

Fact Sheet

Respirable Crystalline Silica



What is respirable crystalline silica?

Respirable crystalline silica (also known as RCS, silica dust, or quartz dust) is a common occupational hazard for coal and metal/nonmetal (MNM) miners. Silica is a common component of rock composed of silicon and oxygen (chemical formula SiO_2). Due to its small size, this dust may be inhaled and move throughout the lungs. It may be deposited in small airways and air sacs in the lungs and may remain there for long periods of time.

How are miners exposed to silica dust?

Silica dust is released through a variety of mining and milling operations. Miners may breathe silica dust while engaging in activities like:

- Cutting
- Scraping
- Excavating
- Sawing
- Sanding
- Jackhammering
- Grinding
- Drilling
- Crushing
- Hauling materials that contain silica

What are some important adverse health effects of silica dust exposure?

Occupational exposure to silica dust results in adverse health effects and increases risk of death. Respirable crystalline silica has been classified by the International Agency for Research on Cancer as **carcinogenic to humans**.

Miners who inhale silica dust may develop:

- Silicosis (i.e., acute silicosis, accelerated silicosis, and chronic silicosis) [See figure 1]
- Nonmalignant respiratory diseases (e.g., emphysema, chronic bronchitis)
- Lung cancer
- Kidney disease

Miners exposed to mixed-mine dust containing crystalline silica can also develop:

- Coal workers' pneumoconiosis (CWP)
- Progressive massive fibrosis (PMF) or complicated silicosis
- Multi-dust pneumoconiosis

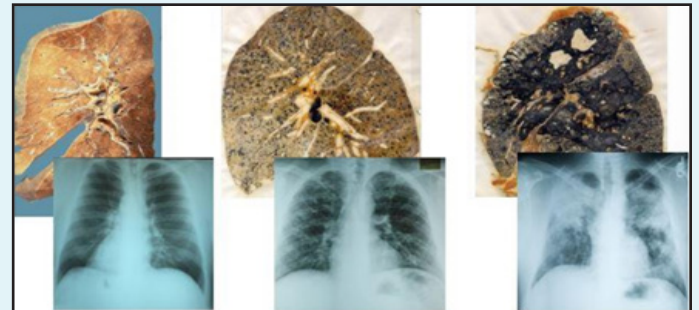


Figure 1: Photos and radiographs of lungs.

Source: NIOSH (2019). Dust Control Handbook for Industrial Minerals Mining and Processing. Second edition.

The lung of a normal, healthy adult is shown in the far-left panel above. With exposure to respirable crystalline silica, the lungs become hardened. For this reason, the lungs cannot expand properly, and breathing becomes more difficult. As silicosis progresses (left to right, above), the ability to perform daily activities (e.g., work, exercise, climbing stairs, walking) will become limited, if not impossible.

**These diseases are chronic, irreversible, and potentially disabling or fatal.
But they are also preventable.**

What actions must operators take to protect miners from silica dust?

MSHA establishes a uniform permissible exposure limit (PEL) for respirable crystalline silica of **50 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)** and an action level of **25 $\mu\text{g}/\text{m}^3$** over a full shift, calculated as an 8-hour time weighted average (TWA) for all mines.

To protect miners from silica dust exposures, operators must:

- Use and maintain **engineering controls**, such as dust suppression systems or enclosed cabs with filtered breathing air, as the primary means of control. [See figures 2 & 3]

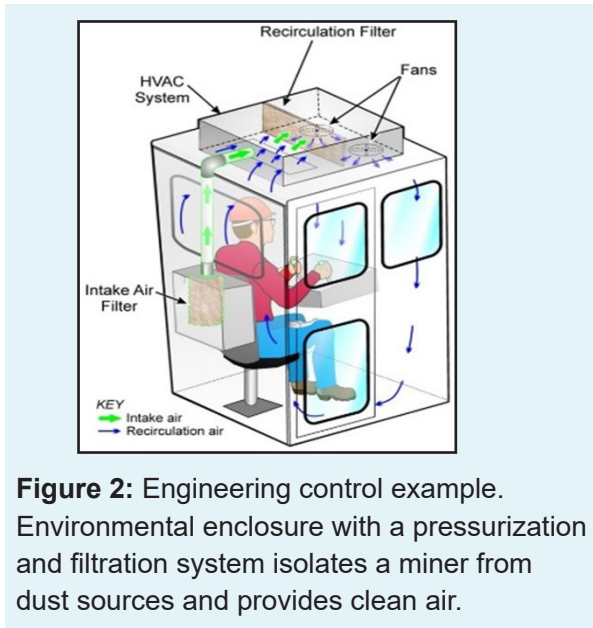


Figure 2: Engineering control example. Environmental enclosure with a pressurization and filtration system isolates a miner from dust sources and provides clean air.

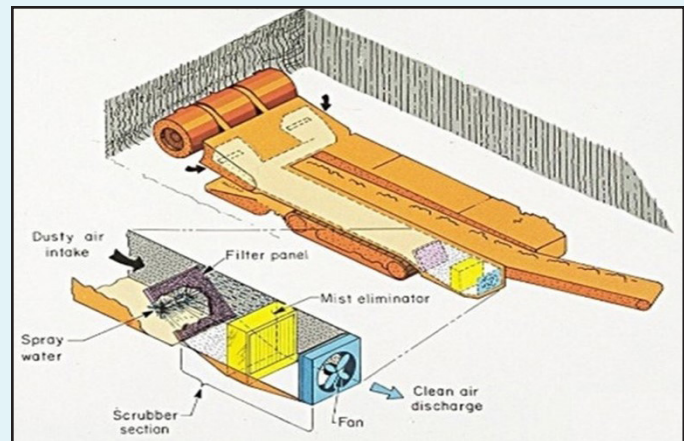


Figure 3: Engineering control example. Flooded-bed scrubber takes in dusty air, and filters and eliminates a large portion of dust particles. Source: NIOSH (2014, 2021)

- Implement **administrative controls**, such as housekeeping procedures, cleaning of spills, or prevention methods to minimize contamination of clothing, as a supplemental control.
 - Rotation of miners as a control method for silica dust exposure is prohibited.
- **Monitor silica dust exposures** through air dust samplings and evaluations of mining environment.
 - Perform **sampling** until the exposure levels of miners (or a representative fraction of miners) are shown to be below the action level from two consecutive samplings.
 - Protect affected miners if sampling indicates miner exposures are **above the PEL** by:
 - Providing **appropriate respirators** and ensuring they are worn properly.
 - Taking **corrective actions** and conducting **additional sampling**.
 - Immediately **reporting** overexposures to the District Manager or designated office
 - Perform a **periodic evaluation at least every 6 months, or whenever there are any changes** in: production; processes; installation or maintenance of engineering controls; installation or maintenance of equipment; administrative controls; or geological conditions.
- Implement a **respiratory protection program consistent with the requirements of ASTM F3387-19 Standard Practice for Respiratory Protection**.
- Provide **medical examinations to MNM miners at no cost to miners**.
 - Ensure medical examinations include a review of the miners' medical and work history, physical exam, chest x-rays, and pulmonary function testing, among other things.

For further assistance, check the MSHA website or contact your MSHA District Office.