

Silica Manager for the Construction Industry

The enclosed document is intended for construction safety personnel who need assistance in developing safe work practices for employees exposed to silica dust. This easy-to-use matrix references common construction tasks, control measures, and the respiratory protection recommended for each task. The matrix consists of those construction tasks which are associated with high exposures to silica. A brief description of each of the columns in the matrix is as follows:

- Column 1. Alphabetic listing of tasks covered;
- Column 2. The measured range of exposure for this specific task when controls are not in place¹;
- Column 3. The type of respirator required for respiratory protection when dust controls are not used;
- Column 4. The recommended dust control measure for each task;
- Column 5. The respiratory protection recommended in addition to the use of the recommended measures to reduce exposure;
- Column 6. Additional hazards associated with the task which may require additional PPE or other safeguards; and
- Column 7. Additional information about the recommended control measure.

The compilation of exposure ranges indicated here were documented through on-site air sampling conducted by Georgia Tech's Safety and Health Consultation Program, which is funded by the Department of Labor (OSHA). The purpose of work conducted under the Consultation Program is to provide individualized compliance assistance to small businesses through monitoring services and evaluation of controls and implementation of applicable OSHA regulations. These exposure ranges are drawn from the Consultation Program experiences, and are presented as a categorization of common tasks and exposure observations intended to guide field personnel in application of appropriate controls. All exposures shown in the matrix represent exposure levels during the actual time that the task was conducted. In all cases, reduction of exposure through engineering controls is the preferred method of employee protection. Air monitoring has consistently shown that use of these controls will reduce exposures to less than 10X the OSHA PEL for silica. However, air monitoring has not reliably demonstrated that control measures will reduce exposures to below the OSHA PEL every time the task is performed, particularly when the worker's breathing zone is close to the point of operation of the tool. For this reason, the matrix recommends the use of at least a NIOSH-approved particulate filtering facepiece (a "dust mask") in addition to the specified engineering control.

The feasible implementation of exposure controls will depend in large part upon the pre-planning for the jobs. Many controls rely on the use of water, and planning for the

¹ Exposures in this guide were calculated using the OSHA General Industry PEL formula ($PEL = 10 / (\% \text{ Quartz} + 2)$). To make reasonably accurate comparisons to measurements expressed as mg/m^3 , a value of $0.1 \text{ mg}/\text{m}^3$ respirable silica can be substituted for the currently enforced OSHA PEL (as of 2013).

supply of water to the location of the particular task is critical. For example, if a job site is in the initial stages of construction (i.e. drilling and leveling of pile-caps), and no plumbed water is readily available, supplying manually pumped water from storage containers may be the only option. Other controls rely on dust collection systems, so the ready availability of dust shrouds, ductwork, and vacuum units is necessary.



The use of these controls was documented and measured on actual active construction sites. These real-life work environments incorporate variable factors such as: breeze/crosswind; individual employee differences in stature and consequently, the force applied during the use of certain tools; consistency in application of suggested control use; and potential additional exposure resulting from adjacent work activities. Potential silica exposure levels can also vary depending on the concentration of silica in the materials at the construction site and characteristics of the work environment (open, semi-enclosed, enclosed or confined spaces). These variables are not quantified in this presentation, and employers are encouraged to conduct their own periodic exposure sampling to verify that controls are working as anticipated and that appropriate respiratory protection is utilized.




Other Useful Resources:


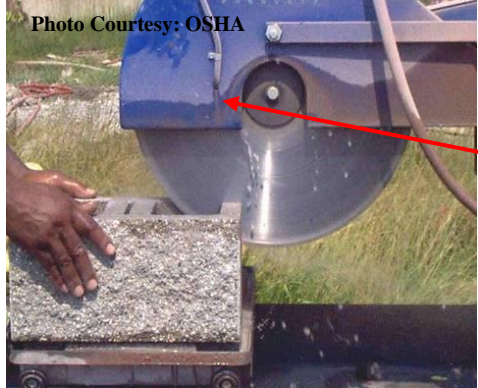


Controlling Silica Exposures in Construction (2009). OSHA.
<https://www.osha.gov/Publications/3362silica-exposures.pdf>





Department of Environmental and Occupational Health: University of Washington
(2007) <http://depts.washington.edu/silica/dust.html>





Work Safely With Silica (2012). CPWR. www.Silica-Safe.org



Task	(Job-task Specific) Potential Exposure Range*	WITHOUT CONTROLS Required Respiratory Protection	Recommended Engineering Control	WITH CONTROLS Required Respiratory Protection	Other Hazards Potentially Present	Other Information
Abrasive Sandblasting 	Always exceeds OSHA PEL	Type CE	Substitution: Alternative blast media	Type CE	Noise (105-125 dBA) Metals dusts	Alternatives: https://www.osha.gov/dsg/etools/silica/protect_against/stopsandblasters/stopsandblasters.html https://www.osha.gov/Publications/3362silica-exposures.pdf
Angle grinding - concrete (dry) (handheld tools) 	7.6 – 10.9 x OSHA PEL	Full-face tight-fitting respirator with particulate filters OR PAPR OR Supplied Air	Vacuum exhausted handtools (i.e. Hilti HG500D with VCD50 vacuum); improved cross-draft general ventilation; use of a dust containment system	N95 or P95 particulate respirator	Noise (90 – 108 dBA); downwind exposures; flying particles	Examples of high-velocity industrial blower with dust containment systems can be viewed at: http://www.icscompany.net/confided_space_ventilation_syst.htm Consider downwind exposures for other employees when using increased general ventilation as the control mechanism. https://www.osha.gov/Publications/3362silica-exposures.pdf




Task	(Job-task Specific) Potential Exposure Range*	WITHOUT CONTROLS Required Respiratory Protection	Recommended Engineering Control	WITH CONTROLS Required Respiratory Protection	Other Hazards Potentially Present	Other Information
Cement/grout mixing 	1.29 – 1.56 x OSHA PEL	N95 or P95 particulate respirator	Cross draft ventilation; improved work practices (timing of bag opening)	N95 or P95 particulate respirator	Skin contact; ergonomic challenges (i.e. lifting/twisting)	Mounting a small fan to the mixing machine rim to blow dusts (released when the bag is ripped open) away from the machine operators breathing zone will lower silica exposure.
Chipping Hammer – on concrete (dry) 	2.0 – 10.0 x OSHA PEL	N95 or P95 particulate respirator	Wet methods; increased general ventilation *GFCI protection when tool operated with water	N95 or P95 particulate respirator	Noise; vibration; ergonomic challenges	 <p>Water attachment</p> <p>https://www.osha.gov/Publications/3362silica-exposures.pdf</p>

Task	<u>(Job-task Specific)</u> Potential Exposure Range*	WITHOUT CONTROLS Required Respiratory Protection	Recommended Engineering Control	WITH CONTROLS Required Respiratory Protection	Other Hazards Potentially Present	Other Information
Cutting – Block (concrete) (dry) (bench saw)  Photo Courtesy: OSHA	8.0 – 10.0 x OSHA PEL	Full-face tight-fitting respirator with particulate filters OR PAPR OR Supplied Air	Wet methods *GFCI protection when tool operated with water	N95 or P95 particulate respirator	Noise (94 dbA); flying particles, downwind exposures	 Photo Courtesy: OSHA https://www.osha.gov/Publications/3362silica-exposures.pdf
Cutting – Granite Slabs and Counters (granite)(dry) 	15 – 30 x OSHA PEL	Full-face tight-fitting respirator with particulate filters OR PAPR OR Supplied Air Respirator	Wet method tools; Vacuum/local exhausted tools; As needed, assistant worker with vacuum	N95 or P95 particulate respirator	Noise (95-105 dBA); Flying particles	Electric tools must have GFCI protection if operated with water. 

Task	<u>(Job-task Specific)</u> Potential Exposure Range*	WITHOUT CONTROLS Required Respiratory Protection	Recommended Engineering Control	WITH CONTROLS Required Respiratory Protection	Other Hazards Potentially Present	Other Information
Cutting -- Groove cutting with circular saw (concrete)(dry) 	15.0 – 35 x OSHA PEL	Full-face tight-fitting respirator with particulate filters OR PAPR OR Supplied Air	Vacuum/local ventilation (via additional machine retrofits or additional employee assistance; see photo) OR Wet cutting *GFCI protection when tool operated with water	N95 or P95 particulate respirator	Noise (>95 dBA); machine guarding issues; ergonomics; downwind exposures	 <p>Vacuum placement at end of cut</p>
Cutting - Pile caps (concrete)(dry) 	14.45 – 58.9 x OSHA PEL	Supplied air	a) apply steady stream of water directly to the blade cutting surface (this must be done correctly and consistently in order to achieve reduction in exposure) b) local exhaust ventilation	N95 or P95 particulate respirator (limit duration of task times)	Noise (92 – 100 dBA); carbon monoxide exposure; ergonomic challenges	 <p>Water nozzle from hand pump</p> <p>Single, steady stream of water applied to blade surface</p> <p>https://www.osha.gov/Publications/3362silica-exposures.pdf</p>

Task	<u>(Job-task Specific)</u> Potential Exposure Range*	WITHOUT CONTROLS Required Respiratory Protection	Recommended Engineering Control	WITH CONTROLS Required Respiratory Protection	Other Hazards Potentially Present	Other Information
Demolition Sawing (concrete;dry) 	10 – 35 x OSHA PEL	Full-face tight-fitting respirator with particulate filters OR PAPR OR Supplied Air	Wet cutting; Vacuum exhaust *GFCI protection when tool operated with water	N95 or P95 particulate respirator	Noise; machine guarding issues	 <p>It is most effective to use a handheld saw (gas-, electric-, air-powered) equipped with a way to supply a constant stream of water to both sides of the blade.</p> <p>https://www.osha.gov/Publications/3362silica-exposures.pdf</p>
Demolition – Fine chip (concrete)(dry) (w/jackhammers) 	3.86 – 15.0 x OSHA PEL	Full-face tight-fitting respirator with particulate filters OR PAPR OR Supplied Air	Apply water directly to chipping site	N95 or P95 particulate respirator (limit duration of task times)	Noise (90 dBA); ergonomic challenges; vibration; flying particles	 <p>Application of water to chipping site</p> <p>Please note appropriate use of personal protective equipment</p> <p>https://www.osha.gov/Publications/3362silica-exposures.pdf</p>

Task	(Job-task Specific) Potential Exposure Range*	WITHOUT CONTROLS Required Respiratory Protection	Recommended Engineering Control	WITH CONTROLS Required Respiratory Protection	Other Hazards Potentially Present	Other Information
Flat surface grinding (concrete)(dry) (electric handheld tools)	9.5 – 18.5 x OSHA PEL	Full-face tight-fitting respirator with particulate filters OR PAPR OR Supplied Air	Vacuum exhausted handtools (i.e. Bosch ventilated hand grinder) – must be used consistently and correctly to achieve reduction in dust exposure	N95 or P95 particulate respirator	Noise (>90 dBA); downwind exposures; flying particles	 <p>Vacuum attachment; see ventilated face</p>
Drywall sanding (handheld sander)(dry)	0 – 6.14 x OSHA PEL	N95 or P95 particulate respirator	Local ventilation (dust shroud and vacuum attachment) OR Increased general ventilation OR wet finishing/ sponging method	N95 or P95 particulate respirator	Ergonomic challenges	 <p>Vacuum attachment goes here</p> <p>https://www.osha.gov/Publications/3362silica-exposures.pdf</p>

Task	(Job-task Specific) Potential Exposure Range*	WITHOUT CONTROLS Required Respiratory Protection	Recommended Engineering Control	WITH CONTROLS Required Respiratory Protection	Other Hazards Potentially Present	Other Information
Drywall sanding (electric pole sander)(dry) 	6.69 – 10.28x OSHA PEL (without vacuum attached)	N95 or P95 particulate respirator OR Full-face tight-fitting respirator with particulate filters OR PAPR	Vacuum attachment (dust shroud and vacuum exhaust); Increased general ventilation	N95 or P95 particulate respirator	Noise; ergonomic challenges; downwind exposure considerations	 Dustless drywall electric sander (attach to shop vacuum with drywall filters) https://www.osha.gov/Publications/3362silica-exposures.pdf
Jackhammering/ Chipping floors (concrete)(dry) 	1.5 – 3.3 x OSHA PEL	N95 or P95 particulate respirator	Wet methods; Chipping tool with equipped with local dust exhaust ventilation (shroud) improved cross-draft general ventilation *GFCI protection when tool operated with water	N95 or P95 particulate respirator	Noise (96 – 102 dbA); vibration; downwind exposures	Examples of high-velocity industrial blower with dust containment systems can be viewed at: http://www.icscompany.net/confided_space_ventilation_syst.htm Consider downwind exposures for other employees when using increased general ventilation. https://www.osha.gov/Publications/3362silica-exposures.pdf

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