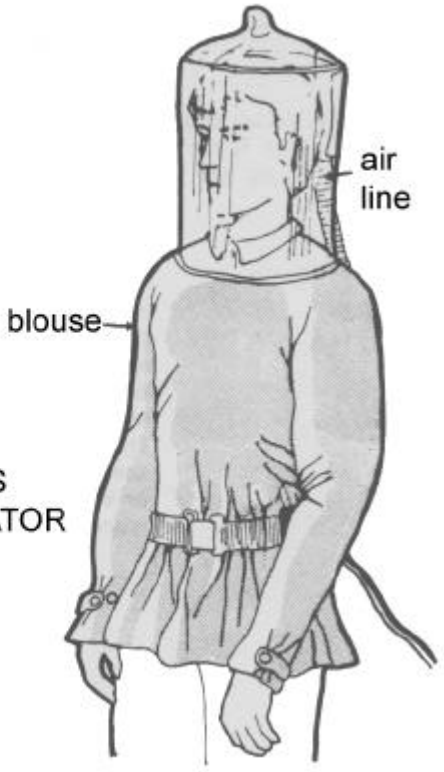


FIGURE 12

FULL SUIT OR
HOOD, CONTINUOUS
FLOW, AIRLINE RESPIRATOR

TABLE 3

GUIDE TO PROBABLE EXPOSURE LEVELS AND APPROPRIATE RESPIRATORY PROTECTION FOR PARTICULAR ASBESTOS REMOVAL JOBS

Adapted from the Health and Safety Executive (UK) publication: *Respiratory Protective Equipment for Use Against Asbestos*[12,13] with changes in nomenclature to suit Australian practice. (Reproduced with permission of the HSE and the Controller of Her Majesty's Stationery Office).

CONCENTRATION (fibres/mL)	JOB	EQUIPMENT
0 to 2	simple short sampling; simple enclosure erection; clearance sampling; but not for use for removal of insulation or use inside enclosures when removal is in progress.	any *approved* respirator, including disposable or half-face cartridge respirators (Class L or M)
2 to 4	some sampling operations; perhaps enclosure erection under adverse conditions; but not for use for removal of insulation or use inside enclosures when removal is in progress.	any *approved* respirator with Class M filters except those fitted with or consisting of half-face masks; or any positive pressure airline respirator.
4 to 20	extensive sampling operations perhaps on friable lagging; some sealing operations; enclosure erection under adverse conditions and on friable lagging, but not for use for removal of insulation or use inside enclosures when removal is in progress.	any *approved* full-face respirator fitted with Class H filters, or any positive pressure demand or continuous flow airline respirator.

TABLE 3 (Continued)

CONCENTRATION (fibres/mL)	JOB	EQUIPMENT
0 to 180	certain forms of wet stripping in which wetting is prolonged and effective, certain small-scale dry stripping operations.	any approved, full-face, (Class H) powered air purifying or airline respirator. Ventilated helmet or visor respirators are not appropriate
180 to 500	certain forms of dry stripping; ineffective wet stripping (light wetting - no time given to saturate).	any approved positive-pressure full-face, airline or powered air purifying (Class H) respirator. NO LESSER RESPIRATOR WILL SUFFICE
500 +	dry stripping in confined areas.	positive pressure, airline supplied suits or hoods only. NO LESSER RESPIRATOR WILL SUFFICE

NOTE: This guide does not take account of personal features such as facial hair or the need to wear spectacles. Full protection will not be achieved if either of these is present and interferes with the face seal. Nor does the guide take any account of misuse of the protective equipment.

TABLE 4

GUIDE TO PROBABLE EXPOSURE LEVELS AND APPROPRIATE RESPIRATORY PROTECTION FOR PARTICULAR JOBS INVOLVING ASBESTOS-CEMENT (FIBRO) PRODUCTS

Adapted from the Health and Safety Executive (UK) publication: *Respiratory Protective Equipment for Use Against Asbestos*,[12,13] with changes in nomenclature to suit Australian practice.
(Reproduced with permission of the HSE and the Controller of Her Majesty's Stationery Office).

CONCENTRATION (fibres/mL)	JOB	EQUIPMENT
0.5 to 5	construction - machine drilling, hand sawing and water jetting* of asbestos-cement; perhaps other processes also.	disposable or half-face particulate cartridge respirators (Class L or M)
10 to 50	cutting asbestos-cement board with circular saws, angle grinders or abrasive wheel cutters which do not have efficient local extraction*.	any approved full-face particulate Class H respirator including high efficiency powered air purifying respirators.

*NOTE: The high pressure water jetting or dry machining of asbestos-cement products with power tools is not recommended.