Health Surveillance – Silica Dust (respirable crystalline)

Appointed Medical Practitioners (AMP) undertaking health surveillance are expected to have an understanding of the potential adverse health effects of respirable crystalline silica, and to use their clinical knowledge to advise on health surveillance for workers in the workplace.

Adverse health effects

Inhalation of fine respirable crystalline silica dust particles can lead to deposition in the respiratory bronchioles, alveolar ducts and alveoli within the lungs. This results in inflammation, cell damage and ongoing fibrosis with the development of silicosis.

1. **Simple chronic silicosis** may occur after many years of exposure to relatively low levels of silica dust. There may be no symptoms or signs for 10-30 years. Some may have mild symptoms of cough, sputum or breathlessness. Silicosis is a progressive disease. Intense but relatively short exposures or the development of symptoms within 10 years have been reported to be associated with increased risk of progressive massive fibrosis.

   Example: foundry work; mining

2. **Accelerated silicosis** is a more rapidly progressive lung disease which can occur after exposure to high concentrations of silica dust over a shorter period (5-10 years). Symptoms of breathlessness are early with rapid deterioration, and complications such as progressive massive fibrosis and respiratory failure.

   Example: sandblasting; stonemasonry using powered tools on high silica content stone (natural or artificial) without respiratory protection

3. **Acute silicosis** (silico-proteinosis from alveolar filling with lipid and proteinaceous material) can occur after a relatively short exposure (few weeks to 4 or 5 years) to very high concentrations of silica dust. There is progressive breathlessness, pleuritic chest pain, fever, cough, fatigue, weight loss and rapid progression to death from respiratory failure.

   Example: sandblasting, silica flour manufacturing, abrasive manufacturing

Silicosis is associated with increased risk of chronic obstructive pulmonary disease and reactivation of tuberculosis. There have been reportedly increased prevalence of antinuclear antibodies and autoimmune disease (rheumatoid arthritis). Silica is a Group 1 carcinogen in humans (IARC) with increased risk of lung cancer.

Surveillance guidelines

It is important to identify those with significant work exposures and increased risk of silicosis and its complications. Risk factors include high occupational exposure levels, high silica content of the stone or stone product and duration of exposure. In recent years, there have been increased reports from a number of countries (including Australia and UK) of cases of accelerated silicosis among
stonemasons in the artificial stone benchtop industry with 3-5 years of exposure to silica dust from dry cutting, drilling, grinding with power tools without adequate respiratory protection.

A baseline health surveillance is recommended prior to commencement of work, followed by annual health surveillance with 2-yearly imaging tests unless otherwise recommended by the AMP. Workers with high risk exposures may request an earlier health surveillance review if concerned about the development of respiratory symptoms including persistent cough, breathlessness or chest pains.

The WorkSafe Health Surveillance Notification form – Silica Dust (respirable crystalline) includes the required health surveillance components:

1. Work history – year of first exposure, nature and extent of silica dust exposure, use of respiratory protection.
2. Respiratory questionnaire and medical history - including cough, breathlessness and chest pains, smoking and relevant conditions (respiratory, cardiac, arthritis)
3. Physical examination (emphasis on lungs, heart, joints)
4. Chest Imaging
   a. Chest x-ray (good quality standard PA with ILO classification)
      I. Initial chest x-ray (CXR)
      II. Repeat CXR every 2 years (in the absence of any adverse finding or development of new symptoms)
   b. Alternatively, low dose CT scan (LDCT) - contemporary generation CT Scanner with modified ILO (Kusaka) classification.
      I. Initial LDCT
      II. Repeat every 2 years (in the absence of any adverse finding or development of new symptoms)
5. Lung Function Tests
   a. Spirometry (standardised) using accredited, calibrated equipment
      II. Measurement to be consistent with American Thoracic Society (ATS/ERS) standards and criteria with at least three valid tests
   b. Alternatively, laboratory respiratory function tests (including DLCO)

Note:

Recent updates from Queensland health surveillance of stonemasons indicate that dry cutting, polishing, grinding, drilling and machining for 1-3 years, and smoking have been associated with increased risks of accelerated silicosis. The Queensland experience demonstrated that CXR’s were not as sensitive or reliable with the observation that a CXR may be reported as normal with no opacities (ILO classification 0/0) whilst the corresponding high resolution CT scan (HRCT) revealed bilateral apical fibrosis consistent with silicosis. Similarly laboratory respiratory function tests including DLCO were found to be more sensitive and reliable than office spirometry.

LDCT where available (with modified ILO (Kusaka) reporting), should ideally be the initial radiologic screening tool for the detection of silicotic changes given its much greater sensitivity than CXR and comparable radiation dose*.

Although HRCT is more sensitive than a LDCT, it is not recommended as a screening tool, given its higher radiation dose. However, HRCT and laboratory lung function tests may form part of the investigations undertaken by the AMP in the presence of concerning respiratory symptoms or abnormalities on CXR or LDCT.
*Estimated radiation dose:

- CXR (digital) 0.05mSv
- LDCT 0.1 - 0.3 mSv
- HRCT 1 - 5 mSv
- Annual background 3 - 4 mSv

Other considerations:

- COPD definition: FEV₁/FVC ratio <70% and FEV₁ <80% predicted (GOLD 2)
- Accelerated annual decline in FEV₁ - in excess of expected decline with age (27-53 ml p.a.)
- For those with an FEV₁ at a low baseline, i.e. lower range of normal, an accelerated decline in lung function will have a greater clinical impact on lung capacity.
- Chest x-ray changes or progression
  - Small rounded nodular opacities (ILO classification p,q,r of 1/1 or higher)
  - Hilar enlargement, “egg shell” calcification of hilar and intrapulmonary lymph nodes (‘egg shell’ calcifications)
  - Apical fibrosis – bilateral
  - Confluent lung opacities/fibrosis (late)
- Low dose CT scan
  - Micronodular infiltrate
  - Hilar or mediastinal adenopathy and/or calcification
  - Confluent lung opacities (late)

Health counselling

- Inform workers of potential adverse health effects from inhaling silica dust
- Counsel all workers to stop smoking
- Be clean shaven for effective respiratory protection
- Reinforce safe work practice (effective dust suppression/extraction, wet work, respirators with appropriate level of protection, protective clothing, etc)
- Reinforce personal hygiene and cleanliness, including:
  - wash face and hands before eating or drinking
  - no eating, drinking or smoking in the (dusty) workshop
  - shower and change into clean clothes and footwear before going home after work
  - park vehicles away from dust
  - do NOT take the dust home

Notification requirements

Health surveillance results are to be sent to WorkSafe Western Australia by the AMP using the WorkSafe Health Surveillance Notification Form (Silica) together with:

- CXR and/or LDCT report(s) by radiologist (include ILO classification for CXR; modified ILO (Kusaka) classification for LDCT)
- Spirometry printouts (values and flow-volume graphs), or Laboratory lung function test (including DLCO)
- HRCT report – if undertaken

The AMP is required to explain the results of the health surveillance to the worker, and provide feedback to the employer to enable remedial action (i.e. review and improve safety controls in the workplace).
The AMP will arrange prompt referral to a respiratory physician (with expertise in occupational lung disease) for assessment, investigations and clinical management where appropriate, based on the health surveillance outcomes. The AMP determines whether further exposure to silica dust should cease pending the outcome of a referral to a respiratory physician.

Respiratory physician advice and workplace environmental controls should be taken into careful consideration by the AMP before determining whether the worker may safely resume work in an environment which potentially exposes them to respirable silica dust and/or other hazardous dust.

Any identified cases or suspected cases of silicosis must be reported by the AMP to WorkSafe promptly. The AMP keeps WorkSafe informed of the outcome of the respiratory physician review by forwarding a copy of the report from the respiratory physician. These cases will require ongoing respiratory physician reviews.

References
Refer to the WorkSafe WA guidelines for health surveillance when planning and implementing health surveillance.

Other References
Safe Work Australia resources are useful as an adjunct resource.