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## Silica dust in the workplace / 工作场所的矽尘

This guidance advises PCBUs of the risks of respirable crystalline silica dust and how to control them and protect their workers.

本指南是为企事业经营者提供了解吸入结晶矽尘的风险和控制方法以及保护员工的建议。

Silicosis is a progressive and deadly disease that causes fibrosis of the lungs from the inhalation of respirable crystalline silica (RCS) dust.

As a PCBU, you have a duty to eliminate, or use controls to minimise worker exposure to the hazard of, and risks from, RCS dust.

矽肺是一种慢性发展和致命的疾病, 通过吸入结晶矽尘引起肺纤维化。

任何企事业经营者都有责任采取控制措施, 消除或最大限度地减少员工接触结晶矽尘的危险。

### Respirable crystalline silica dust / 可吸入结晶矽尘

Silica is a natural substance found in concrete, bricks, rocks, stone (including artificial or engineered stone found in composite kitchen benchtops), sand and clay. RCS dust is created when materials containing silica are cut, ground, drilled, sanded, polished or otherwise disturbed. RCS particles are extremely small; they can't always be seen with the naked eye.

矽是一种天然物质, 存在于混凝土、砖块、岩石(包括人造或合成石质厨房台面)、沙子和粘土中。当含有矽的材料被切割, 研磨, 钻孔, 打磨, 抛光或以其方方式被搅动时, 会产生可吸入的结晶矽尘。矽尘的颗粒非常小, 肉眼通常不能看到。

### How workers can be exposed to RCS dust / 员工接触可吸入矽尘的途径

Workers in the following industries or who work with the following materials are most at risk of being exposed to RCS dust:

- quarrying
- roading
- foundries
- construction: concrete, stone, bricks, mortar, fibre cement products
- manufacturing of concrete, bricks and tiles
- kitchen benchtop manufacturing (natural and engineered stone), finishing and fitting
- abrasive blasting

- monumental masonry work
- mining
- concrete drilling, cutting, grinding, fettling, mixing, handling, dry shovelling, tunnelling.

以下行业的员工或使用以下材料的员工最有可能接触可吸入的结晶矽尘：

- 采石；
- 筑路；
- 翻砂；
- 建筑：混凝土、石材、砖、砂浆、纤维水泥制品；
- 混凝土、砖瓦和瓷砖生产；
- (天然和人造石)厨房台面生产，切割，研磨或抛光；
- 喷砂处理；
- 大型碑石工程；
- 采矿；
- 混凝土钻孔，切割，研磨，修补，搅拌，搬运，铁锹铲动干粉，开凿通道。

## Health effects of exposure to RCS dust / 接触可吸入结晶矽尘对健康的影响

Workers may develop the following lung diseases from breathing in RCS dust:

- **Silicosis:** scarring of lung tissue resulting in shortness of breath. May continue to develop even after exposure to RCS dust has stopped. **The effects of silicosis are permanent.** There are three types of silicosis:
  - **acute silicosis:** may occur after exposure of less than a year to very large amounts of RCS dust
  - **accelerated silicosis:** may occur after exposure to large amounts of RCS dust over a shorter period of time, typically 3 to 10 years. Has been seen in workers from the artificial/engineered stone kitchen benchtop industry
  - **chronic silicosis:** typically results from exposure to RCS dust over more than 20 years.
- **Lung cancer:** may occur in workers exposed to high levels of RCS dust over a long period of time.
- **Chronic obstructive pulmonary disease (COPD):** a chronic lung condition that can lead to breathing difficulties such as emphysema in workers exposed to high levels of RCS dust over a long period of time.

There is some evidence that exposure to RCS dust may also cause kidney disease.

员工接触可吸入结晶矽尘可罹患以下肺部疾病：

- **急性矽肺:** 肺组织瘢痕导致呼吸短促。即使停止接触结晶矽尘后，病情也可能继续发展。**矽肺的影响是永久性的。** 矽肺有三种类型：
  - **急性矽肺:** 过度接触可吸入结晶矽尘不到一年后而致病者；
  - **加速型矽肺:** 过度接触可吸入结晶矽尘3—10年后而致病者。常见于从事人造/合成石质厨房台面的行业员工。
  - **慢性矽肺:** 接触可吸入结晶矽尘超过20年典型结果。
- **肺癌:** 可发生在长期过度接触可吸入结晶矽尘的员工身上。
- **慢性阻塞性肺病(COPD):** 慢性肺病可导致呼吸困难，诸如发生在长期过度接触可吸入结晶矽尘的员工罹患的肺气肿。

一些证据表明，接触可吸入结晶矽尘也可能导致肾病。

## Your responsibilities as a PCBU / 企事业经营者的职责

As a PCBU, you **must** ensure the health and safety of workers and that others are not put at risk from your work.

Before starting work using artificial/engineered stone, you must complete a risk assessment and review your controls.

You **must** eliminate risks that arise from your work so far as is reasonably practicable.<sup>1</sup>

- When deciding how (control measures) to eliminate or minimise risks, you must identify when work tasks may create RCS dust.
- Give preference to effective control measures that protect many workers at the same time.
- Talk to your workers to get their views on which control measures to use.

企事业经营者**必须**确保工作人员的健康和安全,并确保从事的工作不会对他人造成威胁。

在从事人造/合成石质工作之前,您必须完成风险评估并审查控制措施。

您**必须**在合理可行的范围内,消除工作中产生的风险。<sup>1</sup>

- 在决定消除或降低控制风险措施时,您必须确定工作中可能产生可吸入结晶矽尘的时间段。
- 同时应优先考虑保护员工的有效控制措施。
- 与员工进行探讨,了解他们对采用控制措施的看法。

### To eliminate RCS / 消除可吸入结晶矽尘

- Use alternative products (eg metallic shot, slag products or grit instead of sand for abrasive blasting).

If you can't eliminate risks, you must **minimise** them so far as is reasonably practicable.

- 使用替代产品(例如:喷砂处理时使用金属喷砂、矿渣产品或粗砂,而不是细砂)。

如果无法消除风险,则必须**尽量减少**风险,使工作环境合理可行。

### To minimise exposure to RCS dust / 减少接触可吸入结晶矽尘

Instead of using engineered stone, use materials with a lower silica content. Engineered stone has approximately 90% silica compared with natural stone like marble and limestone which have around 2% silica. For more information about managing risk, see: [worksafe.govt.nz](http://worksafe.govt.nz)

使用含矽量较少的材料,替代合成石料。合成石料含矽90%,相比之下,天然石材(如:大理石和石灰石)仅含约为2%的矽。有关管理风险的资讯,请浏览:[worksafe.govt.nz](http://worksafe.govt.nz)

### WET-WORKING CONTROL MEASURES / 湿切工作控制措施

Freshly exposed silica particle surfaces (created due to grinding, drilling, cutting etc) are more toxic than older weathered particle surfaces. Using water to suppress dust has the added benefit of speeding up the weathering process.

接触新产生的矽颗粒表面(因研磨,钻孔,切割等而产生)比接触陈旧的风化颗粒表面更具毒性。用水抑制灰尘具有加速风化工艺的额外好处。

DO	DON'T
Use water spray or misting systems to suppress dust. Keep the work material (eg concrete, engineered stone benchtops) wet while work is carried out on them (eg cutting, polishing, etc). Use on-tool water suppression systems to keep dust out of the air	Dry sweep work areas
Frequently hose down equipment and work areas with water	Use compressed air to blow away dust
可行	禁止
使用喷水或喷雾系统抑制灰尘。在切割,抛光时确保工作材料(例如:混凝土、厨房台面合成石料)水湿状态。使用喷水工具抑制空气中的灰尘。	用扫帚清扫干燥的工作区域
经常用水清理设备和工作区域。	使用压缩空气吹拂灰尘。

<sup>1</sup> 'So far as is reasonably practicable' means you first consider what is possible in your circumstances to ensure health and safety. You then consider what is reasonable to do in your circumstances. You need to achieve a result that provides the highest protection that is reasonably practicable in the circumstances.

<sup>1</sup> “在合理可行的范围内”意指首先考虑所处环境是否可确保对健康和安全的可行。然后需考虑所处环境可合理开展的工作。您需要在提供最高保护的合理可行的环境中获得这种结果。

## DUST CONTROL MEASURES / 控制灰尘措施

- Use physical barriers or computer numerical control (CNC) machines to isolate work areas or tasks that generate dust.
- When purchasing equipment and machinery, look for dust control features and dust collection systems. For example, tools used for cutting, grinding or polishing concrete and masonry should provide water to the blade and/or be fitted with an on-tool extraction system. See: [worksafe.govt.nz](https://www.worksafe.govt.nz)
- Ensure dust-generating equipment has a dust collection system with a filtered air supply to isolate the worker from the dust.
- Use an H-class HEPA-filtered vacuum cleaner in accordance with Standard AS60335-2-69. This includes when working at someone's home (eg to fit a bench). Workers should not use the household vacuum cleaner to remove dust.
- Seal dust waste bags and place them in the correct waste container.
- 使用实际隔离装置或计算机数控机器隔离产生灰尘的工作区域。
- 购买设备和机器时, 请查看防尘功能和集尘系统。例如用于切割, 研磨或抛光混凝土和砖石的工具应提供刀头喷水给刀片和/或配备工具上的除尘系统。请浏览: [worksafe.govt.nz](https://www.worksafe.govt.nz)网站。
- 确保产生粉尘的设备带有集尘和供气系统, 使员工远离灰尘。
- 使用符合AS60335-2-69标准的H级HEPA过滤器。包括在住宅装修厨房台面的工作。员工不应使用家用吸尘器收集灰尘。
- 密封灰尘袋并将其放入正确的废物收集箱中。

## ADMINISTRATIVE CONTROL MEASURES / 管理控制措施

- Set up exclusion zones with signs to mark the boundaries of work areas where RCS dust is created. The signs should warn workers about the hazards and specify the PPE to be used.
- Schedule potential high-exposure work for times when there are fewer workers and others around (eg breaks or after normal working hours).
- 在产生灰尘的工作区域设置禁止入内标志。该标志应提醒员工相关危险并具体指出使用个人防护设备。
- 在人员较少的时间(例如: 休息或正常工作时间之后)安排接触粉尘较多的工作。

## PERSONAL PROTECTIVE EQUIPMENT (PPE) / 个人防护设备

- **PPE is the least effective control measure. It should not be the first or only control measure you consider.**
- PCBUs must provide PPE to workers unless another PCBU provides it or the worker genuinely and voluntarily chooses to provide their own PPE (and you are satisfied it is suitable).
- Seek expert advice when choosing PPE and consult with the workers who will be using it.
- 个人防护设备是最基本的控制措施。不应将其视为首先考虑的或唯一的控制措施。
- 除非其它企事业提供个人防护设备或员工自愿选择自己提供个人防护设备(并您认为是合适的), 否则, 企事业经营者必须向员工提供个人防护设备。
- 在选择个人防护设备时寻求专家建议, 并咨询将要使用这些设备的员工。

### Respiratory (breathing) protection / 呼吸保护措施

- A respirator may be half-face, full-face or a Powered Air Purifying Respirator (PAPR) (see pictures below). The type of respirator you choose will depend on the job and the levels of toxicity and concentration of RCS. Always choose a respirator that fully protects the worker, conforms with AS/NZS 1716 and is selected in accordance with Standard AS/NZS 1715.
- Carry out fit testing for each worker who will wear a respirator that requires a seal against the face.
- Provide information, training and instruction so workers can correctly use, wear, store and maintain their PPE.
- 防尘面罩可以是半罩式、全罩式或动力空气净化防尘面罩(见下图)。您选择的防尘面罩类型取决于工作以及可吸入结晶矽尘的毒性和浓度。始终选择符合AS/NZS 1716标准、全面保护员工的呼吸罩, 并根据AS/NZS 1715标准进行选择。
- 对佩戴防尘面罩的员工进行佩戴测试, 使面罩可以紧密配合面形。
- 提供资讯、培训和指导, 以便员工正确使用, 佩戴, 保存和保养他们的个人防护设备。



**FIGURE 1:**  
Re-usable half-face respirator (cartridge)

**图1:**  
可重复使用的半罩式防尘面罩  
(盒式)



**FIGURE 2:**  
Full-face respirator (cartridge)

**图2:**  
全罩式防尘面罩(盒式)



**FIGURE 3:**  
Full-face powered respirator (cartridge)

**图3:**  
全罩式动力空气净化防尘面罩  
(盒式)

### Protective clothing and cleanliness / 防护服和清洁

- Ensure workers have overalls and gloves to wear at work. Workers should leave their dust-covered clothes at work to be cleaned. They should not wear them home.
- Ensure workers understand the importance of washing their hands before eating, drinking and smoking, and of washing up before they go home at the end of the day.
- Ensure washing facilities are provided.
- 确保员工在工作时穿戴防尘工作服和手套。员工应把防尘工作服留在工作场所进行清洗。他们不应在家中穿戴。
- 确保员工了解在进食, 饮水和吸烟之前洗手, 以及在一天结束回家之前洗手的重要性。
- 确保提供清洗设施。

### Exposure monitoring / 接触程度监测

Exposure monitoring involves measuring and evaluating workers' exposure to a health hazard. It includes monitoring workplace conditions as well as biological monitoring.

- As a PCBU you **must**, so far as is reasonably practicable, monitor workplace conditions if exposure to a particular health risk warrants it.
- Exposure monitoring will confirm whether workers are exposed to RCS dust at potentially harmful levels and if your control measures are working properly.
- Exposure monitoring does not replace the need for control measures.
- You can engage an occupational hygienist from the New Zealand Occupational Hygiene Society: [www.nzohs.org.nz](http://www.nzohs.org.nz) or the Health and Safety Association of New Zealand (HASANZ) Register: <https://register.hasanz.org.nz> to measure RCS dust concentrations and help evaluate risks to worker health.
- Ask your workers for their views when making decisions about exposure monitoring.

接触程度监测包括测量和评估员工接触粉尘对健康造成的危害。其中包括监测工作场所的环境以及生物监测。

- 企事业经营者在合理可行的范围内, **必须**监测工作场所接触粉尘的环境, 是否对健康造成特定危害。
- 接触程度监测将确认员工是否接触对健康有潜在危害的可吸入结晶矽尘, 以及您的控制措施是否正常发挥作用。
- 接触程度监测不能取代控制措施。
- 您可以聘请新西兰职业卫生协会的职业健康师([www.nzohs.org.nz](http://www.nzohs.org.nz))或新西兰健康与安全协会的注册机构(<https://register.hasanz.org.nz>)测试可吸入结晶矽尘浓度, 并帮助评估对员工健康造成的风险。
- 在做出有关接触监测的决策时, 须询问员工的意见。

### Health monitoring / 健康监测

Health monitoring involves testing workers to identify any changes in their health status because of exposure to hazards arising from their work.

- As a PCBU you must, so far as is reasonably practicable, monitor workers' health if exposure to a particular health risk warrants it.

- Provide health monitoring for all your workers who may be exposed to RCS dust. You can engage an occupational health practitioner from the New Zealand Occupational Health Nurses' Association: [www.nzohna.org.nz](http://www.nzohna.org.nz) from the HASANZ Register, and/or the Australian and New Zealand Society of Occupational Medicine: <https://anzsom.org.nz> to perform health monitoring.
- Monitoring should include:
  - collection of workers' demographic, medical and occupational histories
  - records of workers' exposure
  - a respiratory questionnaire
  - respiratory function tests
  - in some cases, chest x-ray or other radiological procedure.
- You must have workers' consent before you monitor their health.
- Ask your workers for their views when making decisions about health monitoring.

健康监测涉及检测员工，以確定他們因接触危害工作环境对其健康状况造成的任何变化。

- 企事业经营者在合理可行的范围内，必须监测工作场所接触粉尘的情况是否对员工健康造成危害。
- 为可能接触可吸入结晶矽尘的所有员工提供健康监测。您可以聘请来自HASANZ注册机构的新西兰职业健康护士协会的职业健康师([www.nzohna.org.nz](http://www.nzohna.org.nz))，和/或澳大利亚和新西兰职业医学会(<https://anzsom.org.nz>)进行健康监测。
- 监测应包括：
  - 种族、疾病和从业历史
  - 员工接触粉尘的记录；
  - 呼吸问卷调查；
  - 呼吸功能检测；
  - 在某些情况下，采取胸部X光或其它透视措施。
- 在监测健康状况之前，您必须征得员工的同意。
- 在做出有关健康监测的决策时，询问员工的意见。

## Health monitoring for workers exposed to engineered stone / 接触合成石料的员工健康监测

Due to the serious risk of developing accelerated silicosis in those working with engineered stone, an Occupational Medicine Specialist should be engaged to provide health monitoring advice and services.

由于使用合成石料的员工发生加速矽肺的严重风险，应聘请职业医学专家提供健康监测建议和服务。

## Training / 培训

- As a PCBU you must, so far as is reasonably practicable, ensure workers are supervised or trained to work healthily and safely.
- Provide your workers with information, training and instruction on the control measures (including the use and care of PPE) and the potential health risks of wearing PPE. For more information, see: [worksafe.govt.nz](http://worksafe.govt.nz)
- Ask your workers for their views when deciding how to provide information and training.
- 企事业经营者必须在合理可行的范围内确保员工得到监督或培训，以便健康安全地工作。
- 为您的员工提供有关控制措施(包括个人防护设备的使用和养护)以及佩戴个人防护设备的潜在健康风险方面的资讯、培训和指导。请浏览：[worksafe.govt.nz](http://worksafe.govt.nz)网站。
- 在做出有关提供资讯和培训决策时，询问员工的意见。

## More information / 更多信息

[Safety alert / 安全提示](#)

[Accelerated silicosis](#)

[加速型矽肺](#)

[Fact sheets / 资料简报](#)

[Controlling dust with on-tool extraction](#)

[Respiratory Protective Equipment – advice for PCBU's](#)

[Workplace Exposure Standards \(WES\)](#)

[HASANZ Register](#)

[NZOHS](#)

[NZOHNA](#)

[ANZSOM](#)

[用吸尘工具控制粉尘](#)

[呼吸保护设备 - 为企事业经营者提供的建议](#)

[工作场所接触粉尘标准](#)

[新西兰健康与安全协会注册机构](#)

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[澳大利亚和新西兰职业医学会](#)