

What Physicians Need to Know About Silicosis and Silica Exposure Sources

Certain Workers Are at Risk of Developing Silicosis

Crystalline silica is found in many common materials, such as those listed in the Box 1 below. When these materials are made into a fine dust in work activities such as those listed in the Box 2, the inhalation and deposition of these fine particles can produce silicosis over time.

Workers in many industries and occupations are at risk, including the examples in Box 3. Other employees who do not work directly with materials containing silica may be exposed as bystanders if they are in the area when crystalline silica-containing materials are being used.



Worker generating respirable crystalline silica dust while cutting concrete bridge column

Box 1: Materials Containing Crystalline Silica

- Granite, marble, artificial stone
- Quartz and quartzite
- Sand, gravel, and sandstone
- Slate and traprock
- Many abrasives used for abrasive blasting
- Concrete, concrete block, cement
- Brick and refractory brick
- Mortar
- Gunitite (dry-mixed form of sprayed concrete)
- Soil, especially sandy soil
- Asphalt-containing rock or stone

Box 2: Work Activities Associated with Silica Exposure

- Drilling, cutting, sawing, grinding, chipping, jack hammering
- Crushing, screening, sorting
- Loading, hauling, dumping, bagging
- Dry sweeping or pressurized air blowing
- Abrasive blasting
- Clean-up/maintenance

Box 3: Examples of At-risk Occupations for Exposure to Crystalline Silica

- Construction, especially bridge, tunnel, and elevated highway
- Wrecking and demolition
- Natural and artificial stone countertop manufacturing
- Concrete work
- Surface mining and quarrying
- Underground mining
- Stone cutting
- Milling stone
- Agriculture
- Foundry
- Ceramics, clay, pottery
- Vitreous enameling of china plumbing fixtures
- Glass manufacturing
- Manufacturing of concrete products and brick
- Manufacturing of soaps and detergents

Definition and Clinical Features

Silicosis is a diffuse, nodular, interstitial pulmonary fibrosis caused by a tissue reaction to inhaled crystalline silica dust. It can take the **acute** form under conditions of intense exposure but usually takes the **chronic** form, requiring several to many years to develop. People who have silicosis have increased susceptibility to infections such as tuberculosis, complicating the patient's prognosis. There is also increasing evidence that crystalline silica causes cancer and that individuals with silicosis are at increased risk of developing lung cancer.

Except in its acute form, silicosis begins with few, if any, symptoms. When clinical symptoms of silicosis are present, they could include cough and shortness of breath of increasing severity. On physical examination, breath sounds may be normal or distant and, with increased severity, there may be signs of right heart failure. Evidence of pathological response to silica exposure exists well before symptoms occur.

Chronic reactions, occurring after 10 or more years from first exposure, involve nodular lesions, (bilateral, multiple, rounded opacities) often more prominent in the upper lobes. In this **simple** stage of silicosis, nodules are usually small (1 cm or less). There may be little effect on pulmonary function at this stage. **Complicated** silicosis or progressive massive fibrosis (PMF) also usually develops in the upper lobes but the nodules go on to consolidate and exceed 1 cm and encompass blood vessels and airways. Lung function may be severely compromised, often with a mixed restrictive/obstructive pattern, but either pure restriction or obstruction may be seen.

Box 4 shows a summary of the clinical signs.

Progression of disease and radiographic findings can continue even after exposure has ended.



Photo: NIOSH

Worker exposed to silica dust at granite countertop fabrication shop

Box 4: Clinical Signs of Silicosis

▶ Simple

- mild restrictive and/or obstructive defects
- small, rounded opacities on X-ray

▶ Accelerated

- diffuse, small rounded opacities on X-ray
- more severe restrictive and/or obstructive defects

▶ Advanced

- increased profusion of small opacities and development of large opacities on X-ray
- more severe restrictive and/or obstructive defects
- cor pulmonale

▶ Acute

- diffuse perihilar alveolar filling process with ground glass opacities on X-ray

Recommended Medical Surveillance

The following are recommended by the New Jersey Department of Health as a baseline before exposure, then periodically as noted:

1. **Occupational history** to determine years of exposure -- update annually. Inquire about the materials used, tasks performed, occupations, and industries in which employed, including those listed in Boxes 1-3.
2. **Medical exam** emphasizing the respiratory system -- annually.
3. **Chest X-ray** to look for evidence of abnormality. Posteroanterior 14" x 17" or 14" x 14", classified according to the 1980 "Guidelines for the Use of ILO International Classification of Radiographs of Pneumoconioses" by a certified class "B" reader, is recommended. The ILO system has the distinct advantage of a standardized set of comparison X-ray films. [Names of B-readers are available from NIOSH](#). Box 5 provides recommendations for the frequency of X-rays. **NOTE:** the potential for excessive X-rays if the employee has also worked with asbestos or other hazards for which OSHA may require employers to provide X-rays.
4. **Pulmonary Function Tests (PFT)** to look for evidence of respiratory impairment. Should include FEV1 (forced expiratory volume in 1 second), FVC (forced vital capacity), and DLCO (diffusion capacity of the lungs for carbon monoxide) -- annually. All PFT should use equipment and follow recommendations issued by the ATS (American Thoracic Society) and be administered by a technician who has successfully completed NIOSH-certified training.

A baseline PPD skin test for tuberculosis because people who have silicosis have increased susceptibility. Repeat annually if there is X-ray evidence of silicosis (1/0 or greater profusion category using the ILO classification) or 25 years or longer exposure.

Box 5: Frequency of Chest X-rays for Silicosis

- Every 3-5 years with normal X-ray, low exposure, and less than 20 years exposure.
- Every 1-3 years with normal X-ray, high exposure, or greater than 20 years exposure.
- Annually with X-ray evidence of silicosis (ILO 1/0 or greater or ILO results A, B, or C large opacities), massive exposure, or positive PPD test.
- See "NOTE" in item 3 left.

Reporting Guidelines

Physicians, radiologists, pathologists and other health care professionals should report cases of silicosis to the health department in their state so that it can be determined whether silica exposures are being controlled at the workplaces where the patient has been employed. Such reporting is mandatory in many states, including New Jersey. In NJ, call 609-826-4984 to report cases. [Click here for reporting forms](#).

If the state has no occupational health program, cases of concern should be discussed with NIOSH (National Institute for Occupational Safety and Health) or the local OSHA (Occupational Safety and Health Administration) or MSHA (Mine Safety and Health Administration) office. Information on how to contact these agencies is given at the end of this bulletin.

The following elements define a case of silicosis for reporting purposes:

- A physician's provisional or working diagnosis of silicosis, **OR**
- Chest X-ray or other imaging technique interpreted as consistent with silicosis, **OR**
- Pathologic findings consistent with silicosis.

Because silicosis is sometimes confused with sarcoidosis, asbestosis, coal miner's pneumoconiosis, or other pneumoconiosis, it is important that all chest X-rays be reviewed by a B-reader.

Medical Management of Silicosis

There is no known medical treatment to reverse silicosis, therefore prevention is critically important. Removal from exposure may decrease the rate of disease progression. Corticosteroids are not useful to reduce the progression of the disease. Appropriate treatment for heart failure and tuberculosis should be started if these complications exist. All individuals should be strongly advised to stop smoking and offered smoking cessation information and support. Regular follow-up exams to assess progression and possibly to screen for lung cancer should be scheduled. Individuals who develop silicosis should be given the option of transfer to jobs without silica dust exposure. In order for this to be a realistic alternative, the individual should be able to maintain the same rate of pay and benefits without loss of seniority.

For Additional Information

► NIOSH (National Institute for Occupational Safety and Health):

Contact info:

Email: <https://wwwn.cdc.gov/dcs/contactus/form>

Phone: Technical Information and Assistance: 1-800-CDC-INFO (1-800-232-4636)

Website:

<https://www.cdc.gov/niosh/topics/silica/default.html>

For information about the health effects of crystalline silica exposure:

- Health Effects of Occupational Exposure to Respirable Crystalline Silica, April 2002
DHHS (NIOSH) Publication Number 2002-129:
<https://www.cdc.gov/niosh/docs/2002-129/default.html>

Additional NIOSH resources:

NIOSH silica publications by industry, including abrasive blasting, construction, dentistry, foundries, mining, oil and gas extraction and rock drilling:

<https://archive.cdc.gov/#/details?url=https://www.cdc.gov/niosh/topics/silica/industry.html>

► OSHA (Occupational Safety and Health Administration):

Contact Info:

[Directory of New Jersey OSHA Area Offices](#), or call the national office for the number of your local office:

800-321-6742 (OSHA).

Additional resources:

- OSHA webpage on health effects of crystalline silica:
https://www.osha.gov/dsg/topics/silicacrystalline/health_effects_silica.html
- Fact Sheet on Silica Standard for Construction Industry and General Industry:
<https://www.osha.gov/Publications/OSHA3681.pdf> (construction);
<https://www.osha.gov/Publications/OSHA3682.pdf> (general industry)
- OSHA Webpage for Clinicians:
<https://www.osha.gov/dts/oom/clinicians/index.html>

► MSHA (Mine Safety and Health Administration):

Contact info:

Mine Safety and Health Administration

201 12th St S

Suite 401

Arlington, VA 22202-5450

Website: www.msha.gov

Email: AskMSHA@dol.gov

Phone: (202) 693-9400

► ATS (American Thoracic Society):

Adverse Effects of Crystalline Silica Exposure. American Journal Respiratory and Critical Care Medicine, 1997; 155:761-765. Standardization of Spirometry - 1994 update. American Journal Respiratory and Critical Care Medicine, 1995; 152: 1107-1136.