Asbestos: Investigation, abatement & management

Reporting Guidelines Module No. 4: Factories, Industrial Plant and Plant Rooms

A supplementary guide to the Code of Practice on Preparation of Asbestos Investigation Report, Asbestos Abatement Plan and Asbestos Management Plan

Asbestos Management and Control Section
Environmental Protection Department

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Introduction

The change from a manufacturing economy to a service economy over the past few decades in Hong Kong has led to a reduction in the number of factories and industrial plant. However, manufacturing industries and industrial areas still exist, and plant rooms are common to many different building types. Asbestos containing materials (ACMs) are common in all types of factories and industrial plant and plant rooms throughout Hong Kong. Industrial plant – even when of fairly recent installation – can contain a variety of ACMs, and investigations should take place prior to engineering works and plant replacement. All types of plant can contain a whole range of ACM products due to the requirement for heat and acoustic protection, hot water/steam supply, ventilation/air conditioning, electrical systems and extraction of waste gases/liquids. ACMs are common to electrical supply systems and air conditioning or ventilation extract systems and these occur in many types of premises. Apart from the plant, the buildings themselves can be constructed from, or contain, a variety of ACMs, including roof and wall sheeting, coatings to support beams and columns, wall and ceiling partitions and floor coverings. There is pressure from society to re-zone industrial areas for other uses, and it is important that owners carry out an asbestos investigation of their premises before removal of plant and equipment. In view of the implementation of a total ban of asbestos, including import and installation of new ACM products since 4 April 2014, the occurrence of these materials in industrial plant will reduce over time. However, the Registered Asbestos Consultant (RAC) should be aware that industrial premises and plant rooms in all types of premises of very recent age can still contain ACMs.

A comprehensive inspection of industrial premises and plant rooms can be difficult to when they are in operation. For example, inspection of plant such as electrical control systems, steam supply, incinerators etc., pose electrocution and burn hazards if operational. High ceilings and large number of plant installed can obscure smaller ACM items and make access difficult. Flues and chimneys often need work platform or scaffold access to inspect. Older plant rooms have had repeated maintenance works since commencing operation – making it a challenge to identify remaining ACMs from redundant services, fixtures and fittings. Asbestos containing plant items can occur along with non-asbestos replacements. There is often a mix of asbestos and non-asbestos compressed fibre gaskets.

Whilst the procedures and advice detailed in the EPD's Code of Practice on Asbestos Control "Asbestos Work Using Full Containment or Mini Containment Method" and the General Guidelines should be followed, these additional guidelines have been produced for preparation of asbestos investigation reports (AIR) and asbestos abatement plans (AAP) which are suitable for industrial premises and plant rooms. Implementation of asbestos management plans (AMP) are considered good practice for these premises in respect of the large quantity of ACM or other considerations in asbestos abatement program which will be specified in this guidelines.

PART ONE: PREPARATION OF ASBESTOS INVESTIGATION REPORT

Section 1 – Asbestos Investigation Planning

1.1 Planning for the asbestos investigation of industrial premises and plant rooms should follow the procedures described in the General Guidelines with the following additional measures specific to factories and plant rooms:

- Planning for investigation of industrial premises may be best carried out by assessing separately the plans to inspect the building structure itself and the plant. The scope of works will depend on the Employers aims and expectations. Inspection of building structure and investigation of plant will have differing access requirements and constraints. Although the scope of works may be just an inspection of plant prior to replacement, the RAC should encourage the investigation of the surrounding building structure and fittings. Dismantling and removal of large plant items and installation of new plant can affect a building structure – through accidental impact damage, requirement for removal of parts of roofs/wall for access to remove plant etc.
- Plant removal and replacement may not require much disturbance to flues and chimneys and extract systems, however, it is highly recommended that these items are included in the investigation because high risk ACM is a common occurrence, and accidental damage may occur to them during engineering works. Inspection of these items – particularly in a high rise building - may require arrangement with building management and other building users for access and arrangement of scaffold or other work platforms for high level inspections.
- Determine when the site is safe for access. Inspection of electrical plant and control systems in particular are best arranged for when they are not in use to avoid electrocution hazards. Plant operating at high heat, such as boilers, steam supply, incinerators etc., pose burn hazards. Therefore, if it is at all possible, inspections of plant rooms should be timed to coincide with maintenance periods when the plant is shut down for inspection. However, it is recognized that some critical plant cannot be shut down purely for asbestos inspection, and the RAC must plan for what sort of inspection is possible and record constraints and areas of uncertainty.
- As standard good practice for inspection of factories and plant rooms containing hazardous plant the RAC should agree the use of permit to work procedures with the Employer. Coordination with other specialist contractors should be made to assist the inspection in respect of other hazard issue.
- The RAC should explore options with the Employer to return once dates for any plant shut down are known.
- The RAC should ask the Employer if as-built drawings are available for plant rooms and if original maintenance manuals for plant are available. Studies of these documents can help identify possible concealed ACMs.

Section 2 – Site Inspection

2.1 **Preliminary site walkthrough and assessment**

The initial phase of investigation of industrial premises and plant rooms shall be a brief walkthrough and should include an inspection to assess if all procedures outlined at the inspection planning stage are suitable and can be implemented. On site checks should follow the procedures described in the General Guidelines with the following site specific measures:

- Check if plant has been isolated and that permit to work forms are available. If plant is still live check which areas of the rooms are safe to access and inspect.
- Often in large plant rooms and those which are critical to building operation, plant maintenance or replacement is arranged in phases. The asbestos inspection should therefore be planned to coincide with these phases and take place as plant is being decommissioned and dismantled. The initial site walkthrough stage of an asbestos inspection should be used by the RAC to classify plant as those containing visible ACMs and those with no visible ACMs but requiring inspection during dismantling. Assess access to floor and wall ducts and whether they can be adequately inspected.
- Plant rooms often have a high ceiling height, and arrangement for ladders or work platforms may be necessary for the inspection. Check if access is sufficient for a comprehensive inspection.
- Check any available as-built drawings against current site situation. Identify if original pipework and flues/chimneys have been removed or relocated and identify locations for inspection to check for buried remnants in walls, service voids etc.
- Inspect the external flues and chimneys and assess how access is going to be safely made.
- Seek help from other specialist contractors, if necessary, to identify any preliminary areas of concern for investigation, e.g., trip, fall, electrocution or burn hazards, dioxin hazard for incinerators, etc., and detail the proposed remedial actions for investigation.

2.2 At the end of the investigation planning stage, and with results obtained from the preliminary walkthrough, the RAC should be in a position to produce a risk assessment of the planned investigation for submission to the Employer.

2.3 **Site Inspection**

The RAC shall enter the factory or plant room using whatever access precautions have been decided upon during the pre-planning and site assessment stage. The asbestos investigation should be carried out as described in the General Guidelines with the following site specific procedures:

- Classify pipework and plant by the inspection that has been carried out:
    - Already asbestos hazard labelled.
    - Accessible items checked, Plant opened for inspection and ACMs present/not present.
    - Not available for inspection and ACM presence assumed due to age or type of plant, or not assumed to contain ACMs due to type of plant or recent manufacture date (note that this option is not acceptable for inspections prior to demolition).
    - Types of ventilation extract and air conditioning systems present.

  - Types of pipe and plant insulation present.
  - Types of pipe/plant flange gaskets present.

- Access to all areas is important or ACMs may be missed. Investigation of service ducts inside the premises must take place. However, at all times the investigation of the plant room, high ceiling areas and external flues/chimneys should be carried out with due regard for personal safety. Areas not inspected shall be clearly detailed in a section of the AIR dedicated to listing inaccessible areas/plant, and also included on site drawings. The default action for un-inspected areas shall be to assume ACMs are present.
- During the investigation the RAC must inspect for and take note of pipe and plant insulation materials and any associated flange gasket material. Relying on random bulk sampling of insulation materials is not sufficient to find and identify all potential ACMs. The investigation of insulation materials is recommended to be undertaken as follows:
  - Identify all suspect plaster/cloth/rope pipe insulation, but do not disturb the material until bulk sample analysis confirms as ACM or non-ACM. The outer cement render common to pipe insulation should also be included in bulk sampling before disturbance.
  - Closely investigate insulation and assess how homogeneous the material is. It is common that, during the lifetime of a factory or plant room, engineering alteration works, plant replacement or repairs through water leakage, valve replacement or impact damage, may have resulted in replacement or repairs to short lengths or areas of insulation. This can result in a mix of ACM and non-ACM insulation materials being present. Differing surface hardness, variations in insulation thickness or smoothness of outer coating, or differing paint colour can all indicate that replacement insulation is present. Differing insulation is common to pipe elbows – particularly where preformed lengths of insulation have been used for straight pipe runs. All of these areas should be visual checked and bulk sampled if different insulation is suspected to be present. Modern, preformed sections of outer metal cladding to pipes and plant are common in some plant rooms and can give the impression that the insulation materials beneath are of recent installation. This is very misleading and older ACM insulation materials can be present. The RAC should arrange to remove sufficient metal cladding to enable a full inspection. This may require arrangement with the client and an engineering contractor employed to re-install cladding – particularly where fixed by rivets.
  - Although a flue, pipe or plant may have non-asbestos insulation, the gasket material used in flange joints may be asbestos – friable asbestos rope/cloth or non-friable hard non-woven sheet gaskets materials. Flange gaskets should be checked, but can be difficult to access for sampling or even dangerous if a burn hazard is present. The RAC should discuss with site engineers about what materials have been installed and make arrangements to make a return inspection when flange joints can be dismantled for inspection. Premises workshops may contain examples of the materials used for flange gaskets , gland packing etc.

- It sometimes occurs that flue, pipe or plant insulation can have two or more types/layers of different insulation. Therefore, whilst insulation that is visibly, or by analysis, confirmed to be ACM should be left undisturbed, insulation that is visibly non-ACM, eg. canvas, glass fibre, polystyrene, foam etc., should be subjected to further investigation. Plaster insulation confirmed by analysis to be non-ACM should also be included in these further investigations as follows: a sharp edged tool, such as a screwdriver or knife, should be used at very regular intervals to check for concealed layers of different insulation. Investigation should be made down to the metal of the pipe/plant. Glass fibre insulation with an inner layer of asbestos rope or cloth is particularly common in Hong Kong, and glass fibre insulation with asbestos plaster to pipe/flue elbows also occurs. The RAC should make enough inspections to ensure that these materials are not missed. Glass fibre insulation is commonly covered by an outer canvas wrap. The string used to stitch the edges of the canvas wrapping together can be asbestos string and should be checked. Pipe valves in particular are prone to replacement or repair and can have differing insulation to pipes either side.
- Even when pipe insulation is visibly non-ACM and inspections show no concealed layers, asbestos cloth or asbestos sheet gasket material has sometimes been used to line the metal pipe support brackets. Therefore, both exposed brackets and those covered by insulation should be checked.
- During the bulk sampling exercise, the RAC should closely supervise the laboratory technician and ensure that full depth bulk samples are taken to ensure that differing insulation layers are sampled. Inspection of sample holes before repair, or the technician reporting differing resistant to the sampling tool can all indicate differing insulation layers. Inspection of the base of a sample hole should always show the bare metal of the pipe/plant to ensure full-depth samples have been taken.

- It is important to carry out a thorough inspection of the floor of industrial premises – particularly around areas where original plant has been removed/replaced and in the base of ducts. Older plant may have been removed in the past without a thorough investigation for ACMs. This can result in ACM debris being left on floors – especially remnants of rope/cloth insulation and hard gaskets. An assessment of potential contamination may have to be made and recommendations given for a remedial decontaminationInspection of plant, such as boilers, calorifiers, incinerators, electric generators should not only check outer insulation materials but must also check for flange gaskets and possible concealed materials as follows:
  - Outer metal casings should be removed to check inner insulation and for gaskets. Inspection should be limited at first to check that outer metal sheeting is not lined with ACMs such as asbestos paper. If this material is present it should be sampled but the cladding left further undisturbed and the plant listed as not fully inspected.
  - Plant rooms with multiple boilers / calorifiers / incinerators commonly rotate the operation of plant leaving down-time for inspection and maintenance. Arrangements should be made to carry out internal inspection of plant during these maintenance periods.

- Inspections should include for multiple layers of insulation, gaskets to flange joints to pipes, burner units and flues. Boilers and incinerators constructed of sectional metal parts can have internal gaskets or packing that can only be identified during dismantling of the plant. Plant is commonly sited on concrete plinths. Check that no suspect insulation materials or sheet linings are present in these areas. Arrangements should be made with the Employer to return for further inspections when this takes place. Service manuals to all plant should be read where available to check for any concealed ACMs. This can reduce the need for inspection during dismantling.
- Inspection of flues to plant and any chimneys they lead to must take place at regular intervals along their length – at least at the base, midway and at exit from the plant room to check for differing insulation or remnants of old ACM insulation. If inspection is not possible along the full length of a flue or chimney, this must be stated in the AIR and uninspected sections marked on drawings. Even though a flue may have non-ACM insulation, inspection hatches or ash collection doors can have asbestos gaskets – both to the interior lining to the hatch, or as a door seal on the hatch and/or flue. Many boiler and generator flues are welded metal pipes and flange gaskets may only occur at connection ends or to service hatches. However, other plant items may use sectional ducting as an extract or air intake and this should be checked for flexible joints, flange gaskets and internal linings along its length. Asbestos cloth flexible joints and flange gasket material is commonly found in plant rooms. Internal insulation linings to metal ducting is less common but should always be checked for. Proprietary metal flues can have differing layers of construction including ACM layers and must be checked. This type of flue often has a manufacturers label or plate installed so an online check can be made as to whether concealed ACMs are present, or the site may have the original service manual. If the flue is not confirmed by research or dismantling as non-ACM it should be listed as not inspected and assumed to contain ACMs.
- Prior to dismantling incinerators, dust sampling for dioxin levels may be necessary, and if the RAC is unfamiliar with this hazard, they should seek expert advice prior to inspections.
- Gas supply pipes and gas burner units to boilers and incinerators often have hard non-woven pipe flange gaskets which can contain asbestos. Pipework and pumps have similar gaskets. Inspection and ACM identification of these materials is difficult due to inaccessibility for sampling, and the fact that gaskets can have been replaced many times resulting in a mix of asbestos and non-asbestos gaskets. The RAC should note differing colours and thickness of gaskets material and sample all types. Replacement sheet gasket material is commonly present either in the plant room or engineering workshops and samples can be taken of these materials as well. With the total ban on use of asbestos in Hong Kong now in force, the RAC should check that no asbestos-containing gasket material on site is still being installed and advise the Employer to dispose of all such material as asbestos waste.

- All service ducts in a factory or plant room should be inspected – both wall and floor ducts. Concealed pipes can be present in these areas with differing insulation to that used in the plant room itself. Ducts may be lined with ACM sheeting.
- Although pipes may be uninsulated or have non-ACM insulation check that no suspect packing is present around the pipes as they exit the plant room walls, ceiling or floor.
- Check walls, floor and ceiling for cut-off remnants of redundant pipework. These may have older suspect insulation still present. Some noisy plant rooms have acoustic wall panels fitted – commonly glass fibre mats with a covering perforated metal sheet. If this is a recent installation in an old plant room it may obscure any redundant cut-off pipe ends and a note should be made for return inspections when the acoustic panels are taken down.
- Although the emphasis in a factory or plant room is on an inspection of the plant and pipe insulation and gaskets, industrial premises and plant rooms also contain many other types of ACMs associated with air supply and conditioning systems, electrical control panels and fuse boxes and used as acoustic or fire protection to walls, ceilings and doors. All areas of the factory or plant room should be thoroughly checked.

Section 3 - ACM Identification

3.1 The ACMs that may be present in factories and plant rooms depends on the construction of the rooms or building, the age of the plant and associated equipment, and whether previous renovations and engineering works have taken place. The ACM Identification and Abatement Library should be referenced for details of associated ACMs that may occur. The RAC should bear in mind that this is not a definitive list of ACMs in Hong Kong and they must use their knowledge, experience and a thorough inspection to identify all ACMs on site.

Associated ACMs

3.2 The following external ACMs can occur in standalone plant rooms:

- asbestos concrete roof tiles to main roofs and podium levels
- bituminous roof coverings
- corrugated asbestos cement canopies or roof sheeting
- asbestos concrete wall grille or louvre panels
- asbestos cement wall sheeting and cladding
- asbestos powdered coating (“Galbestos”) to profiled metal sheet walls and roof
- asbestos cement drainage gutters and down pipes and soil pipes
- asbestos insulation to external hot water pipework and plant
- asbestos insulation and flange gaskets to flues and chimneys
- asbestos gaskets or flexible joints to external air conditioning/extract systems
- linings to condenser pipe support brackets
- packing materials to cable/pipe exit points
- coatings to cables exiting/entering building
- asbestos containing fuse boxes to external plant
- asbestos packing to building expansion joints.

3.3 Common internal occurrences – both to stand-alone buildings and plant rooms within premises – can include the following ACMs:

- sprayed coatings – both to ceilings, walls and support beams
- asbestos cement drain pipes
- asbestos insulation to pipework
- asbestos cloth/sheet linings to pipework support brackets, including water, steam and condenser pipes
- asbestos insulation to flues and linings to chimneys
- asbestos insulation to boilers, incinerators, calorifiers, generators and other plant, including internal joint seals and gasket materials
- Hard non-woven asbestos gaskets to pipe flange gaskets and plant room equipment
- asbestos cloth flexible joints and flange gaskets to ventilation extract systems and air conditioning systems, including internal fire dampers
- asbestos sheet linings (internal and external) to ducts
- asbestos wall sheeting and cladding
- asbestos ceiling tiles
- asbestos sheet lining to fire doors
- asbestos lining to plant plinths
- asbestos cloth blankets to wall and door louvres
- asbestos cloth fire blankets
- asbestos packing to tops of partition walls
- packing materials (cloth, rope, plaster, mastic) to cable/pipe exit/entry points
- asbestos packing or sheeting to bus bar, cables and cable trays through floor and wall slabs
- asbestos containing fuse boxes
- asbestos vinyl floor tiles and adhesive
- asbestos friction gaskets to motors such as lift brakes
- asbestos sheet gasket material and asbestos rope gland packing stored in plant room or workshop.

3.4 The above lists are not a fully comprehensive list of possible ACMs, just the most likely. It is emphasized that it is the duty of the RAC to inspect all areas for both commonly and rarely occurring ACMs. The illustrations attached as appendix B summarises typical ACMs and their locations.

3.5 The ACM Identification and Abatement Library should be consulted for all the associated ACMs listed since they provide recommended best practice for ACM identification.

Section 4 - Bulk sampling

4.1 Bulk sampling should be carried out as detailed in the General Guidelines with the following site specific procedures:

- The RAC must consider how to ensure representative sampling can be done to prove a material asbestos or non-asbestos. For example, pipe and flue insulation can differ along its length or different layers. Asbestos insulation can be concealed beneath

non-asbestos insulation and differing insulation can be used for pipe/flue bends than for straight lengths. Previous improper removal of asbestos insulation can leave debris on metal pipe/flue surfaces that are concealed beneath newer insulation. Therefore, the RAC must not just rely on bulk sample points to identify ACMs, but must carry out physical inspection of pipe and flue insulation, removing non-ACM insulations to inspect beneath at regular intervals along pipe/flue runs. This also applies to inspection of services in wall and floor ducts.

- Best practice advice for bulk sampling is included where necessary in individual ACM Identification and Abatement Library sheets for the associated ACMs.
- Any sampling of elements of plant that is to be returned to working order shall require the prior permission of the owner. The RAC should use visual identification, where possible, to avoid damage.
- Where factories or plant room demolition is to occur, or plant is to be replaced as part of engineering works, all affected plant should be dismantled sufficiently for the RAC to identify all suspect materials inside and allow access for sampling by the laboratory. The RAC should attend all dismantling of plant and stop the procedure before any suspect ACMs are disturbed. The principal shall be to totally dismantle plant to prove no ACMs present or sufficient dismantling to prove ACMs present but not disturb them. Partially dismantled equipment with ACMs identified can be listed as having additional suspect concealed ACMs still present.

Section 5 – Material and Hazard Assessment

5.1 The general guidelines for production of material and hazard assessments should be followed. Industrial premises and plant rooms can contain a wide variety of ACMs, both low and high risk. Throughout the investigation the RAC should record all details necessary for a proper hazard assessment. Human occupation of industrial premises and plant rooms varies dependent on the use and labour requirements of the industrial process. Some premises have very low human activity, others constantly high. The RAC should discuss with the building user the extent and frequency of human activity to make a realistic assessment of the likelihood of their activities disturbing ACMs. Industrial and plant room premises are susceptible to accidental impact damage and water / steam leaks and the effects of these should be fully considered. ACMs can occur at all height levels. If ACMs are present at low level, or as wall boarding, accessible pipes etc., assessments should be made of how supplies and products are moved through the premises to check likelihood of potential impact damage – should precautionary measures such as enclosure etc., be implemented to reduce the hazard? Material assessments can be complicated when long ACM pipe/flue runs have differing assessments along their length. Hazard assessments can be similarly complicated when long pipe/flue runs pass through differing room/occupation types. Differing assessments for differing areas may be necessary. It may therefore be helpful for material and hazard assessments for industrial premises to detail assumptions made and opinions held so that the assessment is more understandable and any disputes over the assessment can be more easily discussed.

5.2 Should any ACMs be identified which are in a poor condition, then the RAC should immediately report these to the Employer and recommend remedial measures.

Section 6 – Format of Asbestos Investigation Report

6.1 The requirements of the Code of Practice and general guidelines for the expected format and contents of the AIR should be followed.

6.2 The AIR should include the following information specific to factories and plant rooms:

- Details of the risk assessment made prior to investigating the site and the precautions taken to access the site/plant for inspection.
- Because operating plant can be difficult to fully access and inspect, the AIR section and drawings detailing inaccessible areas should be comprehensive. The default assumption for inaccessible plant is that ACMs exist inside unless the items can be proved to be of recent manufacture. Many plant items contain manufacturer labels which provide such details. Assumptions made should be consistent with ACM identification elsewhere as well as predicted on the type of use of the plant. If plant of the same model type/manufacturer/age has been fully inspected on other sites, ACM content can be extrapolated to the current site.
- If differing insulation types are present, particular pipes/plant with differing insulation layers, the AIR should include full details of the extent of inspection including photographs detailing the inspections made. Confirm that pipes and flues have been traced from source to factory/plant room exit.
- Detail the inspection of the existing plant, has it been renewed or re-located? Confirm that no suspect debris exists on floors or in ducts caused by removal of plant.
- The RAC and owner of premises are encouraged to submit AIR to EPD even if the report indicates that the premises has no ACM or if only exempted ACM is found.
- Detail APCO requirements on asbestos reporting and abatement from factories and plant rooms – refer to section 7 of the general guidelines for further details.

Section 7 Meeting Environmental Requirements and the respective Codes of Practice

7.1 The general guidelines for preparation of AIR & AAP should be studied for advice and recommendations for preparing the report. The guidance in this AIR/AAP module should be studied to produce a specific AIR / AMP / AAP for EPD's vetting and comment.

7.2 The RAC and owner of premises are encouraged to submit AIR to EPD even if the report indicates that the premises has no ACM/exempted ACM found.

7.3 The RAC shall ensure that the AAW are carried out in compliance with other environmental / health and safety regulation, and shall include such measures in the submitted AAP / AMP.

PART TWO: PREPARATION OF ASBESTOS ABATEMENT PLAN

Section 8 – General Specification Requirements

8.1 The general guidelines for the preparation of Asbestos Abatement Plan all apply for the preparation of an AAP for factories and plant rooms. However, some of the general requirements may need further consideration and adjustment to make them relevant and applicable to these type of premises. Functioning factories and plant rooms can be a problem to access and work in. The common occurrence of high risk ACMs, often in difficult access locations with problems for erection of full containment work zones, can require the general specification to be expanded to include additional specifications – such as scaffolding design and erection. Asbestos abatement should be carried out only when surrounding areas can be shut down and vacated. This specifically applies to removal of pipe and plant insulation. Insulation removal from hot pipes is difficult, causes problems of heat stress and thorough cleaning of metal surfaces. The RAC should consider the requested scope of asbestos abatement and liaise with the Employer to discuss options for abatement. Review the following requirements to ensure the Registered Asbestos Contractor can meet the general specification for the abatement works:

- Responsibility to isolate both electric and gas supplied plant.
- Site access requirements – any particular access restrictions for vehicles, security arrangements?
- Fire safety requirements? Some premises storing toxic or flammable materials have strict fire safety requirements and timber frames for work zones or timber step ladders may not be allowed. For abatement works with incinerators will dioxin containing ash removal be part of the works?
- Industrial premises can have high ceilings. Are temporary work platforms required? Which type is suitable and what protection measures are necessary to avoid contamination during abatement?
- Which plant requires shut down and which pipes isolation and draining of water? Do any new pipe connections/valves / diversions need to be installed to allow work on pipes/plant. If some plant has to remain in operation, will construction of asbestos work zones prevent access or air supply?
- Review removal of insulation from pipework. EPD requirement is for pipes to be wrapped and cut out in whole lengths for disposal as asbestos waste. Advise the Employer of this requirement to allow for any planning of new pipe installations.
- Storage of equipment
- Review the specification for waste handling and disposal.

Section 9 – Method statements for asbestos abatement

9.1 The method statements for asbestos removal should follow the format detailed in the General Guidelines as follows:

- Introduction and description of work
- Work zone setup
- Inspection of work zone setup
- Asbestos removal and inspection
- Air monitoring
- Waste management

9.2 **Asbestos abatement:** The standard general guidelines for specifying asbestos abatement inside work zones should be followed – dependent on the ACMs being removed. Procedures specific to industrial premises should also include:

- Details on measures for minimizing fibre release. Applicable to both segregated and full containment work zones, details must be provided on how the Registered Asbestos Contractor will sufficiently wet friable ACMs to reduce the release of fibres during waste collection, disposal and cleaning of the site.
- Detail the sequence of asbestos abatement work. High level elements should usually be removed first.
- When ACMs are contained within plant or equipment, detail abatement measures and cleaning of adjacent surfaces. Detail how any plant to be left in-situ can be satisfactorily cleaned and inspected or protected from contamination during asbestos abatement work. The RAC should specify the disposal or retention of all materials in the work zone. It should be noted that economic cost is not the controlling factor but it could still be considered if various practical remedial options are available.
- If the AIR has reported any uncertainty about tracing of pipes from source to outlets, the AAP should detail any measures for further tracing and breaking out of pipes in work zones.
- Flues and chimneys are difficult to remove. Access is usually a problem and work zones can impact on adjacent residents. The ACM Identification and Abatement Library sheet for these items should be studied for advisable abatement measures. Work procedures that need careful consideration are scaffold erection, work zone erection on the scaffold, protective measures for window openings adjacent to the work zone, whether power tools have to be used during any non-asbestos works. If asbestos flange gaskets are present and the flue needs to be dismantled, consider loading on work platforms as they are dismantled and require regular transfer out of work zone.
- If plant is to be dismantled during the abatement work, describe the procedures step by step, detail when and if the RAC shall enter the work zone to inspect or take samples from the plant. If large metal pieces have to be handled, consider how the contractor is to do this. Will lifting gear such as block and tackle be required, how will it be incorporated into the work zone and protected from contamination or cleaned? Detail the requirement for photographs to be taken of the process for submission to EPD as part of the completion report.

- In hot plant rooms liaise with the Employer and Registered Asbestos Contractor / general contractor and agree on shorter working shifts and other measures to remedy heat stress. If this is a serious issue, then the Emergency Procedures section of the AAP should include specific measures for monitoring personnel and actions to be taken in case of collapse or burns.
- For partial abatement works, the abatement plan should detail measures for RAC inspection after completion of works to check condition of ACMs left in-situ and requirement for asbestos hazard labels to be fixed and maintained.

9.3 Reference should be made to the ACM Identification and Abatement Library for the ACMs associated with factories and industrial plant. These reference sheets provide specific advice for the preparation of AAP and inspection of abatement works that should be included in the AAP prepared.

Section 10 – Asbestos Work Zone Plans

10.1 The work zone plans should follow the format detailed in the General Guidelines and any specific advice for ACMs associated with factories and plant rooms detailed in the ACM Identification and Abatement Library.

Part 3: PREPARATION OF ASBESTOS MANAGEMENT PLAN

Section 11 – Preparation of Operation and Maintenance Plan

12.1 Following an asbestos investigation, if ACMs are to remain in-situ in a factory or plant room, the RAC should recommend to the Employer that an operation and maintenance plan (O&MP) is prepared and implemented for the identified ACMs.

12.2 Section 9 and 10 of the EPD's Code of Practice on Asbestos Control "Preparation of Asbestos Investigation Report, Asbestos Management Plan and Asbestos Abatement Plan" provides details on the requirements for the production of an O&MP, and the document that the RAC prepares should comply with these requirements.

12.3 In addition to guidelines detailed in the CoP, the RAC is advised to consider the following further measures specific to preparation and implementation of O&MP for factories and plant rooms:

- Organization chart for implementation of the O&MP should include details of the building management for large industrial premises occupied by more than one company. ACMs such as a flue or chimney, may pass through areas of the building outside of the owners control. It is possible that contractors employed to renovate building exteriors could disturb ACMs on flues/chimneys, particularly during scaffold erection, and any group of people who could commission such works should be included in the implementation of the O&MP.
- The condition of ACMs, or assumed ACMs, concealed in premises or plant will be difficult to record and monitor unless inspections are synchronized with regular maintenance inspections of plant. If ACMs have only been assumed to be present – pending confirmation on future inspection – then the condition, type, quantity of ACMs will have to be amended in both the AIR and O&MP as opening-up and inspections allow. The O&MP should detail this requirement.
- Hazard labelling of ACMs – whilst it can be done on the outside of plant – should also be carried out internally where possible as plant is opened up for inspection. Direct labelling of internal ACM components will help prevent disturbance. Obviously, the RAC will have to use their discretion about this labelling and ensure that it does not affect the operation of the machinery or cause a fire hazard. The Employer should be consulted about advisability.
- The RAC should discuss staff turnover rates with the Employer. If they are high, the implementation of staff asbestos awareness training will need careful consideration.
- All engineering contractors employed to work in the premises should also undergo the asbestos awareness training if they frequent the site regularly. The Employer should operate a permit to work system for all work involving contractors and their sub-contractors. The system should be devised so that the Employer is certain that all sub-contractors have been included to ensure no accidents due to communication chain breakdown between themselves and the main contractor. Pro-forma acknowledgement letters signed by all workers visiting the plant room can be used to record awareness of ACMs on site.
- The EPD's CoP recommends a surveillance scheme of re-inspection once every two years. However, the RAC should assess the amount of ACMs in the premises, the

quantity of high risk ACMs, their location and the likelihood of damage in a plant room. It may be advisable to have shorter re-inspection periods.

- Introduction of any materials containing asbestos into premises is now totally banned in Hong Kong. Operators of industrial premises and plant rooms are at risk of not meeting this requirement if a monitoring and checking scheme is not implemented as part of the O&MP. This specifically applies to introduction of plant from countries that may still be using asbestos in the manufacture of their products. Also the provenance of sheeting used to produce hard non-woven plant gaskets should be checked. Electrical and engineering contractors may have stocks of asbestos-containing gasket material that could be used without the Employers knowledge. All works specifications should specify the use of non-ACM gaskets and the RAC should check the material before use. Certificates confirming no asbestos materials may not be reliable – depending on the country of manufacture – and bulk sampling and analysis is recommended in case of doubt. The O&MP should contain a section detailing the procedures for vetting new plant installation and maintenance materials.
- General electrical and plumbing contractors will have to be part of the emergency response team to assist in remedial actions for disturbed and damaged ACMs in a plant room. Their safety procedures for shut down and isolation of plant should be incorporated into the method statements for likely emergency action, and if necessary they should be included in training drills for use of personal protective equipment and ACM cleanup.
- Prior to the implementation of an O&MP the RAC should consider the requirement for any protective measures for ACMs. Impact damage in a factory or plant room, or water leaks, are always a possibility and abatement plans could include protective enclosure measures, for example timber boxing to ACM insulated pipework and flues in vulnerable areas.

Appendix A:

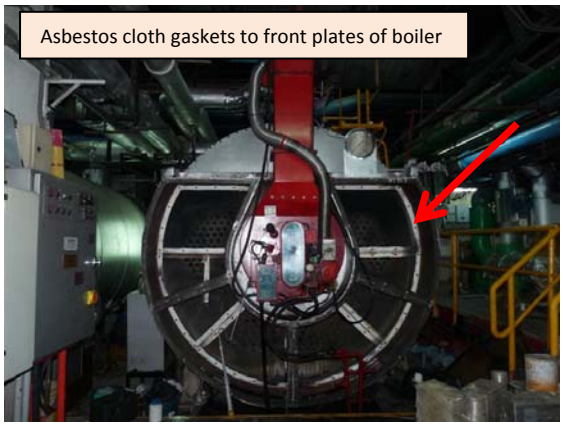
Photographs of typical ACMs in Plant Rooms

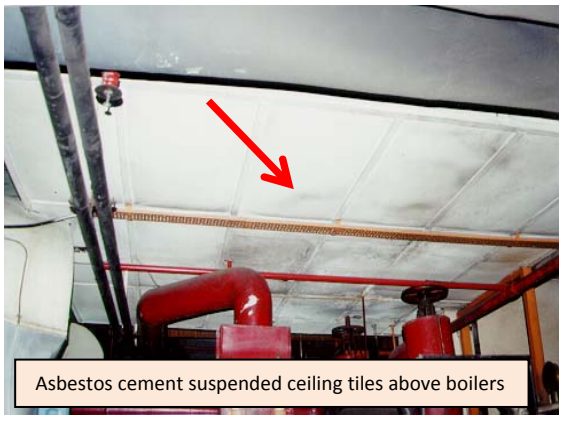

Asbestos boiler and pipe insulation

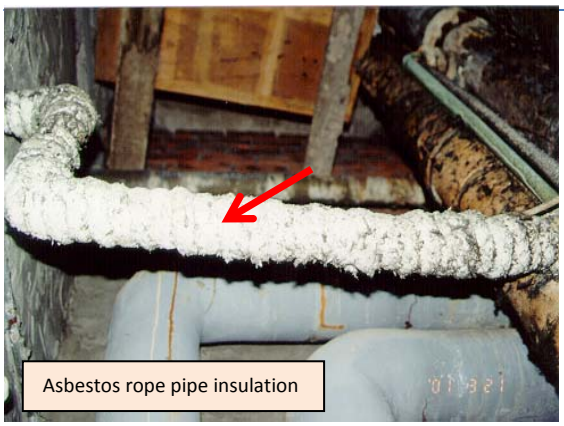

Asbestos insulation to condensate tank


Asbestos calorifier and pipe insulation


Asbestos plaster insulation to boiler flues (beneath metal sheet). Asbestos cloth gaskets to access plates.

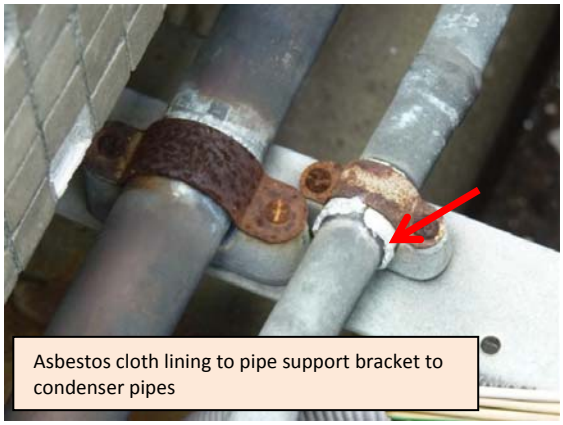

Asbestos cloth gaskets to front plates of boiler


Asbestos cement suspended ceiling tiles above boilers

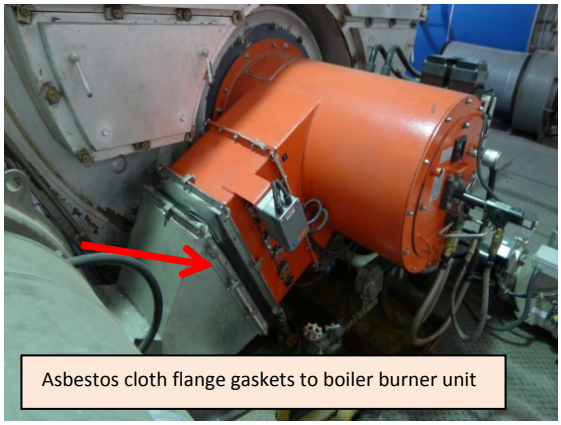


Asbestos rope pipe insulation

Asbestos cloth flexible joint to air handling unit

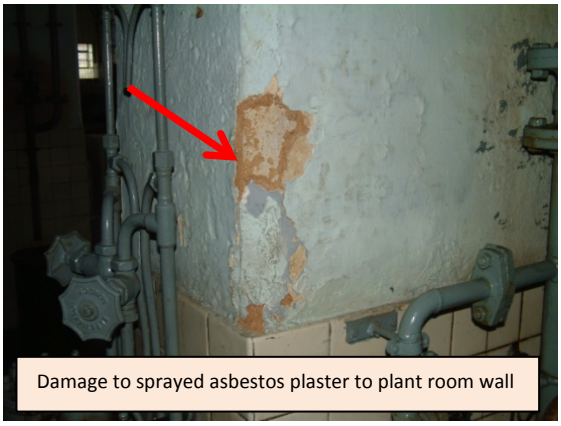


Asbestos cloth lining to pipe support bracket to condenser pipes



Asbestos cloth flange gaskets to boiler burner unit

Asbestos string stitching to canvas wrap over glass fibre pipe insulation



Damage to sprayed asbestos plaster to plant room wall

Asbestos cloth insulation to generator flue

Asbestos gasket sheets for plant flange joints

Asbestos packing to cable points through floor slabs

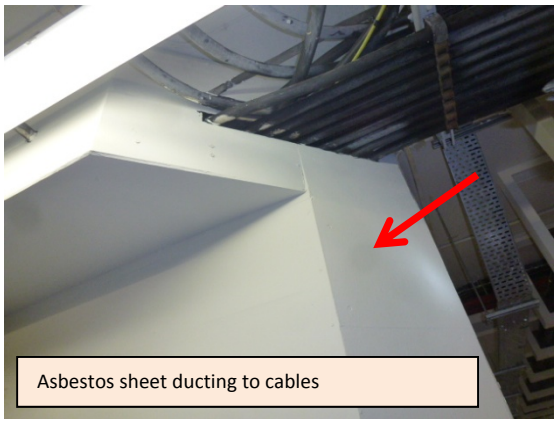
Asbestos cement wall sheeting

Asbestos cement (or coated metal) louvres and canopies

Asbestos coating to metal profile walls (“Galbestos”)

Asbestos gaskets to fire dampers in plant/walls

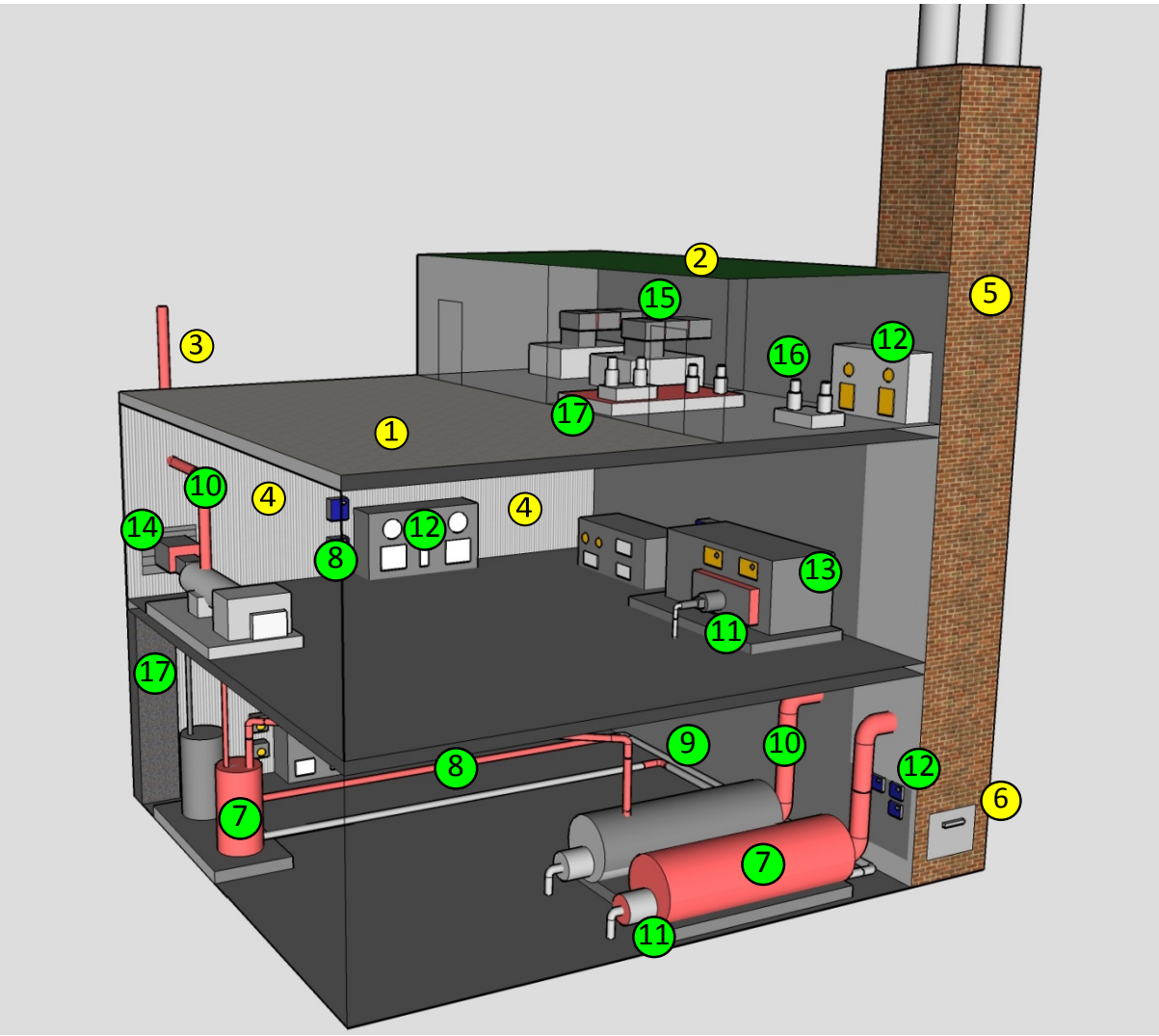
Asbestos pipe insulation in underground service duct



Asbestos sheet ducting to cables

Asbestos flue insulation

Appendix B: Illustration of typical ACM occurrences



1 *Asbestos concrete roof tiles*
2 *Bituminous waterproof roof covering*
3 *Asbestos flue insulation*
4 *Asbestos coating to profile metal wall sheeting*
5 *Asbestos lining to chimney and/or ACM flue inside*
6 *Asbestos rope seals to inspection hatches*

7 *Asbestos boiler/calorifer insulation*
8 *Asbestos pipe insulation*
9 *Asbestos insulation only to pipe elbow*
10 *Asbestos flue insulation*
11 *Asbestos gaskets to plant flange joints*
12 *Asbestos containing fuseboxes/switch board*
13 *Asbestos internal lining to incinerator*
14 *Asbestos cloth flexible joint to generator*
15 *Asbestos cloth gaskets to trunking*
16 *Asbestos gaskets to pumps*
17 *Asbestos sheet to plant plinth*
17 *Sprayed asbestos coating to steel columns*

Appendix C: Checklist for Site Inspection

Item – check for relevance	✓ or ✗	Actions required
Initial Site Assessment		
Has risk assessment been carried out, including trip/slip/burn hazards & remedial action arranged?		
Are arrangements for plant shut down necessary? Are permit to work procedures complete?		
Are as-built drawings and plant maintenance manuals available for inspection?		
Have arrangements been made for access for high level inspections?		
Are arrangements necessary to break open buried / concealed services for inspection?		
Asbestos investigation		
Identify visible ACMs. Refer to associated ACMs in the ACM Identification & Abatement Library. List their type and quantity / condition / location.		
Have all insulated pipes been inspected from source to exit? Record insulation types.		
Is their evidence of insulation repair/replacement? Will bulk sample strategy check all types?		
Have inspections been made completely through plant/pipe insulation to check for different layers?		
Have plant/pipe support brackets been inspected for suspect linings?		
Closely supervise all opening up and dismantling of plant. Stop works before any ACM disturbance.		
Has inspection of plant/pipe flange gaskets been completed, as well as workshop spare parts?		
Are there any poor condition ACMs that require immediate remedial action?		
Identify any inaccessible areas and list plant not opened for inspection. Assume ACM presence or provide justification for no ACM present.		
Take comprehensive photographic record		
Carry out material and hazard assessment of all identified or suspect ACMs		
Record details for AAP preparation		
Are phases of work zones required? Detail work sequence. Is isolation/dismantling plant required?		
Are scaffold / work platforms necessary to access ACMs? Obtain scaffold design drawings for AAP.		
Are measures necessary to prevent disturbance of ACMs by other parties prior to start of abatement?		
Assess practicality of work zone erection and ACM abatement from plant. What constraints are present?		
Are there any constraints or problems with cut and wrap method for removal of pipe/flue insulation?		

Item – check for relevance	✓ or ✗	Actions required
How will pipes/flues be sealed as they exit work zones or pass through walls/ceiling?		
Would partial removal of wall partitions allow simpler/larger work zones to be erected? What measures/checks should be made to ensure no ACM disturbance during wall removal?		
How will plant/pipes be protected from contamination during abatement of adjacent ACMs?		
Will some plant remain in operation? Detail any constraints or special provisions, eg. air supply.		
Will high room temperature be an issue during abatement works? Assess remedial options.		
Assess the ease of air movers being exhausted to open air if full containment work zone is specified.		
Assess waste quantity. What measures can be taken to reduce quantity of ACM waste?		
Assess site for access constraints and storage of waste constraints		
Record air monitoring locations for reassurance, leak and clearance air tests. Are environmental air tests necessary?		