

Review of the Health Effects Associated with Exposure to Respirable Crystalline Silica in Coal Dust

Researchers

The two researchers were:

Martin Jennings – Occupational Hygienist
Principal Consultant
Martin Jennings & Associates

Martyn Flahive – Occupational Physician
Murdoch Vocational Health

Aims

The main aims were to:

1. Determine the adverse health effects from exposure to crystalline silica in respirable coal dust;
2. Determine whether the above health effects are different in any way to those from exposure to pure crystalline silica; and
3. Determine whether the current NSW exposure standard of 0.15 mg/m^3 respirable silica is sufficient to prevent the onset of any disease outcome identified in (1) above.

Background

In 2002, the National Occupational Health and Safety Commission of Australia (NOHSC) recommended a reduction of the Australian occupational exposure standard for respirable crystalline silica to 0.1 mg/m^3 specifically for quartz, cristobalite and tridymite (8hr TWA). This was based upon a scientific review that recommended that a separate review be conducted in respect of occupational exposure to respirable crystalline silica in coal dust.

The authors viewed current available research and data provided by CSPL on coal dust and quartz exposures and on incidence of diseases in NSW coal miners. Where appropriate, personal contacts were initiated with persons identified as having expertise in the area.

Project Outcomes

- The literature indicates that the toxicity of quartz varies with exposure to freshly fractured surfaces; the presence of a coating of aluminium containing clay minerals; and particle size in relation to surface area. There is also evidence that lung macrophages remove the mineral coating from the surface of the quartz particles over time, leaving potentially pathogenic quartz particles in the lungs, which may cause delayed onset of silicosis or lung fibrosis.
- It is well accepted that exposure to coal dust is responsible for disease outcomes such as simple coal worker's pneumoconiosis (CWP) which may progress to progressive massive fibrosis. Silicosis in coal miners is not as well documented, although there is a of coal miners at a Scottish colliery where the miners were exposed to high levels of quartz, which found a significant risk of silicosis that increased exponentially with increasing levels of airborne respirable crystalline silica.
- Some research indicates that where silica is less than 7% of the respirable coal dust, it does not play a significant role in the development in lung fibrosis or CWP. The authors found that this research had limited follow up and a relatively small study group. The authors found that this evidence insufficient to rely on for setting an exposure standard for silica in the coal industry.
- Several studies in relation to lung cancer in coal miners were considered and the consensus of opinion amongst researchers is that there is no conclusive evidence that exposure to coal dust containing respirable crystalline silica is linked to lung cancer. There are reports of an association of gastric cancer and coal mining. The research is inconsistent

and inconclusive. There does not however appear to be an association between respirable coal dust exposure, weakening any proposition of a link between respirable crystalline silica and gastric cancer.

- In considering the current NSW exposure standard of 0.15 mg/m^3 , comparison was made to other standards from Australia, the UK and US. The NSW standard for respirable crystalline silica is higher than most other standards with the notable exception of the standard in the WA Mines Safety and Inspection Regulations (1995) of 0.2 mg/m^3 . Despite an assertion that there have been no compensable cases of silicosis in nearly 20 years in WA, the authors do not feel this is a useful measure of effectiveness of control.
- It was also noted that there have been no reported cases of CWP or silicosis in 18 years among NSW coal miners. However, in the authors' opinion this warrants closer scrutiny as many miners are not subject to regular health surveillance when they retire or leave the industry. This is particularly relevant to silicosis as there is evidence of delayed onset of silicosis or fibrosis in individuals who are no longer exposed to coal dust.
- On reviewing the exposure data provided by CSPL, the authors feel that a small number of coal miners may be exposed to levels of respirable crystalline silica at or above the exposure standard. These would include roof bolters and drillers.

Where there are higher exposures, the exposures may be to more pathogenic silica particles with freshly fractured surfaces. These higher risk occupations should be subject to further investigation.

- Although there is considerable evidence that the current exposure standard will reduce the incidence of CWP and silicosis, the authors are of the opinion that it is unlikely to prevent silicosis developing in all coal miners over their lifetime. Silicosis is an undesirable outcome, where there is no effective treatment.
- In summary the authors were unable to find any evidence that CSPL should not adopt the proposed NOSHHC exposure standard of 0.1 mg/m^3 for respirable crystalline silica collected under the new Australian Standard for respirable dust (AS 2985-2004). At this stage the authors were unable to find strong evidence to support a more stringent standard for the coal industry.

Further Information

Martin Jennings Ph 08 9388 3272
Email mail@martinjennings.com.au

Martyn Flahive Ph 08 9366 1988
Email flahive@optusnet.com.au

September 2005