ROADMAP TO SILICA COMPLIANCE
USING OSHA’S SILICA STANDARD FOR EXPOSURE CONTROL METHODS
ROADMAP OF EXPOSURE CONTROL METHODS

- Written Exposure Control Plan
  - Table 1 Fully Implemented
  - Alternative Exposure Control Method
    - Performance Monitoring Option
    - Scheduled Monitoring Option Worker Assessment
  - Do Not Need to Follow PEL Guideline - No additional Monitoring
The OSHA standard requires employers to develop and implement a written exposure control plan.

This plan describes both work tasks and work place areas where exposures occur. The plan also outlines what actions are going to take place to eliminate and reduce exposure.

The plan must include all work tasks where exposure is anticipated along with equipment and materials used.
ACCORDING TO OSHA, EXPOSURE CONTROL PLANS MUST INCLUDE AT LEAST THE FOLLOWING ELEMENTS:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A description of the task in the workplace that involve exposures to respirable crystalline silica.</td>
</tr>
<tr>
<td>2</td>
<td>A description of the engineering controls, work practices, and respiratory protection used to limit employee exposure to respirable crystalline silica for each task.</td>
</tr>
<tr>
<td>3</td>
<td>A description of the housekeeping measures used to limit employee exposure to respirable crystalline silica.</td>
</tr>
<tr>
<td>4</td>
<td>A description of the procedures used to restrict access to work areas, when necessary, to minimize the number of employees exposed to respirable crystalline silica and their level of exposure, including exposures generated by other employers or sole proprietors.</td>
</tr>
</tbody>
</table>
OSHA requires that “the employer shall review and evaluate the effectiveness of the written exposure control plan at least annually and update it as necessary.”

“The employer shall designate a competent person to make frequent and regular inspections of job sites, materials, and equipment to implement the written exposure control plan.”
1. An individual who is capable of identifying existing and foreseeable respirable crystalline.

2. An individual that has authorization to take prompt corrective measures to eliminate or minimize them.
WHAT RESOURCES ARE AVAILABLE FOR SILICA COMPETENT PERSON TRAINING?

- The American Industrial Hygiene Association (AIHA) has developed the: Recommended Skills and Capabilities for Silica Competent Persons white paper. [PDF File]
WHERE CAN WE FIND EXPOSURE CONTROL PLAN RESOURCES?

- CPWR (The Center for Construction Research and Training) has developed tools to provide guidance on developing site-specific written exposure control plan.

- [https://plan.silica-safe.org/](https://plan.silica-safe.org/)
TABLE-1

THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING (CPWR): TABLE-1 EQUIPMENT NAMES AND BEST PRACTICE TIPS PDF FILE
WHAT IS TABLE-1 AND HOW IS IT APPLIED?

Table-1 is a tool provided in the OSHA silica construction standard that outlines specific tasks common to the construction industry. This tool presents ways to control employee exposure to silica.

Table-1 presents common equipment and tasks that produce respirable crystalline silica and identifies engineering/work practice control methods to reduce exposure.

Table-1 also includes required respiratory protection and minimum assigned protection factor (APF).

In order to assist employers and contractors, OSHA has created detailed fact sheets for Table-1. These fact sheets serve as a resource guide when using Table-1.
Table-1 provides specific construction tasks and equipment with effective dust control methods. Table-1 outlines the procedures necessary in order to limit worker exposures to silica. This provides a framework to employers so they know exactly what is needed for compliance.

Employers who follow Table-1 correctly are not required to measure workers’ exposure to silica and are not subject to the PEL.
MANDATORY ACTIONS WHEN FOLLOWING TABLE -1

- Action Level: 25 µg/m³; 8-hour time-weighted average (TWA).
- Permissible Exposure Limit (PEL): 50 µg/m³; 8-hour TWA.

Prohibited Actions
1. Dry sweeping
2. Compressed air for cleaning
3. Dry brushing

*In the case that these actions are infeasible, use engineering and work practice controls to limit employee exposures to the PEL and supplement the controls with respiratory protection as last resort.

Mandatory actions (when following Table-1 or when exposure is above the Action Level (AL).

1. Establish a written exposure control plan.
2. Designate a competent person
3. Offer medical surveillance
4. Train workers
5. Keep records
6. Restrict housekeeping
CPWR’s Exposure Control Database is an interactive tool for the construction industry that helps you predict exposure to workplace hazards.

To start, choose a hazard

- SILICA
- WELDING FUMES
- NOISE
- LEAD

CPWR has created a resource to help predict silica exposure in the workplace based on tasks.

- In addition to Table-1 tasks, the database has information on additional tasks that produce respirable crystalline silica but are not listed in Table-1.

- The database provides useful resources and cites the sources from where data was collected.

- The data was gathered by government reports/studies as well as studies found in the literature.
EXAMPLES OF SILICA DUST-PRODUCING TASKS: HIGHWAY/ROAD CONSTRUCTION AND REPAIR

<table>
<thead>
<tr>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milling</td>
</tr>
<tr>
<td>Sawing</td>
</tr>
<tr>
<td>Drilling</td>
</tr>
<tr>
<td>Chipping</td>
</tr>
<tr>
<td>Scabbling</td>
</tr>
<tr>
<td>Jackhammering</td>
</tr>
<tr>
<td>Grinding</td>
</tr>
<tr>
<td>Sandblasting</td>
</tr>
<tr>
<td>Grooving</td>
</tr>
<tr>
<td>Clean-up</td>
</tr>
</tbody>
</table>
OCCUPATIONAL HEALTH SURVEILLANCE PROGRAM: SILICOSIS SURVEILLANCE & INTERVENTION PROJECT

Photos by the New Jersey Department of Health
EXAMPLES OF SILICA DUST-PRODUCING TASKS: HIGHWAY/ROAD CONSTRUCTION AND REPAIR

Scabbling

Sweeper-Vacuum-Dust Collector

Photos by the New Jersey Department of Health
EXAMPLES OF SILICA DUST-PRODUCING TASKS: HIGHWAY/ROAD CONSTRUCTION AND REPAIR

Concrete Saws

Concrete Sawing

Photos by the New Jersey Department of Health
EXAMPLES OF SILICA DUST-PRODUCING TASKS:
HIGHWAY/ROAD CONSTRUCTION AND REPAIR

Photos by the New Jersey Department of Health
EXAMPLES OF SILICA DUST-PRODUCING TASKS: HIGHWAY/ROAD CONSTRUCTION AND REPAIR

Photos by the New Jersey Department of Health
EXAMPLES OF SILICA DUST-PRODUCING TASKS: HIGHWAY/ROAD CONSTRUCTION AND REPAIR

Worker Using a Demo Saw to Cut a Drainage Box Along a Highway

Chipping Hammer

Photos by the New Jersey Department of Health
EXAMPLES OF SILICA DUST-PRODUCING TASKS: HIGHWAY/ROAD CONSTRUCTION AND REPAIR

Compressed-Air Cleaning

over 100 mg/m²

Compressed-Air Cleaning

flag person

air lance

Photos by the New Jersey Department of Health
# TABLE-1 STANDARD EXAMPLE BY CPWR: WATER CONTROL METHODS FOR THE USE OF THE JACKHAMMER

<table>
<thead>
<tr>
<th>Equipment/Control</th>
<th>Photos &amp; Video</th>
<th>Engineering, Work Practice Control Methods &amp; Required Respiratory Protection</th>
<th>Best Practice Tips</th>
</tr>
</thead>
</table>
| Jackhammers and handheld powered chipping tools | ![Image](https://via.placeholder.com/150) | **CONTROL:** water + respirators³  
- Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact.  
- Required Respiratory Protection:  
  - Outdoors  
    - <4 hour/shift: NONE  
    - >4 hour/shift: APF 10  
  - Indoors or in an enclosed area  
    - <4 hour/shift: APF 10  
    - >4 hour/shift: APF 10  
  - OR  
    - CONTROL: ventilation + respirators³ (see next page) | OSHA³ requires, for water controls, the employer to ensure that:  
- A continuous stream or spray of water is delivered at the point of impact through direct connections to fixed water lines or portable water tank systems; one or two workers can operate the water delivery system  
- An adequate supply of water for dust suppression is used  
- The spray nozzle is working properly and produce a pattern that applies water at the point of dust generation  
- The spray nozzles are not clogged or damaged  
- All hoses and connections are intact  
- Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space  
- Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust³  
- “Indoors or in enclosed areas” refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed³  

Other tips:  
- Check the hose or spray nozzle regularly to ensure the flow rate is sufficient to control the dust generated so that no visible dust³ is emitted from the process once the breaking/drift has entered the substrate (material)  
- Prevent wet slurry from accumulating and drying |

[Notes courtesy of the International Masonry Institute & OSHA](https://www.youtube.com/watch?v=RxMksx_k7Es) & Espanol options included.
## TABLE-1 EXAMPLE (WATER CONTROL METHOD FOR JACKHAMMERS)

<table>
<thead>
<tr>
<th>Engineering Control</th>
<th>Required Respiratory Protection</th>
<th>Best Practice tips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water + respirators</td>
<td><strong>Outdoors</strong>&lt;br&gt;• ≤4 hours/shift: NONE&lt;br&gt;• &gt;4 hours/shift: APF 10</td>
<td>• Video courtesy of OSHA&lt;br&gt;• <a href="https://www.youtube.com/watch?v=MuLaL7FtB58">https://www.youtube.com/watch?v=MuLaL7FtB58</a></td>
</tr>
<tr>
<td></td>
<td><strong>Indoors or in an enclosed area</strong>&lt;br&gt;• ≤4 hours/shift: APF 10&lt;br&gt;• &gt;4 hours/shift: APF 10</td>
<td></td>
</tr>
</tbody>
</table>

- Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact.

**CPWR Table-1 Equipment names and best practice tips**
This resource is a simplified list to assist with Table-1 compliance. [PDF File]
# TABLE-1 STANDARD EXAMPLE VENTILATION CONTROL METHODS FOR THE USE OF THE JACKHAMMER

<table>
<thead>
<tr>
<th>Equipment/Control</th>
<th>Photos &amp; Video</th>
<th>Engineering, Work Practice Control Methods &amp; Required Respiratory Protection</th>
<th>Best Practice Tips</th>
</tr>
</thead>
</table>
| Jackhammers and handheld powered chipping tools | ![Jackhammer Photo](image1.png) | **CONTROL: ventilation - respirators**<sup>1</sup>  
- Use tool equipped with commercially available shroud and dust collection system.  
- Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust.  
- 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.  
  
**Required Respiratory Protection:**  
- **Outdoors:**  
  - 64 hours/shift: NONE  
  - 44 hours/shift: APF 10  
- **Indoors or in an enclosed area:**  
  - 64 hours/shift: APF 10  
  - 44 hours/shift: APF 10  
  **OR**  
- **CONTROL: water + respirators**<sup>1</sup> (see previous page) | **OSHA**<sup>1</sup> requires, for dust collection controls, the employer to ensure that:  
- The system provides at least the air flow recommended by the manufacturer, a filter with 99% or greater efficiency, and a filter cleaning mechanism  
- The shroud or orifice is intact and installed in accordance with the manufacturer’s instructions  
- The hose connecting the tool to the vacuum is intact and without leaks or right bends  
- The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer’s instructions  
- The dust collection bags are emptied to avoid overfilling  
- Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space  
- Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust<sup>1</sup>  
- “Indoors or in enclosed areas” refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed<sup>1</sup>  
- Employers may rely on statements made by the manufacturer of equipment to determine dust collection systems function at the air flow level required. However, employers must properly select, use, maintain, and replace dust collection systems in order to ensure they function as designed<sup>1</sup>  
- Other tips:  
  - Visually inspect the jackhammer’s impact driller, shroud (cowl or hood) and dust collection system to ensure they are properly connected  
  - Visually inspect the jackhammer’s impact driller, shroud (cowl or hood) and dust collection system for missing or damaged parts |
| Other names:  
- Chipping hammer  
- Chipping gun  
- Chisel gun  
- Demolition hammer<sup>2</sup>  
- Demolition hammer with bushing tool<sup>2</sup> | ![Chipping Hammer Photo](image2.png) | ![Chisel Gun Photo](image3.png) | ![Demolition Hammer Photo](image4.png) | ![Demolition Hammer with Bushing Tool Photo](image5.png) |

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*Images courtesy of the International Masonry Institute & OSHA*

**CPWR Table-1 Equipment names and best practice tips**
# TABLE-1 EXAMPLE (VENTILATION CONTROL METHOD FOR JACKHAMMERS)

<table>
<thead>
<tr>
<th>Engineering Control</th>
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<tbody>
<tr>
<td><strong>Ventilation + respirators</strong></td>
<td><strong>Outdoors</strong></td>
<td>▪ Video courtesy of OSHA</td>
</tr>
<tr>
<td>▪ Use tool equipped with commercially available shroud and dust collection system.</td>
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</tr>
<tr>
<td>▪ Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust.</td>
<td>▪ &gt;4 hours/shift: APF 10</td>
<td></td>
</tr>
<tr>
<td>▪ 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.</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>▪ ≤4 hours/shift: APF 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ &gt;4 hours/shift: APF 10</td>
<td></td>
</tr>
</tbody>
</table>

CPWR Table-1 Equipment names and best practice tips
HOW CAN WE HANDLE UNIQUE TASKS THAT ARISE ON PROJECTS THAT ARE NOT LISTED IN TABLE-1?

- When work tasks are not listed in Table-1 it is important to use initial exposure estimations and to implement interim safety procedures.
- Data from similar tools that operate in a similar manner and perform a similar function may be used.
- Ultimately, tasks not listed in Table-1 need to be supported by further exposure assessment as soon as possible.
- It is essential that a qualified person is utilized to develop interim safety procedures until further worker exposure assessment can be completed.
- As defined in 29 CFR 1926.32(m), a qualified person is “one who by possession of a recognized degree, certificate or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work or the project.”
ALTERNATIVE EXPOSURE CONTROL METHODS

FOR TASKS NOT LISTED IN TABLE-1 OR WHERE ENGINEERING CONTROLS AND WORK PRACTICES DESCRIBED ARE NOT FULLY IMPLEMENTED.
WHEN ALTERNATIVE EXPOSURE CONTROL METHODS APPLY

1) The task is not listed in Table-1.
2) The employer does not use Table-1.
3) Objective data is not available.
4) When initial air monitoring results exceed the action level.
WHEN IS AIR SAMPLING REQUIRED?

- Air sampling, also known as exposure assessment, is required if the employer cannot or chooses not to use the control measures found in Table-1.
- If the task is not shown in Table-1, air sampling (exposure assessment) is required when employees may be exposed to RCS.
- According to OSHA, air monitoring and sample analysis are to be conducted using the requirements of 29 CFR 1926.1153 Appendix A: Methods of Sample Analysis.
- Air sampling (exposure assessment) should be performed by qualified industrial hygienists with expertise in various types of exposure assessment options.
- The American Industrial Hygiene Association (AIHA) provides a listing of industrial hygiene firms that perform exposure assessment.
ROADMAP TO ALTERNATIVE EXPOSURE CONTROL METHOD
WHAT IS THE PERFORMANCE OPTION AND HOW DO WE USE OBJECTIVE DATA?

- **The performance option** is an exposure assessment method that uses air sampling data collected by the employer or the use of objective data compiled from other sources.

- **Objective data** is air sampling information provided by employers, other employers, universities, trade associations or manufacturers that closely represents the work tasks, materials used and the controls used at your job site.

- Objective data can demonstrate that the control methods used at your job site are effective. When available, this can save time and money.
TYPES OF DATA AND EXPOSURE ASSESSMENT STRATEGIES

- Data from industry-wide surveys.
- Data provided by trade or professional associations.
- Data provided by equipment manufacturers.
- Calculations based on the composition of a substance.
- Calculations based on the chemical and physical properties of a substance.
- The employer’s historical air monitoring data, including data obtained prior to the effective date of the standard.

*When employers rely on objective data generated by others as an alternative to developing their own data, they are responsible for ensuring that the data relied upon accurately characterize each employee’s exposures.
WHERE CAN WE FIND OBJECTIVE DATA?

- University of Washington Field Research and Consultation Group website, *Silica It’s More Than Dust*.
- The Georgia Tech Consultation Program *Silica Management Matrix v2. 2013* provide this type of information.
- **The Construction Employers Association**: Silica Sampling & Objective Data Program
- **The Associated General Contractors** are industry organizations that also provide assistance with using objective data that can save time and resources.
The scheduled air monitoring option is the traditional exposure assessment method that uses air sampling data collected by the employer. Scheduled air monitoring is required when:

1) The task is not listed in Table-1
2) The employer does not use Table-1
3) Objective data is not available
4) When initial air monitoring results exceed the action level.

Employers must perform initial monitoring to assess the 8-hour TWA exposure for each employee on the basis of one or more personal breathing zone air samples that reflect the exposures of employees on each shift, for each job classification, in each work area.
SCHEDULED MONITORING OPTION

- Directs employers as to when and how often exposure monitoring must be performed.
- Initial exposure monitoring is required for an 8-hour TWA.
- The employer can apply exposure characteristics for employees performing similar tasks on the same shift.
- When applying characterization of exposure, keeping reports of assessment is important.
When initial exposure assessment is below the AL, exposure monitoring can be discontinued for this task if the results of a near-term follow-up study are the same.

If a change is made to where silica exposure levels can be expected; additional monitoring is required.
SCHEDULED MONITORING OPTION: WHEN EXPOSURE LEVELS ARE ABOVE THE ACTION LEVEL (AL) BUT BELOW THE PEL.

The employer must repeat the monitoring within 6 months.

The employer must all follow mandatory actions (when following Table-1 or when exposure is above the Action Level (AL)).

- Establish a written exposure control plan.
- Designate a competent person
- Offer medical surveillance
- Train workers
- Keep records
- Restrict housekeeping
Scheduled monitoring option: When exposure levels are above the PEL.

The employer must repeat the monitoring within 3 months.

The employer must all follow mandatory actions (when following Table-1 or when exposure is above the Action Level (AL)).

- Establish a written exposure control plan
- Designate a competent person
- Offer medical surveillance
- Train workers
- Keep records
- Restrict housekeeping

*In the case that these actions are infeasible, use engineering and work practice controls to limit employee exposures to the PEL and supplement the controls with respiratory protection as last resort.
It is important to note that whenever a change in production, process, control, equipment, workers, or work practices; the employer needs to reassess exposure.
SOURCES

- CPWR Work Safely with Silica website https://www.silica-safe.org/
- CPWR Training and Other Resources https://www.silica-safe.org/training-and-other-resources/presentations
- CPWR Table-1: Equipment Names and Best Practice Tips https://www.silica-safe.org/plan/body/Silica_Table-1_Equipment-Names_Best-Practices_Sept242018-1.pdf
- CPWR Exposure Control Database http://ecd.cpwrconstructionsolutions.org/
- OSHA safety and Health Topics https://www.osha.gov/dsg/topics/silicacrustalline/
- OSHA Frequently Asked Questions (FAQs) for construction (PDF) https://www.osha.gov/dsg/topics/silicacrustalline/construction_info_silica.html
- OSHA videos for controlling silica dust when using Table-1 on the silica standard for construction web page. https://www.osha.gov/dsg/topics/silicacrustalline/construction.html
SOURCES

CPWR and Industry Resources for Compliance
OSHA Guidance and Related Resources
Training Guides

- Associated General Contractors https://www.agc.org/
- Laborers’ Health & Safety Fund of North America: Controlling Silica Exposure Using Table-1 https://www.lhsfna.org/index.cfm/controlling-silica-exposure/
- The Construction Employers Association https://www.ceacisp.org/safety/silica-sampling-objective-data-program
- University of Washington Field Research and Consultation Group website, Silica It’s More Than Dust
SOURCES ON SILICA EXPOSURE AND HEALTH HAZARDS

- Health Effects Information and Resources [https://www.osha.gov/dsg/topics/silicacrystalline/health_effects_silica.html](https://www.osha.gov/dsg/topics/silicacrystalline/health_effects_silica.html)
- Morbidity and Mortality Weekly Report (MMWR) Silicosis Mortality Trends and New Exposures to Respirable Crystalline Silica — United States, 2001-2010 February 13, 2015 / 64(05):117-120. [https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6405a1.htm?s_cid=mm6405a1_e](https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6405a1.htm?s_cid=mm6405a1_e)
- NIOSH: Silica [https://www.cdc.gov/niosh/topics/silica/default.html](https://www.cdc.gov/niosh/topics/silica/default.html)
- Preventing Silicosis: CDC [https://www.cdc.gov/features/preventing-silicosis/index.html](https://www.cdc.gov/features/preventing-silicosis/index.html)
- Preventing Silicosis and Deaths in Construction Workers [https://www.cdc.gov/niosh/docs/96-112/default.html](https://www.cdc.gov/niosh/docs/96-112/default.html)
- Silicosis-Related Years of Potential Life Lost Before Age 65 Years --- United States, 1968–2005 MMWR [https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5728a3.htm](https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5728a3.htm)