

# Literature review on asbestos pathophysiology and safety guidelines

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## **A) Pathophysiology of crocidolite.**

Pathophysiology refers to both the pathological and physiological effects of a disease or injury. Crocidolite is a type of asbestos which is blue in color which has very thin fibers hair like fibers. This makes it the most dangerous type of asbestos as these thin fibers are very easily inhaled when blown by the wind where the asbestos occurs naturally (Australia) and when people are working with it especially during mining. This type of asbestos is used mainly for insulation as it is sprayed on walls, ceilings, boilers ovens and pipes.

Crocidolite falls under the category of respirable dusts. These are dusts whose particle size is between  $> 0.05 - 2.5$ , they are small enough to enter and lodge in the alveoli, which have no cilia for removal.

Many people come into contact with asbestos during its mining, milling or and during its industrial use such as insulation. These are mainly the construction workers and those who live in those buildings that are constructed using asbestos. The main diseases involved include Asbestosis (chokes lungs), Lung cancer (effects genome) and Asbestos mesothelioma (cancer of lung lining).

The maximum amount of asbestos one can be exposed to is  $0.1\text{f/cc}$  in a span of 8 hours, the lethal dose is not clearly known as most asbestos caused diseases have high latency levels(30-40 years) and the risk of getting the disease is dependent on other factor such as if smokes cigarettes or not.

[7] Exposure levels higher than  $0.1\text{f/cc}$  especially for a long time in the case of those working in the mines leads to asbestos diseases those that are highly susceptible are those working in close contact especially in mines and construction work. The fibres get into the body through inhalation.

Asbestosis occurs when the lung tissue is scarred especially around the alveoli ducts and terminal bronchioles. This is caused mainly by the serpentine crocidolite which is curved and attaches itself to the lungs. The pathophysiology of asbestosis is as follows; when these fibers are inhaled into the alveoli of the lungs, they activate the lungs' immune system because they are foreign bodies. The macrophages in the lungs undergo phagocytosis in an attempt to ingest the fibers. Since asbestos is inert, this fails and the macrophage dies leading to the release of cytokines that cause deposition of connective tissues by fibroblasts. This process continues over and over again and with time there is a large mass of fibrous tissue is formed. This scar tissue causes a decrease in the elasticity of the lungs and impedes gaseous exchange in the lungs. This disease has a high latency period of 30-40 years.[1][2][3]

Asbestos mesothelioma is a rare type of cancer that attacks the cells of the lining that covers a lot of internal organs known as the mesothelium. The most affected area is the lining of the lungs known as the pleura but it can also affect the lining of the stomach and the heart. The pathophysiology is as follows; as asbestos comes into contact with this lining it changes the functional and secretory properties of the macrophages ultimately leading to mesothelioma. When the macrophages attempt phagocytosis, they release free hydroxyl radicals which are carcinogens. This leads to an oncogenic process that ends in mesothelioma.[4]

Lung cancer occurs when asbestos fibers come into contact with the lungs. When the macrophages try to ingest the fibers through the process of phagocytosis hydroxyl radicals are released, these are carcinogens.

Chromosomes are damaged which leads to the loss of their heterozygous nature, this leads to the suppression of tumor suppressor genes. This combined with the presence of carcinogens leads to lung cancer. [5][6]

In the short term there are no clinical symptoms of exposure because all of these diseases have a high latency period of 30-40 years. It is in the long term that diseases such as mesothelioma, lung cancer and asbestosis occur. [4]

## **B) Strategies for hazard reduction during building alteration in Australia, where asbestos might be encountered.**

Since asbestos is found abundantly in Australia it was used in building for the following purposes; insulation of pipes, making fireproof doors, making paint, roofing tiles and cement sheets. At some point it was mandatory to build kitchens using asbestos to reduce the risk of fire as asbestos is fire proof. However in the mid 80's the serious health effects of asbestos exposure was discovered leading to the banning of its use in many countries. This has led to the development of strict guidelines to govern the alterations of these structures so as to protect the health of the construction workers and that of those in the surrounding areas.

### **These guidelines include;**

#### Risk identification

The first step is finding out if the building is built with asbestos containing material(ACM)and if yes what type of asbestos and in what condition. This information can be provided by the owner of the building or even by the local council office.

Work classification is where work is classified according to the level of potential hazard it has class 1 work is the most hazardous as it entails the removal of thermal insulation systems while class 4 is the least hazardous as it entails cleaning up of asbestos waste and debris. This classification helps in the determination of the kind of safety precautions to be taken during alteration activities.[7]

Permissible exposure limits this is the maximum amount of asbestos that one can be exposed to without health risks this is 0. 1f/cc in a span of 8 hours.[7]

A competent person is a trained person who can identify all the asbestos hazards that are found in a particular job and then recommend the necessary precautionary measures that should be undertaken. This person should be registered and certified by the government.[7]

## **Risk management**

These are measures that can be put into to reduce the risk to acceptable levels. They include Monitoring which this involves monitoring the exposure levels on site during the project to ensure that necessary precautions are taken. This should be carried out throughout the project preferably daily to ensure that all safety guidelines are being followed.[7][8]

Decontamination areas should be adjacent to the regulated area where all the protective clothing is removed and the employees shower. This is to avoid spreading the asbestos to other areas. [7][8]

Protective clothing these is a very important part of risk management.

Provision is mandatory and they include such as whole-body clothing like

overalls, head coverings, gloves and foot coverings. These should be properly disposed and inspected constantly to check for wear and tear. Those tasked with cleaning them should be informed that they contain asbestos. The employers should also provide respiratory devices such as respirators to avoid the inhalation of asbestos [7]

Proper disposal of waste and debris from these constructions sites should be properly bagged, removed from the site as soon as possible, transported safely and dumped in an approved dumping site.[9][10]

### **Risk communication**

Employee training is a very important aspect of risk communication as it will enable employees to identify asbestos, to know the risks that are associated with asbestos exposure, to know that smoking increases the chances of getting cancer, to know how to properly use safety wear and equipment.

They should also be advised not to eat or smoke in the regulated areas. This will enable the employees to know how to protect themselves.[7]

Use of warning signs is mandatory in all working areas so as to warn employees so that they can take the necessary precautions to avoid exposure to asbestos.[8]

### **Estimation of risk**

This refers to trying to estimate what risks can occur like failure of protective gear or encountering asbestos where one thought there was none. Since asbestos related diseases do not occur immediately there will be no immediate signs of poisoning however the affected people should see a

doctor that is experienced in managing asbestos related ailments immediately to prevent future problems.[10]

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