AHERA
Project Designer

U.S. EPA and Cal-OSHA Accredited

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by The Asbestos Institute

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POTENTIAL HEALTH EFFECTS RELATED TO ASBESTOS EXPOSURE

OBJECTIVES:

1. Gain a brief understanding of the means by which asbestos can enter the body and cause damage.
2. Conceptually understand the major diseases associated with asbestos exposure.
3. Understand the concept of latency period, or length of time following exposure to asbestos before the onset of disease.
4. Understand the relationship between cigarette smoking and asbestos exposure, and the increased risk of lung cancer.
5. Gain a brief overview of the risks associated with asbestos exposure in the construction industry.

Acronyms and abbreviations used in this chapter:

OSHA: Occupational Safety and Health Administration
ACM: Asbestos Containing Material
EPA: Environmental Protection Agency

POTENTIAL HEALTH EFFECTS ASSOCIATED WITH ASBESTOS EXPOSURE

The adverse health effects associated with asbestos exposure have been extensively studied for many years. Results of these studies and epidemiologic investigations have demonstrated that \inhalation of asbestos – a proven human carcinogen – may result in asbestos disease leading to early mortality.

It is important to recognize that the majority of people in the data collected who have died as a result of asbestos exposure were industrial asbestos workers. These workers were frequently exposed to high concentrations of asbestos fibers each working day with little or no protection. The asbestos abatement worker of today follows specific work practices and wears appropriate protection, including respirators, to minimize the risk of exposure.

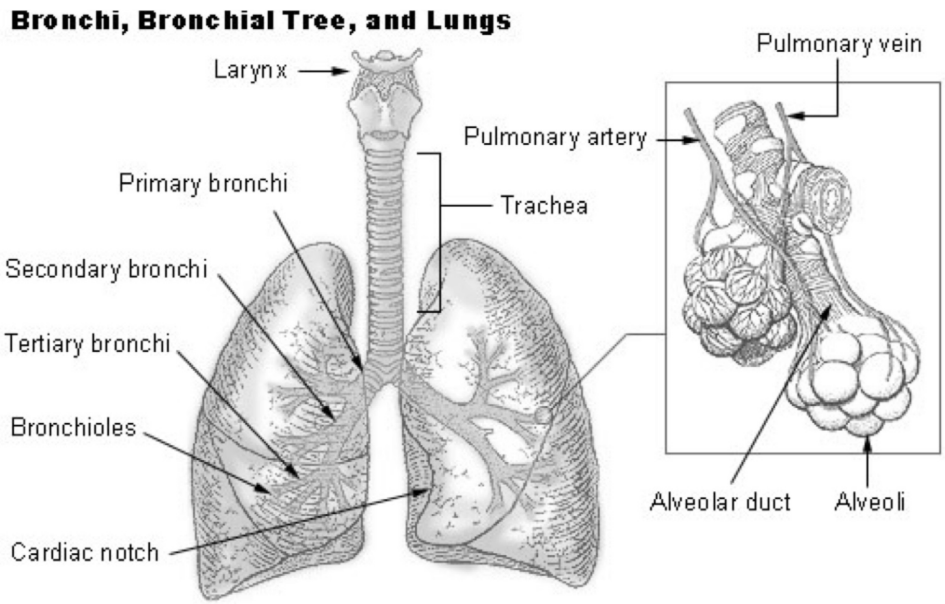
THE RESPIRATORY SYSTEM

Since the primary route of exposure is inhalation, it is necessary to gain a brief understanding of the respiratory system. Air which is breathed into the body passes through the mouth and nose into the windpipe or trachea. The trachea splits into two smaller airways called the bronchi. Each bronchus divides into smaller and smaller tubes which terminate into air sacs called alveoli. It is in these air sacs that oxygen is absorbed into small blood vessels and waste gases, such as carbon dioxide, pass out of the blood. (See Figure 2 1)

The lung itself is divided into two halves and sits in the pleural cavity. This cavity and the outside of the lung itself have a membrane lining (called pleural or mesothelial tissue). These linings are in contact with each other and are very moist. Just like two panes of glass with a drop of water between them, these linings slide easily across each other, but are difficult to pull apart. Accordingly, as the chest cavity expands, the lungs expand and air rushes in. If these linings were to become damaged, inhalation could not occur properly.

The body has several mechanisms by which it filters the air it breathes. First, very large particles are removed in the nose and mouth. Many smaller particles impact on the mucous coated walls of the airways and are caught. These airways have a hair like lining (ciliated cells) which constantly beat upward. Accordingly, particles caught in the mucous are swept up into the back of the mouth. From here it is swallowed or expelled. Unfortunately, cigarette smoking temporarily paralyzes these ciliated cells inhibiting the body's natural defense against unwanted dust.
It should be evident from this why cigarette smokers who are exposed to asbestos have been shown to be at greater risk of lung cancer.

Figure 2-1:



Even with the above mentioned natural defenses of the body, some dust particles inevitably reach the tiny air sacs. When this occurs, large cells (called macrophages) attempt to engulf the particle and digest it. However, because asbestos is a mineral fiber, the macrophages are not successful. When this occurs, these cells deposit a coating on the fiber and may begin forming scar tissue around it. This is just another natural defense mechanism the body uses against unwanted dust and debris in the lung. If many asbestos fibers are inhaled and much scar tissue is formed, a condition develops known as asbestosis.

ASBESTOSIS

Asbestosis is a disease characterized by fibrotic scarring of the lung at the alveoli. This is a restrictive lung disease which reduces oxygen transfer into the blood. The common symptom is shortness of breath. Asbestosis is prevalent among workers who have been exposed to large doses of asbestos fibers over a long period of time. Accordingly, there is a clear dose response relationship between asbestos exposure and developing this disease. This means the greater the asbestos exposure, the more likely asbestosis will develop. All forms of asbestos have demonstrated the ability to cause asbestosis. Like all diseases associated with asbestos exposure, it may take years for the disease to show up. The typical latency period for asbestosis is 15-30 years.

Even after exposure to asbestos has ceased, scar tissue will continue to form around existing scar tissue and fibers in the lung. Limiting exposure will reduce the amount of new scar tissue since

additional fibers entering the lung will be reduced, however, the disease will usually continue to progress because of the fibers deposited over the last 20 years. The current Occupational Safety and Health Administration (OSHA) Asbestos Standards (29 CFR 1910.1001 and 29 CFR 1926.1101) were promulgated to greatly reduce asbestosis among asbestos workers by reducing their daily dose of asbestos.

LUNG CANCER

There are many causes of lung cancer, of which asbestos is only one. While employees exposed to industrial concentration of asbestos in years past have an increased risk of getting lung cancer (at least 5 times), their risk is not as great as the cigarette smoker (10 times). However, together, a cigarette smoker who also works with asbestos is more than 90 times more likely to contract lung cancer than the normal non smoking population. Like asbestosis, there exists a long lag time between initial exposure and the occurrence of lung cancer, typically 20-30 years. There appears to be a dose-response relationship between asbestos exposure and lung cancer, although no "safe level" has yet been determined. Dr. Irving Selikoff has developed the "One Fiber Theory", demonstrating that one asbestos fiber, properly placed in the lung, has the potential to cause a tumor.

MESOTHELIOMA

The asbestos associated disease of greatest concern regarding asbestos in buildings is probably mesothelioma. Mesothelioma is a cancer of the chest lining (mesothelium). Mesothelioma can also occur in the lining of the abdominal cavity. If it occurs in the chest cavity, it is called pleural mesothelioma; in the abdominal cavity, it is known as peritoneal mesothelioma. This type of cancer spreads very rapidly and is always fatal. The exact mechanism of this disease remains unknown. There does not appear to be any increased risk of getting mesothelioma for smokers. Like the other diseases of asbestos, mesothelioma has a latency period of many years after initial exposure, if it occurs. The current mesothelioma data indicates that this disease is more than twice as common as asbestosis, as a cause of early mortality in the U.S. population.

OTHER DISEASES

Several other diseases are found more among persons exposed to asbestos than the normal population. These include cancer of the esophagus, stomach, colon and pancreas, pleural plaques, pleural thickening and pleural effusion. Again, the importance of using the proper work practices and respiratory protection cannot be overemphasized to minimize the occurrence of these diseases due to unnecessary asbestos exposure.

RISKS ASSOCIATED WITH LOW LEVEL EXPOSURE

Asbestos is known to be hazardous based on studies of asbestos workers and laboratory animals. However, the risks associated with low level, non-occupational exposure (for example, an occupant of a building containing ACM) are not well established. Based on a thorough review of the health effects literature, EPA concludes there is no level of exposure below which the risks of contracting an asbestos related disease are zero. That is, there is no safe threshold level of exposure.

Asbestos fibers accumulate in the lungs, the pleural cavity and the peritoneal cavity. As exposure increases, the risk of disease likewise increases. Measures to minimize exposure and consequently minimize the accumulation of fibers, reduces the risk of adverse health effects.

ASBESTOS HEALTH EFFECTS TODAY

Mesothelioma and asbestosis have both been on a sharp increase in the U.S. in the last several decades, with early mortality from mesothelioma at more than twice the rate of asbestosis. Both are expected to continue to increase into the future.

Estimates from federal agencies since 2004 tell us that at least 10,000 people per year die from asbestos diseases in the U.S.

The World Health Organization estimates that at least 100,000 people die annually from asbestos related diseases.

Data from Great Britain shows that mesothelioma is the leading occupational cause of death in that country, more common than death from automobile accidents.

The industry most affected by early mortality due to asbestos disease is the construction industry.

Health effects data such as this underscores and shows the importance of the asbestos regulations in this country, and the important role the certified Project Designer plays in controlling asbestos exposure in construction activities.