SILICA COMPLIANCE

Resource Guide

Protect yourself and your workers with MK Diamond's dust control equipment

Dust control for:

Concrete • Masonry • Grinding • Cutting

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MK Diamond Products, Inc.

Dangers of Silica Exposure

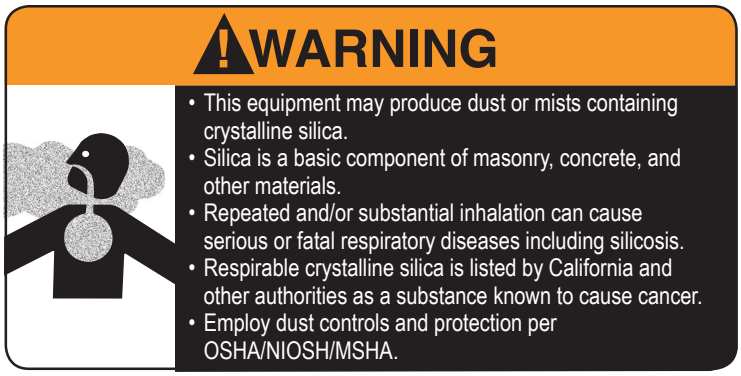
Grinding, cutting, drilling of masonry, concrete, metal and other materials with silica in their composition may give off dust or mists containing crystalline silica. Silica is a basic component of sand, quartz, brick clay, granite and numerous other minerals and rocks. Repeated and/or substantial inhalation of airborne crystalline silica can cause serious or fatal respiratory diseases, including silicosis.

Workers who inhale these very small crystalline silica particles are at increased risk of developing serious silica-related diseases, including:

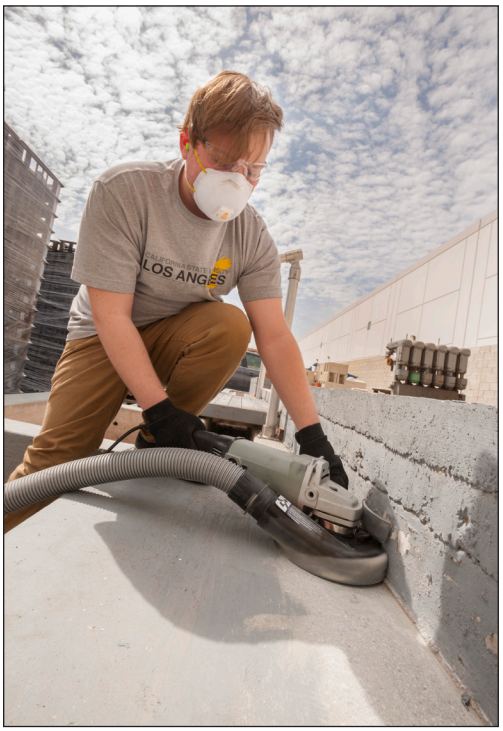
- Silicosis, an incurable lung disease that can lead to disability and death;
- Lung cancer;
- Chronic obstructive pulmonary disease (COPD); and
- Kidney disease.

New OSHA Ruling

The Department of Labor's Occupational Safety and Health Administration (OSHA) is enforcing a reduction in the amount of silica that workers can be exposed to over an eight-hour day from 250 micrograms per cubic meter of air to 50 micrograms.



These new Permissible Exposure Limit (PEL) ratings for the construction industry are now in place. Compliance with the new rule went into effect June 23, 2017, and enforcement began September 23, 2017. According to OSHA, it's estimated that 2.3 million U.S. workers are exposed to respirable silica dust at work each year.



Preventing Health Problems from Silica

When tools and equipment are outfitted with dust containment devices such as shrouds and vacuums, the entire work environment is a safer place to work. Also the use of water to reduce or eliminate the dust at the source, before it becomes airborne can be helpful.

When these controls are not enough, use respiratory protection.

Routinely maintain dust control systems to keep them in good working order.

Wear disposable or washable work clothes and shower if facilities are available. Vacuum the dust from your clothes and change into clean clothing before leaving the work site. Do not brush or blow the dust off.

Avoid eating, drinking and smoking in areas where silica dust is present. Wash your hands and face outside of dusty areas before performing any of these activities.

HEPA Vacuum Requirements

Vacuums need to have a high amount of CFM suction (+150) and a filter cleaning feature built in, and it is ideal for them to be HEPA compliant. To qualify as HEPA, U.S. government standards require that the air filter remove 99.97 percent of particles with a size of 0.3 microns or less. HEPA filters are expensive, but necessary for removing small particles. HEPA vacuum filters that meet OSHA requirements, must state on the filter that it will remove particles three microns in size or less. As a filter removes smaller and smaller particles, the power and airflow of the vacuum, as measured in cubic feet per minute (cfm), must increase.

OSHA requires vacuum filters to function properly at all times. For vacuums intended for concrete/fine dust collection, certain vacuums provide a feature that automatically cleans the filter every 15 seconds with reverse blasts of air to ensure the filter maintains its utility. Consult the full OSHA regulation 29 CFR 1926.1153 before starting any silica work.

Resources

CPWR

The Center for Construction Research and Training (CPWR) offers a one-stop online resource with information and tools to help identify silica hazards, understand the health risk, and easily find equipment and methods to control the dust.
Visit https://www.silica-safe.org/

A central feature of this site is the “Create-a-plan” tool. This e-tool allows you to develop a job-specific plan for controlling silica exposures in just three easy steps, and includes options for identifying a material’s silica content, determining the level of exposure, and finding available controls. As you make selections and enter information, silica-safe generates a control plan tailored to your jobsite that you can save, print, email, and -- as an added benefit -- use as a toolbox talk on the job.

OSHA

OSHA can help answer questions or concerns from employers and workers. Specified exposure control methods are referenced in OSHA Table 1 (osha.gov/silica/Table1sect1926.1153.pdf). To reach OSHA call 1-800-321-OSHA (6742). Information on OSHA’s silica rule can also be found at www.osha.gov/silica

For further information, consult the following sources:

http://www.osha.gov/dsg/topics/silicacrystalline/index.html
http://www.cdc.gov/niosh/consilic.html
http://oehha.ca.gov/prop65/law/P65law72003.html
http://www.dir.ca.gov/Title8/sub4.html
https://www.lhsfna.org/index.cfm/controlling-silica-exposure/

Concrete Dust Solutions

In order to move toward compliancy and protection, MK Diamond provides effective dust collection solutions to help you.

1. Choose the tool that best fits your needs		**TOOL** MK Diamond equipment is designed to control dust with the use of water or dust control systems.
2. Identify the correct attachment that fits your tool		**ATTACHMENT** Vacuum Shrouds and other attachments control silica dust during grinding and cutting operations.
3. Choose a HEPA ready dust extractor with the highest CFM and meets EPA guidelines		**DUST EXTRACTORS** Ermator HEPA Dust Extractors are equipped with tested and certified HEPA filter that trap the smallest, most dangerous-to-breath dust particles and prevents them from being released in the air.
4. Determine the respirator for your application (refer to the OSHA Table 1)		**RESPIRATION** OSHA's Assigned Protection Factor (APF) correlates to specific types of respirators which filter out airborne particles.

Engineering and Work Practice Controls and Respirator Requirements

Equipment/Task	Engineering & Work Practice Control Methods	Respirator Requirements & Minimum Assigned Protection Factor (APF) for 4 Hours or Less	Respirator Requirements & Minimum Assigned Protection Factor (APF) for More Than 4 Hours
Stationary Masonry/Tile Saws   	• Use Saw equipped with integrated water delivery system that continuously feeds water to the blade. • Operate & 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.	None Required	None Required
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 Required	None Required
	• When used indoors or in an enclosed area.	APF 10 Required  	APF 10 Required  

For suggested respiratory protection and other personal protective equipment. Visit www.3M.com/OSHASilica.

Engineering and Work Practice Controls and Respirator Requirements

Equipment/Task	Engineering & Work Practice Control Methods	Respirator Requirements & Minimum Assigned Protection Factor (APF) for 4 Hours or Less	Respirator Requirements & Minimum Assigned Protection Factor (APF) for More Than 4 Hours
Handheld Grinders for Mortar Removal (ie: tuckpointing) 	• Use grinder equipped with commercially available shroud & dust collection system. • Operate & 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 & have a filter with 99% or greater efficiency & a cyclonic pre-separator or filter-cleaning mechanism.	APF 10 Required 	APF 25 Required 
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.	None Required	None Required
	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 Required	None Required
	• When used indoors or in an enclosed area.	None Required	APF 10 Required 

Engineering and Work Practice Controls and Respirator Requirements

Equipment/Task	Engineering & Work Practice Control Methods	Respirator Requirements & Minimum Assigned Protection Factor (APF) for 4 Hours or Less	Respirator Requirements & Minimum Assigned Protection Factor (APF) for More Than 4 Hours
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 Required	None Required
	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 emission. • Dust collector must provide the airflow 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 Required	None Required
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.	None Required	None Required

All information cited in this booklet was assembled by MK Diamond Products, Inc. to serve as a basic summary helping users to understand the OSHA Respirable Crystalline Silica Rule for the construction industry. This is not an official, legal, safety-related or comprehensive interpretation of the Rule; you should always rely on your own review and evaluation of the applicable rules and regulations and understand that it is the individual's and/or employer's obligation to comply with such rules. Also, there may be additional OSHA standards and OSHA-approved state programs that apply. When using the equipment shown in this guide as you strive to meet your required compliances, always use the tools in accordance with the owner's manual and OSHA regulations. For official information, please go to https://www.osha.gov/silica/ and for the complete Rule (including Table 1), please see https://www.osha.gov/silica/SilicaConstructionRegText.pdf.

OSHA® FactSheet

OSHA's Crystalline Silica Rule: Construction

OSHA is issuing two standards to protect workers from exposure to respirable crystalline silica—one for construction, and the other for general industry and maritime—in order to allow employers to tailor solutions to the specific conditions in their workplaces.

Who is affected by the construction standard?

About two million construction workers are exposed to respirable crystalline silica in over 600,000 workplaces. OSHA estimates that more than 840,000 of these workers are exposed to silica levels that exceed the new permissible exposure limit (PEL).

Exposure to respirable crystalline silica can cause silicosis, lung cancer, other respiratory diseases, and kidney disease. Exposure can occur during common construction tasks such as using masonry saws, grinders, drills, jackhammers and handheld powered chipping tools; operating vehicle-mounted drilling rigs; milling; operating crushing machines; and using heavy equipment for demolition or certain other tasks.

Photo: NIOSH

Without dust controls, using a handheld power saw to cut concrete can expose workers to high levels of respirable crystalline silica.

The construction standard does not apply where exposures will remain low under any foreseeable conditions; for example, when only performing tasks such as mixing mortar; pouring concrete footers, slab foundation and foundation walls; and removing concrete formwork.

What does the standard require?

The standard requires employers to limit worker exposures to respirable crystalline silica and to take other steps to protect workers.

The standard provides flexible alternatives, especially useful for small employers. Employers can either use a control method laid out in **Table 1*** of the construction standard, or they can measure workers' exposure to silica and independently decide which dust controls work best to limit exposures to the PEL in their workplaces.

Regardless of which exposure control method is used, all construction employers covered by the standard are required to:

- Establish and implement a **written exposure control plan** that identifies tasks that involve exposure and methods used to protect workers, including procedures to restrict access to work areas where high exposures may occur.
- Designate a **competent** person to implement the written exposure control plan.
- Restrict **housekeeping** practices that expose workers to silica where feasible alternatives are available.
- Offer **medical exams**—including chest X-rays and lung function tests—every three years for workers who are required by the standard to wear a respirator for 30 or more days per year.

- **Train workers** on work operations that result in silica exposure and ways to limit exposure.
- **Keep records** of workers' silica exposure and medical exams.

What is Table 1?

Table 1 matches common construction tasks with dust control methods, so employers know exactly what they need to do to limit worker exposures to silica. The dust control measures listed in the table include methods known to be effective, like using water to keep dust from getting into the air or using ventilation to capture dust. In some operations, respirators may also be needed.

Employers who follow Table 1 correctly are not required to measure workers' exposure to silica and are not subject to the PEL.

Table 1 Example: Handheld Power Saws

If workers are sawing silica-containing materials, they can use a saw with a built-in system that applies water to the saw blade. The water limits the amount of respirable crystalline silica that gets into the air.

Table 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/ Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hrs/ shift	> 4 hrs/ shift
(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. • When used indoors or in an enclosed area.	None APF 10	APF 10 APF 10

Excerpt from Table 1.

*See regulatory text for construction standard, with complete Table 1 at www.osha.gov/silica/SilicaConstructionRegText.pdf.

In this example, if a worker uses the saw outdoors for four hours or less per day, no respirator would be needed. If a worker uses the saw for more than four hours per day or any time indoors, he or she would need to use a respirator with an assigned protection factor (APF) of at least 10. In this case, a NIOSH-certified filtering facepiece respirator that covers the nose and mouth (sometimes referred to as a dust mask) could be used. If a worker needs to use a respirator on 30 or more days a year, he or she would need to be offered a medical exam.

Alternative exposure control methods

Employers who do not use control methods in Table 1 must:

- Measure the amount of silica that workers are exposed to if it may be at or above an **action level of 25 µg/m³** (micrograms of silica per cubic meter of air), averaged over an eight-hour day.
- Protect workers from respirable crystalline silica exposures above the **permissible exposure limit of 50 µg/m³**, averaged over an eight-hour day.
- Use **dust controls** to protect workers from silica exposures above the PEL.
- Provide **respirators** to workers when dust controls cannot limit exposures to the PEL.

When are employers required to comply with the standard?

Construction employers must comply with all requirements of the standard by June 23, 2017, except requirements for laboratory evaluation of exposure samples, which begin on June 23, 2018.

Additional information

Additional information on OSHA's silica rule can be found at www.osha.gov/silica.

OSHA can provide extensive help through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education.

OSHA's On-site Consultation Program offers free and confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify

workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing and improving safety and health management systems. To locate the OSHA On-site Consultation Program nearest you, call 1-800-321-OSHA (6742) or visit www.osha.gov/dcsp/smallbusiness.

For more information on this and other health-related issues impacting workers, to report an emergency, fatality, inpatient hospitalization, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov, or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

U.S. Department of Labor

DSG FS-3681 03/2016

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.

TABLE 1—SPECIFIED EXPOSURE CONTROL METHODS WHEN WORKING WITH MATERIALS CONTAINING CRYSTALLINE SILICA

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 blade. Operate 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 blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions:		
	—When used outdoors	None	APF 10.
	—When used indoors or in an enclosed area	APF 10	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.	None.	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	None.
	—When used indoors or in an enclosed area	APF 10	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.	None	None.
(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.	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 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.	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. 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.	None	None.
	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	None	APF 10.
	—When used indoors or in an enclosed area	APF 10	APF 10.
	OR Use tool equipped with commercially available shroud and dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.		

TABLE 1—SPECIFIED EXPOSURE CONTROL METHODS WHEN WORKING WITH MATERIALS CONTAINING CRYSTALLINE SILICA—Continued

Equipment/task	Engineering and work practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
	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:		
	—When used outdoors	None	APF 10.
	—When used indoors or in an enclosed area	APF 10	APF 10.
(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:	None	None.
	—When used outdoors	None	None.
	—When used indoors or in an enclosed area	None	APF 10.
(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. OR	None	None.
	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 surfactant. Operate 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 dust. Operate and maintain machine to minimize dust emissions.	None	None.
	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.	None	None.
	OR 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.	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, conveyers, 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.	None	None.

TABLE 1—SPECIFIED EXPOSURE CONTROL METHODS WHEN WORKING WITH MATERIALS CONTAINING CRYSTALLINE SILICA—Continued

Equipment/task	Engineering and work practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
(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 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	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. OR	None	None.
	When the equipment operator is the only employee engaged in the task, operate equipment from within an enclosed cab.	None	None.

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

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

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

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

(A) Is maintained as free as practicable from settled dust;

(B) Has door seals and closing mechanisms that work properly;

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

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

(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

(F) Has heating and cooling capabilities.

(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.

(d) *Alternative exposure control methods.* For tasks not listed in Table 1, or where the employer does not fully and properly implement the engineering controls, work practices, and respiratory protection described in Table 1:

(1) *Permissible exposure limit (PEL).* The employer shall ensure that no employee is exposed to an airborne concentration of respirable crystalline silica in excess of 50 μg/m^3, calculated as an 8-hour TWA.

(2) *Exposure assessment*—(i) *General.* The employer shall assess the exposure of each employee who is or may reasonably be expected to be exposed to respirable crystalline silica at or above the action level in accordance with either the performance option in paragraph (d)(2)(ii) or the scheduled monitoring option in paragraph (d)(2)(iii) of this section.

(ii) *Performance option.* The employer shall assess the 8-hour TWA exposure for each employee on the basis of any combination of air monitoring data or objective data sufficient to accurately characterize employee exposures to respirable crystalline silica.

(iii) *Scheduled monitoring option.* (A) The employer shall 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. Where several employees perform the same tasks on the same shift and in the same work area, the employer may sample a representative fraction of these employees in order to meet this requirement. In representative sampling, the employer shall sample the employee(s) who are expected to have the highest exposure to respirable crystalline silica.

(B) If initial monitoring indicates that employee exposures are below the action level, the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

(C) Where the most recent exposure monitoring indicates that employee exposures are at or above the action level but at or below the PEL, the employer shall repeat such monitoring within six months of the most recent monitoring.

(D) Where the most recent exposure monitoring indicates that employee exposures are above the PEL, the employer shall repeat such monitoring within three months of the most recent monitoring.

(E) Where the most recent (non-initial) exposure monitoring indicates that employee exposures are below the action level, the employer shall repeat such monitoring within six months of the most recent monitoring until two consecutive measurements, taken seven or more days apart, are below the action level, at which time the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring, except as otherwise provided in paragraph (d)(2)(iv) of this section.

(iv) *Reassessment of exposures.* The employer shall reassess exposures whenever a change in the production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional exposures at or above the action level, or when the employer has any reason to believe that new or additional exposures at or above the action level have occurred.

Controlling Silica Exposures in Construction *(Per OSHA 3362-05)*

Stationary Masonry Saws

This section covers gas- and electric-powered stationary masonry saws. The term "silica" used in this document refers to respirable crystalline silica.

Introduction

Exposure to fine particles of silica has been shown to cause silicosis, a serious and sometimes fatal lung disease. Construction employees who inhale fine particles of silica may be at risk of developing this disease. Employees produce dusts containing silica when they cut, grind, crush, or drill construction materials such as concrete, masonry, tile and rock. The small particles easily become suspended in the air and, when inhaled, penetrate deep into employees' lungs.

Studies show that using a stationary masonry saw to cut bricks, concrete blocks and similar materials can result in hazardous levels of airborne silica if measures are not taken to reduce dust emissions. Stationary saws should always be used with dust control measures. At worksites without dust controls for these tools, studies have found that employee silica exposures can be as high as 20 times the Occupational Safety and Health Administration's (OSHA) benchmark of 0.1 mg/m^3 (milligrams per cubic meter of air) as an 8-hour time-weighted average (TWA), an exposure approximately equivalent to OSHA's general industry permissible exposure limit (PEL) (OSHA Case Files).[1] Short-term exposures can be even higher.

This section describes methods available to reduce employees' exposures to silica when using stationary masonry saws. OSHA encourages you to use this information to evaluate or improve system performance to reduce dust emissions. Technical notes are found at the end of this section and are referenced throughout the text.

Hazardous exposures to silica can occur when stationary saws are operated without appropriate dust controls. (Photo courtesy of the University of Washington.)

Two primary methods exist to control silica dust while operating a stationary saw: (1) wet cutting, and (2) vacuum dust collection. Ventilated booths, when properly designed, can also reduce silica dust exposure. All of these methods are easy to implement.

Wet cutting, when used properly, is an effective way to reduce employee exposures to silica dust and in most cases maintains exposures below the allowable limit. ***Vacuum dust collection*** can significantly reduce silica levels, but may not reliably keep them below 0.1 mg/m^3 as an 8-hour TWA.

Silica Dust Control Measures

Wet Cutting

Most stationary saws come equipped with a water basin that typically holds several gallons of water and a pump for recycling water for wet cutting.[2] If a saw's water supply system is not currently operating, the manufacturer may be able to supply the necessary accessories to reactivate wet cutting capability. Most suppliers stock these accessories since water cooling prolongs the life of the saw blade and tool.

Wet cutting is the most effective method for controlling silica dust generated during sawing because it controls the exposure at its source. Dust that is wet is less able to become or remain airborne. Results obtained by OSHA and the National Institute for Occupational Safety and Health (NIOSH) at five construction sites indicate that wet masonry saw operators' exposures were routinely below 0.1 mg/m^3, and usually below 0.05 mg/m^3, not only when averaged over an 8-hour shift, but also during just the period evaluated.[3]

At one jobsite, for example, NIOSH recorded a respirable silica exposure level of 0.04 mg/m^3 in the breathing zone of an employee cutting concrete blocks using a water-fed bench saw. The employee operated the saw for approximately 5 of the 8 hours sampled (NIOSH, 1999a). Even if the employee had cut block for a full 8-hour shift, his estimated exposure would have been 0.05 mg/m^3.

In comparison, OSHA reported a significantly higher exposure at another site on a day when wet methods were not used due to cold weather. The employee dry cut concrete block outdoors for a similar period of time (nearly 6 hours), but in this case experienced an 8-hour average exposure of 2 mg/m^3 (OSHA Case Files).[4]

Employee exposures associated with uncontrolled dry cutting tend to be lower for employees operating saws for a smaller percentage of their shift, as well as for jobs involving materials with

lower silica content. However, among the nine results obtained by OSHA and NIOSH, the average exposure for dry cutting outdoors was 0.56 mg/m^3 (with a median of 0.25 mg/m^3) for the periods sampled.[5] These values exceed OSHA limits, and were associated with employees dry cutting for 10 to 60 percent of the time sampled. At three construction sites, employee exposures exceeded 2 mg/m^3, presumably during periods of intensive cutting lasting from 2 minutes to 6 hours (Lofgren, 1993; OSHA Case Files).

Maintenance. To minimize dust emissions from saws equipped for wet cutting, keep pumps, hoses and nozzles in excellent operating condition. Regular saw maintenance reduces silica exposures and ensures optimal operation of the equipment. Saws and dust control devices should be on a routine maintenance schedule.

Maintaining a Water-Feed System

- Check the pump to ensure that it is working properly and make sure that hoses are securely connected and not cracked or broken.
- Adjust nozzles to ensure that water is directed so that the maximum amount reaches the cutting area while still cooling the blade.
- Rinse or replace water filters at appropriate intervals to ensure that the flow of clean water is not restricted and to prevent damage to the pump.
- Replace basin water when it gets gritty or begins to silt up with dust. Depending on use, this step may need to be repeated several times per day to prevent the nozzle from clogging and to ensure that mist generated during cutting does not carry extra dust from the recycled water.
- Dispose of water containing silica in a way that prevents the silica from becoming resuspended in the air. If the silica is allowed to become airborne, it can contribute to employee exposures.
- Consult the manufacturer for equipment operating specifications and recommendations that apply to the specific saw model including electrical fault protection, such as a ground-fault circuit interrupter (GFCI).

Freezing Temperatures. Freezing temperatures complicate the use of water.[6] Consider heating the local work area, if practical, to prevent ice from forming in the water-feed system. Drain the system when not in use. Large portable heating units are commonly used to heat commercial and sometimes road and highway projects. If water freezes on the ground, chip away the ice or use deicing compounds or sand to control the slipping hazard.

Electrical Safety. Use ground-fault circuit interrupters (GFCIs) and watertight, sealable electrical connectors for electric tools and equipment on construction sites (OSHA, 1996). These features are particularly important to employee safety in wet or damp areas, such as where water is used to control dust. Although an assured equipment grounding conductor program is an acceptable alternative to GFCIs, OSHA recommends that employers use GFCIs where possible because they afford better protection for employees. (See 29 CFR 1926.404(b)(1) for OSHA's ground-fault protection requirements.)

Visible and Respirable Dust

Visible dust contains large particles that are easy to see. The tiny, respirable-sized particles (those that can get into the deep lung) containing silica pose the greatest hazard and are not visible. Most dust-generating construction activities produce a mixture of visible and respirable particles.

Do use visible dust as a general guide for improving dust suppression efforts. If you see visible dust being generated, emissions of respirable silica are probably too high. Measures that control tool-generated dust at the source usually reduce all types of particle emissions, including respirable particles.

Do not rely only on visible dust to assess the extent of the silica hazard. There may be more airborne respirable dust present that is not visible to the naked eye.

Vacuum Dust Collection Systems

When wet methods cannot be implemented, one alternative is the use of vacuum dust collection (VDC) systems. Stationary masonry saws with VDC systems are commercially available and have the ability to capture a substantial amount of dust.

With these systems, a vacuum pulls dust from the cutting point through special fittings connected directly to the saw (fixed-blade saws) or, alternatively, through a dust collection device connected to the back of the saw (plunge-cut saws) (Croteau, 2000). A dust collector (exterior hood) mounted to the back of a saw requires a high exhaust airflow to ensure good dust capture between the saw blade and dust collector.

Under experimental conditions, a VDC system for a fixed-blade saw reduced short-term (15-minute) exposures by 80 to 95 percent when compared to uncontrolled masonry cutting. Because the saw

produced unusually high levels of dust in the enclosed, ventilated test area, the operators' silica exposure levels exceeded OSHA limits by a wide margin, even with the VDC system equipment activated. However, the authors of the study reported that uncontrolled silica exposure levels in the study were considerably greater than those observed in actual construction industry exposure assessment studies. Consequently, use of the VDC system in an actual construction setting could reduce silica exposure levels below OSHA limits (Croteau, 2000; Croteau et al., 2002). Even when operators' silica exposure still exceeds OSHA limits, the level of exposure could be substantially reduced through the use of the VDC system.

Recommendations for Vacuum Dust Collection Systems. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends airflow of 25 cubic feet per minute (CFM) per inch of blade diameter (ACGIH, 2007). If airflow is too low, the hose may clog with particulate matter. A study by Croteau et al. (2002), which tested an abrasive wheel saw, indicated that a ventilation flow rate of 75 CFM and an air velocity of 3440 feet per minute (FPM) should be considered the minimum ventilation rate for a 2-inch diameter vacuum hose. If the system provides a higher flow rate, then it is acceptable to use a larger hose.

VDC systems can be purchased as a kit. These kits should include a dust collector (exterior hood), vacuum, vacuum hose, and filter(s). The components of a VDC system are discussed below.

- *Dust collector (exterior hood)*: Be sure to use the appropriate sized dust collector for the wheel and if it is a retrofit on the saw, be sure to follow the manufacturer's instructions when installing the device.
- *Vacuum*: Choose a vacuum with the appropriate power and capacity for your job. Obtaining a flow rate on a VDC system of 80 CFM or better will give the best results while performing mortar removal (Heitbrink and Watkins, 2001).
- *Vacuum hose*: A flow rate of 80 CFM is best maintained with a 1½- to 2-inch diameter hose. If the diameter is larger, the airflow velocity will be reduced. If the diameter is smaller, airflow resistance will be higher. Airflow resistance also increases with hose length; excessively long hoses should be avoided.
- *Filters*: Double filtration is important. The use of a high-efficiency particulate air (HEPA) filter is critical to prevent the escape of respirable silica dust from the vacuum exhaust. HEPA filters are at least 99.97 percent efficient in removing fine dust particles from the air. A prefilter or cyclonic separator in addition to a HEPA filter will improve vacuum efficiency and extend the service life of the more costly HEPA filter. A cyclonic separator removes large particles that are capable of overloading or clogging the filter (Heitbrink and Collingwood, 2005).[7]
- *Systematic cleaning*: Choose a vacuum equipped with a back-pulse filter cleaning cycle. Such auto-cleaning mechanisms will reduce the time required for vacuum maintenance and improve the overall efficiency of the dust collection system. If the vacuum does not have an auto-cleaning mechanism, the employee can periodically turn the vacuum cleaner on and off. This allows the bag to collapse and causes the prefilter cake to dislodge from the filter.
- *Monitoring VDC efficiency*: Purchasing a dust collection system equipped with a static pressure gauge allows the employee to monitor the system's efficiency. Systems lacking a static pressure gauge can be monitored visually. If a dust plume increases and becomes more visible where the dust collector meets the working surface, the system is not working efficiently (Heitbrink and Collingwood, 2005).

Tips for Operating a Vacuum Dust Collection System

- Make sure that all hoses are clean and free of cracks.
- Ensure that appropriate filters and dust bags are in good condition and changed or emptied as needed (may be necessary several times per shift under some circumstances).
- Check the entire system daily for signs of poor dust capture or dust leaks.
- Use high-efficiency (HEPA) filters for maximum dust control.
- Erect baffles on either side of the saw to improve dust capture by rear-mounted dust collection devices (exterior hoods).
- Review manufacturers' operating specifications and recommendations for your equipment.

Work Practice Controls to Enhance Vacuum Effectiveness. Studies have shown that the effectiveness of VDC systems is enhanced by the use of proper work practices (NIOSH, 1999; Croteau et al., 2002). However, use of these work techniques without a dust collection system will not substantially reduce dust exposures.

With any type of vacuum system, employee protection from respirable dust is only as good as the filter in the vacuum. The less efficient the filter, the more respirable dust will pass through with the vacuum exhaust air. Locating the vacuum as far from employees as possible is one way to help limit exposure.

For optimal dust collection, the following measures are recommended:

- Keep the vacuum hose clear and free of debris, kinks and tight bends. Maintain the vacuum at peak performance to ensure adequate airflow through the dust collector and vacuum hoses.
- On vacuums with manual back-pulse filter cleaning systems, activate the system frequently (several times per day). Empty collection bags and vacuums as frequently as necessary. Dispose of collected dust in a way that prevents it from becoming resuspended in the air.
- For best results, set up a regular schedule for filter cleaning and maintenance. For example, institute a rule to clean the filter or change the bag at each break. This will prevent pressure loss and ensure that exhaust airflow stays constant on the VDC system.
- Remember, the absence of visible dust does not necessarily mean that employees are adequately protected from silica exposure.

Considerations

While dust control using vacuum dust collection may be an attractive option in some circumstances, it is not as effective as wet cutting for controlling respirable dust. Respiratory protection may still be needed to reduce employee exposures to levels of 0.1 mg/m^3 or less when using vacuum dust collection.

Provide employees with respiratory protection until air sampling indicates that their exposure is adequately controlled.

Compressed Air

The use of compressed air to clean surfaces or clothing is strongly discouraged. Using compressed air to clean work surfaces or clothing can significantly increase employee exposure, especially in enclosed and semi-enclosed spaces. Cleaning should be performed with a HEPA-filtered vacuum or by wet methods.

Excerpt from OSHA publication OSHA 3362-05, 2009, "Controlling Silica Exposures in Construction."

Hand-Operated Grinders

This section covers electric- and pneumatic-hand-operated grinders used for surface finishing and cutting slots. Angle grinders used for tuckpointing are addressed in a separate section. The term "silica" used in this document refers to respirable crystalline silica.

Introduction

Employees produce dusts containing silica when they grind on concrete and similar materials. The grinders' abrasive action generates fine particles that easily become suspended in the air and, when inhaled, penetrate deep into employees' lungs. Exposure to fine particles of silica has been shown to cause silicosis, a serious and sometimes fatal lung disease. Construction employees who inhale fine particles of silica may be at risk of developing this disease This section discusses the methods available to reduce employee exposures to silica during grinding activities.

Data compiled by the Occupational Safety and Health Administration (OSHA) indicate that, among employees who grind concrete, most are exposed to silica at levels that exceed OSHA's benchmark of 0.1 mg/m³ (milligrams of silica per cubic meter of air) as an 8-hour time-weighted average (TWA), an exposure approximately equivalent to OSHA's general industry permissible exposure limit (PEL).[1] In fact, on average, grinder operators' silica exposures (along with those of tuckpointers) are among the highest in the construction industry.[2] More than half of all grinder operators experience silica exposures above 0.2 mg/m³ (milligrams per cubic meter of air).[3] During periods of intensive grinding, concrete finishers' exposures can exceed 1.2 mg/m³ outdoors and 4.5 mg/m³ indoors (Lofgren, 1993; OSHA Case Files).[4]

Vacuum dust collection systems are used to reduce silica dust during concrete grinding operations. Vacuum methods can significantly reduce dust emissions, but thus far have not been shown to reliably keep silica levels below 0.1 mg/m³ as an 8-hour time-weighted average (TWA).

Wet grinding is highly effective in reducing silica exposures. Handheld water-fed grinding equipment is commercially available for concrete applications, granite grinding, and polishing operations. Conventional grinding equipment can be retrofitted to add a water-feed capability.[5]

Using a grinder in poorly controlled conditions. (Photo courtesy of the University of Washington.)

Adjustments in work methods and equipment, when possible, can lower exposure levels. For example, the use of jigs to increase the distance between the employee and the point of work can reduce exposure levels. Modifications in construction work methods for pouring, casting, finishing and installing concrete can reduce the amount of grinding required, which, in turn, can lower exposures.

Visible and Respirable Dust

Visible dust contains large particles that are easy to see. The tiny, respirable-sized particles (those that can get into the deep lung) containing silica pose the greatest hazard and are not visible. Most dust-generating construction activities produce a mixture of visible and respirable particles.

Do use visible dust as a general guide for improving dust suppression efforts. If you see visible dust being generated, emissions of respirable silica are probably too high. Measures that control tool-generated dust at the source usually reduce *all* types of particle emissions, including respirable particles.

Do not rely *only* on visible dust to assess the extent of the silica hazard. There may be airborne respirable dust present that is not visible to the naked eye.

Silica Dust Control Measures

Vacuum Dust Collection Systems

Vacuum dust collection (VDC) systems for grinders include a shroud, which surrounds the grinding wheel, hose, filters and a vacuum to pull air through the shroud. Many manufacturers offer grinders with dust collection options. Employers

may also purchase equipment to retrofit grinders for vacuum dust collection. The effectiveness of vacuum systems depends on several factors, including the user's technique, the surfaces being finished, and the efficiency of the dust collection system.

The addition of the shroud and vacuum hose may make it more difficult to work effectively while reaching overhead.

Recommendations for Vacuum Dust Collection Systems. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends airflow of 25 cubic feet per minute (CFM) per inch of blade diameter (for example, a 4-inch grinder would need a vacuum with airflow of 100 CFM). If airflow is too low, the hose may clog with particulate matter. However, employers should be aware that rated airflows provided by manufacturers may be different from actual airflow once attached to the tool. A study by Croteau et al. (2002), which tested an abrasive wheel saw, found a 2-inch diameter vacuum hose and a flow rate of 75 CFM achieved an air velocity of 4,000 feet per minute (FPM). Achieving this air velocity prevented particulate matter from settling in the hose.

VDC systems can be purchased as a kit. These kits should include a grinder shroud (exterior hood), vacuum, vacuum hose, and filter(s). The components of a VDC system are discussed below.

- Grinder shroud (exterior hood): Employees should use a shroud appropriate for the grinder and wheel size.
- Vacuum: Choose a vacuum with the appropriate power and capacity for your job. Croteau et al. (2002) found a flow rate greater than 70 CFM to be effective.
- Vacuum hose: A 1½- to 2-inch diameter hose is usually best for smaller vacuums. If the diameter is larger, the airflow velocity of the vacuum will be reduced. If the diameter is smaller, airflow resistance will be higher. Airflow resistance also increases with hose length; excessively long hoses should be avoided.
- Filters: Double filtration is important. The use of a high-efficiency particulate air (HEPA) filter is critical to prevent the escape of respirable silica dust from the vacuum exhaust. HEPA filters are at least 99.97 percent efficient in removing fine dust particles from the air. A prefilter or cyclonic separator in addition to a HEPA filter will improve vacuum efficiency and extend the service life of the more costly HEPA filter. A cyclonic separator removes large particles that are capable of overloading or clogging the filter (Heitbrink and Collingwood, 2005).
- Systematic cleaning: Regular cleaning of the filter is critical to maintaining high airflow. Choose a vacuum equipped with a back-pulse filter cleaning cycle. Such auto-cleaning mechanisms will reduce the time required for vacuum maintenance and improve the overall efficiency of the dust collection system. If the vacuum does not have an auto-cleaning mechanism, the employee can periodically turn the vacuum cleaner on and off. This allows the bag to collapse and causes the prefilter cake to dislodge from the filter.
- Monitoring VDC efficiency: Purchasing a dust collection system equipped with a static pressure gauge allows the employee to monitor the system's efficiency. Systems lacking a static pressure gauge can be monitored visually. If a dust plume increases and becomes more visible where the shroud meets the working surface, the system is not working efficiently. When relying on this technique to monitor the efficiency of the dust collection system, try to locate the vacuum as far away from adjacent employees as possible to help limit their exposure to silica (Heitbrink and Collingwood, 2005).

System Maintenance. For optimal dust collection, the following measures are recommended:

- Keep the vacuum hose clear and free of debris, kinks and tight bends. Maintain the vacuum at peak performance to ensure adequate airflow through the shroud and ducts.
- On vacuums with back-pulse filter cleaning systems, activate the system frequently (several times per day). Empty collection bags and vacuums as frequently as necessary. Dispose of collected dust in a way that prevents it from becoming resuspended in the air.
- For best results, set up a regular schedule for filter cleaning and maintenance. For example, institute a rule to clean the filter or change the bag at each break. This will prevent pressure loss and ensure that exhaust airflow stays constant on the VDC system.
- Remember, the absence of visible dust does not necessarily mean that employees are adequately protected from silica exposure.

Excerpt from OSHA publication OSHA 3362-05, 2009, "Controlling Silica Exposures in Construction."

General Housekeeping and Use of Dust Suppressants

This section covers dust control methods for general housekeeping activities at construction sites, including site cleaning, material handling and the use of dust suppressants. The term "silica" used in this document refers to respirable crystalline silica.

Introduction

Exposure to fine particles of silica has been shown to cause silicosis, a serious and sometimes fatal lung disease. Construction employees who inhale fine particles of silica may be at risk of developing this disease. Silica dust can be generated when materials such as ceramics, concrete, masonry, rock and sand are mixed, blasted, chipped, cut, crushed, drilled, dumped, ground, mixed or driven upon. Employees at construction sites may be exposed to silica dust during general housekeeping activities such as sweeping, emptying vacuum cleaners and using compressed air for cleaning. Silica exposures may also occur whenever silica-containing dusts are disturbed, such as during material handling. The small particles generated during these activities easily become suspended in the air and, when inhaled, penetrate deep into employees' lungs.

Examples of Construction Materials that Contain Silica

- Concrete
- Brick, tile and other masonry
- Mortar
- Asphalt
- Sand
- Many stone products (such as granite, slate and sandstone) and rock aggregate[1]

In several studies of construction sites, silica exposure levels rose when employees engaged in general construction cleaning activities such as dry sweeping, using backpack blowing equipment and emptying vacuums used to collect concrete dust.[2] For example, the National Institute for Occupational Safety and Health (NIOSH) determined that a concrete finisher handling a vacuum bag containing concrete dust was exposed to approximately 0.79 mg/m^3 (milligrams of silica per cubic meter of air) (NIOSH, 2001b).[3] This level is more than five times higher than the finisher's average silica exposure for the day, which already exceeded the Occupational Safety and Health Administration's (OSHA) benchmark of 0.1 mg/m^3 (milligrams per cubic meter of air) as an 8-hour time-weighted average (TWA), an exposure approximately equivalent to OSHA's general industry permissible exposure limit (PEL).[4] While most employees do not handle vacuum bags for their full shifts, this activity presents a significant source of exposure for employees who may also be exposed to silica from other sources.

Housekeeping Activities that Can Release Airborne Dust Containing Silica

- Dry sweeping
- Using blowers or compressed air for cleaning
- Dumping bags of raw material
- Dumping wheelbarrow loads
- Breaking or crushing materials
- Spreading crushed materials (concrete, aggregate)
- Dropping, tossing, or pouring dusty materials
- Operating a vacuum with the air discharge near a source of dust
- Emptying vacuums
- Driving over piles of dust or debris
- Other actions that disturb or create dust

This section describes several methods available to reduce employees' silica exposure during housekeeping and related activities. These methods include general measures to suppress the creation of dusts (use of water and other dust suppressants), vacuuming, using cabs and enclosures, and modification of work practices. Many of these methods can be used to reduce exposures to silica in a broad range of construction activities in addition to housekeeping tasks.

Visible and Respirable Dust

Visible dust contains large particles that are easy to see. The tiny, respirable-sized particles (those that can get into the deep lung) containing silica pose the greatest hazard and are not visible. Most dust-generating construction activities produce a mixture of visible and respirable particles.

Do use visible dust as a general guide for improving dust suppression efforts. If you see visible dust being generated, emissions of respirable silica are probably too high. Measures that control tool-generated dust at the source

usually reduce *all* types of particle emissions, including respirable particles.

Do not rely *only* on visible dust to assess the extent of the silica hazard. There may be more airborne respirable dust present that is not visible to the naked eye.

Silica Dust Control Measures

Dust Suppressants

Dust suppression is a dust control method that can be applied to many different operations, such as materials handling, rock crushing, abrasive blasting and operation of heavy construction vehicles. Types of dust suppressants include water (mists, sprays, steam and fog), surfactants (including foams), acrylic polymers, asphalt, chloride compounds, lignin compounds, natural oil resins, organic resin emulsions and petroleum-based oils and waste products.

Dust suppression is generally effective in controlling respirable silica dust, although few data are available regarding specific exposure reductions. Many of these methods have also been successful in reducing erosion and fugitive dust emissions (PM_{10}) regulated by the Environmental Protection Agency (EPA).[5]

Water

Wet methods (i.e., methods involving the application of water) are often the easiest and most effective way to reduce potential silica exposures. Dust that is wet is less able to become or remain airborne. Water can be applied in different ways to suit the specific situation. For example:

- Wet mopping or spraying water, followed with a wet vacuum or squeegee will collect dust and create less airborne dust than dry sweeping.
- The point where dust will be generated or has settled can be flooded by flushing surfaces with water or wet scrubbing.
- Particles can be removed from surfaces by water under pressure (pressure washing).[6]

Water can be used as a dust suppressant during a variety of activities, including:

- *Use of heavy construction vehicles on unpaved surfaces:* A water truck can spray the site grounds.
- *Blasting operations:* A separate water hose can be strung next to the hose containing the blasting medium; the two materials can be sprayed simultaneously.
- *Materials handling and transport operations:* It is often most efficient to spray a material before it reaches a transfer point so that the dust has time to absorb the water before being disturbed. Increasing moisture content decreases the amount of dust generated (Plinke et al., 1992).

Construction employees can use a variety of equipment to apply water, depending on the size and type of the job. A spray or mist can be an efficient way to distribute adequate amounts of water over a large area. For a small job, a portable garden sprayer with a hand pump may be adequate; a larger job might require a garden hose with a mister nozzle. On a demolition site, a fire hose can be used to apply water rapidly over a large area, but employees must be able to control both the spray nozzle and the water pressure or volume.

Start with a Gentle Spray or Mist

Avoid blasting dry dust with a forceful stream of water. The energy of the water and surrounding air can disturb the dust and cause it to become airborne before it is wet.

Instead, use a gentle spray or mist to moisten the particles first. When washing large quantities of dust from a surface, increase the water force only after pre-wetting all the dust with a gentle spray. Use the minimum amount of water needed to get the job done, particularly where runoff is a concern.

For optimal results:

- Use nozzles and flow regulators to control water volume.
- Clean up water and slurry as soon as practical (using a wet/dry shop vacuum or squeegees and scoops). If allowed to dry, the dust contained in the slurry may become a source of silica and other dust exposure.
- Rewet surfaces as often as necessary to maintain dust control.

Excerpt from OSHA publication OSHA 3362-05, 2009, "Controlling Silica Exposures in Construction."

MADE IN USA

MK-SDG-7 7" Grinder

Perfect for small jobs, the MK SDG-7 is designed to grind concrete to a smooth finish and provide dust control. Utilizing diamond cup wheels, contractors can use the SDG-7 for grinding, cleaning, and leveling concrete, masonry, and mortar. Other applications include removal of thick coatings like epoxies and urethanes, adhesives, thin set mortar, rubber, floor coverings and waterproofing materials.

- 115V/15 Amp motor, disc RPM of 3,500
- Constructed with sturdy heavy gauge steel
- MK-IXL vacuum shroud for dust control
- Shroud accommodates diamond cup wheels up to 7" in diameter
- Attaches to traditional shop vacuum, reducing risk of respiratory problems
- Lightweight portable size for use in small areas
- Adjustable handlebar for operator comfort
- Removable handlebars make it easy to store and to transport
- Easy to maneuver by one person
- Levels uneven surfaces and quickly removes epoxies and thin coatings

Disc RPM	3,500	
Disc Capacity	7" (178 mm)	
L x W x H (inches) L x W x H (mm)	34.6" x 17.5" x 32" 879 x 445 x 813	
Power	115V, 15 AMP	
Weight	44 lbs. (20 kg)	
Includes	• MK IXL Vacuum Shroud • Vacuum Connection Port • 7" Cup Wheel	
Part#	166859	
Optional	IXL Hinged Shroud	ZEK Wheel Adapter
Part#	166964	169216

Built-in nose weight for easy grinding

Adjustable handlebar for operator comfort

Easy to attach to vacuum system

Fits these popular grinders:
Dewalt, MK Diamond, Metabo, Makita, and Milwaukee

MK-IXL 5” Vacuum Shroud

The MK Diamond IXL 5” Vacuum Shroud is for concrete and surface grinding dust control. The shroud easily attaches to a vacuum or dust extractor resulting in a cleaner working environment and increasing visibility during grinding.

The MK-IXL 5” vacuum shroud is easy to install on popular grinders.

- Developed for grinding concrete, masonry and mortar
- Increases cup wheel life by removing abrasive dust
- Dust control reduces clean up time and provides better visibility for operator
- Designed for use when cleaning, leveling spots, removing epoxies, urethanes, paint and other coatings
- Fits popular 4”-5” hand grinders
- The hinged shroud is designed for grinding against walls and edges.

Description	Part#
5" Hinged Vacuum Shroud	170762
5" Full Vacuum Shroud	172366

Installs easily on most 4", 4-1/2" and 5" grinders.

Easily attaches to vacuums or dust extractors

Designed for 4" - 5" diamond cup wheels

The IXL full shroud is designed for open areas.

The IXL hinged shroud is designed for grinding against walls and edges.

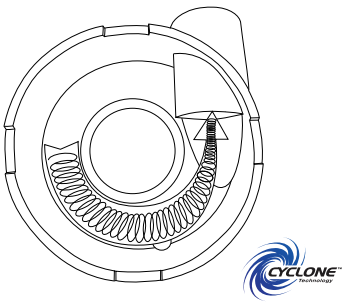
MK-IXL 7" Vacuum Shroud

The MK-IXL shroud has been engineered to fit popular 7" grinders. It's perfect to control dust when grinding.

- Developed for heavy-duty use by contractors for grinding concrete, masonry, and mortar
- Uses Cyclone Dust Extraction technology to control dust
- Dust control reduces clean up time
- Made from an "abrasive resistant" plastic to prevent wear from the grinding process
- Reinforced steel ring in shroud assists in gliding over concrete and helps resist wear
- Attaches to many traditional shop vacuums or commercial vacuums
- Easy to install, no tools are required

Description	Part#
7" Full Vacuum Shroud - 5 pack	167129
7" Hinged Vacuum Shroud - 5 pack	167130
7" Full Vacuum Shroud - Single	166037
7" Hinged Vacuum Shroud - Single	166964

Each individual shroud includes shroud clamp, cup nut assembly, IXL shroud spacers (set of 5) and shroud instruction manual.



Cyclone Dust Extraction System

The IXL shroud's snail shape design utilizes the air velocity created by the rotating grinding wheel to efficiently channel dust particles away from the work surface and into the vacuum port. This technology results in less airborne dust, less cleanup and improved grinding efficiency.

7" Shrouds sold in a Master Pack of 5 in a display tray.

MK-IXL Shroud is easy to install, no tools are required, and is designed to fit 7",15 amp grinders - Milwaukee, Dewalt, Metabo, Hitachi, Makita, and MK Diamond.

Vacuum Shroud Kit Includes:

- MK-IXL shroud
- Diamond Cup wheel
- Cup wheel washer
- IXL shroud clamp
- IXL shroud spacers (set of 5)
- IXL shroud instruction manual
- Cup nut assembly (5/8" arbor to 5/8"-11 nut adapter)

Description	Part#
7" Full Vacuum Shroud Kit	167127
7" Hinged Vacuum Shroud Kit	167128

Recommended 7" Cup Wheels For A Variety Of Applications

Single Row Grinding Cup Wheels

Part# 155446

MK-304CG-1
- 12 segment cup wheel
- 6mm diamond depth height
- 600-800 sq. ft. area
- For concrete deburring & rough surface grinding

Double Row Grinding Cup Wheels

Part# 155447

MK-304SG-2
- 24 segment cup wheel
- 6mm diamond depth height
- 800-1200 sq. ft. area
- For concrete deburring & rough surface grinding

Turbo Cup Wheels

Part# 158734

MK-504CG-1
- 12 segment cup wheel
- 6mm diamond depth height
- 1800-2400 sq. ft. area
- For fast surface grinding

Part# 158736

MK-504SG-2
- 24 segment cup wheel
- 6mm diamond depth height
- 2400-3000 sq. ft. area
- For fast surface grinding

PCD Cup Wheels

Part# 162789

MK-604CG-1
- 12 segment cup wheel
- 800-1000 sq. ft. area
- For epoxy/paint removal

Part# 162792

MK-604SG-2
- 18 segment cup wheel
- 1400-1800 sq. ft. area
- For epoxy/paint removal

T-Segment Cup Wheel

Part# 166378

T-Segment
- 14 segment cup wheel
- 6mm diamond depth height
- 1800-2400 sq. ft. area
- For smooth surface grinding

Bi-Turbo Cup Wheel

Part# 167115

MK-704SG-2
- 18 segment cup wheel
- 6mm diamond depth height
- 5000-8000 sq. ft. area
- For high efficiency surface grinding

SDG-11

SDG-3

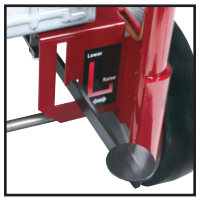
MADE IN USA

SDG-11/SDG-3 10" Single Disc Grinders

The heavy-duty SDG Single Disc Grinders are excellent for smoothing rough areas and other surface irregularities, feathering patches and cleaning industrial floors. Front tapered nose provides enhanced visibility. Removable handles and nose weight provide for easy transportation and storage. Water control valve is included for wet grinding. One-year limited warranty.

Disc RPM	980	
Disc Capacity	10" (254 mm)	
L x W x H (inches) L x W x H (mm)	40" x 16" x 42" 1,016 x 406 x 1,066	
Model	SDG-11	SDG-3
Engine/Motor	Honda (Gas)	Baldor (Electric)
Power	GXV340	3 Hp 208V/230V
Weight	212 lbs. (96 kg)	212 lbs. (96 kg)
Part#	157377	161180

Optional Grinding Heads.



Pedal raises grinding discs off the ground for engine starting and idling.

Removable nose weight

MK-SDG grinding disc mount

DDG-11

DDG-5

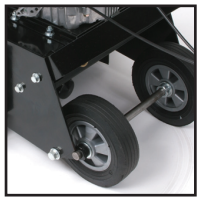
DDG Series Double Disc Grinders

The MK DDG Dual Disc Grinder has been designed with two counter-rotating heads that prevent pulling. Ergonomically designed handles provide improved handling and comfort. Vacuum port allows for dust-free dry grinding. Water control valve is included for wet grinding. One-year limited warranty.

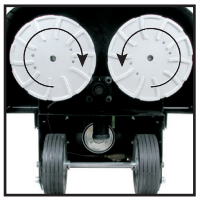
Disc RPM	550	
Disc Capacity	10" (254 mm)	
L x W x H (inches) L x W x H (mm)	50" x 25" x 40" 1,270 x 635 x 1,016	
Model	DDG-11	DDG-5
Engine/Motor	Honda (Gas)	Baldor (Electric)
Power	GXV340	5 Hp, 230V 1PH
Weight	234 lbs. (106 kg)	272 lbs. (123 kg)
Part#	157012	158780

Optional Grinding Heads.

User friendly control panel



Two position wheel carriage



Counter rotating discs

MK Diamond Products, Inc.

1315 Storm Parkway, Torrance, CA 90501 • Tel: 1.800.421.5830, 310.539.5221 • mkdiamond.com