

A photograph showing three workers from the waist down, wearing blue jeans and safety boots. They are using large, yellow and silver pneumatic tools, likely jackhammers or breakers, on a concrete surface. The tools are connected to yellow hoses. Dust is being kicked up from the ground. The workers are wearing safety gloves: red and white for the worker on the left, and grey for the others. A blue semi-transparent box is overlaid on the left side of the image, containing the title text.

Understanding Table 1

*and the specified exposure
control methods for silica dust*



Department of Consumer
and Business Services

Understanding Table 1

and the specified exposure control methods for silica dust.

About this guide

"Understanding Table 1 and the specified exposure control methods for silica dust." is an Oregon OSHA Standards and Technical Resources Section publication.

This guide is intended to help construction employers understand the methods listed in Table 1 (see 437-002-1057, *Specified exposure control methods*) for controlling exposures to silica dust. For more information about Oregon OSHA's silica rules, see Oregon OSHA's companion guide, "It's not just dust. What you should know about crystalline silica, silicosis, and Oregon OSHA silica rules."

Piracy notice

Reprinting, excerpting, or plagiarizing this publication is fine with us as long as it's not for profit! Please inform Oregon OSHA of your intention as a courtesy.



Table of Contents

What is Table 1?	2
What do Oregon OSHA’s silica rules require me to do when I follow a Table 1 task?	3
A complete description of Table 1 tasks	4
Stationary masonry saws	4
Handheld power saws (any blade diameter)	5
Handheld power saws for cutting fiber-cement board (with blade diameter of 8 inches or less)	6
Walk-behind saws	7
Drivable saws	8
Rig-mounted core saws and drills	9
Handheld and stand- mounted drills (including impact and rotary hammer drills)	10
Dowel drilling rigs for concrete	11
Vehicle-mounted drilling rigs for rock and concrete	12
Jackhammers and handheld powered chipping tools	13
Handheld grinders for mortar removal (tuckpointing)	15
Handheld grinders for uses other than mortar removal	16
Walk-behind milling machines and floor grinders	18
Small drivable milling machines (less than half-lane)	20
Large drivable milling machines (half-lane and larger)	21
Crushing machines	22
Heavy equipment and utility vehicles used to abrade or fracture silica containing materials or used during demolition activities involving silica-containing materials	23
Heavy equipment and utility vehicles used for tasks such as grading and excavating but not including demolishing, abrading, or fracturing silica-containing materials	24
Water delivery systems	25
Dust collection systems	25
Indoors and enclosed areas	25
Enclosed cabs and booths	26
Determining task duration and requirements for respirator use	26
Notes	27
Oregon OSHA Services	28

What is Table 1?

Table 1 lists 18 common construction tasks (and the equipment used) that create high levels of silica dust. The table also describes the engineering controls, work practices, and respiratory protection necessary for each task. If your employees do construction work that could expose them to silica dust, then the exposure control methods in Table 1 can help you lower their exposures.

Table 1 tasks are specific. If you can *fully and properly implement* the exposure control methods listed in Table 1 for a particular task, then you are not required to determine the silica exposure levels for the employees who do the task. Fully and properly implemented means that exposure control methods are working and properly maintained, and that employees know how to use them.

However, if you do not follow the exposure control methods listed for a particular task or if your employees perform tasks that are not listed in Table 1, then you must do air monitoring to determine the exposure levels for those employees.

The required exposure control methods for each Table 1 task cover the equipment, the equipment operator, and any other employees who are responsible for completing the task.

Engineering controls are required for most Table 1 tasks. Equipment that has an engineering control and still generates large amounts of dust generally means that the control is not working properly. Always follow the manufacturers' instructions to keep engineering controls working properly.

A common misunderstanding about Table 1 is that respirators are always required to protect employees. Respirators are required for some Table 1 tasks, but only when engineering and work practice controls do not keep silica dust at acceptable levels. When a Table 1 task requires respirators, you must provide them to all employees responsible for completing the task.



What do Oregon OSHA's silica rules require me to do when I follow a Table 1 task?

The silica rule	If you fully and properly implement a Table 1 task...	If you do not fully and properly implement Table 1 task...
Air monitoring (437-002-1056)	Not required	Required
Exposure assessment (437-002-1056)	Not required	Required when exposures are expected to be above the action level
Methods of compliance (437-002-1059)	Not required	Required
Written exposure control plan (437-002-1059)	Required	Required
Respiratory protection (437-002-1060)	Required if the Table 1 task requires a respirator	Required if necessary to reduce exposures to or below the PEL
Housekeeping (437-002-1061)	Required	Required
Medical surveillance (437-002-1062)	Required if employees must wear a respirator for 30 or more days a year	Required if employees must wear a respirator for 30 or more days a year
Communication of hazards (437-002-1063)	Required	Required
Recordkeeping (437-002-1064)	Required for employees who receive medical surveillance	Required for air monitoring exposure assessments and for employees who receive medical surveillance

A complete description of Table 1 tasks

Stationary masonry saws

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
Use a saw equipped with an integrated water delivery system that continuously feeds water to the blade. Operate and maintain the saw in accordance with manufacturer's instructions to minimize dust.	None	None

Stationary masonry saws must be equipped with an integrated water delivery system (commercially developed specifically for the saws) that continuously feeds water to the blade. The system usually includes a nozzle for spraying water attached near the blade connected to a water basin by a hose and pump. The equipment must be operated and maintained in accordance with manufacturer's instructions to minimize dust. Stationary masonry saws equipped with an integrated system for blade cooling must also suppress dust and meet Table 1 requirements.

Full and proper implementation of water delivery systems on stationary masonry saws must meet all of the following:

- An adequate supply of water for dust suppression is used
- The spray nozzle is working properly to apply water at the point of dust generation
- The spray nozzle is not clogged or damaged
- All hoses and connections are intact

Table 1 does not specify a minimum flow rate for water delivery systems; however, water must be applied at the flow rates specified by the manufacturer.

When your employees use stationary masonry saws indoors or in enclosed spaces, you must provide additional exhaust to minimize the accumulation of visible airborne dust.

[See the *Indoors or enclosed areas* section for more information.](#)

Respiratory protection is not required for work with stationary masonry saws.



Handheld power saws (any blade diameter)

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
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. <ul style="list-style-type: none">• When used outdoors• When used indoors or in an enclosed area	None APF 10	APF 10 APF 10

Handheld power saws must be equipped with an integrated water delivery system (commercially developed specifically for saw used) that continuously feeds water to the blade. The water delivery system usually includes a nozzle for spraying water attached near the blade that is connected to a water basin via a hose and pump. The equipment must be operated and maintained in accordance with manufacturer’s instructions to minimize dust. Handheld power saws equipped with an integrated water delivery system for blade cooling must also suppress dust and meet Table 1 requirements.

Full and proper implementation of water controls on handheld power saws must meet all of the following:

- An adequate supply of water for dust suppression is used
- The spray nozzle is working properly to apply water at the point of dust generation
- The spray nozzle is not clogged or damaged
- All hoses and connections are intact

Table 1 does not specify a minimum flow rate for water delivery systems; however, water must be applied at the flow rate specified by the manufacturer.

When working with handheld power saws of any blade diameter, respiratory protection with a minimum assigned protection factor (APF) of 10 is required for outdoor work more than four hours per shift and for work done indoors or in an enclosed location.

When your employees use a handheld saw indoors or in an enclosed space, you must provide additional exhaust to minimize the accumulation of visible airborne dust.

[See the Indoors or enclosed areas section for more information.](#)



Handheld power saws for cutting fiber-cement board (with blade diameter of 8 inches or less)

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
<p>For tasks performed outdoors only:</p> <ul style="list-style-type: none"> • Use a saw equipped with commercially available dust collection system. • Operate and maintain the saw in accordance with manufacturer’s instructions to minimize dust emissions. • The dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99 percent or greater efficiency. 	None	None

Handheld power saws with a blade diameter of eight inches or less used for cutting fiber-cement board must be equipped with commercially available dust collection systems and a filter with a 99 percent or greater efficiency. The saws must be operated and maintained in accordance with the manufacturer’s instructions to minimize dust; the dust collector must provide at least the air flow rate recommended by the manufacturer. The saws must only be used outdoors to meet Table 1 requirements.

Full and proper implementation of dust collection systems on handheld power saws for cutting fiber-cement board must meet all of the following:

- The shroud or cowling is intact and installed in accordance with the manufacturer’s instructions
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends
- The filters on the vacuum are cleaned or changed in accordance with the manufacturer’s instructions to prevent clogging
- The dust collection bags are emptied to avoid overfilling

Respiratory protection is not required outdoors while cutting fiber-cement board with a specialty handheld power saw.



Walk-behind saws

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
<p>Use a saw equipped with integrated water delivery system that continuously feeds water to the blade.</p> <p>Operate and maintain the saw in accordance with manufacturer's instructions to minimize dust.</p> <ul style="list-style-type: none"> • When used outdoors • When used indoors or in an enclosed area 	<p>None</p> <p>APF 10</p>	<p>None</p> <p>APF 10</p>

Walk-behind saws must be equipped with an integrated water delivery system (commercially developed specifically for the type of tool in use) that continuously feeds water to the blade. The tool must be operated and maintained in accordance with manufacturer's instructions to minimize dust.

Full and proper implementation of water controls on walk-behind saws must meet all of the following:

- An adequate supply of water for dust suppression is used
- The spray nozzles are working properly to apply water at the point of dust generation
- The spray nozzles are not clogged or damaged
- All hoses and connections are intact

Table 1 does not specify a minimum flow rate; however, water must be applied at the flow rate specified by the manufacturer.



Walk-behind saws used to cut roads and cut pavement are typically used outdoors, though they can also be used indoors to cut concrete floors. When your employees use walk-behind saws indoors or in enclosed areas, you must provide additional exhaust to minimize visible airborne dust.

[See the *Indoors or enclosed areas* section for more information.](#)

When employees are working outdoors, respiratory protection is not required for work with walk-behind saws. When employees are working indoors, or in an enclosed location, respiratory protection with a minimum APF of 10 is required.

Drivable saws

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
<ul style="list-style-type: none">• For tasks performed outdoors only• Use a saw equipped with an integrated water delivery system that continuously feeds water to the blade• Operate and maintain the equipment in accordance with manufacturer’s instructions to minimize dust emissions	None	None

Drivable saws used to cut silica-containing materials (such as concrete, asphalt, granite, and terrazzo) must be equipped with an integrated water delivery system (commercially developed specifically for saw used) that continuously feeds water to the blade; the equipment must be operated and maintained in accordance with manufacturer’s instructions to minimize dust.

Drivable saws must be used outdoors to meet the requirements in Table 1.

Full and proper implementation of water controls on drivable saws must meet all of the following:

- An adequate supply of water for dust suppression is used
- The spray nozzles 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

Respiratory protection is not required for work with drivable saws.



Rig-mounted core saws and drills

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
<ul style="list-style-type: none">• Use equipment with an integrated water delivery system that supplies water to cutting surface• Operate and maintain the equipment in accordance with manufacturer's instructions to minimize dust	None	None

Rig-mounted core saws and drills must be equipped with an integrated water delivery system (commercially developed specifically for the saw or drill) that supplies water to the cutting surface; the equipment must be operated and maintained in accordance with manufacturer's instructions to minimize dust.

Full and proper implementation of water controls on rig-mounted core saws or drills must meet all of the following:

- An adequate supply of water for dust suppression is used
- The spray nozzles 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

When your employees use rig-mounted core saws or drills indoors or in enclosed areas, you must provide additional exhaust to minimize the accumulation of visible airborne dust.

[See the *Indoors or enclosed areas* section for more information.](#)

Respiratory protection is not required for work with rig-mounted core saws or drills.



Handheld and stand-mounted drills (including impact and rotary hammer drills)

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
<ul style="list-style-type: none"> • Use a drill equipped with a commercially available shroud or cowling with dust collection system • Operate and maintain the drill in accordance with manufacturer's instructions to minimize dust emissions • The dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99 percent or greater efficiency and a filter-cleaning mechanism • Use a HEPA-filtered vacuum when cleaning holes 	None	None

Handheld and stand-mounted drills must be equipped with a commercially available shroud or cowling with a dust collection system that provides at least the minimum air flow recommended by the manufacturer. The dust collection system must include a filter-cleaning mechanism and be equipped with a filter with 99 percent or greater efficiency. The equipment must be operated and maintained in accordance with manufacturer's instructions to minimize dust.

Full and proper implementation of dust collection systems on handheld and stand-mounted drills must meet all of the following:

- The shroud or cowling is intact and installed in accordance with the manufacturer's instructions
- The filters on the vacuum are cleaned or changed in accordance with the manufacturer's instructions
- The dust collection bags are emptied to avoid overfilling

A HEPA-filtered vacuum must be used when cleaning holes. Compressed air can be used to clean holes when used in conjunction with a HEPA-filtered vacuum to capture the dust, or a hole cleaning kit designed for use with compressed air.

When your employees use handheld and stand-mounted drills indoors or in enclosed areas, you must provide additional exhaust to minimize the accumulation of visible airborne dust.

[See the *Indoors or enclosed areas* section for more information.](#)

Respiratory protection is not required when employees use handheld or stand-mounted drills equipped with a dust collection system, including overhead drilling.



Dowel drilling rigs for concrete

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
<p>For tasks performed outdoors only:</p> <ul style="list-style-type: none"> • Use a shroud around the drill bit with a dust collection system. The dust collector must have a filter with 99 percent or greater efficiency and a filter-cleaning mechanism. • Use a HEPA-filtered vacuum when cleaning holes. 	APF 10	APF 10

Dowel drills for concrete (gang drills) are drills equipped with multiple drill bits that drill several holes at the same time. Dowel drills must be equipped with a shroud around the drill bit and a dust collection system that has a filter with 99 percent or greater efficiency. The dust collection equipment must be equipped with a filter cleaning mechanism. Dowel drilling rigs can be used outdoors only under Table 1 requirements.

Full and proper implementation of dust collection systems on dowel drilling rigs must meet all of the following:

- The shroud is intact and installed in accordance with the manufacturer's instructions
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends
- The filters on the vacuum are cleaned or changed in accordance with the manufacturer's instructions
- The dust collection bags are emptied to avoid overfilling



A HEPA-filtered vacuum must be used to clean holes. Compressed air can be used to clean holes when used in conjunction with a HEPA-filtered vacuum to capture the dust, or a hole cleaning kit designed for use with compressed air.

Respiratory protection with a minimum APF of 10 is required for all work with dowel drilling rigs.

Vehicle-mounted drilling rigs for rock and concrete

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
Use a dust collection system with a close capture hood or a shroud around the drill bit with a low-flow water spray to wet the dust at the discharge point.	None	None
Or Operate the rig within an enclosed cab and use water for dust suppression on drill bit.	None	None

Vehicle-mounted rock and concrete drilling rigs must be equipped with a dust collection system with a close capture hood or shroud around the drill bit, and a low-flow water spray to wet the dust discharged from the dust collector.

The drill operator can also work within an enclosed cab and, when necessary, apply water at the drill bit, as described above, to reduce exposures to other employees in the area.

[See the *Enclosed cabs* section for more information.](#)

Full and proper implementation of dust collection systems on vehicle-mounted drilling rigs must meet all of the following:

- The shroud or hood is intact and installed in accordance with the manufacturer's instructions
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends
- The filters on the vacuum are cleaned or changed in accordance with the manufacturer's instructions
- The dust collection bags are emptied to avoid overfilling

Full and proper implementation of water controls on vehicle-mounted drilling rigs must meet all of the following:

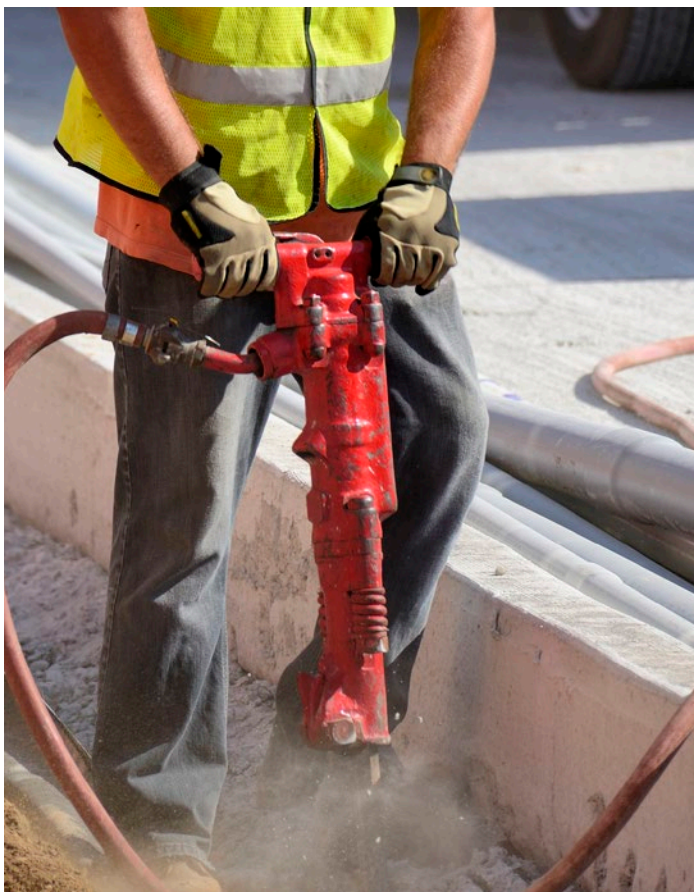
- An adequate supply of water for dust suppression is used
- The spray nozzles are working properly and produce a pattern that applies water on the discharge point from the dust collector
- The spray nozzles are not clogged or damaged
- All hoses and connections are intact

Respiratory protection is not required for work with vehicle-mounted drilling rigs.



Jackhammers and handheld powered chipping tools

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
<p>Use a tool with water delivery system that supplies a continuous stream or spray of water at the point of impact.</p> <ul style="list-style-type: none"> • When used outdoors • When used indoors or in an enclosed area <p>Or</p> <p>Use a tool equipped with commercially available shroud and dust collection system</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust</p> <p>The dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99 percent or greater efficiency and a filter-cleaning mechanism</p> <ul style="list-style-type: none"> • When used outdoors • When used indoors or in an enclosed area 	<p>None</p> <p>APF 10</p>	<p>APF 10</p> <p>APF 10</p>
	<p>None</p> <p>APF 10</p>	<p>APF 10</p> <p>APF 10</p>



Jackhammers and handheld powered chipping tools must be operated with either a water delivery system that supplies a continuous stream of water at the point of impact, or a tool equipped with a commercially available shroud and vacuum dust collection system. Jackhammers and other handheld powered chipping tools must be operated and maintained in accordance with manufacturer's instructions to minimize dust.

If a shroud and dust collection system is used, the system must provide at least the air flow recommended by the manufacturer, a filter with 99 percent or greater efficiency, and a filter cleaning mechanism.

The water delivery system is not required to be integrated or mounted on the tool, but can be assembled and installed by you. It must deliver a continuous stream or spray of water at the point of impact, however.

Full and proper implementation of water controls on jackhammers and other handheld powered chipping tools must meet all of the following:

- An adequate supply of water for dust suppression is used

- The water sprays are 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

Acceptable water delivery systems include direct connections to fixed water lines or portable water tank systems. These water delivery systems can be operated by one worker or could require a second worker to supply the water at the point of impact.

Full and proper implementation of dust collection systems must meet all of the following:

- The shroud is intact and installed in accordance with the manufacturer's instructions
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends
- The filters on the vacuum are cleaned or changed in accordance with the manufacturer's instructions
- The dust collection bags are emptied to avoid overfilling

Respiratory protection with an APF of 10 is required when the task is done outdoors for more than four hours per shift, or when the task is done indoors or in an enclosed location regardless of task duration.

When your employees are working indoors or in an enclosed space, you must provide additional exhaust to minimize the accumulation of visible airborne dust.

[See the *Indoors or enclosed areas* section for more information.](#)

Handheld grinders for mortar removal (tuckpointing)

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
<p>Use a grinder equipped with a commercially available shroud and dust collection system.</p> <p>Operate and maintain the grinder in accordance with the manufacturer's instructions to minimize dust.</p> <p>The dust collector must provide 25 cubic feet per minute or greater of airflow per inch of wheel diameter and have a filter with 99 percent or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.</p>	APF 10	APF 25

Tuckpointing involves removing deteriorating mortar from between bricks using a handheld grinder and replacing it with fresh mortar.

The handheld grinders must be equipped with a commercially available shroud and dust collection system and operated and maintained in accordance with manufacturer's instructions to minimize dust. The dust collection system must provide at least 25 cubic feet per minute of air flow per inch of wheel diameter and have a filter that has a 99 percent or greater efficiency and either a cyclonic pre-separator or a filter-cleaning mechanism. Cyclonic pre-separators and filter-cleaning mechanisms improve the suction of dust collection systems by preventing debris from building up on the filter.



Full and proper implementation of dust collection systems on handheld grinders must meet all of the following:

- The shroud is intact, encloses most of the grinding blade, and is installed in accordance with the manufacturer's instructions
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends
- The filters on the vacuum are cleaned or changed in accordance with the manufacturer's instructions
- The dust collection bags are emptied to avoid overfilling
- The blade is kept flush against the surface whenever possible
- The tool is operated against the direction of blade rotation, whenever practical

When your employees used handheld grinders for mortar removal indoors or in enclosed areas, you must provide additional exhaust if needed to minimize the accumulation of visible airborne dust.

[See the *Indoors or enclosed areas* section for more information.](#)

Respiratory protection with a minimum APF of 10 is required for work with handheld grinders for mortar removal lasting four hours or less in a shift. Respiratory protection with a minimum APF of 25 is required for work lasting more than four hours per shift.

Handheld grinders for uses other than mortar removal

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
For tasks performed outdoors only:		
Use a grinder equipped with integrated water delivery system that continuously feeds water to the grinding surface	None	None
Operate and maintain the grinder in accordance with manufacturer's instructions to minimize dust		
Or		
Use a grinder equipped with commercially available shroud and dust collection system		
Operate and maintain the grinder in accordance with manufacturer's instructions to minimize dust emissions		
The dust collector must provide 25 cubic feet per minute or greater of airflow per inch of wheel diameter and have a filter with 99 percent or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.		
• When used outdoors	None	None
• When used indoors or in an enclosed area	None	APF 10

Handheld grinders may also be used for tasks other than mortar removal, such as removing thin layers of concrete and surface coatings. Two engineering controls may be used:

Option 1: A grinder equipped with an integrated water delivery system (commercially developed specifically for the type of grinder used) that continuously feeds water to the grinding surface operated for outdoor work. The integrated water delivery system can be a free-flowing water system designed for blade cooling or a manufactured system designed only for dust suppression. This option applies only when grinders are used outdoors.

Option 2: A dust collector equipped with a commercially available shroud and dust collection system with the same features as the dust collection system used for mortar removal for outdoor and indoor work. The dust collector must be rated to provide 25 cubic feet per minute or greater air flow per inch of wheel diameter, have a filter with a 99 percent or greater efficiency, and a cyclonic pre-separator or filter-cleaning mechanism.



Cyclonic pre-separators and filter-cleaning mechanisms improve the suction of dust collection systems by preventing debris from building up on the filter. The grinder must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions.

Full and proper implementation of water controls on grinders must meet all of the following:

- An adequate supply of water for dust suppression is used
- The spray nozzles are 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

Handheld grinders equipped with dust collection systems may be used outdoors or indoors. *Full and proper implementation* of dust collection systems on handheld grinders that:

- The shroud is intact and installed in accordance with the manufacturer's instructions
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends
- The filters on the vacuum are cleaned or changed in accordance with the manufacturer's instructions
- The dust collection bags are emptied to avoid overfilling

Respiratory protection is not required when water-based dust suppression systems are used regardless of task duration. When dust collection systems are used, respiratory protection with a minimum APF of 10 is required only when engaged in a task indoors or in an enclosed location for more than four hours per shift.

When your employees use handheld grinders indoors or in enclosed areas, you must provide additional exhaust as needed to minimize the accumulation of visible airborne dust.

[See the *Indoors or enclosed areas* section for more information.](#)

Walk-behind milling machines and floor grinders

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
Use a machine equipped with an integrated water delivery system that continuously feeds water to the cutting surface. Operate and maintain the machine in accordance with manufacturer's instructions to minimize dust emissions. Or Use a machine equipped with dust collection system recommended by the manufacturer. Operate and maintain the machine in accordance with manufacturer's instructions to minimize dust emissions. The dust collector must provide the air flow recommended by the manufacturer, or greater, and have a filter with 99 percent or greater efficiency and a filter-cleaning mechanism. Use a HEPA-filtered vacuum indoors or in enclosed areas to remove loose dust in between passes.	None	None
	None	None

There are two engineering control options that can be used with walk-behind milling machines and floor grinders. Regardless of the option used, the equipment must also be operated and maintained in accordance with manufacturer's instructions for minimizing dust.

Option 1: Use an integrated water delivery system (commercially developed specifically for the type of machine used) that continuously feeds water to the cutting surface. Table 1 does not specify a minimum flow rate; however, water must be applied at flow rates specified by the manufacturer.

Full and proper implementation of water controls on walk-behind milling machines and floor grinders must meet all of the following:

- An adequate supply of water for dust suppression is used
- The spray nozzles are 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



Option 2: Use a dust collection system recommended by the milling machine or floor grinder manufacturer, a filter with 99 percent or greater efficiency, and a filter-cleaning mechanism.

Full and proper implementation of dust collection systems on walk-behind milling machines and floor grinders must meet all of the following:

- The hose connecting the tool to the vacuum is intact and without kinks or tight bends
- The filters on the vacuum are cleaned or changed in accordance with the manufacturer's instructions to prevent clogging
- The dust collection bags are emptied to avoid overfilling

When your employees use a dust collection system indoors or in enclosed areas, loose dust must be cleaned up with a HEPA-filtered vacuum in between passes of the milling machine or floor grinder to prevent the loose dust from being re-suspended. Removing loose dust with a HEPA vacuum also maximizes vacuum suction by improving the seal between the machine and floor. Provide additional ventilation as needed to minimize the accumulation of visible airborne dust.

[See the *Indoors or enclosed areas* section for more information.](#)

Respiratory protection is not required for work with walk-behind milling machines and floor grinders.



Small drivable milling machines (less than half-lane)

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
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

Small drivable milling machines must be used with supplemental water sprays designed to suppress dust and must be operated and maintained to minimize dust emissions. The water must be combined with a surfactant.

Full and proper implementation of water controls on small drivable milling machines must meet all of the following:

- An adequate supply of water for dust suppression is used
- The spray nozzles are 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

When your employees use small drivable milling machines indoors or in enclosed areas, you must provide additional exhaust as needed to prevent the accumulation of visible airborne dust.

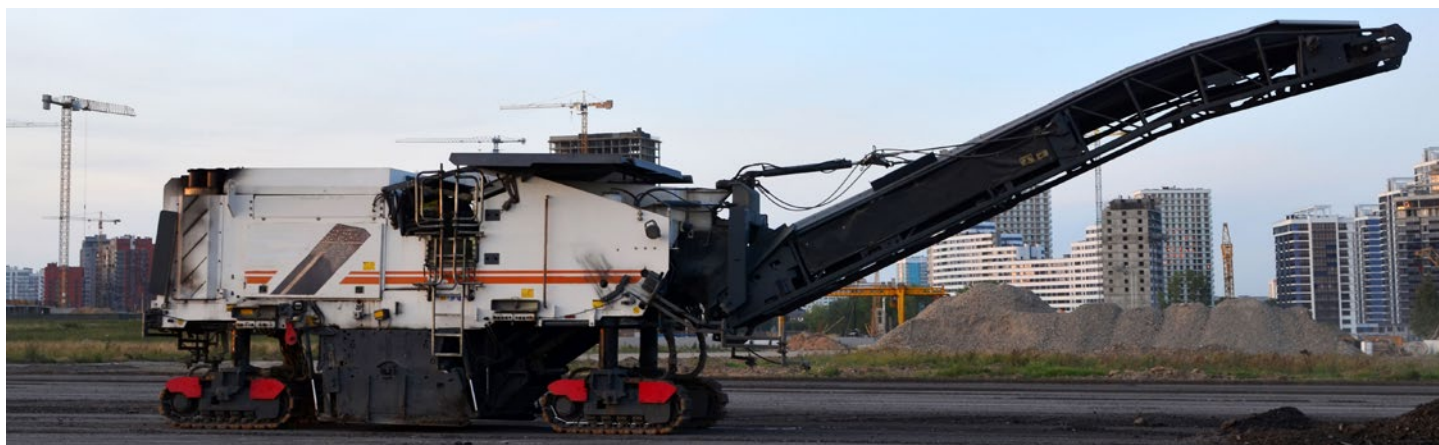
[See the *Indoors or enclosed areas* section for more information](#) on how to determine when those work situations apply.

Respiratory protection is not required for work with small drivable milling machines (less than half-lane).



Large drivable milling machines (half-lane and larger)

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
For cuts of any depth on asphalt only: Use a machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust. Operate and maintain the machine to minimize dust emissions.	None	None
For cuts of four inches in depth or less on any substrate: Use a machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust. Operate and maintain machine to minimize dust.	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 the machine to minimize dust emissions.	None	None



Employers whose employees operate large milling machines have two engineering control options for cuts of four inches in depth or less on any substrate and one control option for cuts of any depth on asphalt. Regardless of the option, the machine must be operated and maintained to minimize dust.

Option 1: Use a machine equipped with exhaust ventilation on the drum enclosure and supplemental water sprays designed to suppress dust.

Option 2: Use a machine equipped with a supplemental water spray, combined with a surfactant, designed to suppress dust.

When making cuts of any depth on roadway material containing asphalt only, the only control option is to use a machine equipped with exhaust ventilation on the drum enclosure and supplemental water sprays designed to suppress dust.

Respiratory protection is not required for work with large drivable milling machines (half-lane or larger).

Crushing machines

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
<p>Use equipment designed to deliver water spray or mist for dust suppression at crusher and other points where dust is generated (such as hoppers, conveyers, sieves/sizing or vibrating components, and discharge points).</p> <p>Operate and maintain the machine in accordance with manufacturer's instructions to minimize dust emissions.</p> <p>Use a ventilated booth that provides fresh, climate-controlled air to the operator, or a remote control station.</p>	None	None

When your employees use crushing machines, you must provide them with a remote control station or ventilated booth that provides fresh, climate-controlled air. Water sprays or mists must be used for dust suppression at the crusher and other points where dust is generated (for example at hoppers, conveyors, sieves or vibrating components, and discharge points).

Table 1 also requires that the machine is operated and maintained according to the manufactures instructions to minimize dust.

[See the *Enclosed cabs* section for more information.](#)



Water spray systems can be installed to be activated by remote control. To prevent airborne dust from being generated, *full and proper implementation* of controls must meet all of the following:

- Nozzles are located upstream of dust generation points and positioned to thoroughly wet the material
- The volume and size of droplets is adequate to sufficiently wet the material (optimal droplet size is between 10 and 150 micrometer)
- Spray nozzles are located far enough from the target area to provide complete water coverage but not so far that the water is carried away by wind.

Respiratory protection is not required for crusher operators.

Heavy equipment and utility vehicles used to abrade or fracture silica containing materials or used during demolition activities involving silica-containing materials

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
Operate the equipment from within an enclosed cab.	None	None
When employees outside of the cab are engaged in the task, apply water and dust suppressants, or both, as necessary to minimize dust emissions.	None	None

This equipment is used for activities such as fracturing or abrading rock and soil, and demolishing concrete or masonry structures. The operator must be in an enclosed cab. Modern heavy equipment already comes equipped with enclosed, filtered cabs that meet the requirements of Table 1.

When other employees are engaged in the task, water, dust suppressants, or both must also be applied as necessary to minimize dust emissions.

[See the *Enclosed cabs* section for more information.](#)

Respiratory protection is not required for heavy equipment operators and laborers who help heavy equipment operators during this task.

When the operator exits the enclosed cab and is no longer performing the task, the task is considered to be finished. However, if other abrading, fracturing, or demolition work is performed by other heavy equipment and utility vehicles in the area while an operator is outside the cab, that operator is considered to be an employee “engaged in the task” and must be protected.



Heavy equipment and utility vehicles used for tasks such as grading and excavating but not including demolishing, abrading, or fracturing silica-containing materials

Engineering and work practice controls	Required respiratory protection and minimum assigned protection factor (APF)	
	≤ 4 hours/shift	> 4 hours/shift
Apply water, dust suppressants, or both, as necessary to minimize dust emissions.	None	None
Or When the equipment operator is the only employee engaged in the task, operate equipment from within an enclosed cab.	None	None

There are two engineering control options:

Option 1: Apply water, dust suppressants, or both to minimize dust. Water must be applied at rates sufficient to minimize release of visible dust when:

- (a) Grading and excavating equipment is not equipped with enclosed, filtered cab
- (b) Employees other than the operator are also engaged in the task.

Option 2: Require the equipment operator to operate the equipment within an enclosed filtered, cab when the operator is the only employee in the area. Most heavy equipment have enclosed, filtered cabs. See the section on *Enclosed cabs* for more information.

Respiratory protection is not required for work with heavy equipment when it is operated from within an enclosed cab, or when water or other dust suppressants are used.



Water delivery systems

Integrated water delivery systems are required for several types of equipment in Table 1. The integrated water system must be developed specifically for the tool used so that it will apply water at the appropriate dust emission points and does not interfere with other tool components or safety devices. Water systems designed for blade cooling also suppress dust and meet Table 1 requirements.

The water must be applied at flow rates sufficient to minimize release of visible dust. Effective control of the dust depends on factors such as dust particle size, dust particle velocity, spray nozzle size and location, use of surfactants or other binders, and factors such as water hardness, humidity, and weather; all these factors must be considered when using water delivery systems.

Because the appropriate water flow rates for controlling silica dust emissions vary, it is necessary to follow the equipment manufacturers' instructions to determine the required water flow rate.

Any slurry generated when using water to suppress dust should be cleaned up to limit secondary exposure to silica dust when the slurry dries. Follow the cleanup procedures described in your written exposure control plan.

In cold temperatures, where there is a risk of water freezing, additional work practices such as insulating drums, wrapping drums with gutter heat tape, or adding environmentally-friendly antifreeze additives to water may be needed.

Dust collection systems

"Commercially available" dust collection systems are required for several types of equipment in Table 1. However, employers can use products that are made by aftermarket manufacturers (someone other than the original tool manufacturer) that are compatible with the make and model of their equipment.

These systems must be designed to work effectively with the equipment and not introduce new hazards such as obstructing or interfering with safety mechanisms. When employers use methods other than commercially available systems for dust suppression, they must conduct exposure assessments to ensure the equipment reduces exposures to, or below, the permissible exposure limit..

Some Table 1 requirements for dust collection systems specify cyclonic pre-separators and filter cleaning mechanisms to prevent the buildup of debris on filters. A cyclonic pre-separator collects large debris before the air reaches the filters. A filter cleaning mechanism prevents the need for manually cleaning filters to prevent buildup of debris.

Some vacuums are equipped with a gauge indicating filter pressure to help employees in determining when it is time to run a filter-cleaning cycle.

Indoors and enclosed areas

Several Table 1 entries refer to tasks performed indoors or in enclosed areas. These are areas where airborne dust can build up unless additional exhaust is used. For example, an open-topped structure with three walls and limited air movement within the walls – or a roof that does limit dispersal – would be considered enclosed.

Sufficient air circulation indoors or in enclosed areas is an important factor in preventing the accumulation of airborne dust.

Employers who follow Table 1 requirements must provide a means of exhaust to minimize the accumulation of visible airborne dust for tasks performed indoors or in enclosed areas. Exhaust could include portable fans, portable ventilation systems, and other systems that increase air movement and disperse airborne dust. To be effective, the ventilation must be set up so that work tasks, or the opening of doors and windows, will not disrupt the airflow.

Enclosed cabs and booths

Enclosed cabs and booths are generally required for rock drilling, crushers, and heavy equipment. Employers must ensure that the enclosed cab or booth:

- Is kept as free as possible from settled dust
- Has door seals and closing mechanisms that work properly
- Has gaskets and seals that are in good condition and work properly
- Is under positive pressure maintained through continuous delivery of filtered air
- Has intake air that is filtered through a pre-filter that is 95 percent efficient in the 0.3-10.0 micrometer range
- Has heating and cooling capabilities

The controls for enclosed cabs and booths reduce the potential for dust to enter or be suspended inside. The controls also ensure that the interior filtered air keeps operators comfortable and does not contain silica particles.

Cleaning and maintenance procedures for enclosed cabs and booths must be included in your written exposure control plan.

Determining task duration and requirements for respirator use

There are two levels of task duration in Table 1 for respirator use:

1. Less than or equal to four hours per shift
2. More than four hours per shift

Each of the following is considered a shift:

- An eight-hour work day
- A day with scheduled breaks – for example, four hours on, two hours off, four hours on
- Work periods longer than eight hours
- Double shifts within a single day
- A work period spanning two calendar days (for example, 8 p.m. to 4 a.m.)

Task duration starts when a worker begins using equipment and continues until the worker completes the task. Included in the time are intermittent pauses in equipment use and clean-up time.

The requirements for respirators in Table 1 respirators are based on the anticipated duration of the task. You must make a good-faith judgment of the task's anticipated duration over the work shift based on your previous experience with the task.



Notes

[illegible]

Getting help

The following sources offer more information about how to protect yourself, your co-workers, and your employees from silicosis.

- ▶ Your insurance carrier offers on-site safety and health consultations including air sampling and air monitoring. Contact your carrier to request a consultation.
- ▶ Oregon OSHA offers no-charge, on-site workplace consultations, full-service safety and health training, a video-lending library, and information online. To contact us, see the back page of this publication.
- ▶ Other resources
 - National Institute for Occupational Safety and Health (NIOSH), www.cdc.gov/niosh
 - Occupational Safety and Health Administration (OSHA), www.osha.gov
 - Mine Safety and Health Administration (MSHA), www.msha.gov

Oregon OSHA Services

Oregon OSHA offers a wide variety of safety and health services to employers and employees:

Enforcement

- ▶ **503-378-3272; 800-922-2689; enforce.web@dcbs.oregon.gov**
- Offers pre-job conferences for mobile employers in industries such as logging and construction.
- Inspects places of employment for occupational safety and health hazards and investigates workplace complaints and accidents.
- Provides abatement assistance to employers who have received citations and provides compliance and technical assistance by phone.

Consultative Services

- ▶ **503-378-3272; 800-922-2689; consult.web@dcbs.oregon.gov**
- Offers no-cost, on-site safety and health assistance to help Oregon employers recognize and correct workplace safety and health problems.
- Provides consultations in the areas of safety, industrial hygiene, ergonomics, occupational safety and health programs, assistance to new businesses, the Safety and Health Achievement Recognition Program (SHARP), and the Voluntary Protection Program (VPP).

Standards and Technical Resources

- ▶ **503-378-3272; 800-922-2689; tech.web@dcbs.oregon.gov**
- Develops, interprets, and gives technical advice on Oregon OSHA's safety and health rules.
- Publishes safe-practices guides, pamphlets, and other materials for employers and employees.
- Manages the Oregon OSHA Resource Center, which offers safety videos, books, periodicals, and research assistance for employers and employees.

Oregon OSHA Services *(continued)*

Appeals

► 503-947-7426; 800-922-2689; admin.web@dcbs.oregon.gov

- Provides the opportunity for employers to hold informal meetings with Oregon OSHA on concerns about workplace safety and health.
- Discusses Oregon OSHA's requirements and clarifies workplace safety or health violations.
- Discusses abatement dates and negotiates settlement agreements to resolve disputed citations.

Conferences

► 503-378-3272; 888-292-5247, Option 1; oregon.conferences@dcbs.oregon.gov

- Co-hosts conferences throughout Oregon that enable employees and employers to learn and share ideas with local and nationally recognized safety and health professionals.

Public Education

► 503-947-7443; 888-292-5247, Option 2; ed.web@dcbs.oregon.gov

- Provides workshops and materials covering management of basic safety and health programs, safety committees, accident investigation, technical topics, and job safety analysis.

Need more information? Call your nearest Oregon OSHA office.

Salem Central Office

350 Winter St. NE
Salem, OR 97301-3882
Phone: 503-378-3272
Toll-free: 800-922-2689

Fax: 503-947-7461
en Español: 800-843-8086
Website: osha.oregon.gov

Bend

Red Oaks Square
1230 NE Third St., Suite A-115
Bend, OR 97701-4374
541-388-6066
Consultation: 541-388-6068

Eugene

1500 Valley River Drive, Suite 150
Eugene, OR 97401-4643
541-686-7562
Consultation: 541-686-7913

Medford

1840 Barnett Road, Suite D
Medford, OR 97504-8250
541-776-6030
Consultation: 541-776-6016

Pendleton

200 SE Hailey Ave.
Pendleton, OR 97801-3056
541-276-9175
Consultation: 541-276-2353

Portland

Durham Plaza
16760 SW Upper Boones
Ferry Road, Suite 200
Tigard, OR 97224-7696
503-229-5910
Consultation: 503-229-6193

Salem

1340 Tandem Ave. NE, Suite 160
Salem, OR 97301
503-378-3274
Consultation: 503-373-7819

Salem Central Office

350 Winter St. NE
Salem, OR 97301-3882

Phone: 503-378-3272

Toll-free: 800-922-2689

Fax: 503-947-7461

en Español: 800-843-8086

Website: osha.oregon.gov

