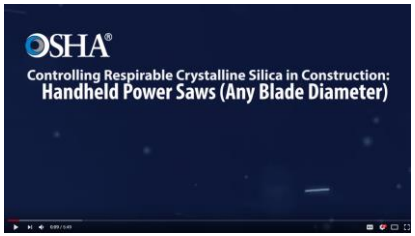
Table 1 – Equipment Names and Best Practice Tips – Update September 2018

- Includes equipment terms commonly used by different trades and in different geographic areas
- 'Best practice' tips are intended to help employers and their employees operate the equipment-control options effectively and are based on 1) OSHA's Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction; 2) OSHA's Frequently Asked Questions ("FAQs") for the Construction Industry; 3) silica standard's Table 1; 4) manufacturer specifications; and 5) craft worker/contractor input based on experience in the field.

Equipment/ Control	Photo & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(i) Stationary masonry saws Other Names: Table saw Brick/block saw Tile saw[4]	 *Photo courtesy of the International Masonry Institute & OSHA*  *Video courtesy of OSHA (https://www.youtube.com/watch?v=WtoBc34EbBo)* English & Spanish subtitle options included.	**CONTROL: water** • 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. **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE	OSHA[1] requires the employer to ensure that: • The saw is equipped with an integrated water delivery system (commercially developed specifically for the type of tool in use) • 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 • Water is applied at least at the flow rate specified by the manufacturer • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space (area where airborne dust can build up) • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] Tips for this tool continued on next page.

			Other tips: • Visually inspect the water attachment to ensure it is properly connected to the water source and the tool • Inspect the blade for cracks, loose segments, or other damage • Check the hose or water tubes and the water flow rate regularly to ensure it is sufficient to control the dust generated so that no visible dust[2] is emitted from the process once the blade has entered the substrate (material) being cut • If recycling water, check regularly to make sure the water is circulating and change water to avoid silt build-up in water • Prevent wet slurry from accumulating and drying

Equipment/ Control	Photo & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(ii) Handheld power saws (any blade diameter) Other names: Chop saw Cut-off saw Wet saw Partner saw Tile saw[4]	 *Photo courtesy of the International Masonry Institute & OSHA*  *Video courtesy of OSHA (https://www.youtube.com/watch?v=vRySFJIr0IA)* English & Spanish subtitle options included.	**CONTROL: water + respirators[3]** • 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. **Required Respiratory Protection:** <u>Outdoors</u> • ≤4 hours/shift: NONE • >4 hours/shift: APF 10 <u>Indoors or in an enclosed area</u> • ≤4 hours/shift: APF 10 • >4 hours/shift: APF 10	OSHA[1] requires the employer to ensure that: • 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 • Water is applied at least at the flow rate specified by the manufacturer • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space (area where airborne dust can build up) • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] Other tips: • Visually inspect water attachment to ensure it is properly connected to the water source and the tool • Inspect the blade for cracks, loose segments, or other damage • Check the hose and the water flow rate regularly to ensure it is sufficient to control the dust generated so that no visible dust[2] is emitted from the process once the blade has entered the substrate (material) being cut • Adjust nozzles so that water goes to the cutting area but still cools the blade • Prevent wet slurry from accumulating and drying

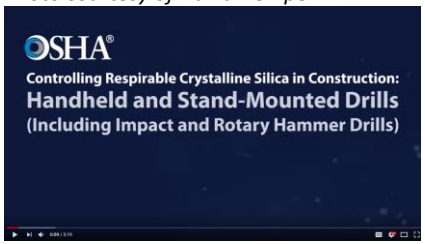
Equipment/ Control	Photo & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(iii) Handheld power saws for cutting fiber-cement board (with blade diameter of 8 inches or less) Other names: Worm drive Circular saw Cement saw	 *Photo courtesy of NIOSH*  *Video courtesy of NIOSH (https://www.youtube.com/watch?v=2KlTXdL6TUI)*	**CONTROL: ventilation (local exhaust ventilation or LEV)** For tasks performed outdoors only: • Use saw equipped with commercially available dust collection system. • Operate and maintain tool in accordance to 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. **Required Respiratory Protection:** <u>Outdoors</u> • ≤4 hours/shift: NONE • >4 hours/shift: NONE	OSHA[1] requires the employer to ensure that: • 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 filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions • The dust collection bags are emptied to avoid overfilling • The air flow rate is equal or greater than recommended by the manufacturer • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space (area where airborne dust can build up) • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] • Employers may rely on statements made by the manufacturer of equipment to determine dust collection systems function at the air flow level required. However, employers must properly select, use, maintain, and replace dust collection systems in order to ensure they function as designed[4] Tips for this tool continued on next page.

			Other tips: • When working indoors, provide sufficient ventilation to prevent build-up of visible airborne dust • Visually inspect the blade, hood (shroud or cowl) and the shop vacuum system for missing or damaged parts • Check the hood (shroud or cowl) and dust collection system regularly to ensure the system is operating so that no visible dust[2] is emitted from the process once the blade has entered the substrate (material) • The hose should be of sufficient size (≤1.25-inch inner diameter) to allow adequate airflow for the dust capture and transport, only be as long as necessary, and be kept as straight as possible • Visually inspect the blade, hood (shroud or cowl) and shop vacuum system to ensure they are properly connected • A high efficiency disposable filter bag can be used as a prefilter in the shop vacuum to capture most of the dust to prolong the life of the filter cartridge • Plug the shop vacuum or saw into intelligent vacuum switches or use a shop vacuum with a built-in intelligent vacuum switch • Regularly clean the saw, check and replace the filter, and empty the dust collection unit to prevent clogging and overheating • Do not use compressed air to clean the equipment, filters, work clothing, or work environment (compressed air can damage the filter)

Equipment/ Control	Photo	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(iv) Walk-behind saws Other names: Concrete saw Floor saw	 *Photo courtesy of the NJ Department of Health and Senior Services' NIOSH-funded Silicosis Surveillance Project*	**CONTROL: water + respirators[3]** • Use saw equipped with integrated water delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance to manufacturer's instructions to minimize dust emissions. **Required Respiratory Protection:** <u>Outdoors</u> • ≤4 hours/shift: NONE • >4 hours/shift: NONE <u>Indoors or in an enclosed area</u> • ≤4 hours/shift: APF 10 • >4 hours/shift: APF 10	OSHA[1] requires the employer to ensure that: • 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 • Water is applied at the flow rate specified by the manufacturer or greater • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space (area where airborne dust can build up) • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust [4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] Other tips: • Visually inspect the water attachment to ensure it is properly connected to the water source and the tool • Inspect the blade and shroud for cracks, loose segments, or other damage • Check the water nozzles and the water flow rate regularly to ensure it is sufficient to control the dust generated so that no visible dust[2] is emitted from the process once the blade has entered the substrate being cut • Prevent wet slurry from accumulating and drying

Equipment/ Control	Photo	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(v) Drivable saws	 *Photo courtesy of Diamond Products Limited*	**CONTROL: water** 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 to manufacturer's instructions to minimize dust emissions. **Required Respiratory Protection:** <u>Outdoors</u> • ≤4 hours/shift: NONE • >4 hours/shift: NONE	OSHA[1] requires the employer to ensure that: • 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 • Water is applied at the flow rate specified by the manufacturer or greater • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space (area where airborne dust can build up) • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust [4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] Other tips: • Visually inspect the water attachment to ensure it is properly connected to the water source and the tool • Inspect the blade and shroud for cracks, loose segments, or other damage • Check the water nozzles and the water flow rate regularly to ensure it is sufficient to control the dust generated so that no visible dust[2] is emitted from the process once the blade has entered the substrate (material) being cut • Prevent wet slurry from accumulating and drying

Equipment/ Control	Photo	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(vi) Rig-mounted core saws or drills Other names: Core drilling machine/ equipment	 *Photo courtesy of Hilti, Inc. Copyright 2017*	**CONTROL: water** • Use tool equipped with integrated water delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance to manufacturer's instructions to minimize dust emissions. **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE	OSHA[1] requires the employer to ensure that: • An adequate supply of water for dust suppression is used • The spray nozzle is working properly and produces a pattern that applies water at the point of dust generation • The spray nozzle is not clogged or damaged • All hoses and connections are intact • Water is at the flow rate specified by the manufacturer or greater • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space (area where airborne dust can build up) • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] Other tips: • Visually inspect the water attachment to ensure it is properly connected to the water source and the tool • Inspect the drill for cracks, loose segments, or other damage • Check the hose or water tubes and the water flow rate regularly to ensure it is sufficient to control the dust generated so that no visible dust[2] is emitted from the process once the blade has entered the substrate (material) being cut • Prevent wet slurry from accumulating and drying

Equipment/ Control	Photos & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(vii) Handheld and stand-mounted drills (including impact and rotary hammer drills) Other names: Hammer drill Rotohammer Roto-hammer	 (Handheld) *Photo courtesy of the International Masonry Institute & OSHA*  (Stand-mounted) *Photo courtesy of David Rempel*  *Video courtesy of OSHA (https://www.youtube.com/watch?v=Y43RGMKrrW4)* English & Spanish subtitle options included.	**CONTROL: ventilation (local exhaust ventilation or LEV)** • Use tool equipped with commercially available shroud or cowling with dust collection system • Operate and maintain tool in accordance to manufacturer's instructions to minimize dust emissions. **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE	OSHA[1] requires the employer to ensure that: • 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 filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions • The dust collection bags are emptied to avoid overfilling • The air flow rate is equal to or greater than recommended by the manufacturer • A HEPA-filtered vacuum is used when cleaning holes. Compressed air can be used in conjunction with a HEPA-filtered vacuum or hole cleaning kit designed for use with compressed air to clean holes • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space (area where airborne dust can build up) • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] Tips for this tool continued on next page.

			• Employers may rely on statements made by the manufacturer of equipment to determine dust collection systems function at the air flow level required. However, employers must properly select, use, maintain, and replace dust collection systems in order to ensure they function as designed[4] Other tips: • Visually inspect the drill, hood (shroud or cowl) and the dust collection system to ensure they are properly connected • Visually inspect the drill, hood (shroud or cowl) and the dust collection system for missing or damaged parts • Check the drill, hood (shroud or cowl) and dust collection system regularly to ensure the system is operating so that no visible dust[2] is emitted from the process once the drill has entered the substrate (material) • Check and replace the filter and empty the dust collection unit, and use filters and collection bags for collecting silica dust • If applicable, regularly check the automatic filter cleaning system to ensure it is operating properly to maintain maximum air flow and suction power and can be used in conjunction with the HEPA filter

Equipment/ Control	Photo	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(viii) Dowel drilling rigs for concrete	 *Photo courtesy of the Laborers Health and Safety Fund*	**CONTROL: ventilation + respirators**[3] 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. **Required Respiratory Protection:** <u>Outdoors</u> • ≤4 hours/shift: APF 10 • >4 hours/shift: APF 10	OSHA[1] requires the employer to ensure that: • 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 filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions • The dust collection bags are emptied to avoid overfilling • The equipment is equipped with a shroud around the drill bit and a dust collection system that has a filter with 99% or greater efficiency • The dust collection equipment has a filter cleaning mechanism • A HEPA-filtered vacuum is used when cleaning holes; compressed air can be used in conjunction with a HEPA-filtered vacuum or hole cleaning kit designed for use with compressed air to clean holes Other tips: • Visually inspect the tool, hood and the dust collection system to ensure they are properly connected, and there are no missing or damaged parts • Check the tool, hood and dust collection system regularly to ensure the system is operating so that no visible dust[2] is emitted from the process once the drill has entered the substrate (material) • Use smooth ducts and maintain duct transport velocity at 3,500 to 4,000 feet per minute [ACGIH 2010] • Provide duct clean-out points • Install pressure gauges across dust collection filters so the drill operator knows when to clean or change the filter

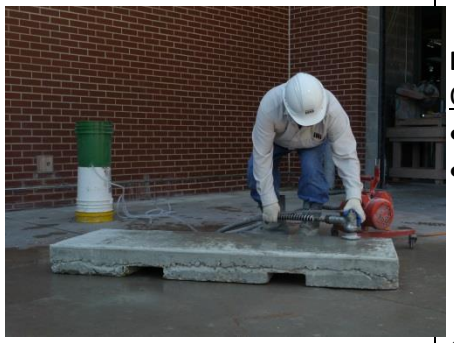
Equipment/ Control	Photo & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(ix) Vehicle-mounted drilling rigs for rock and concrete	 *Photo courtesy of NIOSH*  *Video courtesy of NIOSH (https://www.youtube.com/watch?v=pk5C-bCuXns)*	**CONTROL: ventilation (local exhaust ventilation or LEV) + water** • 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. **Required Respiratory Protection:** • ≤4 hours/shift: APF 10 • >4 hours/shift: APF 10 OR **CONTROL: enclosed cab + water** • Operate from within an enclosed cab and use water for dust suppression on drill bit. **Required Respiratory Protection:** • ≤4 hours/shift: APF 10 • >4 hours/shift: APF 10	OSHA[1] requires the employer to implement dust collection systems and water controls that ensure that: • 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 filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions • The dust collection bags are emptied to avoid overfilling • 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 OR • Enclosed cab is: ○ Maintained as free as practicable from dust ○ Has door seals and closing mechanism 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% efficient in the 0.3-10 µm range (e.g., MERV-16 or better) ○ Has heating and cooling capabilities • 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

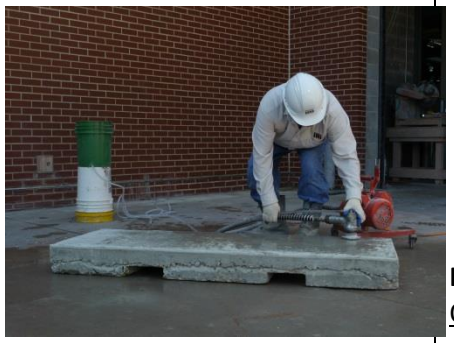
Equipment/ Control	Photos & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(x) Jackhammers and handheld powered chipping tools Other names: Chipping hammer Chipping gun Chisel gun Demolition hammer[4] Demolition hammer with bushing tool [4]	 (water)  (vacuum) *Photos courtesy of the International Masonry Institute & OSHA*  *Video courtesy of OSHA (https://www.youtube.com/watch?v=MuLaL7FtB58)* English & Spanish subtitle options included.	**CONTROL: water + respirators[3]** • Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact. **Required Respiratory Protection:** Outdoors • ≤4 hours/shift: NONE • >4 hours/shift: APF 10 Indoors or in an enclosed area • ≤4 hours/shift: APF 10 • >4 hours/shift: APF 10 OR CONTROL: ventilation+ respirators[3] (see next page)	OSHA[1] requires, for **water controls**, the employer to ensure that: • A continuous stream or spray of water is delivered at the point of impact through direct connections to fixed water lines or portable water tank systems; one or two workers can operate the water delivery system • An adequate supply of water for dust suppression is used • The spray nozzle is working properly and produce a pattern that applies water at the point of dust generation • The spray nozzles are not clogged or damaged • All hoses and connections are intact • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] Other tips: • Check the hose or spray nozzle regularly to ensure the flow rate is sufficient to control the dust generated so that no visible dust[2] is emitted from the process once the breaker/drill has entered the substrate (material) • Prevent wet slurry from accumulating and drying

Equipment/ Control	Photos & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(x) Jackhammers and handheld powered chipping tools Other names: Chipping hammer Chipping gun Chisel gun Demolition hammer[4] Demolition hammer with bushing tool [4]	 (water)  (vacuum) *Photos courtesy of the International Masonry Institute & OSHA*  *Video courtesy of OSHA (https://www.youtube.com/watch?v=MuLaL7FtB58)* English & Spanish subtitle options included.	**CONTROL: ventilation+ respirators[3]** • Use tool equipped with commercially available shroud and dust collection system. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust. • Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. **Required Respiratory Protection:** Outdoors • ≤4 hours/shift: NONE • >4 hours/shift: APF 10 Indoors or in an enclosed area • ≤4 hours/shift: APF 10 • >4 hours/shift: APF 10 OR CONTROL: water + respirators[3] (see previous page)	OSHA[1] requires, for **dust collection controls**, the employer to ensure that: • The system provides at least the air flow recommended by the manufacturer, a filter with 99% or greater efficiency, and a filter cleaning mechanism • The shroud or 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 filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions • The dust collection bags are emptied to avoid overfilling • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] • Employers may rely on statements made by the manufacturer of equipment to determine dust collection systems function at the air flow level required. However, employers must properly select, use, maintain, and replace dust collection systems in order to ensure they function as designed[4] Other tips: • Visually inspect the jackhammer/ impact driller, shroud (cowl or hood) and dust collection system to ensure they are properly connected • Visually inspect the jackhammer/ impact driller, shroud (cowl or hood) and dust collection system for missing or damaged parts

Equipment/ Control	Photo & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(xi) Handheld grinders for mortar removal (i.e. tuckpointing) Other names: Tuckpointing grinder Angle grinder Grinder	 *Photo courtesy of the International Masonry Institute & OSHA*  *Video courtesy of OSHA (https://www.youtube.com/watch?v=GcmkIoUJmJY)* English & Spanish subtitle options included.	**CONTROL: ventilation (local exhaust ventilation or LEV) + respirators[3]** • 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. **Required Respiratory Protection:** • ≤4 hours/shift: APF 10 • >4 hours/shift: APF 25	OSHA[1] requires the employer to ensure that: • The system provides at least 25 CFM of air flow per inch of wheel diameter, a filter with 99% efficiency or greater, and either a cyclonic pre-separator or a filter-cleaning mechanism • The shroud or cowling 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 filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions • The dust collection bags are emptied to avoid overfilling • The blade is kept flush against the surface whenever possible • The tool is operated against the direction of blade rotation whenever practical • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] Tips for this tool continued on next page.

			• Employers may rely on statements made by the manufacturer of equipment to determine dust collection systems function at the air flow level required. However, employers must properly select, use, maintain, and replace dust collection systems in order to ensure they function as designed[4] Other tips: • Visually inspect the grinder, shroud (cowl or hood) and dust collection system to ensure they are properly connected, and there are no missing or damaged parts Other tips (continued): • Check the grinder, shroud (cowl or hood) and dust collection system regularly to ensure the system is operating so that no visible dust[2] is emitted from the process once the grinder is flush against the work surface • If applicable, regularly check the automatic filter cleaning system to ensure it is operating properly to maintain maximum air flow and suction power • Place one side of the shroud against the working surface before inserting the blade into the mortar joint – this directs the dust into the shroud as the blade cuts into the mortar joint • Do not move the grinder back and forth along the slot as this will create a gap that increases dust escape – for better results, move the grinder in one direction, making a second pass only if necessary • Back off the cutting pressure of the blade a short distance before removing it from the slot so the vacuum can have enough time to clear any dust buildup • Use only enough cutting force to operate the tool effectively and keep the leading tool edge flush against the working surface

Equipment/ Control	Photos & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(xii) Handheld grinders for uses other than mortar removal Other names: Surface Grinder Sander Polisher	 (vacuum)  (water) *Photos courtesy of the International Masonry Institute & OSHA*  *Video courtesy of OSHA (https://www.youtube.com/watch?v=q2u7u2nsTeA)* English & Spanish subtitle options included.	**CONTROL: water** For tasks performed outdoor 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. **Required Respiratory Protection:** Outdoors • ≤4 hours/shift: NONE • >4 hours/shift: NONE OR CONTROL: ventilation (local exhaust ventilation or LEV) + respirators[3] (see next page)	OSHA[1] requires, for **water controls**, that the employer ensure that: • An integrated water system is provided that continuously feeds water to the grinding surface • An adequate supply of water for dust suppression is used • The spray nozzle is working properly and produces a pattern that applies water at the point of dust generation • The spray nozzle is not clogged or damaged • All hoses and connections are intact Other tips: • Visually inspect the water attachment to ensure it is properly connected to the water source and the tool, and for missing or damaged parts • Check the hose and water flow rate regularly to ensure it is sufficient to control the dust generated so that no visible dust[2] is emitted from the process once the grinder is flush with the cutting/work surface • Prevent wet slurry from accumulating and drying • Use the smallest wheel and least aggressive tool necessary to complete task • Use a static pressure gauge, where available, to monitor performance

Equipment/ Control	Photos & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
xii) Handheld grinders for uses other than mortar removal Other names: Surface Grinder Sander Polisher	 (vacuum)  (water) *Photos courtesy of the International Masonry Institute & OSHA*  *Video courtesy of OSHA (https://www.youtube.com/watch?v=q2u7u2nsTeA)* English & Spanish subtitle options included.	**CONTROL: ventilation (local exhaust ventilation or LEV) + respirators[3]** • 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. **Required Respiratory Protection:** Outdoors • ≤4 hours/shift: NONE • >4 hours/shift: NONE Indoors or in an enclosed area: • ≤4 hours/shift: NONE • >4 hours/shift: APF 10 OR CONTROL: water (see previous page)	OSHA[1] requires, for **dust collection controls**, that the employer ensure that: • The system provides at least 25 CFM of air flow per inch of wheel diameter, a filter with 99% efficiency or greater, and either a cyclonic pre-separator or a filter-cleaning mechanism • The shroud or cowling is intact 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 filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions • The dust collection bags are emptied to avoid overfilling • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] • Employers may rely on statements made by the manufacturer of equipment to determine dust collection systems function at the air flow level required. However, employers must properly select, use, maintain, and replace dust collection systems in order to ensure they function as designed[4] Tips for this tool continued on next page.

			Other tips: • Use the smallest wheel and least aggressive tool necessary to complete task • Visually inspect the grinder, shroud (cowl or hood) and dust collection system to ensure they are properly connected, and for missing or damaged parts • Check the grinder and dust collection system regularly to ensure the system is operating so that no visible dust[2] is emitted from the process once the grinder is flush with the work surface/substrate • If applicable, regularly check the automatic filter cleaning system to ensure it is operating properly to maintain maximum air flow and suction power and can be used in conjunction with the HEPA filter • Use a static pressure gauge, where available, to monitor performance

Equipment/ Control	Photo	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(xiii) Walk-behind milling machines and floor grinders	 *Photo courtesy of OSHA*	**<u>CONTROL: water</u>** • 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. **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE OR CONTROL: ventilation (see next page)	OSHA[1] requires, for **water controls**, that the employer ensure that: • An integrated water system is provided that continuously feeds water to the cutting surface • 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 nozzle is not clogged or damaged • All hoses and connections are intact • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space (area where airborne dust can build up) • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] Other tips: • Check the hose or spray nozzle regularly to ensure the flow rate is sufficient to control the dust generated so that no visible dust[2] is emitted from the process once the breaker/drill has entered the substrate (material) • Prevent wet slurry from accumulating and drying

Equipment/ Control	Photo	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(xiii) Walk-behind milling machines and floor grinders	 *Photo courtesy of OSHA*	**<u>CONTROL: ventilation</u>** • 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. **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE OR CONTROL: water (see previous page)	OSHA[1] requires, for **dust collection controls**, that the employer ensure that: • The system provides a filter with 99% efficiency or greater and a filter-cleaning mechanism • The hose connecting the tool to the vacuum is intact and without kinks or tight bends • The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions • The dust collection bags are emptied to avoid overfilling • Loose dust must be cleaned with a HEPA-filtered vacuum in between passes of the machine to prevent the loose dust from being re-suspended • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space (area where airborne dust can build up) • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] Other tips: • Visually inspect the milling machine, shroud (hood or cowl) and dust collection system to ensure they are properly connected • Visually inspect the milling machine, shroud (hood or cowl) and dust collection system for missing or damaged part • Check the milling machine, shroud (hood or cowl) and dust collection system regularly to ensure the system is operating so that no visible dust[2] is emitted from the process once the once the blade has entered the substrate being cut • Use dust collector in accordance with manufacturer specifications including airflow rate

Equipment/ Control	Photo	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(xiv) Small drivable milling machines (less than half-lane)	 *Photo courtesy of © WIRTGEN GmbH*	**CONTROL: water + surfactant** • 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. **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE	OSHA[1] requires the employer to ensure that: • Supplemental water sprays are designed to suppress dust • Water used is combined with a surfactant • 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 • Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space (area where airborne dust can build up) • Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust[4] • "Indoors or in enclosed areas" refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed[4] Other tips: • See NAPA and CPWR's "Field Guide for Controlling Silica Dust Exposure on Asphalt Pavement Milling Machines" (https://tinyurl.com/NAPA-FieldGuide)

Equipment/ Control	Photo	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(xv) Large drivable milling machines (half-lane and larger)	 *Photo courtesy of NAPA*	**CONTROL: water + ventilation** For cut of any depth on asphalt only or 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. **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE OR **CONTROL: water + surfactant** For cuts of four inches in depth or less on any substrate: • 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 **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE	OSHA[1] requires the employer to ensure that: For **water and ventilation controls**, • The machine is equipped with exhaust ventilation on the drum enclosure and a supplemental water spray is designed to suppress dust OR For **water and surfactant controls**, • The machine is equipped with a supplemental water spray • Water used is combined with a surfactant Other tips: • See NAPA and CPWR's "Field Guide for Controlling Silica Dust Exposure on Asphalt Pavement Milling Machines" (https://tinyurl.com/NAPA-FieldGuide) • Ensure the correct controls are being used for the depth of the asphalt cut

Equipment/ Control	Photo & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(xvi) Crushing machines	 *Used by permission of Screen Machine Industries™*  *Video courtesy of NIOSH (https://www.youtube.com/watch?v=pk5C-bCuXns)*	**CONTROL: water + ventilated booth** • 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. **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE	OSHA[1] requires the employer to ensure that: • Enclosed cabs or booths: ○ Are maintained as free as practicable from dust ○ Have door seals and closing mechanism that work properly ○ Have gaskets and seals that are in good condition and work properly ○ Are under positive pressure maintained through continuous delivery of filtered air ○ Have intake air that is filtered through a pre-filter that is 95% efficient in the 0.3-10 µm range (e.g., MERV-16 or better) ○ Have heating and cooling capabilities • Water sprays or mists are at the crusher and other points where dust is generated (e.g., hoppers, conveyers, sieves, sizing or vibrating components, and discharge points) • 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 µm) • 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

Equipment/ Control	Photo & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(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	 *Photo Courtesy of OSHA Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction/CPWR*  *Video courtesy of NIOSH (https://www.youtube.com/watch?v=pk5C-bCuXns)*	**CONTROL: enclosed cab AND water + ventilation (if workers outside cab are engaged in task[5])** • 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. **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE	OSHA[1] requires the employer to ensure that: • Enclosed cabs or booths: ○ Are maintained as free as practicable from dust ○ Have door seals and closing mechanism that work properly ○ Have gaskets and seals that are in good condition and work properly ○ Are under positive pressure maintained through continuous delivery of filtered air ○ Have intake air that is filtered through a pre-filter that is 95% efficient in the 0.3-10 µm range (e.g., MERV-16 or better) ○ Have heating and cooling capabilities • Water, dust suppressants, or both are applied as necessary when other employees are engaged in the task outside of enclosed cabs

Equipment/ Control	Photo & Video	Engineering, Work Practice Control Methods & Required Respiratory Protection	Best Practice Tips
(xviii) Heavy equipment and utility vehicles for tasks such as grading and excavating but not including: demolishing, abrading, or fracturing silica-containing materials	 *Photo courtesy of NIOSH*  *Video courtesy of NIOSH (https://www.youtube.com/watch?v=pk5C-bCuXns)*	**CONTROL: enclosed cab (if only operator is engaged in task[5])** • When the equipment operator is the only employee engaged in the task, operate equipment from within an enclosed cab. **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE OR **CONTROL: water + ventilation** • Apply water and/or dust suppressants as necessary to minimize dust emissions. **Required Respiratory Protection:** • ≤4 hours/shift: NONE • >4 hours/shift: NONE	OSHA[1] requires the employer to ensure that: • Enclosed cabs or booths: ○ Are maintained as free as practicable from dust ○ Have door seals and closing mechanism that work properly ○ Have gaskets and seals that are in good condition and work properly ○ Are under positive pressure maintained through continuous delivery of filtered air ○ Have intake air that is filtered through a pre-filter that is 95% efficient in the 0.3-10 µm range (e.g., MERV-16 or better) ○ Have heating and cooling capabilities • Water, dust suppressants, or both are applied as necessary when other employees are engaged in the task outside of enclosed cabs.

[1]Best practice requirements from OSHA's Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction

[2]Although many of the entries on Table 1 require employers to"[o]perate and maintain" tools "in accordance with manufacturer's instructions to minimize dust emissions," 29 C.F.R. § 1926.1153(c)(1)(i)-(vii), (x)-(xiii), (xvi), or to "[o]perate and maintain machine[s] to minimize dust emissions," 29 C.F.R. § 1926.1153(c)(1)(xiv)-(xv), the standard does not separately require employers to minimize dust emissions. An employer generating a limited amount of dust when engaging in a task listed on Table 1 would not be in violation of the standard if it is fully and properly implementing the engineering controls, work practices, and respiratory protection specified on the Table (including operating and maintaining controls so as to minimize emissions). A small amount of dust can be expected even with new equipment that is operating as intended by the manufacturer. However, a noticeable increase in dust emissions may indicate that the dust control system is not operating properly. See OSHA's Q&A's #15 at https://www.osha.gov/dsg/topics/silicacrystalline/construction_info_silica.html.

[3]Respirator use is conditional on time spent using equipment (less than or equal to 4 hours/shift or greater than 4 hours/shift) and if task is done outdoors, indoors or in an enclosed area. See Table 1 in the standard for specific requirements including the assigned protection factor (respiratory protection). The employer does not have the track the exact amount of time that employees are performing a job throughout a shift to be in compliance with Table 1. Before the task is performed, the employer must make a good-faith judgement about whether the task will take more than 4 hours based on previous experience and other available information. At the beginning of the task, the employer must provide the employee the respiratory protection required for the anticipated time the employee will be engaged in the task. However, if unforeseen difficulties or other circumstances are expected to extend the task duration beyond 4 hours, the employer must provide the appropriate respiratory protection as soon as it becomes evident. (In that situation, the 4-hour mark is still measured from the beginning of the task, not from the time the expected duration of the task changes.) See OSHA's Q&A's #14 at https://www.osha.gov/dsg/topics/silicacrystalline/construction_info_silica.html.

[4]In August 2018, OSHA released new Q&A's. These additions are based on information included in the responses. Q&A #11 addresses manufacturer air flow recommendations; #12 addresses use of additional exhaust; #13 addresses indoor and enclosed spaces; #14 addresses respirator requirements based on duration of task; #15 addresses minimizing dust emissions; #17 addresses demolition hammers with bushing tools; #18 addresses tile saws. For more information, see https://www.osha.gov/dsg/topics/silicacrystalline/construction_info_silica.html.

[5]Employees engaged in the Table 1 task means the equipment operator; helpers, laborers and other employees who are assisting with the task; or any other employee responsible for completing the task. For example, an employee operating a walk-behind saw and another employee helping the operator guide the saw are both engaged in the task. An employee operating a jackhammer would be engaged in the task, but another employee directing traffic near the employee jackhammering would not be engaged in the task. OSHA's Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction, page 5.