

## **1-A. Asbestos Hazard Identification**

### **Objectives**

This compendium describes the types of asbestos and their physical and chemical properties, together with their available hazard information. It is appended by a practical checklist for hazard identification used commonly in Japan.

### **Asian Context**

Asbestos is still widely used in Asian countries, however, the basic information about asbestos hazards is lacking in the region. This compendium along with the reference documents should provide useful information on asbestos to promote better understanding of its hazard in the region and means for their identification.

### **References**

#### **IPCS Environmental Health Criteria 203 - Chrysotile Asbestos**

Available from <http://www.inchem.org/documents/ehc/ehc/ehc203.htm>

(Accessed 11 August 2011)

#### **IPCS Environmental Health Criteria 53 – Asbestos and Other Natural Mineral Fibres**

Available from <http://www.inchem.org/documents/ehc/ehc/ehc53.htm>

(Accessed 11 September 2011)

#### **Health Canada – Chrysotile Asbestos Consensus Statement and Summary – Chrysotile Asbestos Expert Panel**

Available from <http://bwcase.tripod.com/panel.pdf>

(Accessed 31 August 2011)

#### **European Commission – Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) – Risk to Human Health from Chrysotile Asbestos and Organic Substitutes**

Available from [http://ec.europa.eu/food/fs/sc/sct/out169\\_en.pdf](http://ec.europa.eu/food/fs/sc/sct/out169_en.pdf)

(Accessed 31 August 2011)

#### **International Chemical Safety Data Card for Chrysotile, World Health Organization (WHO), ICSC 0014**

Available from [http://www.ilo.org/dyn/icsc/showcard.display?p\\_lang=en&p\\_card\\_id=0014](http://www.ilo.org/dyn/icsc/showcard.display?p_lang=en&p_card_id=0014) (Accessed 28 June 2012)

**International Chemical Safety Data Card for Chrysotile, World Health Organization (WHO), ICSC 1314**

Available from [http://www.ilo.org/dyn/icsc/showcard.display?p\\_lang=en&p\\_card\\_id=1314](http://www.ilo.org/dyn/icsc/showcard.display?p_lang=en&p_card_id=1314)

(Accessed 28 June 2012)

**Cancer Control; Knowledge into Action, World Health Organization (WHO) Guide for Effective Programmes, Prevention**

Available from <http://www.who.int/cancer/modules/Prevention%20Module.pdf> (Accessed 28 June 2012)

## 1. Asbestos - General information

### **Summary of IPCS Environmental Health Criteria 53 and IPCS Environmental Health Criteria 203**

In general, the commercial term asbestos refers to a group of fibrous serpentine and amphibole minerals. The principal varieties of asbestos historically used in commerce are chrysotile, a serpentine mineral, and crocidolite and amosite, both of which are amphiboles. Anthophyllite, tremolite, and actinolite asbestos are also amphiboles, but they are rare, and the commercial exploitation of anthophyllite asbestos was discontinued. Since the turn of the century, amphiboles have not been used commercially.

Asbestos is a collective name given to minerals that occur naturally as fiber bundles and possess unusually high tensile strength, flexibility, and chemical and physical durability. Fiber bundles may be several centimeters long. Bundle diameters may vary significantly, but tend to be in the millimeter range. This has given rise to a technical grading based on fiber bundles, lengths, and diameters. However, when these fiber bundles are manipulated, they may break down into smaller units, a portion of which have dimensions in the submicron range. The asbestos minerals are not classified on a mineralogical basis, but rather on a commercial basis because of their unique properties. The asbestos variety commercially known as crocidolite is referred to in the mineralogical literature as riebeckite. The asbestos variety called amosite is known mineralogically as grunerite. All other asbestos types are referred to by their proper mineral names.

The World Health Organization (WHO) declared that the principal varieties of asbestos (chrysotile, crocidolite, amosite, anthophyllite, tremolite and actinolite) **are all carcinogenic to humans**.

#### **1.1 Asbestos hazard information**

Inhalation is the main route of exposure to asbestos fibers. The most common asbestos-related diseases are pleural plaques, diffuse pleural thickening, asbestosis, lung cancer and mesothelioma. A well known characteristic of asbestos-related diseases, in general, and asbestos-related cancer, in particular is the long latency required for the development of the disease after initial exposure to asbestos.

##### *1.1.1 Pleural plaques*

Pleural plaques are discrete fibrous or partially calcified thickened areas arising from the surface of the parietal pleura and sometimes visualized on chest radiographs. Pleural plaques are an indicator of past asbestos exposure and can develop following low level of exposures. Pleural plaques generally do not in themselves cause respiratory symptoms but can complicate other asbestos-related diseases such as asbestosis, mesothelioma or lung cancer.

### *1.1.2 Diffuse pleural thickening*

Diffuse pleural thickening can be considered as fibrosis of the pleura involving a wide surface area. It can involve both layers of the pleura, but particularly the inner lining. It is less common than pleural plaques but produces more symptoms due to the larger area affected. It is usually asymptomatic, but if extensive, it may cause shortness of breath and chest pain which usually develops 10-15 years after exposure.

Diffuse pleural thickening may occur with or without prior effusion. It may or may not be associated with asbestosis.

### *1.1.3 Asbestosis*

Asbestosis is the pulmonary scarring or fibrosis of the lung tissue itself. People with extensive asbestosis experience severe shortness of breath and even die from this disease. The development of asbestosis normally follows high level of asbestos exposures with a latency of 15-30 years. The diagnosis of asbestosis is essentially made by radiological examination (chest X-ray and/or computed tomography)

### *1.1.4 Lung cancer*

Asbestos exposure may also cause lung cancer with a latency period of 20 or more years. The risk of lung cancer increases if the individual has smoked cigarettes. Lung cancer is widely accepted as due to asbestos exposure if there is concomitant asbestosis, but the attribution is less clear with lower levels of asbestos exposure. Symptoms include chronic cough, breathlessness and chest pain as well as haemoptysis (coughing up blood), hoarseness of the voice and wheezing. Lung cancer induced by asbestos exposure is indistinguishable from that caused by other agents.

### *1.1.5 Mesothelioma*

Malignant mesothelioma is an aggressive and fatal cancer of the parietal pleural that is primarily caused by asbestos exposure. There is scientific consensus that approximately 85% of mesothelioma cases are due to asbestos exposure. In general, the risk of mesothelioma is greater for crocidolite than other asbestos varieties. Malignant mesothelioma has also been documented to develop after domestic forms of exposure, e.g., laundry of contaminated clothing. Another important scientific consensus is that smoking does not influence the risk of mesothelioma. The latency period between first exposure to asbestos and the development of mesothelioma ranges from 15 to 40 or more years. Weight loss, fever and night sweating are examples of early symptoms but may be subtle. Chest pain, breathlessness on exertion and/or pleural effusion are frequently present at the time of diagnosis. Individuals with malignant mesothelioma have a very short survival time of less than 18 months after diagnosis. Currently, there is no proven cure for malignant mesothelioma, although some treatments may prolong survival.

## 2. Chrysotile

### Summary of IPCS Environmental Health Criteria 53 and IPCS Environmental Health Criteria 203, and Health Canada – Chrysotile Asbestos Consensus Statement and Summary – Chrysotile Asbestos Expert Panel

#### 2.1 Background

The IPCS (International Programme on Chemical Safety) Environmental Health Criteria (203) was produced to describe chrysotile asbestos. **Chrysotile**, commonly referred to as **white asbestos**, is a naturally occurring fibrous hydrated magnesium silicate belonging to the serpentine group of minerals.

#### 2.2 Chemical composition

The composition of chrysotile is close to the ideal unit cell formula  $(\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4)$ . Substitution by other elements in the crystal structure is possible.

#### 2.3 Structure

Chrysotile is a sheet silicate with a basic building block of  $(\text{Si}_2\text{O}_5)_n$  in which three of the oxygen atoms in each tetradedron base are shared with adjacent tetrahedral in the same layer.

#### 2.4 Fiber properties

In terms of the relative flexibility, fibers may be “harsh” or “soft”. Chrysotile fibers generally occur with properties between these end-types. Harsh chrysotile fibers tend to be straighter and less flexible than the soft fibers. Inhalation of respirable straight fibers is known to be associated with increased penetration to the terminal bronchioles than in the case of “curly” fibers. The fibers can be classified into crude chrysotile (hand-selected fibers in essentially native or unfiberized form) and milled fibers (after mechanical treatment of the ore).

#### 2.5 Associated minerals in chrysotile ore

The mineral dusts to which miners or millers may be exposed are determined by the minerals associated with each of the chrysotile ore deposits. These depend on the composition of the original rock types and on the materials added or removed during geological events, e.g., surface weathering processes, etc. The spatial relationships among these components within ore bodies vary significantly from deposit to deposit.

Iron is ubiquitous in chrysotile deposits derived from ultramafic rocks. In some of these, magnetite occurs in intimate association with the fibers. In other deposits types, e.g., in carbonate rocks, the iron content is low. Brucite, or nemalite (the fibrous form of brucite) is found in some deposits. Micas, feldspars, altered feldspars, talc and carbonate minerals may be present. Trace metals have been described in association with fibers, particularly chromium, cobalt, nickel, iron and manganese.

Naturally occurring chrysotile has been shown to contain trace quantities of organic compounds, which are predominantly straight-chain alkanes. Processed fibers may also contain organic compounds including polycyclic aromatic hydrocarbons.

## **2.6 Physical properties**

Heating of chrysotile fiber at 700°C for an hour converts it to an amorphous, anhydrous magnesium silicate material. Intensive dry grinding also destroys the structure of chrysotile. Analysis of wear debris from brake linings made with asbestos has shown that virtually all of the chrysotile fiber is converted to amorphous material, in association with the mineral forsterite (a recrystallization product).

Size and shape are the most important characteristics for defining the respirability of fibers. Chrysotile fibrils are long, flexible, and curved, and they tend to form bundles that are often curvilinear with splayed ends. Such bundles are held together by hydrogen bonding and/or extrafibril solid matter. Chrysotile fibers naturally occur in lengths varying from 1 to 20 mm, with occasional specimens as long as 100 mm.

Chrysotile bundles may be split longitudinally to form thinner fibers. The fibers of significance in health risk evaluation are those that can be inhaled. Chrysotile fibers less than about 3.5  $\mu\text{m}$  in diameter can enter the conducting airways of the lung. The radius of the curvature of chrysotile fiber may play a role in the ability of a fiber to penetrate to distant sites along the conducting airways. The vast majority of airborne chrysotile fibers are short. The percentage of fibers more than 5  $\mu\text{m}$  long in mining and milling is about 1.3 and 4.1%, respectively. Up to 24% of fibers may be longer than 5  $\mu\text{m}$  in certain textile spinning operations. Virtually all airborne fibers have a diameter of less than 3  $\mu\text{m}$  which are respirable. The cross-section of a chrysotile fibril is approximately circular. This is important in calculating the mass of individual fibers. Generally, the surface area depends on the degree of fiber openness. It has been suggested that surface area plays a role in imparting biological potential. Industrial processing of fibers from different sources may affect total airborne dust concentrations.

## **2.7 Chemical properties**

Chrysotile exhibits significant solubility in aqueous neutral or acidic environment. Chrysotile fibers are almost completely destroyed within 1 hour when placed in hydrochloride acid at 95°C. Chrysotile is highly susceptible to acid attack, but it is more resistant to attack by sodium hydroxide than any of the amphibole fibers.

Exposure to acid results in the liberation of magnesium ions and the formation of a siliceous residue. In contact with diluted acids or aqueous medium at pH less than 10, magnesium leaches from the outer brucite layer. The surface area of leached chrysotile is greatly increased. The solubility of the

outer brucite layer of chrysotile in body fluids greatly affects bioaccumulation in lung tissue. The role of chemical properties in the biological behavior of chrysotile is important in that the adsorption of polar organic agents on the surface of chrysotile is higher than that of less polar or non-polar agents. Adsorption of components of cigarette smoke onto the surface of chrysotile fiber has been suggested to play a role in the etiology of lung cancer in fiber-exposed cigarette smokers.

## **2.8 Hazard information**

The interaction of chrysotile fibers with the DNA in mammalian cells may result in chromosomal or mutational events that can initiate carcinogenesis or genetic damage. The ability of chrysotile to induce inflammation, oxidative stress and genotoxicity in several cell and animal experimental systems has been confirmed. It has been confirmed that animals incurred chrysotile-induced fibrosis.

Human studies have detected increased levels of DNA damage (8-hydroxyguanine adducts and strand fragmentation) in the blood cells of workers occupationally exposed to asbestos (primarily chrysotile, but also to other forms of asbestos, including crocidolite). Although levels of 8-hydroxyguanine were higher in asbestos-exposed workers than in the control group, no correlation with the duration, level or latency of exposure was found. The assessment of dose- and time-response relationships is thus difficult.

Occupational exposure to chrysotile in a working population has caused a high incidence of lung cancer as well as of pleural and peritoneal mesotheliomas. Although to a much lesser extent, cancers of the gastrointestinal tract and larynx have been demonstrated to increase in groups exposed occupationally to chrysotile.

## **3. Amphibole fibers**

### **Summary of IPCS Environmental Health Criteria 53**

#### **3.1 Background**

The International Programme on Chemical Safety (IPCS), Environmental Health Criteria (53) gives description on the amphibole type of asbestos. Amphibole type asbestos consists of crocidolite (commonly referred to as blue asbestos), amosite (brown asbestos), anthophyllite, tremolite and actinolite. They are naturally occurring fibers which consist of double chains of silica tetrahedral cross-linked with bridging cations.

#### **3.2 Chemical composition and structure**

Magnesium, iron, calcium, and sodium are the principal cations in the amphibole structure.

The compositions of crocidolite, amosite, anthophyllite, tremolite and actinolite are as follows:

Crocidolite:  $\text{Na}_2\text{FeII}_3\text{FeIII}_2(\text{Si}_8\text{O}_{22})(\text{OH})_2$   
 Amosite:  $(\text{Fe}, \text{Mg})_7(\text{Si}_8\text{O}_{22})(\text{OH})_2$   
 Anthophyllite:  $(\text{Mg}, \text{Fe})_7(\text{Si}_8\text{O}_{22})(\text{OH})_2$   
 Tremolite:  $\text{Ca}_2\text{Mg}_5(\text{Si}_8\text{O}_{22})(\text{OH})_2$   
 Actinolite:  $\text{Ca}_2(\text{Mg}, \text{Fe})_5(\text{Si}_8\text{O}_{22})(\text{OH})_2$  .

The amphibole structure allows great latitude in cation replacement, and the chemical composition and physical properties of various amphibole asbestos fibers cover a wide range. Only rarely does the composition of a field sample coincide with the assigned theoretical or idealized formula. However, theoretical compositions are used for identifying the various fibers as a matter of convenience.

### 3.3 Fiber properties

The breakage (both parting and cleavage) of amphiboles occurs along defined crystallographic planes. Parting along some of these surfaces may result in fibrils of amphibole, which are typically 4.0 nm in diameter. The mechanism of amphibole breakage is important with reference to: i) resultant particle number, ii) surface area, iii) general respirability (all of which control penetration to target cells and delivered dose), and iv) expressed chemical information contained on the fiber surface.

#### 3.3.1 Crocidolite

Crocidolite is represented by the “idealized” empirical formula where iron can be partially substituted by  $\text{Mg}^{2+}$  within the structure. Typical crocidolite fiber bundles easily disperse into fibers that are shorter and thinner than other amphibole asbestos fibers, similarly dispersed. However, these ultimate fibrils are generally not as small in diameter as fibrils of chrysotile. In comparison with other amphiboles or chrysotile, crocidolite has a relatively poor resistance to heat, but its fibers have been used extensively in applications requiring good resistance to acids. Crocidolite fibers have fair to good flexibility, fair spinnability, and a texture ranging from soft to harsh. Unlike chrysotile, crocidolite is usually associated with organic impurities, including low levels of polycyclic aromatic hydrocarbons.

Physical and chemical properties of crocidolite are summarized as follows:

Decomposition temperature: 400-600 °C

Fusion temperature of residual material: 1,200 °C

Density: 3.3 – 3.4 g/cm<sup>3</sup>

Resistance to acids: good

Resistance to alkalis: good



### 3.3.2 Amosite

The  $\text{Fe}^{2+}$  to  $\text{Mg}^{2+}$  ratio varies within the structure, but is usually about 5.5 : 1.5. Amosite fibrils are generally larger in diameter than those of crocidolite, but smaller than particles of anthophyllite asbestos similarly comminuted (breaking into very small parts). Most amosite fibrils have straight edges and characteristic right-angle fiber axis terminations.

Physical and chemical properties of amosite are summarized as follows:

Decomposition temperature: 600-800 °C

Fusion temperature of residual material: 1,400 °C

Density: 3.4 – 3.5 g/cm<sup>3</sup>

Resistance to acids: attacked slowly

Resistance to alkalis: good

### 3.3.3 Anthophyllite

Anthophyllite is a relatively rare, fibrous, orthorhombic (a structure characterized by three unequal axes at right angles to each other), magnesium-iron amphibole, which occasionally occurs as a contaminant in talc deposits. Typically, anthophyllite fibrils are more massive than other common forms of asbestos.

Physical and chemical properties of anthophyllite are summarized as follows:

Decomposition temperature: 600-850 °C

Fusion temperature of residual material: 1,450 °C

Density: 2.85 – 3.1 g/cm<sup>3</sup>

Resistance to acids: very good

Resistance to alkalis: very good

### 3.3.4 Tremolite and actinolite

Tremolite is a monoclinic (structure characterized by 3 unequal axes with 2 perpendicular and 1 oblique intersection) calcium-magnesium amphibole, and its iron-substituted derivative is actinolite asbestos. Both rarely occur in the asbestos habit, but are common as contaminants of other asbestos deposits. Actinolite occurs as a contaminant of both chrysotile and talc deposits. Tremolite fibrils range in size but may approach the dimensions of fibrils of crocidolite and amosite.

Physical and chemical properties of tremolite are summarized as follows:

Decomposition temperature: 950-1,040 °C

Fusion temperature of residual material: 1,315 °C

Density: 2.9 – 3.1 g/cm<sup>3</sup>

Resistance to acids: very good

Resistance to alkalis: good

Physical and chemical properties of actinolite are summarized as follows:

Decomposition temperature: 620-960 °C

Fusion temperature of residual material: 1,400 °C

Density: 3.0 – 3.2 g/cm<sup>3</sup>

Resistance to acids: attacked slowly

Resistance to alkalis: good

### 3.4 Hazard information

Occupational exposure to amosite, anthophyllite and mixed fibers in a working population has caused a high incidence of lung cancer. A predominantly tremolitic material mixed with anthophyllite has also caused an increased incidence of lung cancer. Many pleural and peritoneal mesothelioma cases have been observed after occupational exposure to crocidolite and amosite. An excess risk of gastrointestinal tract and laryngeal cancers has been demonstrated in groups exposed to amosite or mixed fibers containing crocidolite in occupational settings. Mesothelioma also occurs among individuals living in the vicinity of the crocidolite mines and by household contacts of workers.

### 3.5 Hazard identification via checklist

“Checklist for Asbestos Exposure”

Study No.:                      Informant's name:  
   Address:  
   Phone:  
   Relationship:

I. Have you ever worked in the following industries?

- ☐ Mining (of what? \_\_\_\_\_ )
- ☐ Shipbuilding
- ☐ Cement
- ☐ Smelting
- ☐ Metal grinding / polishing
- ☐ Plastic materials
- ☐ Shoes manufacture / repair
- ☐ Furniture / wooden product manufacture
- ☐ Gas industry
- ☐ Construction
- ☐ Chemicals production
- ☐ Insulation
- ☐ Refinery

- ☐ Casting / minting
- ☐ Chromic acid production
- ☐ Rubber products
- ☐ Printing
- ☐ Steel industry
- ☐ Paper / pulp production

II. Occupation from graduation of school to present

(include part-time job during student time; work during the war; short-term work and any other work)

Company name	Company location / address	Content of work of the company	Content of your work in the company	Materials and equipment at work	Working duration (YY/MM-YY/MM)

III. Have you ever worked at the following places?

1. ☐ Factory handling asbestos ☐ Warehouse for asbestos products
2. ☐ Construction
  - ☐ Building demolition
    - ☐ Painting / spraying work ☐ Soundproofing work
    - ☐ Insulation / fireproof / thermal work ☐ Prefabricated (asbestos mill board) factory
    - ☐ Cutting of ceiling / flooring materials ☐ Corrugated concrete sheet factory
    - ☐ Electricity / gas / steam pipe laying work
3. ☐ Shipbuilding industry
  - ☐ Ship repairing / breaking industry
    - ☐ Pipe wrapping / insulation work
    - ☐ Electric wiring works
    - ☐ Welding
    - ☐ Sheet metal processing
    - ☐ Crane / car operating
    - ☐ Clerical worker
    - ☐ Boiler manufacture / equipment
    - ☐ Maintenance (pipe; boiler)
    - ☐ Painting

- ☐ Carpenter
  - ☐ Worker
  - ☐ Other \_\_\_\_\_
4. ☐ Insulation work ☐ Thermal work
  5. ☐ Boiler manufacture / install / repair ☐ Burner manufacture / install / repair
  - ☐ Blast furnace manufacture / install / repair ☐ Steam / pipe manufacture / install / repair
  6. ☐ Boiler operating
  - ☐ Welding work
  - ☐ Sheet metal processing
  - ☐ Work which require wearing heat-resistant clothes or fireproof gloves
  7. ☐ Car repair work
  - ☐ Gasoline station
  - ☐ Manufacture of brake / lining / clutches
  8. ☐ Production of electric appliances (condenser / electric battery / car battery / insulating tape)
  9. ☐ Painting factory ☐ Soap factory
  - ☐ Oil / chemical refinery factory
  10. ☐ Laundry / cleaning shop ☐ Handling of working clothes contaminated with dust
  11. ☐ Transportation of things contaminated with dust
  - ☐ Merchantship sailor ☐ Truck-driver ☐ Railway worker
  - ☐ Lighterman ☐ Harbor worker ☐ Crane operating worker
  12. ☐ Sewage / waste collection / waste disposal / waste transportation
  13. ☐ Repair / disassemble of steam locomotives
  14. ☐ Gasmask production
  15. ☐ Handiwork of jewelry / precious metals
  16. ☐ Fire fighter
  17. ☐ Dental hygienist

IV. Have you ever been engaged in work handling the following asbestos products?

- ☐ Asbestos fiber
- ☐ Asbestos pipe
- ☐ Asbestos tube
- ☐ Asbestos cement sheet / tube
- ☐ Asbestos rolled paper
- ☐ Asbestos gasket
- ☐ Asbestos tape
- ☐ Asbestos insulation felt
- ☐ Cardboard / insulation sheet
- ☐ Asbestos textile / cloth

- ☐ Asbestos rope
- ☐ Asbestos packing
- ☐ Asbestos curtain
- ☐ Asbestos paper
- ☐ Asbestos pipe line felt
- ☐ Insulation pad (for packing)
- ☐ Others \_\_\_\_\_

V. Have you (interviewee) ever worked near by the following works which were done by someone?

1. ☐ Installation / removal of insulation pad (for packing)
2. ☐ Installation / removal of asbestos pipes
3. ☐ Welding
4. ☐ Installation / removal of pipes wrapped with thermal materials
5. ☐ Attaching / removal of precut asbestos blocks
6. ☐ Attaching / removal of asbestos wall boards / asbestos cardboards
7. ☐ Attaching / removal of fireproof coating for props / partitions (bulkhead) / girders
8. ☐ Installation / removal of valves and packing
9. ☐ Roll / peel boilers and boiler pumps with thermal materials
10. ☐ Roll / peel steam tubes with insulation materials
11. ☐ Cut asbestos tube / pipe / board / cardboard / insulation materials or install them

VI.

1. ☐ At home, have you ever had fixing / repairing work (insulating things, heating furnace cement / insulator / water-based painting of ceiling and wall / asbestos product)
2. ☐ Have you ever used talc powder (body-talc, talc for face care)?
3. ☐ At home, have you ever used asbestos products (ironing board cover / heat-resistant gloves)?
4. ☐ Have you ever lived near an asbestos factory?
  - ☐ Have you ever lived near a shipbuilding factory?
  - ☐ Have you ever lived near places storing construction materials?
  - ☐ Have you ever lived near a brake repairing factory?

Interviewer's Remarks:

Date:

Interviewer: \_\_\_\_\_

This checklist is originally Japanese and was developed by the Osaka Mesothelioma Research Group. Although unauthorized and unofficial, English translation has been done by the Department of Environmental Epidemiology, UOEH, Japan, for the sake of reference by concerned parties in other countries. Note that the applicability of this checklist to conditions in different countries is variable and only some components may be used. Every country should identify their own source of asbestos exposure reflecting their industrial profile (historical and present) to ultimately develop their own country-specific checklist.