Silicosis and Its Effects

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What is Silicosis?

Silicosis is a disease of the lungs caused by the inhalation of crystalline silica, or quartz. This disease is not genetic, caused by an abnormal gene, but is acquired through the inhalation of minute, airborne particles of silica. The micron-sized silica dust, which is ingested through the normal breathing process, coats the inner lining of the lungs (alveoli) and forms fibrous scar tissue that reduces the lungs' ability to extract oxygen from the air. **[Note: a micron is about one twenty-five thousandth of an inch; a human hair averages 40 microns.]**

Silicosis is similar to Coal Workers' Pneumoconiosis (CWP), or "Black Lung", and has the same basic effects on the body. CWP is caused by the inhalation of coal dust into the worker's lungs and is inherent to mining and other coal-related work. Silica, however, is far more prevalent than coal, since it is a basic component of the earth's crust, present in both sand and granite.

How do you get Silicosis?

Every time we breathe we inhale airborne particles. In a dusty atmosphere, some of the various-sized particles in the air can actually be seen. The air and the particles it carries pass through the entrances to our respiratory system (the nose and mouth). The moist linings of these areas trap the largest dust particles, which are either exhaled (sneezed, blown or spit) or swallowed. Air containing the remaining particles passes through the windpipe (trachea) and into the bronchial tubes (bronchi). These tubes have a moistened lining that not only prevents their walls from drying, but also traps some of the dust particles that were not stopped at the mouth or nose. The walls of these tubes contain special cells with whip-like projections (cilia), which move the trapped particles up through larger tubes to the mouth, where they are either swallowed or spit out. The cilia and mucus lining is called the mucociliary escalator.

Particles that get past the mucociliary escalator are considered "respirable", and are able to be transmitted through the respiratory system. Respirable particles, which are less than 10 microns in diameter, are invisible to the naked eye. They travel through the respiratory system, eventually depositing themselves in the air sacs (alveoli). The alveoli extract oxygen from the air and use it to enrich the blood. This exchange of oxygen takes place in more than 300 million alveoli located throughout the lungs. Blood passes through the lungs at approximately five liters per minute (lpm) under normal conditions. Exertion and an accelerated heart rate increase this circulation.

One of the lungs' defense systems is a group of special cells called macrophages. The role of these cells is to engulf some of the particles that find their way to the alveoli and return them to the bronchioles. When there is a high concentration of dust, the macrophages cannot keep pace and a large number of them are deposited onto the alveoli, creating a buildup. This eventually causes scarring (fibrosis) of the air sacs, making it very difficult to breathe. The disease that causes this scarring is called pneumoconiosis.

What industries have the risk of Silicosis?

The basic composition of the earth is granite and sand, or a derivative of the two. In general, all mining or digging sites contain a high level of silica dust. Related worker exposure can be found in the **construction industry** (sandblasting, jackhammering and rock drilling), the **mining industry** (cutting, drilling through sandstone and granite), the **foundry industry** (grinding, molding, working in shake-out and core rooms), the

ceramics industry (working with clay and pottery) and the **glass industry**, to name a few. Almost all industries possess the threat of Silicosis, since, as a general rule, almost all dust contains silica.

What are the symptoms of Silicosis?

Silicosis is not like a cold or flu. The disease does not result in immediate bodily dysfunction. Rather, Silicosis is a progressive disease that develops in roughly four stages. In the disease's early stages, which are unnoticeable to most, a person may experience a slight shortness of breath with simple exertion or exercise. Continued exposure will reveal signs of fever and bluish skin discoloration around the lips or ear lobes. As the disease progresses, fatigue, shortness of breath, loss of appetite or chest pains may be noticed. The final stage of chronic Silicosis is death.

There are three types of Silicosis. They differ based on concentration and exposure:

Chronic Silicosis	Usually occurs after 10 or more years of exposure.
Accelerated Silicosis	Results from a higher level of exposure and develops within 5 to 10 years.
Acute Silicosis	Results from an even higher level of exposure and can develop in as little as a few weeks or as much as 5 years.

What are the Effects?

Depending on age, physical condition, physical activity or work requirements, the development of the disease may produce a variety of effects in different people. Only one thing is certain—continued exposure to silica dust eventually kills even the strongest.

Is there a cure?

The answer, quite frankly, is "**NO**". ***There is no cure for Silicosis.*** The only solution is **prevention.**

In dusty environments, respirators should be worn at all times. In addition, wear disposable or washable clothing. If you are exposed, shower and put on clean clothing. Do not eat, drink or smoke in atmospheres where silica is in the air; and always wash your hands and face before eating, drinking, smoking or applying makeup.

Permissible exposure limits

The permissible exposure limit is the amount of silica that a person can be exposed to for a specific period of time. The unit of measurement is milligrams per cubic meter of air. This reading is usually taken over an eight-hour period, a normal workday. The U.S. Department of Labor and government agencies (MSHA, NIOSH and OSHA) establish permissible exposure limits.

For additional information and regulatory standards, contact NIOSH by phone at 1-800-35-NIOSH or on the Internet at http://www.cdc.gov/niosh/homepage.html or contact MSHA at 1-888-249-8223 or http://www.msha.gov.

Sampling methods

The approved sampling method for the collection of airborne contaminants (respirable dust), includes the use of a sampling pump, a Cyclone Assembly and a pre-weighed filter cassette. The accuracy of the collection sample is determined by the accuracy of the sampling equipment.

MSA has a Silicosis-sampling program

MSA has introduced a pre-weighted filter cassette that can be used for silica sampling. Since

this cassette is not limited to silica or quartz, it can also be used for the general collection of airborne particulate. The cassette is identical to the MSHA coal dust cassette, and is very similar to the OSHA cassette for dust and quartz collection.

MSA is a major supplier of dust collection cassettes to MSHA and OSHA.

This cassette, MSA part number 711361, is individually packaged in a sealed plastic bag. The cassette inlet contains a tamper-proof deflector plate, and the outlet contains an anti-blow back check valve. Both the inlet and outlet openings are capped to ensure that they stay clean. The perimeter of the cassette housing is sealed with a tamperproof sealing tape.

The cassette is precision-weighed to .01 mg. in a clean room environment. Each cassette is conditioned for 24 hours in a controlled chamber to ensure the accuracy of the temperature and moisture content. Weighing conditions are controlled to a temperature of 65-75°F and relative humidity of 35-55%.

Each cassette is individually serialized and is accompanied by an individual weight data card that lists the cassette serial number and actual capsule weight. Because of the extreme accuracy of the MSA weighing process, users of this cassette can sample the atmosphere for dust particulate and be assured of an accurate analysis.

To collect an atmospheric sample, the most important tool needed is an accurate pump. The MSA Escort ELF® Sampling Pump, MSA part number 497701, is the most accurate pump available. Accuracy is +/- 2.5% at a flow rate of 1-3 lpm over an 8-hour shift. The ELF Pump, with the Electronic Laminar Flow feature, adjusts pump speed to compensate for sample train resistance. This ensures that the set flow rate is maintained throughout the entire sampling period. The Electronic Laminar Flow, included in the MSA ELF Pump, is considered a secondary calibration standard, thus eliminating the need to check calibrate the pump before each use. As with all pumps, calibration of the ELF Pump should follow the recommended calibration procedure established by regulatory agencies. The ELF Pump is approved for respirable coal dust sampling as well as silica sampling. It only requires checking against a primary standard once a month, or after every 200 hours of usage. ELF Pumps are UL approved as intrinsically safe for use in hazardous locations—Class I, Groups A, B, C and D; Class II, Groups E, F and G; and Class III, Division I locations. They are also NIOSH certified for coal mine dust sampling (TC-74-030) and are MSHA certified as intrinsically safe for underground use (Approval No. 2G-3924-1).

The collection of respirable dust is critical. Incorrect sampling will cause an inaccurate dust concentration analysis. The MSA Cyclone Assembly and cassette holder, part number 456243, ensures that only respirable dust is collected on the cassette filter. The Cyclone Assembly is designed for use with the ELF Pump and cassette and is approved for coal mine dust collection, including coal and quartz (silica). The MSA Escort ELF Pump, cassette, and Cyclone Assembly are all acceptable equipment for silica sampling.

Rick Hartman is a product line specialist for the MSA Instrument Division. If you have any questions about the Escort ELF Sampling Pump or would like information on products available from MSA, please call us at 1-800-MSA-2222.

For your local distributor or more information, call 1-800 MSA-2222.

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