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SILICOSIS- A MAJOR OCCUPATIONAL HEALTH PROBLEM IN THE INDIAN CONSTRUCTION SECTOR

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ABSTRACT India's construction industry employs a work force of nearly 32 million, as construction constitutes 40% to 50% of India's capital expenditure on various sectors like highways, roads, railways, irrigation etc and construction industry is one of the second largest industry in India after agriculture. Construction industry employs a large number of skilled and unskilled labourers often subjected to construction site accidents and health risks. In addition to concerns over safety there are worries about the health of construction workers. The main occupational health problems in the construction industry are back injuries from carrying heavy loads, musculoskeletal disorders and respiratory disease from inhaling dust. Over 500 construction workers are believed to die from exposure to silica dust every year. Construction sites can create high dust levels often invisible, fine, toxic mixture of hazardous materials and fibres that can damage the lungs, leading to diseases such as chronic obstructive pulmonary, asthma and silicosis. The present article focuses on silicosis among workers in Indian construction industry with ways to control and prevent crystalline silica exposure.

KEYWORDS :

INTRODUCTION

There's a hazardous substance that most of the construction workers are exposed to on a daily basis that doesn't look hazardous at all. It looks like common materials such as bricks or stone, and it's called silica. Silica, also called silicon dioxide, is a family of minerals with the chemical formula SiO_2. It's one of the main components that make up the earth's crust and abounds in a variety of natural, everyday materials. It comes in two basic forms - Noncrystalline and crystalline silica. Noncrystalline silica is found in materials like silicon carbide, glass and silicone. This type of silica is not as much of a health concern. Crystalline silica is termed as "respirable crystalline silica" as this silica particles are small enough to be inhaled and more of a health concern than noncrystalline silica. It's most prevalent in the form of quartz. This natural substance is found in many different types of rock and building materials, such as sand, gravel, granite, sandstone, clay, concrete, asphalt, bricks and more. Exposure to silica dust can lead to the development of lung cancer, silicosis (an irreversible scarring and stiffening of the lungs), kidney disease and chronic obstructive pulmonary disease. It is estimated that 230 people develop lung cancer each year as a result of past exposure to silica dust at work. Not all exposed workers will develop cancer; cancer risk increases with long term or repeated high level exposure.

SILICA AND SILICOSIS

Quartz is abundant in most rocks, sands, and soils. The extensive natural occurrence of quartz and the wide uses of the materials that contain quartz are directly related to potential occupational exposures to quartz for workers in many industries and occupations. Virtually any process that involves movement of earth (e.g., mining, farming, construction), disturbance of silica-containing products such as masonry and concrete, or use of sand and other silica-containing products (e.g., foundry processes) may potentially expose workers to quartz. Exposure of workers to respirable crystalline silica is associated with elevated rates of lung cancer. The strongest link between human lung cancer and exposure to respirable crystalline silica has been seen in studies of quarry and granite workers and workers involved in ceramic, pottery, refractory brick, and certain earth industries. Consequentially, exposure to crystalline silica remains a problem in both developed and developing nations.

Silicosis is the result of the body's response to the presence of silica dust in the lung(s). Exposure to silica occurs by inhaling airborne particles of silica dust, typically ranging from 5.0µm to 0.5µm. The respirable fraction of the dust (particles generally considered to be smaller than five-millionth of a meter) can penetrate to the innermost layers i.e. the alveoli (airsacs) where the exchange of oxygen and carbon dioxide occurs. When workers inhale crystalline silica, they land on the alveoli, and white blood cells (macrophages) try to remove them. However, the particles of free crystalline silica cause the macrophages to break open. The lung tissues react by developing fibrotic nodules and scarring around the trapped silica particles.

Formation of large numbers of "scars" following prolonged exposure causes the alveolar surface to become less elastic. This is noticed as shortness of breath following exertion. Symptoms seldom develop in less than five years and, in many cases, may take more than 2 years to become disabling or cause death.

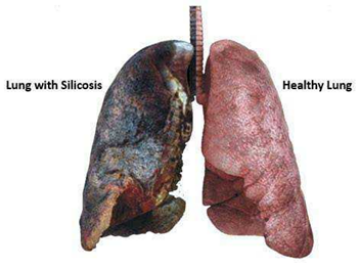

Figure 1: Image Showing A Healthy Lung And Lung With Silicosis

TYPES OF SILICOSIS

1. Chronic silicosis can be simple or complicated and occurs after 10 years of exposure at low concentrations:

- Chronic simple silicosis is asymptomatic and consists of multiple small, round, pulmonary opacities. It is the most common form.
- Chronic complicated silicosis (progressive massive fibrosis) has progressively worsening symptoms and large conglomerate pulmonary opacities.

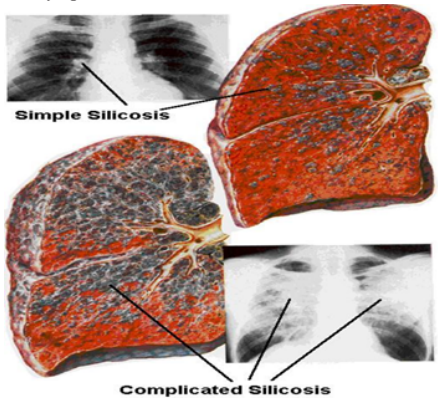

Figure 2: Chest X-ray of Patients with simple silicosis and Complicated silicosis

2. Accelerated silicosis which results from exposure to high concentrations of crystalline silica and develops five to ten years after the initial exposure.

3. Acute silicosis, which occurs where exposure concentrations are the highest and can cause symptoms to develop within a few weeks to four or five years after the initial exposure.

FACTORS THAT INFLUENCE THE DEVELOPMENT OF SILICOSIS

Development of silicosis is influenced by several factors that include:
·Form of the silica
·Content of crystalline-free silica in the dust
·Amount and kind of dust inhaled
·Relative size of the inhaled particles
·Duration of exposure
·Individual susceptibility
·Smoking habits
·Disease status
·Age

SILICA EXPOSURE DURING CONSTRUCTION

Since Crystalline silica in the form of quartz is a major component of concrete, airborne respirable quartz dust may be produced during construction work involving the disturbance of concrete, thereby producing a silicosis hazard for exposed workers. The construction activities that may produce crystalline silica dust include jack--hammer operations, rock/well drilling, concrete mixing, concrete tunneling, and brick and concrete block cutting and sawing. Tunneling operations, repair, or replacement of linings of rotary kilns and cupola furnaces, and setting, laying, and repairing railroad tracks are also potential sources of exposure. Concrete and masonry products contain silica sand and rock containing silica. Construction workers are exposed to respirable crystalline silica in course of following activities chiefly:

- Demolition or concrete and masonry structures.
- Crushing, loading, hauling, and dumping of rock.
- Chipping, hammering, and drilling of rock.
- Abrasive blasting using silica sand as the abrasive.
- Abrasive blasting of concrete (regardless of abrasive used).
- Sawing, hammering, drilling, grinding, and chipping of concrete or masonry.
- Dry sweeping or pressurized air blowing of concrete, rock, or sand dust.
- Certain processes of traditional brick manufacture

The quantity of silica contained in stone and other materials of workers exposure at construction site:

Table-1: Approximate Crystalline Silica Content Of Different Materials At Construction Site

Sandstone	70–90%
Concrete, mortar	25–70%
Tile	30–45%
Granite	20–45%, typically 30%
Slate	20–40%
Brick	Up to 30%
Limestone	2%
Marble	2%

PREVENTION AND CONTROL OF SILICOSIS

Occupational Safety and Health Administration (OSHA) suggests employers and employees take measures to protect against exposure to crystalline silica, including:

- Replacing crystalline silica materials with safer substitutes, when possible.
- Recognize when silica dust may be generated and plan ahead to eliminate or control dust at the source.
- Knowing how to protect against exposure to crystalline silica dust.
- Providing engineering or administrative controls, where feasible, such as local exhaust ventilation with dust collectors, blasting cabinets and/or wet methods to prevent dust from becoming airborne.
- Using all available work practices to control dust exposures, such as water spray.
- Routinely maintain dust control systems to keep them in good working condition.
- Wearing only an N95 NIOSH-certified respirator, if respirator protection is required.
- Wearing only a Type-CE abrasive-blast supplied-air respirator for abrasive blasting.
- Wearing only disposable or washable work clothes and shower if facilities are available.
- Vacuuming the dust from clothes or changing into clean clothing before leaving the worksite.
- Participating in training, exposure monitoring, health screening and surveillance programs to monitor any adverse health effects caused by crystalline silica exposure.
- Providing workers with training that includes information on health effects, work practices and protective equipment to protect against respirable crystalline silica.
- Being aware of the health hazards related to crystalline silica exposures and the additional lung damage that may occur from smoking.
- Refraining from eating, drinking, smoking and/or applying cosmetics in areas where crystalline silica dust is present. Taking care to wash hands and face outside of dusty areas before performing these activities.
- Preventing dust from becoming airborne during cleans up by using water hoses or wet wiping rather than compressed air. Using vacuums with hi-efficiency particulate air (HEPA) filters and wet sweeping rather than dry sweeping.

Effective prevention and control of silica dust is possible only if substitution, control methods, and surveillance are used together. As well, construction industries must provide the adequate resources and administrative support to make control and prevention possible.

CONCLUSION

Occupational exposure to respirable crystalline silica is a serious but preventable health hazard in the construction workers of the country. As occupational exposure to different kinds of dusts is widespread throughout the world, it was agreed that prevention of all kinds of pneumoconioses may be included as a part of the programmes at the regional and country levels. Though there are several regulations like the Factories Act, 1948, Mines Act, 1952, Metalliferous Mines regulation, 1961, and Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Rules, they specify much higher limits of particulate matter and silica dust which are harmful to construction workers. Moreover, these limits are rarely imposed. Overall, 50% of exposed workers had an exposure value exceeding the limit (TLV) proposed by ACGIH. Furthermore, lack of literacy and less knowledge regarding the use of protective measures can produce a surplus effect. This indicates that there is a need for more intense dust control interventions and training on the use of protective devices (PPE). These control and intervention measures should target sectors, such as construction, at greater risk of exceeding occupational exposure threshold limits. It is suggested that the construction sectors should increase the awareness about the cause and complications for silicosis among construction workers.

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