

Common Questions About Crystalline Phase Silica

1. What is Crystalline Phase Silica?

Silica is a term commonly used for silica dioxide or SiO_2 , one of the most abundant minerals found in the earth's crust. This naturally occurring mineral can be found in the amorphous or vitreous (glassy) state, in fused form, and in crystalline forms. Making up roughly 18% of earth's crust, most naturally occurring silica deposits are found in the form of crystalline quartz. Common natural sources of quartz include beach sand, limestone, clay, shale and granite. Another form of crystalline silica, resulting primarily from high-temperature processes, is referred to as cristobalite.

2. What is the concern over crystalline silica?

The health concern over crystalline silica is associated with the inhalation of extremely tiny particles that can do damage to the lung. These fine particles, referred to as *respirable* dust, are smaller than the diameter of a human hair. When inhaled (breathed into the lung), crystalline silica can cause long-term, irreversible lung disease. For this reason, workplace exposures to fine airborne crystalline silica containing dust must be minimized.

3. Is crystalline silica a carcinogen?

In June 1997, the International Agency for Research on Cancer (IARC) issued an updated ruling on the carcinogenicity of crystalline silica. IARC concluded that "Crystalline silica (inhaled in the form of quartz or cristobalite from occupational sources) is carcinogenic (Group 1) to humans." The National Institute for Occupational Safety and Health (NIOSH) Center for Disease Control and Prevention has determined that crystalline silica exposures may lead to irreversible lung disease (silicosis), although the observable effects may follow a lengthy latency period (time from exposure to the onset of disease).

4. Do synthetic vitreous fibers (SVF's) contain crystalline phase silica?

No. As produced, Synthetic (meaning man-made) Vitreous (meaning glassy) Fibers (referring to the shape of the individual particles) do not contain crystalline silica. Fiberfrax[®], Insulfrax[™], and Isofrax[™] are all members of the group of materials commonly referred to as synthetic vitreous fibers (SVF's). Refractory ceramic fiber (RCF), for example, is an amorphous glass fiber, the composition of which is roughly 50% amorphous silica (SiO_2) and 50% alumina (Al_2O_3), marketed by Unifrax under the trade name Fiberfrax[®].

5. Can the handling of synthetic vitreous fibers (SVF's) result in exposure to crystalline silica?

Amorphous SVF's may devitrify following *sustained exposure to high temperatures* (typically >1800°F). For example, the first crystalline compound to form from the devitrification of RCF is referred to as mullite. The chemistry of mullite is 72% alumina (Al_2O_3) & 28% silica, (SiO_2). Mullite can begin to form at temperatures of $\approx 1800^\circ\text{F}$, depending on the duration of exposure to heat and the presence of "fluxing agents." Crystalline phase silica, if formed, is the result of the devitrification of remnant amorphous silica (left over after mullite formation). Crystalline phase silica (e.g., cristobalite and quartz) form at temperatures of approximately 2200°F or greater.

6. Do conventional "hard" refractories contain crystalline silica?

Conventional hard refractories can contain up to 70% crystalline silica as produced. With conventional refractories, exposure to crystalline silica can occur during both the handling and installation of new materials as well as during repair and removal activities. Conventional refractories typically require more energy intensive removal techniques (e.g., use of a jack hammer, front end loader etc...), which can greatly increase the possibility of creating airborne dust.

7. How likely is exposure to crystalline silica during the handling and use of synthetic vitreous fiber (SVF's)?

Synthetic vitreous fibers *do not* contain crystalline phase silica as produced, therefore, there is no potential exposure to crystalline silica during handling, processing, use and/or installation of Fiberfrax®, Insulfrax™, or Isofrax™, SVF's may form crystalline silica after exposure to high temperatures over extended periods of time. The process of devitrification would also depend on fiber chemistry and the presence of fluxing agents. Exposure to airborne dust containing crystalline silica is possible during activities associated with after-service fibers (e.g., repair or removal of after-service SVF's; routine maintenance).

8. What are the results of exposure monitoring conducted during after-service RCF furnace lining removals?

Analysis of data associated with after-service RCF furnace lining removals has revealed only minimal workplace exposures to crystalline silica. During a recent study, 158 measurements for respirable crystalline silica were collected throughout the duration of 42 different RCF furnace lining removal projects. Of the 158 measurements obtained, only 14 samples (8.9%) had detectable levels of crystalline silica, two of which had silica concentrations at or above the occupational exposure limit (OEL) for silica. In the remaining 144 samples (91.1%) the presence of crystalline silica was not detected.

9. How do you know if crystalline silica is present in the materials you handle?

Manufacturers are required to indicate on product warning labels and material safety data sheets (MSDS) if a product contains crystalline silica. If warning labels and MSDS's are unavailable or if you are working with after-service refractories, a laboratory analysis is the only sure way to know if the materials contain crystalline silica. Samples of each potential silica containing source material (e.g. refractory brick, mortar, castable shapes, burner ports, kiln furniture, SVF etc. . .) should be collected and analyzed by a professional certified laboratory.

10. What has OSHA done to protect workers from exposure to crystalline silica?

The Occupational Safety and Health Administration (OSHA) has determined that crystalline silica presents a "serious occupational health hazard." Under the OSHA Hazard Communication Standard (29 CFR 1910.1200), most materials containing more than 0.1% of a known carcinogen, such as crystalline silica, must be clearly labeled as a *cancer hazard* both on the product warning label and on accompanying material safety data sheets (MSDS's).

In addition to product warnings, OSHA has also established a permissible exposure limit (PEL) based on an 8 hour time weighted average (TWA) exposure to silica containing dust. A Special Emphasis Program (SEP) was also recently implemented wherein industries with known over exposures to crystalline silica (e.g., Clay Refractories, Masonry, and Other Stone Work, etc. . .) are targeted for OSHA compliance inspections.

11. What precautions should be taken when working with silica containing materials?

The first step that must be taken to protect workers from exposure to crystalline silica is the proper identification of *all* potential silica containing source materials. Once silica, if present, is properly identified, engineering controls are the first line of defense in controlling airborne silica dust exposures. If engineering controls are ineffective or unavailable, respiratory protection should be used. Consult with your employer to make sure that all crystalline silica source materials are properly identified and proper workplace precautions (e.g., engineering controls & respiratory protection) are taken.

For additional information contact the Unifrax Health Hotline at 1(800) 322-2293.

