



Sampling for Silica Dust

Crystalline Silica: Exposure Sources and Health Effects

Workers typically inhale crystalline silica during abrasive blasting to clean and remove paint from metal surfaces, stone buildings, and foundry castings, or for finishing tombstones, etching or frosting glass, and artistic projects.

Crystalline silica has been classified as a human lung carcinogen¹. Additionally, when crystalline silica enters the lung, fibrotic nodules and scarring can occur around the trapped silica particles. This lung condition is called silicosis. If nodules grow too large, breathing becomes difficult and death may result. Silicosis victims are also at high risk for developing active tuberculosis.

There are three types of silicosis a worker may develop depending upon the airborne concentration of respirable crystalline silica:

- **Chronic silicosis:** The most common, usually occurs after 15 to 20 years of moderate to low exposures.
- **Accelerated silicosis:** This can occur after 5 to 10 years of high exposures.
- **Acute silicosis:** Occurs anytime after a few months up to two years following exposures to extremely high concentrations.

NIOSH recommends that crystalline silica levels not exceed 0.05 mg/m^3 as an eight-hour Time-Weighted Average (TWA)². The OSHA standard is determined by performing a calculation that takes into consideration the percentage of silicon dioxide (SiO_2) in the sample³. For respirable dust containing quartz, the calculation is as follows:

$$\frac{10 \text{ mg/m}^3}{\% \text{SiO}_2 + 2}$$

Sampling Respirable Crystalline Silica

Airborne crystalline silica is collected using a size-selective cyclone sampler. The cyclone with filter cassette is clipped in a worker's breathing zone and attached to a calibrated personal sample pump at the worker's waist. The pump pulls air through the cyclone which removes larger non-respirable size particles from the airstream via a centrifugal motion and allows smaller respirable-size particles to move into the cassette and collect on the filter. The sample on the filter is analyzed by an accredited laboratory to determine workplace silica concentrations.

To minimize measurement bias and variability, respirable cyclones should conform to the AGIH/ISO/CEN criteria for respirable particle mass (i.e., dust with a mass median aerodynamic diameter of $4.0 \mu\text{m}$). Cyclones should also have enough conductivity to minimize electrostatic effects on particle collection⁴.

SKC Chemical Fact Files® for Silica

For details on sampling crystalline silica, reference the following SKC publications on line at www.skcinc.com:

- **Silica, Crystalline, Quartz, Respirable Dust**
by OSHA Method ID 142
SKC Publication 1003
- **Silica, Crystalline by XRD**
by NIOSH Method 7500
SKC Publication 1370

This publication is designed to assist health and safety professionals in choosing the appropriate testing equipment and methodology to assess crystalline silica exposure. Sources of additional information are described below:

NIOSH Hazard Review: Health Effects of Occupational Exposure to Respirable Crystalline Silica at <http://www.cdc.gov/niosh/docs/2002-129/02-129a.html> (DHHS [NIOSH] Publication No. 2002-129, April 2002)

SKC at 724-941-9701 or www.skcinc.com for equipment to sample respirable crystalline silica.

References

- ¹ *Crystalline Silica Exposure: Health Hazard Information for Construction Employees*, OSHA, Publication No. 3177, 2002, <http://www.osha.gov/Publications/osha3177.pdf>
- ² *NIOSH Manual of Analytical Methods [NMAM], Fourth Edition*, March 15, 2003, <http://www.cdc.gov/niosh/docs/2003-154/>
- ³ *OSHA 29 CFR 1910.1000, Table Z-3*, <http://www.osha.gov>
- ⁴ *NIOSH Hazard Review: Health Effects of Occupational Exposure to Respirable Crystalline Silica*, DHHS (NIOSH) Publication No. 2002-129, April 2002, <http://www.cdc.gov/niosh/docs/2002-129/02-129a.html>

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