

Generic Methodology of ACM Removal

(Please note that this appendix only serves a general guide to removal of asbestos containing materials and hence generic method statements are presented herein for reference only.)

1 Introduction

As specified in Environmental Permit Clause, all asbestos containing materials (ACM) shall be removed prior to demolition of the existing structures within the Kwai Chung Incineration Plant (KCIP). In certain areas of the site facility or plant, it has been found that there is a close distance between dioxin contaminated ash and asbestos materials, thus it is advisable to remove the contaminated ash material before asbestos removal works. In order to prevent the release and re-suspension of ash particles during site preliminary decontamination and to provide prior preparation for asbestos removal in close proximity to the dioxin containing areas, removal of ACM will be conducted using full containment method as described in the "Code of Practice on Asbestos Control for Asbestos Work using Full Containment or Mini Containment Method" issued by Environmental Protection Department. Extraction from the Code of Practice with regard to the section on Full Containment setup is enclosed in this appendix. In cases where only ACM are present in the work area, removal methods in Segregation setup for "Low-Risk ACM Only" scenario are outlined in other sections of this document.

2 Work Site Preparation

The asbestos work areas shall be segregated from all adjacent work-free areas or structures using red/white plastic tapes to prohibit and give visual warning of unauthorized access to the work site. Warning notices or signs printed in both Chinese and English shall be attached in a conspicuous position of work area every time and shall remain posted until removal work has been completed. Before setting up full containment for removal of ACM, each work area shall be preliminarily decontaminated (refer to section on Preliminary Decontamination enclosed in this appendix). No matter what the existing site condition and the extent of contamination are, the workers should wear appropriate air respirators for cleaning. Full-body protective clothing and negative air pressure environment will be required if seriously damaged ACM prior to removal are found on site. Any movable items within the work areas shall be cleaned by wet-wiping and vacuuming with High Efficiency Particulate Air (HEPA) filter equipment. Any unmovable objects and surfaces without ACM shall be decontaminated by a vacuum cleaner fitted with HEPA filter and then covered with two layers of polythene sheeting.

3 Equipment and Materials for ACM Removal

The Contractor shall acquire and provide all necessary equipment and materials for the asbestos removal works including but not limited to the following:

- (a) Air mover which shall be a local exhaust system equipped with HEPA filtration with a filter efficiency of 99.97% at 0.3µm mass median aerodynamic diameter.

The system shall be capable of creating a negative pressure differential between the outside and inside of the work area and provide sufficient air changes for workers. Each air mover shall be brought to the site without filters (i.e. pre-filters) and new filters shall be fitted on site before use. The Contractor shall keep sufficient spare filters on site for replacement purpose.

- (b) HEPA vacuum cleaner which shall be a piece of vacuuming equipment with a HEPA filter capable of trapping and retaining 99.97% of particles (or fibres) greater than 0.3µm in mass median aerodynamic equivalent diameter.

At least two HEPA filter type heavy duty vacuum cleaners suitable for use in asbestos removal works shall be provided for operation in each work zone. One small vacuum cleaner unit shall be provided at the exit of the asbestos working area for personal cleaning. In situations where a Hygiene Unit is attached to the exit of the asbestos working area, the vacuum cleaner may be located in the dirty chamber for surface cleaning. Each vacuum cleaner shall be brought to the work site without filters (i.e. pre-filters), and new filters shall be fitted on site before use. The Contractor shall keep sufficient spare filters on site for replacement purpose.

- (c) Respirators to protect workers during ACM removal works:

Full-face positive pressure type as approved under the Factories and Industrial Undertakings (Asbestos) (Approval of Respiratory Protective Equipment) Notice; and

Half-face or nasal respirators of nominal protection factor of 10, equipped with HEPA replaceable cartridge type filters as approved under the Factories and Industrial Undertakings (Asbestos) (Approval of Respiratory Protective Equipment) Notice.

- (d) Decontamination Unit

A 3-compartment air-locked Hygiene Unit comprising Dirty Room, Shower Room and Clean Room, which should be constructed with timber or metal frames, 3 layers of 0.15mm thick polythene sheeting and sealed with 75mm tape. An I-slit opening door with cover flap weighted at bottom is made to separate the Dirty Room from the Shower Room. In the Dirty Room, facilities for temporary storage of soiled equipment and footwear and a waste bag should be provided. Likewise, another I-slit opening door with cover flap weighted at bottom shall separate the Shower Room from the Clean Room. Before being discharged to the site, covered drainage, waste water shall pass through a filter unit approved by the client. The Clean Room shall provide secure storage of personal protective clothing, respirator face pieces, gloves, etc as well as a mirror and a charging unit for the respirator batteries. A third door of the same design shall give access to and from the outside of the Clean Room.

- (e) Other Essential Materials and Instruments

Asbestos Waste Bags – double-bagging with 0.15mm polythene bags colour-coded should be available for use in the work area:

- white inner bag for chrysotile (white asbestos); and
- orange inner bag for amosite (brown asbestos) or crocidolite (blue asbestos).

The outer bag should be transparent to facilitate visual inspection.

The inner bag should be labelled or printed "Danger Asbestos Waste" in English and Chinese as shown in "Code of Practice on the Handling, Transportation and Disposal of Asbestos Wastes" issued by the Environmental Protection Department.

Nylon woven sacks may be required to be used as the innermost bag (i.e. triple-bagging) when the debris contains sharp edges and/or proves to be too heavy for the plastic waste bags.

Round containers with airtight seal caps may be used to pack all cement/dioxin ash mixtures.

Chemical waste drums should be used to store wet or heavy asbestos or dioxin waste. They are of the full aperture type and the lids may be secured with latch, lever, or nut and bolt closures. Protective clothing shall be of a disposable type and approved by the Labour Department under the Factories and Industrial Undertakings (Asbestos) Special Regulations. Protective coveralls shall be with integral hoods, elasticized cuffs and ankles and zipper fastening. Workers should wear rubber knee length boots with non-slip soles or wear shoe covers. Eye protection and safety helmets shall be made available as appropriate. In other words, the Contractor shall provide all necessary protective outfits for the on-site working staff and other Government officials during the dioxin/asbestos removal work period.

Amended water shall be water to which a wetting agent is added for damping asbestos prior to removal. A wetting agent is 50% polyoxyethylene ester and 50% polyoxyethylene ether or equivalent.

Coating material/sealant for coating surfaces previously contaminated with asbestos. A suitable sealant is polyvinyl acetate (PVA) emulsion adhesive.

Pressure monitor capable of continuously measuring the static negative pressure of a contained work area and producing a permanent print-out record should be provided. The normal negative pressure range of -0.05" to -0.15" (or -1.5mm to -4mm) water gauge inside the containment should be maintained during the course of asbestos removal work. The pressure monitoring device should also be fitted with an audible alarm to give early warning of abnormal pressure differential.

4 Maintenance and Testing of Plant and Equipment for Asbestos Removal Works

The Registered Asbestos Contractor shall ensure that personal protective equipment, mechanical plant and equipment brought to the work site are all uncontaminated, well maintained and in efficient working order, and that all scaffolding, working platforms, tools, equipment, etc brought to the site are also free of contamination. It should be noted that metal scaffold as the necessary structural aid is to be used for removal of ACM as advised by the Environmental Protection Department (EPD) and hence Labour Department "Code of Practice for Metal Scaffolding Safety" is to be referred to. Certified records of routine maintenance of all plant and equipment, particularly the HEPA equipment, shall be prepared for inspection by the Registered Asbestos Consultant (hereinafter referred to as the Consultant).

Similarly, all mechanical plant and equipment, scaffolding, working platforms, tools and equipment, etc used for asbestos removal shall be decontaminated before leaving the work site.

5 Construction of Full Containment

For removal of friable ACM or ACM with dioxin contaminated materials in the vicinity, a full containment under negative pressure is always required to ensure air-tightness of the enclosed work area. Containment setup is shown on layout plans attached to this appendix. Details of constructing full containment on site are also listed in section on Full Containment setup.

6 List of ACM Items

A list of identified ACM items at KCIP is given below for quick reference:

(a) ACM in Main Building (Incineration Plant)

The ACM item involved is weather cladding on metal corrugated sheets.

(b) ACM in Main Building Offices/Workshops/Lab (Incineration Plant) & Site Office Block

The ACM items involved are fuse boxes with arc chutes, floor tiles with adhesive and gasket/ribbon sealant of ventilation duct outside Kitchen, all located in Incineration Plant, and also floor tiles inside rooms on 1/F of Site Office Block.

(c) ACM in Ash Bunker Area

The ACM item involved is the cement water pipe adjacent to the ash bunker on the rear side of Incineration Plant, close to chimney.

(d) ACM inside Chimney

The ACM items involved are the lining material of flue guides from Platform No.7 down to No.1 and the 6 ventilation louvres on Platform No.7.

The ACM items involved are the sampling port gaskets from Platform No.2 down to No.1 and the gas tight doors on Platform No.1. In addition, there are 4 ACM flexible joints at chimney base.

The ACM will be removed together with DCM inside the same containment. The method statement will be discussed in separate WMP for DCM.

7 The Proposed ACM Removal Methods

The methods suggested below are applicable to various types of ACM present in the existing buildings and facilities at Kwai Chung Incineration Plant (KCIP). In the event that dioxin contaminated materials and ACM are located in the same work zone, no asbestos abatement work should be carried out until all ash material, deposits or rubbles contaminated with dioxin in the surroundings have been thoroughly removed. Detailed

procedures of asbestos removal work in containment and segregation setup can be referred to corresponding sections at the end of this appendix.

7.1 Removal of Weather Cladding on Metal Corrugated Sheets in Segregation Setup

The ACM paint coating applied to the metal wall sheets as weather cladding covers most of the main building. Although these materials have been subject to heavy rain and wind over the years, the mastic type paint is designed to resist weathering and the coating which contains the ACM has stood up well. There is little chance of fibre release if it is left undisturbed. It is proposed that the individual sections be unbolted and dismantled from the steel supporting beams. Metal scaffolding and working platforms are required for carrying out bolts or screw removal process. Caution should also be exercised while loosening or breaking bolts or screws with hand tools like screwdrivers, pliers or clippers. Continuous PVA spraying would help minimize accidental release of fibres or particles. A mechanical crane is then used to enable safe transfer of these metal corrugated sheets individually to ground level for wrapping and disposal in line with EPD "Code of Practice on Safe Handling of Low Risk ACM" (Refer to Segregation setup section and layout plan-Fig. B1).

7.2 Removal of Vinyl Floor Tiles & Fuse Box Arc Chutes in Segregation Setup

Removal of ACM vinyl floor tiles in demolition works not within a fire site is regarded as "Class II" under section 75(5) of the Air Pollution Control Ordinance (APCO) and is thus exempted from the appointment of a registered asbestos contractor (RACr). For the asbestos arc chutes inside fuse boxes, they belong to "Class I" item exempted under section 69(3) of the APCO. As a result, the owner of premises is not required to submit an asbestos investigation report or an asbestos abatement plan concerning these two ACM items to the Authority under section 69(1) of the APCO. However, with such extensive asbestos abatement at KCIP, it may be convenient for the proponent to include the abatement of these ACM items in a contract for the RACr.

Since the vinyl floor tile adhesive is the asbestos-containing part and is not friable although with localized cracks, asbestos fibres effectively encapsulated within the mastic adhesive bottom layer can be easily prised from the floor using hand tools like scrapers or chisels with moderate force in a segregated work area. In applying such force and methods, care should be taken not to cause the flooring to crumble in such a way as to release the asbestos fibres. Such work should be conducted in a segregated area with continuous floor skirting up to 300mm from ground. Concerning fuse box arch chutes, the whole fuse box is to be removed with the ACM intact in a segregation zone with the ACM inside remaining intact.

All such asbestos removal procedures can be carried out in line with EPD "Code of Practice on Safe Handling of Low Risk ACM" (Refer to Segregation setup section and layout plan-Fig. B2).

7.3 Removal of Gasket at the Kitchen Ventilation Duct in Segregation Setup

The ACM gasket at the ventilation duct outside the kitchen although friable is only exposed at the edges such that in demolition the ACM can remain undisturbed and removal can be accomplished as duct is dismantled. When the main civil demolition contractor reaches the kitchen area, the metal flange sections around the gasket can be cut out and the excised material, i.e. metal and ACM, can be wrapped ready for disposal. Either side of the flange should be supported by metal scaffolding that structurally complies with the standards set by the Labour Department. After the construction of the segregated area, the ductwork could be cut, at least 20cm from the gasket joint. It is recommended that the section of metal and ACM could be lowered to ground level by block and tackle without disturbing the joint. At ground level the section would be lowered into a segregated area and placed in drums or wrapped ready for disposal in line with EPD "Code of Practice on Safe Handling of Low Risk ACM" (Refer to Segregation setup section and layout plan-Fig. B3).

7.4 Removal of Cement Pipe in Ash Bunker Area (near Chimney) in Full Containment

In general, a full containment should be constructed to enclose the dioxin contaminated area where negative pressure condition is maintained by HEPA air movers producing 6 air changes per hour. The full containment layout as shown in Fig. B4 attached to this appendix should be adopted for removal of the dioxin material present in ash bunker prior to removal of ACM. Details of full containment setup and calculation of number of air mover units required are presented in supplementary section on Full Containment setup.

The ACM cement pipe in the ash bunker area is present as twelve sections of 20cm diameter pipe of varying lengths up to 5m. Although it has been cracked open, there is little chance of fibre release if left undisturbed due to its non-friable nature. Asbestos fibres are effectively encapsulated within the cement which can be easily lifted from its joints by hand or using a lifting device such as a block-and-tackle secured to the steel beams of the ash bunker frame above. The pipe can be lifted by exercising moderate force. In applying such force and methods, care should be taken not to cause the pipe to crumble in such a way as to release the asbestos fibres. In addition, the area adjacent to the pipe may require segregation, so work can be carried out in line with EPD "Code of Practice on Safe Handling of Low Risk ACM" (Also refer to Full Containment & Segregation setup sections and layout plan-Fig. B5).

8 Air Monitoring for Removal of ACM

For airborne fibre concentration in relation to ACM removal, the air monitoring program and requirements given in Asbestos Investigation Report (AIR) and Asbestos Abatement Plan (AAP) submitted in 2000 should be referred to.

Annex I

Site Location Plan of KCIP & Proposed Buffer Store

Annex II

ACM Removal Work Layout Plans

Annex III – Full Containment & Segregation Setup

C1 Removal of Asbestos Containing Materials (ACM) in Full Containment Setup

Site Preparation

All loose materials and movable objects should be decontaminated and then taken away from the work area. The work area should be pre-cleaned systematically by HEPA vacuuming and wet-wiping. Preliminary decontamination as detailed in Annex IV may be followed.

- C1.1 Warning sign should be posted at the entrance of the work area to alert the public to the ACM removal work in progress to avoid unauthorized entry.
- C1.2 Before the commencement of the ACM abatement work, any water and gas supplies to the work area should be isolated from the mains. Any openings in the work area such as ceiling/wall/floor voids, floor drains and power points in the vicinity should be sealed off with duct tape or 2 layers of polythene sheet securely taped in place. The registered asbestos contractor should find out all such openings and seal them up with 2 layers of polythene sheeting in advance.
- C1.3 For objects that will remain in the work area, they should be decontaminated and enclosed with a minimum of 2 layers of polythene sheet sealed to protect from re-contamination.
- C1.4 All used cloths should be removed and packed for disposal as asbestos waste.
- C1.5 Background air samples for presence of ACM should also be taken prior to commencement of any asbestos abatement activities.

Construction of Containment

The containment should be of a manageable size without exceeding 2,800m³ in total volume. The containment boundary is individually shown on layout plans in Annex II.

- C1.6 All workers should wear approved half-face respirators of minimum nominal protection factor 10, equipped with HEPA replaceable cartridge type filters, and full-body protective clothing with hood (a safety helmet with headlight if required), safety goggles and shoe covers. If necessary, additional battery powered lights should be placed inside the work zone so that sufficient lighting are provided.
- C1.7 Partitions should be constructed of 37 mm x 63 mm minimum wood strut framing or equivalent material of sufficient strength (maximum spacing 400 mm centre-to-centre) to support plastic barrier sheeting on all openings larger than 2.9 m². except where one dimension is 0.3m or less or where openings are for emergency exit. As a general rule, each expanse of plastic sheeting should not exceed 2.9 m² without adequate continuous support.

- C1.8 The partition should be caulked/sealed at the floor, ceiling, walls, joints and fixtures to form an airtight seal.
- C1.9 Individual polythene sheeting should be fixed to the timber frame by running a length of duct tape on the sheeting along a line of support provided by the frame then stapling through the duct tape and applying another length of tape on top to strengthen the grip. Timber battens (say, 25 mm x 50 mm) or equivalent material may be used instead but they need to be dyed red for easy identification later on as contaminated items.
- C1.10 All floor, ceiling and wall surfaces inside the containment should be masked and sealed with double polythene sheeting. Each layer of plastic sheeting should be applied separately and the minimum number required is given respectively below:
- - 2 individual layers to solid wall
 - 2 individual layers to solid floor
 - 3 individual layers to temporary partition wall
 - 4 individual layers to temporary platform
- C1.11 If containment is built onto any window, wood battens should be put on the window framework and plywood of at least 6mm thickness should be applied to the battens. In secure interior areas where partitions are not subject to access from the public, an additional layer of polythene sheeting (i.e. giving a total of 3 layers) may be substituted for solid construction material.
- C1.12 The plastic layer on the floor should extend at least 300 mm up all wall surfaces to form a continuous skirting while plastic sheeting on the walls should overlap this floor skirting by a minimum of 300 mm. Floor sheeting should be applied first, followed by wall sheeting, and then alternatively until the required number of layers is met. Joints throughout should be lapped for at least 150 mm and securely sealed with moisture resistant duct tape.
- C1.13 Clear viewing panels (300mm x 450mm with the lower edge no more than 1.2 m above floor level) should be provided in the barrier walls of the containment at strategic locations so as to facilitate observation of the abatement work from the outside. The panel should comprise one 2 mm thickness clear acrylic sheet per layer of polythene sheeting, have at least 50 mm overlap with the polythene sheeting at the edges, and be securely fixed with 50 mm wide duct tape.
- C1.14 A 3-chamber decontamination unit should be constructed to isolate the work area and permit safe access and egress of authorised working personnel. Connect temporary water supply for use in decontamination unit. Post warning signs in both English and Chinese at all access points and doorways to the work area. Annex IV for the construction and use of decontamination facilities may also be referred to.

C1.15 The location and arrangement of each full containment, decontamination unit, etc as illustrated in Annex II should be re-confirmed by the appointed Registered Asbestos Contractor ("the Contractor") and Registered Asbestos Consultant ("the Consultant"). Any modifications deemed necessary should be submitted to the Environmental Protection Department (EPD) before commencement of asbestos abatement work.

C1.16 HEPA-filter equipped air movers should be used to exhaust the enclosed work area (i.e. each containment) having a volume, say $V \text{ m}^3$. Openings made in the containment to accommodate the air movers must be made airtight. As a minimum of six air changes per hour is required, the number of air mover units of $1200 \text{ m}^3/\text{hr}$ flow capacity required is calculated as follows:

$$\text{No. of air movers required} = \frac{6 \text{ air changes/hr} \times \text{Containment Volume } V (\text{m}^3)}{\text{Design Flow Capacity of Air Mover } (\text{m}^3/\text{hr})}$$

C1.17 The air filtration system should maintain a static negative air pressure within the range from $-0.05''$ to $-0.15''$ (or -1.5 mm to -4 mm) water gauge inside the containment across all faces. An additional air mover should also be installed to function as a standby in case any other unit breaks down. The flow capacity of the standby unit should match that of the largest unit in use.

C1.18 If there is physical constraint hindering proper ventilation in the work area, the exhausted air should be diverted to the ambient environment by using an extended flexible hose securely attached to the air mover exhaust.

Smoke Test and Negative Pressure Monitoring

A portable, purpose-built smoke generator should be used to test for air-tightness of the containment prior to the actual asbestos removal work.

C1.19 The entire volume of the containment, including various chambers of the decontamination unit, should be filled with sufficient amount of smoke to reduce the visibility inside to no more than 2 metres. The smoke generator should be switched off and a thorough check for smoke leakage can proceed from outside the containment. Any leaks spotted should be immediately rectified.

C1.20 When integrity of the containment is satisfactorily concluded, the air mover (other than the one on standby which should be tested separately) should be switched on and timed to find out how long it would take to clear 90% of the smoke for 6 air changes per hour. The acceptable time limit should be within 30 minutes. Meanwhile, filtration efficiency of the air movers should be checked qualitatively by looking for traces of white fume at their exhaust.

- C1.21 The Consultant should confirm in writing the integrity and air-tightness of the containment after checking.
- C1.22 In general, the full containment and the decontamination unit(s) should be thoroughly checked for leaks by the supervisor on site with the aid of smoke tubes for at least twice per shift.
- C1.23 A negative pressure monitoring equipment with an audible alarm should be installed at the location of containment with the lowest pressure differential to monitor the static negative pressure inside the containment. The monitoring equipment should also produce hard copy time record of pressure differential on a continuous basis and the records (in the form of chart recording) should be kept on site for inspection by the Consultant.

Abatement Method

- C1.24 Inside the containment, all workers should wear approved full-face powered air-purifying respirators of minimum nominal protection factor 100, equipped with HEPA filters, as well as full-body protective clothing with hood and shoe covers. If necessary, additional battery powered lights should be placed inside the work zone to maintain sufficient lighting.
- C1.25 While DCM is being removed, impact air monitoring should be conducted as scheduled to cover the entire dioxin removal process to detect for any ambient dioxin concentration. Leakage air samples outside the containment should also be collected daily during the asbestos removal work to check for any escape of fibres from the enclosed work area. If air samples indicate fibre counts greater than original background levels or greater than 0.01 fibre/ml, whichever is larger, work should stop immediately for inspection and remedy.
- C1.26 One personal air sample for every 4 workers on each shift should be taken to monitor fibre exposure level throughout the asbestos removal process inside each containment.
- C1.27 Hand tools (e.g. hammer, chisel, hand-drill and pliers) should only be used to carefully scabble ash material with continuous HEPA-vacuuming or they are used to break up and cut the material surrounding the ACM. The ACM incorporated material should be made wet by spraying wetting agent such as polyvinyl acetate (PVA) or amended water before and during cutting. Any particle release during the removal process should then be kept to minimum by spraying the wetting agent and HEPA vacuum cleaner should be used to remove debris as it is created.
- C1.28 All wastewater should pass through a filter of an approved type, for removal of particles down to 5 micron in suspension, before being discharged into the drainage system.

- C1.29 Debris should be collected into waste bags and duct tape sealed as soon as it is generated. The workplace atmosphere should be mist-sprayed continuously along with stripping and wire-brushing.
- C1.30 Asbestos waste properly wrapped and sealed should be transported out through the decontamination unit.
- C1.31 When the ACM has been removed, all stripped metal surfaces should be wire-brushed carefully to remove all residues. The metal body could be cut into sections of manageable size using a handsaw, triple-wrapped and then disposed of as chemical waste. Workplace atmosphere should be kept moist by mist-spraying all over.

Final Cleaning

- C1.32 Upon completion of wire-brushing of surfaces previously covered with ash or asbestos, final clean-up of work area can start. HEPA vacuuming followed by wet-wiping should be performed on all surfaces from top to bottom and in a direction from the decontamination unit towards the air movers. Wet-wiping materials such as rags, mops and sponges must be discarded after single use to avoid re-contamination.
- C1.33 All exposed plastic surfaces inside the containment including the decontamination unit(s) should be sprayed with PVA solution, allowed to dry, peeled off (only the innermost layer) and placed in approved plastic bags for disposal as asbestos waste.
- C1.34 The 'new' plastic surfaces, i.e. the second plastic layer, should be HEPA vacuumed and wet-wiped to remove any visible debris. The work area should then be ready for penultimate air tests (evenly distributed inside the abatement area) to check on the effectiveness of cleaning.
- C1.35 If the air test result is below 0.01 fibre/ml, a thorough visual inspection should be made by the Consultant to certify in writing that all visible asbestos has been removed to a satisfactory standard with no visible debris or dust present; otherwise the containment should be re-cleaned and penultimate air samples should be retaken. This procedure should be repeated until the penultimate test results are satisfactory.
- C1.36 Upon written approval by the Consultant, all surfaces stripped of ACM should be sealed with PVA or other suitable sealing materials. The second layer of plastic sheeting should be PVA sprayed and removed for disposal as asbestos waste. Peripheral barrier sheeting including the decontamination unit(s) should remain in place so that the work area is still segregated from the ambient environment.

- C1.37 The area should be vacated for 12 hours to allow fibres to settle and then all objects and surfaces in the work area should be HEPA vacuumed and wet-cleaned systematically from top to bottom and in a general direction from the decontamination unit(s) towards the air movers.
- C1.38 Final clearance air tests evenly distributed inside the abatement area should be performed to confirm an air quality of no more than 0.01 fibre/ml is attained or else the work area should be re-cleaned and further clearance air tests should be carried out.
- C1.39 Upon satisfactory air test results, all remaining plastic sheeting, decontamination facility, air movers, etc. may be dismantled. All used plastic sheeting, etc. should be disposed of as contaminated waste.
- C1.40 All used clothes, gloves and polythene sheeting should be treated as contaminated waste and should be disposed of along with the ACM removed. All such waste materials generated are to be treated as the highest category of chemical waste for Type 3 asbestos waste.
- C1.41 All tools and equipment that have been used inside containment including air movers, vacuum cleaners, ladders, sprayers, hard hats, goggles etc. must be properly decontaminated by HEPA vacuuming and wet-wiping before being taken out of containment.
- C1.42 The work area should be thoroughly cleaned with a HEPA vacuum cleaner. The Consultant will carry out a reassurance visual inspection in writing for reoccupation after successful final clearance test and removal of all remaining polythene sheeting, air mover, air locks and disposal of asbestos waste to certify the absence of any visible ash or asbestos debris and proper decontamination of hand tools and transit of packed chemical/asbestos waste to a temporary buffer store as shown in Annex I.

Work Completion

- C1.43 If requested, the final completion certificate or report, along with air monitoring results and copies of waste disposal trip tickets, should be submitted to EPD by the supervising consultant within 14 days after completion of the asbestos abatement work.

If during the course of asbestos abatement work an accident or adverse weather is encountered, the emergency procedures as described in Annex V should be followed.

C2 Removal of ACM in Segregation Setup

A segregation work zone should be constructed for protection to remove the low-risk and asbestos-containing materials present. Details of the procedures applicable to removal of asbestos-containing weather cladding, floor tiles & fuse box arc chute, cement pipe, flue guides, gaskets, rope seal, ventilation louvres are as follows:

- C2.1 All workers should wear approved half-face respirators of minimum nominal protection factor 10, equipped with HEPA replaceable cartridge type filters; and full-body protective clothing with hood, goggles and shoe covers.
- C2.2 A 3-chamber decontamination unit should be constructed to isolate the work area and permit safe access and egress of authorized working personnel for the segregated area. Refer to Annex IV for the construction and use of decontamination facilities.
- C2.3 Before the start of the asbestos removal work, a continuous nylon or tarpaulin dust barrier sealed to the floor and high enough (approximately two metres high) to fully cover the ACM should be constructed around the segregated work area and preliminary decontamination of the work area should be carried out as detailed in Annex IV. In close proximity to the ACM, double-layer plastic sheeting should also be laid to form a continuous floor skirting of 300mm up from the ground.
- C2.4 Cloths used for wet cleaning, gloves and polythene sheets used in the following procedures should be treated as asbestos waste and disposed of with the ACM.
- C2.5 After preliminary decontamination has been completed, background air samples should be taken in the work area.
- C2.6 Personal air samples at daily intervals should be taken to monitor the fibre level to which workers are exposed throughout the asbestos removal process.
- C2.7 Environmental air samples at daily intervals should be taken in the nearest neighbourhood from the work area to monitor the fibre level during the asbestos removal process.
- C2.8 Such low-risk ACM items are to be removed by unscrewing, scrapping or cutting using hand tools with continuously PVA spraying and then double-wrapped with properly labelled plastic sheets or bags. Detailed mechanism for transfer of cut or dismantled asbestos-containing parts should be referred to the corresponding layout plans attached to this document.
- C2.9 All ACM removed should then be placed into transparent outer plastic bags, put in containers, vacuum packed and sealed.
- C2.10 After completion of the removed work, surfaces which have been in contact with the ACM should be wire-brushed and wiped to remove all visible residues.

- C2.11 HEPA-vacuuming followed by wet-wiping should be performed on all contact surfaces.
- C2.12 A thorough visual inspection should then be performed by the Contractor to ensure that any debris regarded as contaminated items, dust, chips, untreated effluents, etc. have been cleared from the work area.
- C2.13 Reassurance air samples should be taken to monitor the cleanliness of the site after clearance. Air test results showing fibre concentration in excess of 0.01 fibre/mL will not be accepted and the work area should be re-cleaned until airborne fibre level below the regulatory limit is attained.
- C2.14 When satisfactory air test result is obtained, all exposed plastic surfaces inside the work area should be sprayed with a PVA solution, allowed to dry, peeled off and disposed of as contaminated waste.
- C2.15 The site should be declared clean for the conduct of any other demolition work after a satisfactory visual inspection by the Consultant.

If during the course of asbestos abatement work an accident or adverse weather is encountered, the emergency procedures as described in Annex V should be followed.

Annex IV – Construction of Decontamination Facilities & Preliminary Decontamination

CONSTRUCTION REQUIREMENTS AND USE OF DECONTAMINATION FACILITIES

A 3-chamber airlock decontamination hygiene unit with water supply, waste water filters and HEPA vacuum unit should be constructed at the entrance of each work area. Workers who have entered contaminated areas must carry out thorough decontamination every time they leave the site. Detailed construction requirements and use of decontamination facilities as outlined below should be followed.

D1 Construction of Decontamination Unit

- D1.1 The decontamination unit should consist of three sealable compartments namely the dirty room, the shower room and the clean room. Each compartment should have a minimum size of 2m (height) x 1m (width) x 1m (length). The size of the shower room should be 1m square and 2m headroom for every shower head provided. Appropriate warning notices should be posted conspicuously at eye level at the clean entrance of the decontamination unit.
- D1.2 The unit can either be of a prefabricated design (thoroughly cleaned and decontaminated before re-use) or it can be constructed on site with 3 individual layers of plastic sheeting with sealed taped joints supported on suitable framing.
- D1.3 Each compartment is separated by a curtained doorway consisting of a polythene sheet with an I-shaped slit opening covered by a plastic flap which hangs and lifts in the direction of access. The plastic flap should have an overlap of at least 100mm on each side of the slit opening and weighted at the bottom to maintain a good seal.
- D1.4 The shower room should be constructed and tested against water leakage and fitted with a tray of adequate size to collect waste water. Water adjustable at the shower should be provided at a minimum of one shower per 6 workers calculated on the basis of the largest shift. All waste water should be taken by a sump pump through pipework/hosing to an aquarium type filter unit to remove suspended particles (down to 5 microns) before being discharged either to the soil drainage system or drummed and then properly disposed of. The sump pump should be switched on while the facility is in use to prevent overflow of waste water. The electrical fittings, etc. must also be installed and protected to eliminate any chance of electrocution.
- D1.5 The shower room should be wet-cleaned and HEPA-vacuumed after each shift change and meal break.

D2 Use of Decontamination Facilities

Procedures for Using the 3-chamber Decontamination Unit

Preparing for work

IN THE CLEAN ROOM, WORKER:

1. Removes clothing, places in locker
2. Puts on nylon swim suit (optional) or disposable underpants
3. Puts on clean coveralls
4. Puts on separate disposable foot coverings if necessary
5. Applies tape around ankles, wrists, etc.
6. Inspects respirator, puts it on, checks if close-fitting
7. Puts on hood over respirator headstraps
8. Proceeds to Equipment Room

IN THE EQUIPMENT ROOM, WORKER:

9. Puts on any additional clothing - deck shoes, hard hat, etc.
10. Collects necessary tools and proceeds to Work Area

Exiting

IN INDIVIDUAL WORK AREA, WORKER:

11. Cleans tools and equipment by HEPA vacuum cleaner and wet-wiping
12. HEPA-vacuums or wet-wipes protective clothing
13. Leaves the work area and enter the Equipment Room of the decontamination unit for further cleaning and disinfection

IN THE EQUIPMENT ROOM, WORKER:

14. Removes all protective clothing except respirator
15. Wipe-cleans the hands and the respirator externally
16. Disposes of used wet cloths and contaminated coveralls into the labelled asbestos waste bags
17. Stores used tools and any other cleaned articles
18. Proceeds to Shower Room

D2 Use of Decontamination Facilities (cont'd)

IN THE SHOWER ROOM, WORKER:

19. Washes respirator and soaks filters (without removing)
20. Removes respirator, discards used air filters and washes the face piece with soap and water
21. Washes swim suit if applicable, or places disposable underpants and used air filters in the bag or bin placed inside the Equipment Room
22. Thoroughly washes body and hair
23. Proceeds to Clean Room

IN THE CLEAN ROOM, WORKER:

24. Dries off, dresses in clean coveralls or street clothes
25. Cleans and dries respirator, replaces filters (if applicable)
26. Leave the Clean Room

PRELIMINARY DECONTAMINATION

After the completion of the decontamination facilities, the segregated areas should be pre-cleaned systematically by HEPA-vacuuming and wet-wiping methods. Procedures of preliminary decontamination as outlined below should be followed.

- D3.1 Workers should wear half-face respirators and protective clothing.
- D3.2 All openings of the segregated areas such as windows, corridors, doors, grilles, floor drains and power points should be individually sealed off with 2 layers of polythene sheet securely taped in place. HVAC ducting or other system components that pass through the work area should also be enclosed with 2 layers of polythene sheet.
- D3.3 If the asbestos-containing materials have been damaged or in poor condition, the whole unit might have been contaminated with released asbestos fibres.
- D3.4 Immediate repair to these damaged asbestos-containing materials to curb further deterioration should be carried out, but care must be taken not to disturb any of the other part of the asbestos-containing materials unnecessarily.
- D3.5 Movable objects within the areas should be decontaminated before being removed.
- D3.6 Those objects which would remain should be decontaminated and enclosed with a minimum of 2 layers of polythene sheeting sealed to protect from re-contamination.
- D3.7 Large asbestos debris should be collected and removed by hands. The work areas will be pre-cleaned by HEPA vacuuming and wet-wiping methods.
- D3.8 All used filters as well as contaminated cloths, etc. should be removed and packed for disposal as asbestos waste.
- D3.9 The segregated areas should be vacated for 12 hours to allow fibres to settle. All objects and surfaces in the area should be HEPA vacuumed and wet cleaned for a second time.
- D3.10 A visual inspection should be carried out by the Consultant who should verify that preliminary decontamination has been satisfactorily completed and the area deemed temporarily uncontaminated. The acceptance criterion should be free of visible debris and dust.
- D3.11 Background air sampling may therefore be conducted.

Annex V – Emergency Procedures

EMERGENCY PROCEDURES

E1: Procedures in the Case of a Fire Outbreak

If during the course of asbestos abatement work, a fire breaks out, the Contractor should immediately:

1. Stop all work.
2. Leave the work area and follow normal decontamination procedures. For life-threatening situations, however, decontamination should take a lower priority. The operatives evacuated from the containment should avoid contact with other parties to prevent spread of asbestos fibres unless proper decontamination has been performed.
3. Switch off power fuel supply to machinery and plant.
4. Seal up the decontamination unit with adhesive tape.
5. Leave the premises as quickly as possible.
6. Urge and assist other workers on the premises to leave if necessary.
7. Supervisor should take roll calls for the workers.

After Fire

8. Spray all surfaces and debris with amended water in a fine mist spray, using airless spray equipment, when the site is safe for re-entry.
9. Place all loose asbestos materials/debris into suitably labelled containers.
10. Wipe clean the surfaces and thoroughly clean the contaminated area with a HEPA vacuum cleaner once the surfaces become dry.
11. The works are allowed to proceed only after a satisfactory visual inspection by the Consultant.

E2: Procedures in the Case of an Accident

If during the course of asbestos abatement work, a worker collapses or some other accident occurs, the Contractor should immediately:

1. Stop all work and if necessary remove worker or workers to safety.

2. Assist the victim(s) to follow normal decontamination procedures before exiting the work area. For life-threatening situations, however, decontamination should take a lower priority and every effort should be made to ensure the victim(s) receives immediate medical treatment.
3. Carry out normal Emergency First Aid procedures. Dial 999, and arrange for the victim(s) to be taken to a Hospital, if necessary.
4. Clean thoroughly any area contaminated during the emergency by wet-wiping and HEPA vacuuming at the earliest opportunity and ask the Consultant to verify before works are allowed to continue.

E3: Procedures in the Case of a Rainstorm or Typhoon

If during the course of asbestos abatement work, a rainstorm warning signal or Typhoon Signal Number Three or above is issued, the Contractor should immediately:

1. Stop all processes which would result in producing more asbestos debris.
2. Place all loose asbestos materials/debris into suitably labelled containers and remove to the secure storage area.
3. Clean the contaminated area thoroughly with a HEPA vacuum cleaner. Cut off all power and water supplies and secure all loose equipment and materials against rain-storm or typhoon damage.
4. Move all bags of asbestos waste to a secure storage area.
5. Prepare the site for visual inspection by the Contractor, who shall verify that the above measures have been carried out, before workers are allowed to leave the site.
6. Recommence the abatement work only after the rainstorm signal has been cancelled, or after Typhoon Signal Number Three has been lowered in the case of a typhoon, and the Consultant has verified that any necessary cleaning up work and repairs to the setup have been completed.

E4: Procedures in the Case of Exceeding the Environmental Limits

If during the course of asbestos abatement work environmental air samples collected at the periphery of the site during abatement indicate fibre counts greater than 0.01 fibre/ml, the Contractor should immediately:

1. Stop all work immediately for inspection and remedy.
2. Inform the Consultant of the exceedances immediately.

3. Clean up all surfaces outside within 6 m from the working area by HEPA vacuuming and wet-wiping methods.
4. Carry out air monitoring and the test results should be reviewed by the Consultant.
5. Recommence the abatement works when the Consultant is satisfied with the results of air monitoring test and visual inspection.

E5: Procedures in the Case of a HEPA Air Mover Breakdown

If during the course of asbestos abatement work the HEPA air mover breaks down, the Contractor should immediately:

1. Stop the work.
2. Evacuate all work personnel and follow normal decontamination procedures.
3. Seal the exhaust outlet of air mover with plastic sheeting, and the decontamination unit and the debris port with adhesive tape to prevent asbestos fibre released from the containment.
4. Monitor all adjacent areas for increases in the airborne fibre level.
5. Switch on the standby air mover.
6. Check to ensure that a static negative pressure of 1.5 to 4mm (approx. 0.05 to 0.15 inch) water gauge is maintained inside the containment across all faces.
7. Recommence the abatement works.

E6: Procedures in the Case of Flooding

If during the course of asbestos abatement work the work area is flooded, the Contractor should immediately:

1. Stop the work.
2. Evacuate all work personnel and follow normal decontamination procedures.
3. Shut off the leaking pipe.
4. Use the sump pump to drain the work area.
5. The Contractor should check the condition of the segregated area and repair any damaged area.
6. Recommence the abatement works after the above measures have been carried out.