

Silica/Silicosis Awareness

What is Silica?

Silica is the name applied to a natural mineral composed of silicon dioxide, known for its hardness since the 9th century, which occurs in either the crystalline or amorphous form. Silicon dioxide is an acidic oxide, chemical formula SiO_2 with a melting point of about 1650 degrees Centigrade, which is practically insoluble in water, but can be attacked/dissolved by hydrogen fluoride, and hot alkali and basic metal oxides. Silica makes up about 21% of the earth's crust, and is the most abundant mineral and the most common of all chemical compounds. Crystalline silica is the basic component of soil, sand, granite, and many other minerals. Pure silicon dioxide crystals are found naturally in three polymorphic forms: quartz (the most common type which is often called free silica); tridymite; and cristobalite, all of which involve tetrahedral SiO_4 units linked together by shared vertices in different arrangements/bond lengths, some with chains of edge sharing SiO_4 tetrahedra.

Where is Silicon Dioxide-Containing Material (Silica) Found?

Silica is located in nearly all buildings, Industrial and construction workplaces and areas of the world in which we live. Examples of silica-containing products may include but are not limited to:

- Glass found in drinking glasses, bottles, ceramics, and windows;
- As a food additive, primarily as a dehydrating or flow agent in powdered foods;
- Plasters, ceiling tiles, transite, cement, concrete, fiberglass and mineral wool insulation;
- Soaps, toothpaste, adhesives, paints, pesticides, cosmetics, etc., etc., etc.....

When is Silica Potentially Hazardous/Dangerous?

Silicon dioxide or silica is most hazardous when it is an airborne dry finely-powdered sub-micron particle, which may be inhaled deep into the lungs. If a silica-containing material is drilled, broken, ground, buffed, cut, sawed, struck or otherwise damaged/pulverized, it will release particles into the air. In respects other than inhalation, pure silica is inert and harmless. When ingested orally, silica passes unchanged through the gastrointestinal tract, with zero nutritional value and zero toxicity. Shattered glass fragments with jagged edges, of course, present a different type of physical hazard.

What are the Potential Adverse Health Effects of Overexposure?

Silica materials are generally not considered to be harmful unless it is being pulverized or damaged to the extent that very tiny particles are being released into the atmosphere (so small that these can only be seen using a microscope), where they may stay suspended for hours or even days. Silica is generally considered to be potentially harmful when very small particles are inhaled deep into the lungs, where the macrophages are unable to remove the fragments which then become lodged in the alveolar lung tissue, causing miliary nodulation (classic silicosis) and scarring/fibrotic changes in both lungs. Lung cancer is believed to be more common among persons who were cigarette smokers and were exposed to significant amounts of fine silica dust in various workplaces (mines, mills, quarries, foundries, construction, rock drilling, abrasive blasting, tunneling, and factories).

Two determining factors are related to the probability of developing these diseases: 1) The amount and duration of exposure - persons exposed frequently over a long period of time are more at risk, making it important to minimize time and amount of exposures, and 2) Whether or not one smokes cigarettes - the first thing a smoker should do to reduce their risk of developing lung cancer is to stop smoking.

(NOTE: Self-help smoking cessation materials are available through the UNM Employee Health Promotion Program (Johnson Center at 272-4460), the National Cancer Institute (1-800-4-CANCER), the American Heart Association (1-800-242-8721) and the American Lung Association (216 Truman NE at 265-0732))

How Does One Avoid Unnecessary Free Silica Exposure?

- All surfaces should be maintained as free as practicable of accumulations of free silica dusts.
- Surfaces contaminated with fine silica dust should not be cleaned with compressed air, or dry sweeping. HEPA vacuuming or wet methods must be used.
- Never break, saw, cut, hammer, drill, sandblast, jackhammer, or otherwise damage any suspect silica-containing materials, without being equipped with an appropriate respirator.

Silica is a naturally occurring mineral and is ubiquitous in our natural environment, including the soil, mountains, dirt, building materials, gardens, playgrounds, roadways, cement, parks, air, etc. As such, it is impossible to achieve zero exposure, but it is possible to minimize unnecessary exposure. Remember: If it's free silica, it's not just ordinary dust. Clinical manifestations of excessive exposure include shortness of breath, decreased chest expansion, lessened capacity for work, fatigue, weakness, weight loss, chest pain, absence of fever, increased susceptibility to tuberculosis, and/or respiratory failure.

Amorphous Silica: Multiple studies have found amorphous silica to be biologically inert when ingested and inhaled, with the exception of extruded fiberglass and ceramic fibers (which have been designated as carcinogens by the National Toxicology Program), which are hazardous due to their very small size and their high length to width aspect ratio. Because of this inertness, the US Food and Drug Administration permits the use of amorphous silica (not fiberglass or ceramic fibers!) in food and medicine.

For further information about what employers/employees can do to protect against workplace exposures to silica, go to www.osha.gov.