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**1.0 Purpose & Application**

This Penn State *Respirable Crystalline Silica Program (Silica Program)* outlines the University’s requirements necessary to support the safe handling and use of respirable crystalline silica (RCS)-containing materials or products by Penn State employees, faculty, students, researchers, and research affiliates, who may be exposed to airborne RCS in one or more forms including: quartz, cristobalite, and tridymite.

**2.0 Scope**

This Silica Program addresses Penn State requirements for hazard identification, evaluation and control of potential exposure to RCS, and further supports compliance with the U.S. Department of Labor/Occupational Safety and Health Administration (OSHA) standards for RCS, where pertinent to Penn State’s operations. These standards include: Title 29 of the Code of Federal Regulations, Part 1910.1053 (general industry), and Part 1926.1153 (construction). Refer to Section 9.0 OSHA Requirements for further details.

**3.0 Roles and Responsibilities**

Across Penn State University, managers, supervisors, and employees at all levels, in coordination with EHS and safety representatives, play a role in ensuring that the hazards associated with respirable crystalline silica exposure, are controlled. Specific roles and responsibilities include:

* 1. **Budget Executives and Administrators**
	+ Maintain a safe work environment within their jurisdiction, by monitoring and exercising control over their assigned areas.
	+ Assign a representative from each academic and administrative unit to ensure these guidelines and any pertinent requirements are addressed.
	+ Monitor pertinent requirements to ensure these are implemented.
	+ Ensure adequate resources are available to support the program.
	1. **Work Unit Management (all levels) and Supervisors**
* Ensure employees are properly trained,
* Ensure program is compliant with EHS and OSHA requirements,
* Ensure necessary equipment and controls are available, functional, and ready for required use,
* Monitor/affirm site personnel compliance with program requirements,
* Assist EHS in periodic overall program evaluation and updates.
	1. **Employees**
* Participate in, and comply with all program requirements, and
* Notify supervisors, safety liaisons, and EHS of any new or potential exposures.
	1. **Penn State Environmental Health and Safety (EHS)**
	+ Establish policy, procedure, training, and any future program requirements regarding RCS hazard management.
	+ Provide guidance and support in the evaluation and control of RCS hazards, and in the implementation of necessary policy, procedure, training, and prospective program requirements.
	+ Conduct periodic program review, evaluation and updating.
	1. **Work Unit Facility Coordinators/Safety Officers, and Campus Safety Representatives**
* Implement the RCS program and provide ongoing support in the implementation of the RCS program and compliance requirements,
* Periodically review local written exposure control plan and update as necessary, and implement corrective actions as required.
* Ensure that program participants receive necessary training, equipment/controls, and medical surveillance, as required.
	1. **Office of Physical Plant (OPP) Project Teams**
* Advise contractors and subcontractors to review the OPP Design and Construction Standards, and particularly Section 01 50 00 Temporary Facilities and Controls, OPP Contractor Safety Requirements, and Site Specific Safety Plan requirements, and this EHS Silica Program to ensure that contractor work operations involving RCS are properly controlled.
	1. **Penn State Contractors & Subcontractors**
* Adhere to Penn State guidelines and requirements as pertinent to individuals or contractors responsibilities as required by the OSHA Silica Standards.
* Understand responsibilities and actions relating to OSHA requirements for RCS hazard control, hazard communication and applicable training, regulated areas, and other aspects, while conducting work on Penn State University property.
* Comply with applicable Penn State contract requirements, Penn State OPP Design & Construction Standards, OPP Contractor Safety Requirements, OPP Site-Specific Safety Plan requirements, and pertinent OSHA requirements.
* Notify Office of Physical Plant Project teams of any potential RCS exposures and support reduction and control of RCS exposures.

**4.0 Terms & Definitions**

**Employee**

**Exposure Level** An airborne concentration of an agent such as respirable crystalline silica, measured in an employee’s breathing zone, or representative of the employee’s exposure to the agent, and measured over a specified period, for comparison with an exposure standard such as the OSHA Action Level or Permissible Exposure Limit. Sampling periods may range from instantaneous (Ceiling Limit) to a work shift “time-weighted average” (TWA) concentration.

**Exposure**

**Monitoring Methods** Air sampling or monitoring which may be conducted by various measurement methodologies. OSHA or NIOSH-approved methods (e.g. NIOSH Methods 0600 and 7500, OSHA Method ID-142) are most often used to quantify employee exposure levels to respirable crystalline silica, particularly where exposure levels may equal or exceed the OSHA Action Level.

**NIOSH** National Institute of Occupational Safety and Health

**Objective**

**Exposure Data** Data and information such as respirable silica content of materials or products from Safety Data Sheets, other workplace information, and/or other representative exposure information which may be used to represent employee exposure levels.

**OSHA** Occupational Safety and Health Administration

**OSHA Action Level** Employee exposure level as determined by an OSHA or NIOSH-Approved methodology, and equivalent to 25 micrograms per cubic meter (ug/m3) air, as an eight-hour time-weighted average measurement (TWA8)

**OSHA Silica**

**Standards** OSHA Silica Standards or Silica Rules refer to OSHA’s standards governing occupational exposure to respirable crystalline silica, cited at:

Construction Title 29 Part 1926.1153 of the Code of Federal Regulations.

General

Industry/Maritime Title 29 Part 1910.1053 of the Code of Federal Regulations.

**OSHA Permissible**

**Exposure Limit** Employee exposure level as determined by an OSHA or NIOSH-Approved methodology, and equivalent to 50 micrograms per cubic meter air (ug/m3) air, as an eight-hour time-weighted average exposure (TWA8).

**Silica or**

**Silicon Dioxide (SiO2)** Predominant constituent of most sand, second-most common mineral present in the earth’s crust; found in many soils, rocks and mineral deposits, as *quartz*. Silica is formulated into many man-made construction materials such as: manufactured stone, concrete, brick, pottery, floor tile, ceiling tile, drywall, and insulating materials.

Amorphous Silica Non-crystalline, less hazardous type of silica, includes forms such as silica gel, fused silica, and glass.

Crystalline Silica Crystalline type of silica, with repeating molecular structure; characterized as durable, chemically inert, and with a high melting point. Present in three forms:

*Quartz (most common form), Cristobalite and Tridymite* *Cristobalite* and *Tridymite* are often formed by high temperature conversion of quartz, and may occur in high temperature industrial processes.

*Respirable*

*Crystalline Silica* Crystalline silica particles which are less than 10 microns in size, and which can deposit in deep lung tissue, causing chronic respiratory diseases and lung cancer.

**TWA8** Eight-hour time-weighted average exposure result.

An employee’s exposure to respirable crystalline silica must be normalized to a TWA8 result for comparison to the OSHA AL and PEL standards. The TWA8 is calculated by a prescribed formula, defined at the OSHA standards.

**Written Exposure**

**Control Plan (Silica)** A listing or description of specific engineering, work practice, and administrative controls, housekeeping measures, and respiratory protection, required by OSHA to ensure employee exposure levels are maintained as low as possible, and where employee exposure levels have been or may be found to exceed the OSHA Action Level. The WECP should be periodically reviewed and updated to ensure it remains effective.

**5.0 Health Hazards of Respirable Crystalline Silica (RCS)**

*Why does RCS pose a significant health risk?*

**5.1 Respirable Crystalline Silica – Qualities and Characteristics**

Durable, highly fractured respirable (less than 10 microns in size) crystalline silica (RCS) particles when airborne, may remain airborne for long periods, and may be readily inhaled. RCS can penetrate deep into the gas exchange (alveolar) region of the lung, as well as other tissues causing significant risk of health effects, particularly if exposed frequently, and over a long-duration.

**5.2 Amorphous Silica – Qualities and Characteristics**

A*morphous Silica* forms such as *glass, fused silica, and silica gel* are typically found as larger particles, characterized by rounded edges and surfaces. Amorphous silica may be more readily cleared from the lungs, and therefore does not pose the same heightened health risk as RCS.

**5.3 Silica-Related Illness & Disease**

*Are there specific diseases associated with RCS exposure?*

In the occupational setting, four diseases have been primarily associated with excessive exposures to RCS, including:

* Silicosis – a chronic, debilitating lung disease, which may also be coincident with tuberculosis, linked to silica exposure.
* Lung cancer
* Other “non-malignant respiratory disorders” such as chronic obstructive pulmonary disease or *COPD*
* Kidney disease (resulting from metabolic processing of RCS)

**6.0 Hazard Identification & Assessment**

*How can I determine if there is a significant exposure hazard to RCS in my work?*

*The work unit Facility Coordinator/Safety Officer, Departmental Safety Officer, or Campus Safety Officer, in coordination with Penn State EHS should be reached with initial questions or concerns regarding possible RCS exposure.*

**6.1 Silica Exposure Factors – Potential Exposure to RCS**

*What are some of the primary factors that can lead to RCS exposure?*

**6.1.1 Mechanical action**

* Saw cutting
* mechanical or hand sanding
* grinding
* milling
* coring or drilling
* mechanical testing (by crushing pressure or force),
* mechanical sorting or processing of dry RCS-containing materials,
* crushing/pulverizing
* jack-hammering/chipping

**6.1.2 Heavy equipment traffic or disturbance**

* Heavy equipment traffic, mechanical movement, grading or mechanical disturbance of soils, sand, gravel, limestone, clays, rocks, etc. and particularly dry or fine materials

**6.1.3 Hand-sanding or finishing using RCS-containing materials**

**6.1.4 Mixing, pouring, processing or recycling of fine or ultrafine powders or materials**

**6.1.5 Working in close proximity to dusty operations involving RCS**

* Exposure from indoor or outdoor nearby task operations.

**6.1.6 3D Printing operations**

* Certain 3D printing operations may include generation of RCS, and should be properly contained and conducted with ventilation, or in well-ventilated areas.

Refer to Appendix D for a listing of Penn State Work Operations likely to involve RCS.

**6.2 Initial Hazard Assessments**

An initial hazard assessment must be conducted to determine whether employees may be exposed at or above the OSHA Action Level. *This may be determined from objective data or other sampling data*.

**6.2.1 Coordinated Assessments**

Penn State EHS will conduct or arrange initial hazard assessments in coordination with Facility Coordinators, Safety Officers, other work unit safety representatives, and qualified contractors to determine the potential for RCS exposure by Penn State personnel.

**6.2.2 Extent of Exposure to RCS**

The extent of exposure is a function of several factors:

* Percent RCS in material or product used (refer to Safety Data Sheets, or material composition references),
* Intensity of the work activity,
* Extent of mechanical energy applied to disturb or abrade material,
* Frequency of work performed (daily, monthly, yearly, etc.),
* Duration of work performed (minutes, hours, all day)
* Environmental factors (outdoors vs. indoors, windy/agitated air movement vs. stable or quiet conditions),
* Control measures available and used (engineering, work practice or administrative controls), and whether these are appropriate and effective for the specific task.

*Contact Penn State EHS* (5-6391) *to discuss questions regarding possible RCS exposure.*

**6.3 Exposure Monitoring Assessments**

**6.3.1 Air Monitoring Survey**

Subsequent to initial hazard assessments, and particularly where necessary to determine actual exposure to RCS, Penn State EHS in coordination with Facility Coordinators, Safety Officers, other work unit safety representatives, and qualified contractors, will arrange exposure monitoring during the work tasks, using OSHA and/NIOSH-approved methods to determine exposure levels to respirable crystalline silica.

**6.3.2 Survey Outcomes**

If exposure levels are determined to be equal to or in excess of the OSHA Action Level, each work unit will prepare a Written Exposure Control Plan (WECP), to list the controls and measures which will be taken to maintain RCS exposure levels as low as possible. Refer to Appendix A for a blank WECP with instructions.

**6.4 Written Silica Exposure Control Plan**

**6.4.1 WECP Content**

The *Written Exposure Control Plan* (Silica) MUST be completed wherever employee exposure may equal or exceed the OSHA Action Level. OSHA specifies that components of the written exposure control plan must describe:

* Tasks involving exposure to RCS,
* Engineering controls, work practices, and respiratory protection to limit exposures to tasks,
* Housekeeping measures used to limit exposure

**6.4.2 WECP Annual Review**

The WECP must be reviewed annually for effectiveness and updated, as necessary.

**6.5 OSHA-Defined Construction Work**

The OSHA Construction Standard (Silica) lists several controls, measures and respiratory protection at *Table 1 – Specified Exposure Control Methods When Working With Materials Containing Crystalline Silica*. Refer to Appendix B – Excerpted OSHA Construction Standard Table 1 for detailed information.

**6.5.1 Mandatory Table 1 Use**

* If exposure monitoring is NOT conducted to determine exposure level, and necessary protections, then the specific Table 1-listed task-operations, and associated controls, measures, and respirator requirements MUST be used, and listed in the work unit WECP.

**6.5.2 Project and Contract Compliance**

* In addition to compliance with the OSHA Silica Standards, and this PS Silica Program where work may impact PS employee or facility operations, contractor work operations involving RCS disturbance shall comply with:
	+ Penn State OPP contract obligations,
	+ OPP Design & Construction Standards,
	+ OPP Contractor Safety Requirements, and
	+ OPP Site-Specific Safety Plan,

**6.6 General Industry/ Research Work**

For all other general industry, maintenance and research task operations, and wherever an exposure may be anticipated or found to exceed the OSHA Action Level:

**6.6.1 Written Exposure Control Plan (Silica)**

* Must be based on exposure monitoring results, and include the required elements.

**6.6.2 Mechanical Tool Controls**

* Must include integral, manufacturer-designed tool attachments for control water, and for HEPA vacuum attachments.

**6.6.3 Respiratory Protection**

* Respirators must be used, where necessary to protect employees exposed at or above the OSHA PEL. Refer to the PS Respiratory Protection Program for detailed requirements.

**7.0 Silica Hazard Control**

**7.1 Silica Control Measures**

*How can RCS hazards be eliminated, reduced or controlled?*

**7.1.1 Engineering & Work Practice Controls**

RCS is a fine dust. It should be controlled at the source of generation by:

* High-efficiency particulate absolute (HEPA) filtered vacuum collection, or
* Integrated water attachments to mechanical equipment or tools. Such attachments should be approved or installed by the equipment/tool manufacturer.
* Wet misting or surface wetting with water/approved wetting or dust control agents for the intended use/application may be used outdoors to reduce gross airborne RCS on construction sites, or dusty sites, due to heavy vehicle traffic on soils or temporary roadways.
* Local exhaust ventilation should be used to contain and/or collect airborne dust, or remove dust from breathing zone of personnel at work processes.

**7.1.2 Abrasive Blasting Cabinets**

The following requirements pertain to use of Abrasive Blasting Cabinets, (where RCS-containing blast grit or sand are used, or where RCS-materials are being cleaned, polished or finished):

* Must be properly ventilated.
* Protective measures during maintenance – Maintenance or change-out of blast grit or sand may potentially expose personnel to airborne RCS. Such maintenance shall be conducted using:
	+ Proper SOP’s or protocols,
	+ Appropriate PPE and respirators (suitable to hazardous materials encountered,
	+ Where practicable, substitute of RCS-containing blast grit with non-silica grit
	+ Avoid blasting RCS-containing material substrates
	+ Abrasive blasting controls (where RCS used) must comply with applicable OSHA standards (29 CFR 1910.94 Ventilation, 29 CFR 1915.34 (Mechanical Paint Removers), and 29 CFR 1915 Subpart I (PPE) requirements.

**7.1.3 Administrative Controls**

Administrative controls such as limiting the time of worker exposure to RCS. Work practices and housekeeping measures are similar to administrative controls and may be used to reduce exposure to RCS; however, these are not preferred over substitution with less toxic materials or products, or engineering controls, except where not feasible.

*Contact your Facility Coordinator/Safety Officer and/or consult Penn State EH&S for questions concerning controls, acceptable exhaust ventilation/ filtration.*

**7.1.4 Respiratory Protection**

Respiratory protection (respirators) must be used as an interim measure until engineering, work practice or other controls are in place, or wherever such controls are ineffective to reduce exposure levels to within acceptable criteria.

Specifically, respiratory protection is required:

* Where RCS exposures exceed the OSHA PEL-TWA8,
* Where required by the OSHA Construction Standard Table 1 (above-referenced).

Refer to the PS Respiratory Protection Program for detailed requirements.

**8.0 Education & Training**

*What specific education and training are needed, when working with RCS?*

**8.1 Initial On-Line Training**

Penn State personnel working with RCS should contact EHS for assistance in accessing on-line silica training. On-line training is currently available through the Penn State *Learning Resource Network/ Cornerstone/ Skillsoft* modules. Training includes the on-line module, plus review of a Penn State Supplemental Training document.

**8.2 Specific Controls Training**

Subsequent to completing on-line training, each affected employee shall be trained by their Supervisor and/or Safety Officer in pertinent use of job-specific engineering and work practice controls and housekeeping measures. These may be required in certain work task-operations, or where airborne exposure levels to RCS may approach or exceed the OSHA Action Level.

**8.3 Re-Training**

Periodic training is not required except under certain circumstances:

* Employee lack of understanding is demonstrated (improper use of controls, etc.)
* Where required by new OSHA or Penn State requirements, and
* As necessary to ensure employee understanding of hazards, controls and how to effectively protect against RCS exposure.

**9.0 OSHA Standards & Requirements**

Refer to *Appendix C – Comparative Summary of OSHA’s RCS Requirements* for a detailed comparison of requirements of the Construction and General Industry respirable crystalline silica standards.

*Consult Penn State EHS for assistance and information regarding RCS exposure evaluation, and work unit obligations to comply with the OSHA Silica Standards.*

**9.1 RCS Standards – Compliance Dates**

OSHA’s RCS standards became effective June 23, 2016.

Compliance (start-up) Dates include:

* September 23, 2017 (construction)
* June 23, 2018 (general/ maritime industries)

**9.1.1 Compliance Date Exceptions**

* Medical Surveillance is required:
	+ Prior to work assignment requiring respirators (when respirator use is required pursuant to OSHA Respiratory Protection Standard – 29 CFR 1910.134)
	+ June 23, 2018 – Employees exposed above OSHA Permissible Exposure Limit (PEL) for 30 or more days per year
* June 23, 2020 – Employees exposed above OSHA Action Level (AL) for 30 or more days per year.

**10.0 Resource Links & Information**

The subsequent additional information are available at the EHS website, and specifically at the *Workplace Safety/ Respirable Crystalline Silica* webpage.

1. Penn State EHS RCS Snapshot
2. OSHA General Industry and Construction Silica Standards
3. OSHA RCS Construction Standard Table 1 (excerpted)
4. OSHA’s Occupational Exposure to RCS and Final Rule Preamble

[**https://www.osha.gov/laws-regs/federalregister/2016-03-25-1**](https://www.osha.gov/laws-regs/federalregister/2016-03-25-1)

1. Silica Rule Enforcement Guidance for Construction
2. OSHA Silica Webpage:

[**https://www.osha.gov/dsg/topics/silicacrystalline/**](https://www.osha.gov/dsg/topics/silicacrystalline/)

1. OSHA Final Rule Preamble – Excerpted Scope and Application Section
2. OSHA FR Silica Construction (1926.1153) – Excerpted Table 1
3. OSHA Silica Small Employer Compliance Guide 3911

**Appendices**

A Written Exposure Control Plan (blank with instruction for use)

B Excerpted OSHA Construction Standard (Silica) Table 1 – Specified Exposure Control Methods When Working With Materials Containing Crystalline Silica

C Comparative Summary of OSHA’s RCS Requirements

D Penn State Work Operations Involving RCS

**Campus: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ College or Work Unit: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Initial Issue Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**College FC/SO or Campus Liaison Name/Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Current Revision Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| **Work Unit/Dept.** | **Task/Activity** | **Indoor (I)****Outdoor (O)** | **Exposure Level (ug/m3-TWA8)** | **Engineering****Control** | **Admin/Work Practice Control**  | **PPE/Respirator** | **Housekeeping Measures** | **Supplies/****Equipment Used** |
| **PRELIMINARY NOTE TO ALL WORK UNITS** | **PLEASE USE each line of this form to indicate all equipment/tasks, and associated controls, PPE, and housekeeping measures applicable to this location, where RCS exposure may equal or exceed the OSHA Action Level. Consult Penn State EHS for assistance. Refer to Summary of Codes for Exposure Control Plan at page 2 of this table.**For construction tasks, refer to the Excerpt – OSHA Construction Standard (29 CFR 1926.1153 (c) (1) Table 1 – *Specified Exposure Control Methods When Working With Materials Containing Crystalline Silica*. WHEN COMPLETING CONSTRUCTION TASKS LISTED AT TABLE 1, ALL CONTROLS, HOUSEKEEPING MEASURES AND PPE MUST BE USED, IF NO EXPOSURE MONITORING HAS BEEN CONDUCTED, OR IN LIEU OF EXPOSURE MONITORING.  |
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| List procedures used to restrict access to work areas to minimize number/type employees exposed to RCS, including exposure from contractor activities at this Campus/Work Unit: |

**Summary of Codes for Exposure Control Plan**

|  |  |  |  |
| --- | --- | --- | --- |
| **Engineering Control Codes** | **Administrative, Work Practice, and Housekeeping Controls** | **Personal Protective Equipment (PPE) cont.** | **Supplies/ Equipment** |
| **1** | **Exhaust Fan** | **A1** | **Routine Inspection (CompPerson, Other)** | **PPE6** | **Disposable coveralls, full-hood and boots** | **S1** |  |
| **E2** | **Local Exhaust Ventilation System** | **A2** | **Work Area Signage** | **PPE7** | **Safety glasses** | **S2** | **Jackhammer** |
| **E3** | **Negative Pressure Enclosure** | **A3** | **Work after routine Occupancy** | **PPE8** | **Chem protective goggles** | **S3** | **Hand-held chipper** |
| **E4** | **Other Work Enclosure** | **A4** | **Other Scheduling** | **PPE9** |  | **S4** | **Bush hammer** |
| **E5** | **Isolation Barriers - Seals** | **A5** | **Limit Work Group Exposure Time** | **Respirators** | **S5** | **Drill** |
| **E6** | **HEPA Vacuum Tool Attachment** | **A6** | **Wet Misting or Wetting Practices** | **R1** | **Filtering facepiece, N95** | **S6** | **Partner saw** |
| **E7** | **Dust Collection System** | **A7** | **Wet Wiping Practices** | **R2** | **Filtering facepiece, P100** | **S7** | **Walk-behind saw** |
| **E8** | **Integrated Water-Dust Suppression** | **A8** |  | **R3** | **Elastomeric ½ APR** | **S8** | **Grinder** |
| **E9** | **Abrasive Blast Box/Booth** | **A9** |  | **R4** | **Elastomeric FF APR** | **S9** | **Mixer** |
| **E10** |  | **Personal Protective Equipment (PPE)** | **R5** | **PAPR, tight-fitting** | **S10** | **Soil pick** |
| **E11** |  | **PPE1** | **Disposable nitrile gloves** | **R6** | **PAPR, loose-fitting**  | **S11** | **Vibratory plate** |
| **E12** |  | **PPE2** | **Work gloves** | **R7** | **Cartridge type: P100**  | **S12** | **Tractor-Excavator, filtered cab** |
| **E13** |  | **PPE3** | **Long-sleeve clothing/covers** | **R8** | **Cartridge type: P100 combination** | **S13** | **Other:** |
| **E14** |  | **PPE4** | **Disposable apron** | **R9** | **Abrasive blast/SA (specify):** | **S14** | **Other:** |
|  |  | **PPE5** | **Disposable coveralls, no hood or boots** |  |  | **S15** | **Other:** |
|  |  |  |  |  |  |  |  |

**ADDITIONAL CODES:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Engineering Controls** |  | **Work Practice/Housekeeping Controls** |  | **Personal Protective Equipment** |  | **Supplies/Equipment** |
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**1926.1153(c)**

*Specified exposure control methods*.

**1926.1153(c)(1)**

For each employee engaged in a task identified on Table 1, the employer shall fully and properly implement the engineering controls, work practices, and respiratory protection specified for the task on Table 1, unless the employer assesses and limits the exposure of the employee to respirable crystalline silica in accordance with paragraph (d) of this section.

|  |  |  |
| --- | --- | --- |
| **Equipment/task** | **Engineering and work practice control methods** | **Required respiratory protection and minimum assigned protection factor (APF)** |
|  |  | **≤ 4 hours/shift** | **> 4 hours/shift** |
| (i) Stationary masonry saws | Use saw equipped with integrated water delivery system that continuously feeds water to the bladeOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions | **None** | **None** |
| (ii) Handheld power saws (any blade diameter) |

|  |
| --- |
| Use saw equipped with integrated water delivery system that continuously feeds water to the bladeOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions: |
| - When used outdoors |

 | **None** | **APF10** |
|  | -When used indoors or in an enclosed area | **APF10** | **APF10** |
| (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 systemOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissionsDust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency | **None** | **None** |

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| (iv) Walk-behind saws | Use saw equipped with integrated water delivery system that continuously feeds water to the bladeOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions:- When used outdoors | **None** | **None** |
|  | - When used indoors or in an enclosed area | **APF10** | **APF10** |
| (v) Drivable saws | For tasks performed outdoors only: Use saw equipped with integrated water delivery system that continuously feeds water to the bladeOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions  | **None** | **None** |
| (vi) Rig-mounted core saws or drills | Use tool equipped with integrated water delivery system that supplies water to cutting surfaceOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions | **None** | **None** |
| (vii) Handheld and stand-mounted drills (including impact and rotary hammer drills) | Use drill equipped with commercially available shroud or cowling with dust collection systemOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissionsDust 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 mechanismUse a HEPA-filtered vacuum when cleaning holes | **None** | **None** |
| (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 | **APF10** | **APF10** |
| (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 | **None** | **None** |
|  | 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 | **None** | **APF10** |
|  | - When used indoors or an enclosed area | **APF10** | **APF10** |
|  | OR |  |  |
|  | Use tool equipped with commercially available shroud and dust collection systemOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissionsDust 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: |  |  |
|  | - When used outdoors | **None** | **APF10** |
|  | - When used indoors or in an enclosed area | **APF10** | **APF10** |
| (xi) Handheld grinders for mortar removal (*i.e.*, tuckpointing) | Use grinder equipped with commercially available shroud and dust collection systemOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissionsDust 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 | **APF10** | **APF25** |
| (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 surfaceOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions |  |  |
|  | OR |  |  |
|  | Use grinder equipped with commercially available shroud and dust collection systemOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissionsDust 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** | **None** |
|  | - When used indoors or in an enclosed area | **None** | **APF10** |
| (xiii) Walk-behind milling machines and floor grinders | Use machine equipped with integrated water delivery system that continuously feeds water to the cutting surfaceOperate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions | **None** | **None** |
|  | OR |  |  |
|  | -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 | **None** | **None** |
| (xiv) Small drivable milling machines (less than half-lane) | Use a machine equipped with supplemental water sprays designed to suppress dust. Water must be combined with a surfactantOperate and maintain machine to minimize dust emissions | **None** | **None** |
| (xv) Large drivable milling machines (half-lane and larger) | For cuts of any depth on asphalt only:Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dustOperate and maintain machine to minimize dust emissionsFor cuts of four inches in depth or less on any substrate: | **None** | **None** |
|  | Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dustOperate and maintain machine to minimize dust emissions | **None** | **None** |
|  | OR |  |  |
|  | Use a machine equipped with supplemental water spray designed to suppress dust. Water must be combined with a surfactantOperate and maintain machine to minimize dust emissions | **None** | **None** |
| (xvi) 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 emissionsUse a ventilated booth that provides fresh, climate-controlled air to the operator, or a remote control station | **None** | **None** |
| (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 | Operate equipment from within an enclosed cab | **None** | **None** |
| Ditto above | When employees outside of the cab are engaged in the task, apply water and/or dust suppressants as necessary to minimize dust emissions | **None** | **None** |
| (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 | **None** | **None** |
|  | OR |  |  |
|  | When the equipment operator is the only employee engaged in the task, operate equipment from within an enclosed cab | **None** | **None** |

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**1926.1153(c)(2)**

When implementing the control measures specified in Table 1, each employer shall:

**1926.1153(c)(2)(i)**

For tasks performed indoors or in enclosed areas, provide a means of exhaust as needed to minimize the accumulation of visible airborne dust;

**1926.1153(c)(2)(ii)**

For tasks performed using wet methods, apply water at flow rates sufficient to minimize release of visible dust;

**1926.1153(c)(2)(iii)**

For measures implemented that include an enclosed cab or booth, ensure that the enclosed cab or booth:

**1926.1153(c)(2)(iii)(A)**

Is maintained as free as practicable from settled dust;

**1926.1153(c)(2)(iii)(B)**

Has door seals and closing mechanisms that work properly;

**1926.1153(c)(2)(iii)(C)**

Has gaskets and seals that are in good condition and working properly;

**1926.1153(c)(2)(iii)(D)**

Is under positive pressure maintained through continuous delivery of fresh air;

**1926.1153(c)(2)(iii)(E)**

Has intake air that is filtered through a filter that is 95% efficient in the 0.3-10.0 μm range (*e.g.*, MERV-16 or better); and

**1926.1153(c)(2)(iii)(F)**

Has heating and cooling capabilities.

**1926.1153(c)(3)**

Where an employee 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.

Columns for General Industry (29 CFR 1910.1053) and Construction (29 CFR 1926.1153) include paragraph references in each standard, with each section and associated content by standard.

|  |  |  |  |
| --- | --- | --- | --- |
| **General Industry** | **Construction** | **Section Heading** | **Content** |
| (a) | (a) | Scope and application | Occupational exposure exceeding OSHA AL-TWA8. |
| (b) | (b) | Definitions | Terms and definitions |
| (c) |  | PEL-TWA8 (Gen Industry) | Not to be exceeded |
|  | (c) | Specified control methods (Construction) | Table 1 Construction-specific tasks and required controls. |
| (d) |  | Exposure assessment | Monitoring requirements, schedule of requirements, employee notification of results, observation of monitoring Exposures must not exceed PEL. |
|  | (d) | Alternative control methods and required monitoring |  If not be Table 1, varied monitoring options, reassessment per scheduled frequency. Methods of analysis, employee notification, and observation of monitoring requirements, compliance methods, abrasive blasting |
| (e) |  | Regulated areas (exposure > PEL) | Requirements to establish, demarcate, access, and respirator requirement  |
|  | (e) | Respiratory protection | Pertinent respirator requirements including OSHA 1910.134; in compliance with section if employer uses Table 1 |
| (f) |  | Methods for compliance | Must use engineering and work practice controls exposures > PEL or to lowest feasible level, supplemented by respirators; requirements for written exposure control plans, and abrasive blasting. |
|  | (f) | Housekeeping | Same as Gen Industry para. (h) |
| (g) |  | Respiratory protection | Where required, must also comply with 1910.134 |
|  | (g) | Written exposure control plan | Detailed requirements |
| (h) |  | Housekeeping | No dry sweeping nor compressed air cleaning, unless HEPA or wet methods infeasible. |
|  | (h) | Medical surveillance | Refer to Gen Industry para (i). |
| (i) |  | Medical surveillance | Requirements for initial, periodic and additional exams, information provided to physicians, reporting and medical opinion requirements. |
| **General Industry** | **Construction** | **Section heading** | **Content** |
|  | (i) | Communication of RCS hazards to employees | Refer to Gen Industry para. (j). |
| (j) |  | Communication of RCS hazards to employees | Hazard communication program must address (reference) silica hazards (cancer, lung effects, immune system effects, and kidney effects), and employees have access to RCS labels, access to SDS, and specified training; Regulated area signs. |
|  | (j) | Recordkeeping | Refer to Gen Industry para. (k) |
| (k) |  | Recordkeeping | Various recordkeeping for air monitoring and objective data, and medical surveillance.  |
|  | (k) | Dates | Refer to Gen Industry para. (l) |
| (l) | Not Applicable | Dates | Effective and compliance dates of the standards |
| Appendix A | Appendix A | Methods of sample analysis | Where required, must meet certain methods and protocols. |
| Not applicable | Appendix B | Medical surveillance guidelines | Information and recommendations to support physicians and other licensed health care professionals (PLHCP’s) to comply with med. Surveillance requirements. |

End of Appendix C

The following Penn State work and research operations may involve handling and disturbance of respirable crystalline silica (RCS)-containing materials:

|  |  |
| --- | --- |
| **Work Task-Operations** |  |
| Masonry | Mixing and installing brick, concrete, and man-made stone- or clay-based products |
| Painting & Finishing | Mixing, application, grinding and sanding of fillers, putties, textures and bonding agents |
| Utility Work | Digging trenches, jack-hammering rock, working with stone, gravel, sand, asphalt or removing external insulation materials |
| Abrasive Blasting/ Cleaning | Use of abrasive blast grits and sand to smooth or finish metals or surfaces which may also contain RCS |
| Custodial/Labor/ Utility Cleaning | Sweeping or clean-up of RCS-containing dusts and debris, particularly on a recurring basis. |
| Carpentry/ Roofing/ Flooring | Cutting, shaping, grinding, sanding, installing slate concrete, terrazzo, tile, quartz, stucco, glass or other natural or man-made RCS-containing materials; sanding and finishing plasters, wallboard, joint compounds, putties, mortars, grouts, and surfacing. |
| Interior or Exterior Demolition/ Renovation | Mechanical or manual demo of structures, walls, floors, building exterior, roofing, or associated equipment work |
| Landscaping  | Spreading and work with fine sand, gravel, or other dusty RCS-containing materials; may also involve cutting and installing stone, block, brick and tile. |
| Field Dressing & Grooming | Playing field preparation and maintenance using RCS-containing sand, clay, and products. |
| Engineering, Foundry  | RCS sand is used in casting molds, and may be airborne during mechanical mixing and recycling processes. |
| **Research**  |  |
| Archaeological  | Excavating sites involving manual or mechanical handling or processing of natural soils/earthen materials. |
| Visual & Theatre Arts  | Mixing, modeling, shaping, sanding of RCS-containing boards, finishes, putties, plaster, textures, and materials used for set construction, and for other architectural and artistic crafts such as: ceramics/pottery, sculpting stone and other RCS-containing materials, and specialized foundry casting. |
| Earth & Mineral Science; Civil/ Env. Engineering | Cutting, preparation, coring, drilling, testing, stress testing, and sorting of natural and man-made materials. |
| Abrasive Blasting/ Testing | Abrasive blasting for industrial applications |
| Geological Testing/ Research | Geological testing using RCS to observe effects resulting from natural atmospheric or ground phenomena. |
| Joint Architectural/ Engineering  | Specialized 3D printing with RCS-containing materials. |

End of Appendix D

End of Penn State Respirable Crystalline Silica Program