Chapter 56: Respirable Crystalline Silica

General Requirements

1 Purpose

The purpose of these requirements is to ensure that worker exposure to respirable crystalline silica remains below the permissible exposure limit (PEL) and that material containing silica is properly handled and disposed of. They cover all work that could cause the release of silica, such as demolition or drilling of concrete or work with materials that contain silica. They apply to workers potentially exposed to airborne concentrations of respirable crystalline silica, their supervisors, competent persons, subcontractors, and the respirable crystalline silica program manager; and Waste Management and Occupational Health.

2 Requirements

2.1 Hazard Identification and Control Selection

Cutting, drilling, grinding, coring, and other abrasive operations on concrete are potential sources of airborne silica, as are operations on sheetrock, surfaces painted with low volatile organic compounds, tile, brick, some insulation products, and silica-containing mortar, paints, or insulation. Where process knowledge indicates the presence of silica, the controls required by Table 1 in 29 CFR 1926.1153(c) will be implemented or an exposure assessment will be conducted in accordance with 8 CCR 5204(d) and controls used based on the results.

Note: The exposure assessment includes an initial determination, which may be based on “any combination of air monitoring data or objective data sufficient to accurately characterize employee exposures”, including data from manufacturers or other third parties on the efficacy of silica control measures, or on “scheduled monitoring” (8 CCR 5204 (d)(3)).

2.1.1 Table 1

Table 1 in 29 CFR 1926.1153 (reproduced here as Table 1) lists common airborne silica generating activities, the required controls, and required levels of respiratory protection. Generally the controls in Table 1 are adequate to limit exposure for the activities listed and no further analysis is necessary.

The primary silica generating activities performed by SLAC workers involve the use of handheld drills, stand-mounted core drills, and rotary hammers. These activities can be completed using the dust control methods called out in Table 1 without requiring the use of respirators.

Respirable Crystalline Silica: Handheld and Stand-mounted Drill Work Plan and Respirable Crystalline Silica: Rig-mounted Core Saw or Drill Work Plan are Table 1-compliant work plans for these activities.
### Table 1  Silica-generating Equipment/tasks, Controls, and Respiratory Protection (29 CFR 1926.1153[c] Table 1)

<table>
<thead>
<tr>
<th>Equipment / Task</th>
<th>Engineering and Work Practice Control Methods</th>
<th>Required Respiratory Protection and Minimum Assigned Protection Factor (APF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Stationary masonry saws</td>
<td>Use saw equipped with integrated water delivery system that continuously feeds water to the blade, Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions</td>
<td>≤ 4 hours/shift: None &gt; 4 hours/shift: None</td>
</tr>
</tbody>
</table>
| (ii) Handheld power saws (any blade diameter) | Use saw equipped with integrated water delivery system that continuously feeds water to the blade, Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions:  
  - When used outdoors: None  
  - When used indoors or in an enclosed area: APF 10 | ≤ 4 hours/shift: None > 4 hours/shift: APF 10 |
| (iii) Handheld power saws for cutting fiber-cement board (with blade diameter of 8 inches or less) | For tasks performed outdoors only:  
  - Use saw equipped with commercially available dust collection system  
  - Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions  
  Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency | ≤ 4 hours/shift: None > 4 hours/shift: None |
| (iv) Walk-behind saws | Use saw equipped with integrated water delivery system that continuously feeds water to the blade, Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions:  
  - When used outdoors: None  
  - When used indoors or in an enclosed area: APF 10 | ≤ 4 hours/shift: None > 4 hours/shift: APF 10 |
| (v) Drivable saws | For tasks performed outdoors only:  
  - Use saw equipped with integrated water delivery system that continuously feeds water to the blade  
  Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions | ≤ 4 hours/shift: None > 4 hours/shift: None |
<p>| (vi) Rig-mounted core saws or drills | Use tool equipped with integrated water delivery system that supplies water to cutting surface, Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions | ≤ 4 hours/shift: None &gt; 4 hours/shift: None |</p>
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| (vii) Handheld and stand-mounted drills (including impact and rotary hammer drills) | Use drill equipped with commercially available shroud or cowling with dust collection system  
Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust emissions  
Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism  
Use a HEPA-filtered vacuum when cleaning holes | ≤ 4 hours/shift > 4 hours/shift |
| (viii) Dowel drilling rigs for concrete | For tasks performed outdoors only:  
Use shroud around drill bit with a dust collection system.  
Dust collector must have a filter with 99% or greater efficiency and a filter-cleaning mechanism.  
Use a HEPA-filtered vacuum when cleaning holes | APF 10 APF 10 |
| (ix) Vehicle-mounted drilling rigs for rock and concrete | Use dust collection system with close-capture hood or shroud around drill bit with a low-flow water spray to wet the dust at the discharge point from the dust collector  
or  
Operate from within an enclosed cab and use water for dust suppression on drill bit | None None |
| (x) Jackhammers and handheld powered chipping tools | Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact  
- When used outdoors | APF 10 |
| | None |
| | APF 10 |
| | None |
| | APF 10 |
### Equipment / Task

- **(xi) Handheld grinders for mortar removal (i.e., tuckpointing)**
  - Use grinder equipped with commercially available shroud and dust collection system
  - Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions
  - Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.

- **(xii) Handheld grinders for uses other than mortar removal**
  - For tasks performed outdoors only:
    - Use grinder equipped with integrated water delivery system that continuously feeds water to the grinding surface.
    - Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.
  - or
    - Use grinder equipped with commercially available shroud and dust collection system
    - Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions
    - Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism
      - When used outdoors: None
      - When used indoors or in an enclosed area: None

- **(xiii) Walk-behind milling machines and floor grinders**
  - Use machine equipped with integrated water delivery system that continuously feeds water to the cutting surface
  - Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions

### Required Respiratory Protection and Minimum Assigned Protection Factor (APF)

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| **(xi) Handheld grinders for mortar removal (i.e., tuckpointing)** | Use grinder equipped with commercially available shroud and dust collection system
Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions
Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism. | APF 10 | APF 25 |
| **(xii) Handheld grinders for uses other than mortar removal** | For tasks performed outdoors only:
Use grinder equipped with integrated water delivery system that continuously feeds water to the grinding surface.
Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust emissions.

or
Use grinder equipped with commercially available shroud and dust collection system
Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust emissions
Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism
- When used outdoors: None
- When used indoors or in an enclosed area: None | None | None |
| **(xiii) Walk-behind milling machines and floor grinders** | Use machine equipped with integrated water delivery system that continuously feeds water to the cutting surface
Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions | None | None |
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<td>Or</td>
<td>Use machine equipped with dust collection system recommended by the manufacturer. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide the air flow recommended by the manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. When used indoors or in an enclosed area, use a HEPA-filtered vacuum to remove loose dust in between passes.</td>
<td>≤ 4 hours/shift  &gt; 4 hours /shift</td>
</tr>
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<td>(xiv) Small drivable milling machines (less than half-lane)</td>
<td>Use a machine equipped with supplemental water sprays designed to suppress dust. Water must be combined with a surfactant. Operate and maintain machine to minimize dust emissions.</td>
<td>None  None</td>
</tr>
<tr>
<td>(xv) Large drivable milling machines (half-lane and larger)</td>
<td>For cuts of any depth on asphalt only:  - Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust.  - Operate and maintain machine to minimize dust emissions.  For cuts of four inches in depth or less on any substrate:  - Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust.  - Operate and maintain machine to minimize dust emissions.</td>
<td>None  None</td>
</tr>
<tr>
<td>Or</td>
<td>Use a machine equipped with supplemental water spray designed to suppress dust. Water must be combined with a surfactant. Operate and maintain machine to minimize dust emissions.</td>
<td>None  None</td>
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### Equipment / Task

- **Crushing machines**
  - Use equipment designed to deliver water spray or mist for dust suppression at crusher and other points where dust is generated (e.g., hoppers, conveyors, sieves/sizing or vibrating components, and discharge points).
  - Operate and maintain machine in accordance with manufacturer’s instructions to minimize dust emissions.
  - Use a ventilated booth that provides fresh, climate-controlled air to the operator, or a remote control station.

- **Heavy equipment and utility vehicles used to abrade or fracture silica-containing materials** (e.g., hoe-ramming, rock ripping) or used during demolition activities involving silica-containing materials:
  - Operate equipment from within an enclosed cab.
  - When workers outside of the cab are engaged in the task, apply water and/or dust suppressants as necessary to minimize dust emissions.

- **Heavy equipment and utility vehicles for tasks such as grading and excavating but not including: demolishing, abrading, or fracturing silica-containing materials**:
  - Apply water and/or dust suppressants as necessary to minimize dust emissions.
  - Or
  - When the equipment operator is the only employee engaged in the task, operate equipment from within an enclosed cab.

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<td>(xvi) Crushing machines</td>
<td>Use equipment designed to deliver water spray or mist for dust suppression at crusher and other points where dust is generated (e.g., hoppers, conveyors, sieves/sizing or vibrating components, and discharge points). Operate and maintain machine in accordance with manufacturer’s instructions to minimize dust emissions. Use a ventilated booth that provides fresh, climate-controlled air to the operator, or a remote control station.</td>
<td>None</td>
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<td>(xvii) Heavy equipment and utility vehicles used to abrade or fracture silica-containing materials (e.g., hoe-ramming, rock ripping) or used during demolition activities involving silica-containing materials</td>
<td>Operate equipment from within an enclosed cab. When workers outside of the cab are engaged in the task, apply water and/or dust suppressants as necessary to minimize dust emissions</td>
<td>None</td>
<td>None</td>
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</table>
| (xviii) Heavy equipment and utility vehicles for tasks such as grading and excavating but not including: demolishing, abrading, or fracturing silica-containing materials | Apply water and/or dust suppressants as necessary to minimize dust emissions. Or
When the equipment operator is the only employee engaged in the task, operate equipment from within an enclosed cab. | None | None |

For each task above, the engineering controls, work practices, and respiratory protection specified must be fully and properly implemented. When implementing these measures,

- For tasks performed indoors or in enclosed areas, a means of exhaust must be provided as needed to minimize the accumulation of visible airborne dust.
- For tasks performed using wet methods, water must be applied at flow rates sufficient to minimize the release of visible dust.
- For measures implemented that include an enclosed cab or booth, the enclosed cab or booth must be maintained as free as practicable from settled dust. Have door seals and closing mechanisms that work properly. Have gaskets and seals that are in good condition and working properly. Be under positive pressure maintained through continuous delivery of fresh air.
– Have intake air that is filtered through a filter that is 95 percent efficient in the 0.3–10.0 μm range (for example, MERV-16 or better)
– Have heating and cooling capabilities

Where a worker performs more than one task on Table 1 during the course of a shift, and the total duration of all tasks combined is more than four hours, the required respiratory protection for each task is the respiratory protection specified for more than four hours per shift. If the total duration of all tasks on Table 1 combined is less than four hours, the required respiratory protection for each task is the respiratory protection specified for less than four hours per shift.

2.1.2 Exposure Assessment

If not following Table 1 or if performing an activity not identified in Table 1, when workers may be exposed to airborne silica at or above the action level (one half of the PEL, or 25 µg/m³ calculated as an eight-hour time-weighted average), an exposure assessment must be conducted by a competent person to determine the extent to which workers are exposed and the appropriate exposure controls required. The exposure assessment must meet these requirements:

- An initial determination of exposure must be made at the beginning of operations. This determination may be based on “any combination of air monitoring data or objective data sufficient to accurately characterize employee exposures”, including data from manufacturers or other third parties on the efficacy of silica control measures, or on “scheduled monitoring” (8 CCR 5204 (d)(3)).
- If scheduled monitoring is used,
  – The determination must consist of the collection of personal air samples representative of a full shift, including at least one sample for each job classification in each work area, either for each shift or for the shift with the highest exposure level.
  – During the initial determination, until such time that actual airborne concentrations are determined, personnel must be protected by respiratory protection based on task-specific anticipated airborne concentrations of silica.
  – During the initial determination, and in addition to the respiratory protection required, personnel must be provided with protective clothing and equipment, hygiene facilities, and training.
  – When an assessment determines that exposure has occurred above the action level but below the PEL, additional monitoring must be required at least every six months. Additional monitoring must continue until such time that the monitoring results fall below the action level on two separate occasions at least seven days apart.
  – When monitoring yields results above the PEL, then quarterly monitoring is required. The quarterly monitoring may be suspended when additional monitoring results fall below the action level on two separate occasions at least seven days apart.
- In the absence of air monitoring or objective data, where the competent person can clearly demonstrate that a work activity will not create airborne silica concentrations in excess of the action level, scheduled monitoring may be unwarranted. Where a negative initial determination is reached without air monitoring, the competent person must develop a written explanation as to why exposures are not expected to exceed the action level.

Whenever a change in equipment, process, or controls occurs, or a new task has been initiated, an additional exposure assessment is required.
Exposure assessments will be recorded in the Industrial Hygiene Document Database. The results of the assessment will be used by the competent person to select required controls, which must be documented in the relevant work planning and control documents (see Section 2.2). In addition the assessment will be made available to the affected workers within 15 working days after completion, in accordance with 8 CCR 5204 (d)(6)(A).

2.2 Control Methods

When performing airborne-silica generating tasks, the control methods to be used (as determined above) must be documented, in work planning and control documents such as a job safety analysis (JSA), activity training and authorization (ATA), or standard operating procedure (SOP) (see Chapter 2, “Work Planning and Control”), or in a penetration permit (see Chapter 44, “Penetration Safety”) or other appropriate document.

Engineering and work practice controls, including administrative controls, must be implemented to the extent feasible to reduce and maintain employee exposure to silica at or below the PEL. Where all feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PEL, respiratory protection will also be required (see Section 2.2.2).

The following sections provide additional detail on control methods.

2.2.1 Housekeeping

All surfaces must be maintained as free as possible from accumulations of silica. Methods for cleaning surfaces and floors that minimize the likelihood of silica becoming airborne (such as using a high-efficiency particulate [HEPA] vacuum or wet sweeping) must be selected. Dry sweeping is only allowed if other methods are not feasible.

2.2.1.1 Vacuum Cleaners

If vacuuming is the housekeeping method selected, vacuums with HEPA filtration are required. HEPA vacuums used for silica control must undergo annual emery oil aerosol or equivalent challenge testing and be certified as in passing condition before work commencing. Vacuum testing must include checking around the exhaust vents and the canister/filter housing seals. Before a third-party vendor performs HEPA filter testing, it is advised that the vacuum cleaner owner change the collection bag and inspect the unit for wear and damage.

Subcontractors must have their silica-control HEPA vacuum cleaners undergo HEPA filter efficiency testing, as described above, before use at SLAC. The date of the vacuum testing must be no earlier than a year before the end of the SLAC project. Documentation of third-party certification of HEPA filter efficiency must be provided to the SLAC project manager.

The following requirements apply to the disposal of dust from vacuums:

- Respiratory protection must be worn when emptying contents of vacuum cleaners.
- Vacuum contents musts be contained and disposed of in bags that can effectively hold dust without breaking.
Silica waste characterization and disposal must be coordinated with Waste Management. Waste Management will determine if any special handling is required because of contamination or activation due to previous activities. Generally debris does not require special handling beyond that stated above.

Workers must not leave the workplace wearing any protective clothing or equipment that is required to be worn during their work shift without first using a HEPA vacuum to remove dust.

### 2.2.2 Personal Protective Equipment (PPE)

Respiratory protection must be used for the following conditions:

- When required in order to comply with Table 1
- For work operations where engineering and work practice controls are not sufficient to reduce employee exposure to or below the PEL
- During periods when respirators are required to provide interim protection while conducting initial exposure determination

Respiratory protection must be selected based on guidance in Table 1 or on a certified industrial hygienist’s or competent person’s assessment of the potential airborne exposure that may be created by the means and methods of work (high-energy operations with high airborne dust generation or low-energy operations with low dust generation).

For information on how to obtain and use respirators, including required training, see Chapter 29, “Respiratory Protection”.

Disposable coveralls are recommended when clothing may become contaminated with dust or slurry.

### 3 Forms

The following are forms required by these requirements:

- None

### 4 Recordkeeping

The following recordkeeping requirements apply for these requirements:

- The competent person will record exposure assessments in the [Industrial Hygiene Document Database](#) and make the assessment available to the affected workers within five working days
- The Occupational Health Center will relay written results of examinations to affected worker within 30 days and maintain the medical records

### 5 References

[SLAC Environment, Safety, and Health Manual](#) (SLAC-I-720-0A29Z-001)

- Chapter 56, “Respirable Crystalline Silica”
– **Respirable Crystalline Silica: Handheld and Stand-mounted Drill Work Plan** (SLAC-I-730-0A09C-011). Describes requirements for work with handheld and stand-mounted drills (including impact, rotary hammer, and other drill types)

– **Respirable Crystalline Silica: Rig-mounted Core Saw or Drill Work Plan** (SLAC-I-730-0A09C-012). Describes requirements for work with rig-mounted core saws and drills

– **Crystalline Silica Exposure Control Program Site** (SharePoint)

  - Chapter 2, “Work Planning and Control”
  - Chapter 29, “Respiratory Protection”
  - Chapter 44, “Penetration Safety”

Other SLAC Documents

  - **Industrial Hygiene**

Other Documents
