

OSHA SILICA STANDARD TRAINING

August 2017

Provided as a service to members of the
Nebraska Building Chapter AGC

OSHA Standard Overview – 1926.1153

June 23, 2016; two new standards went into effect, one for general industry / maritime and the other one for construction

Construction employers originally were to comply with all requirements of their standard by June 23, 2017. Enforcement date now moved back to September 23, 2017.

Requires employers to use engineering controls to limit worker exposure

Discussion Topics

1. Introduction to Silica
2. OSHA Requirements Overview
3. Common Construction Exposures
4. Controls Used to Reduce Silica Exposures
5. Silica Compliance Processes



- ❖ In today's construction industry, there are many health hazards, which can cause serious employee illness or even death, if they are not adequately controlled.
- ❖ U.S. workers being exposed to silica, is one of those health concerns.
- ❖ Effective safety and health programs must take into account health related exposures and control measures.
- ❖ Silica is the second most common mineral in the earth's crust!

The term “Silica” refers to silicon dioxide (SiO_2), which can take two separate forms: amorphous and crystalline.

- 1. Amorphous Silica** = Includes noncrystalline forms of silicon dioxide (SiO_2):
 - ❖ Diatomaceous earth
 - ❖ Silica gel
 - ❖ Diatomite



2. **Crystalline Silica** = Crystalline form of silicon dioxide (SiO₂):

- ❖ Quartz
- ❖ Cristobalite
- ❖ Tridymite
- ❖ Tripoli



From an occupational disease standpoint, **Crystalline silica poses the greatest concern** of the two.

Amorphous forms of silicon dioxide do not present the serious health hazard associated with the crystalline forms.

Working in any dusty environment where crystalline silica is present can potentially increase a person's chances of getting silicosis (more on this later).

Can you identify some examples of **construction** related activities that pose the greatest potential risk for worker exposures?

- ✓ Demolition
- ✓ Sandblasting
- ✓ Rock / stone cutting
- ✓ Sawing
- ✓ Abrasive drilling
- ✓ Masonry work
- ✓ Jack hammering
- ✓ Blasting
- ✓ Chipping
- ✓ Grinding
- ✓ Tunneling
- ✓ Concrete mixing

What is **Respirable** Crystalline Silica?



- ❖ Respirable = Very small particulate matter, capable of being taken into the body by breathing

Respirable crystalline silica – **very small particles typically at least 100 times smaller than ordinary sand** found on beaches or playgrounds; Generated by high-energy operations like cutting, sawing, grinding, drilling and crushing stone, rock, concrete, brick, block and mortar, or when abrasive blasting with sand.

OSHA's Definition (in part): “*Respirable crystalline silica*” means quartz, cristobalite, and/or tridymite contained in airborne particles that are determined to be respirable by a sampling device.

Potential Health Effects of Overexposure

Workers exposed to respirable crystalline silica are at increased risk of developing serious adverse health effects including:

1. Lung cancer
2. Chronic obstructive pulmonary disease (COPD)
3. Pulmonary tuberculosis
4. Kidney disease
5. Silicosis



Silicosis



Silicosis is a disabling, nonreversible and sometimes fatal lung disease caused by overexposure to **respirable** crystalline silica.

Overexposure to dust that contains microscopic particles of crystalline silica can cause **scar tissue** to form in the lungs, which reduces the lungs' ability to extract oxygen from the air we breathe.

There is **no cure** for the disease, but it is 100 percent preventable if employers, workers and health professionals work together to reduce exposures.

Common Silica Exposures



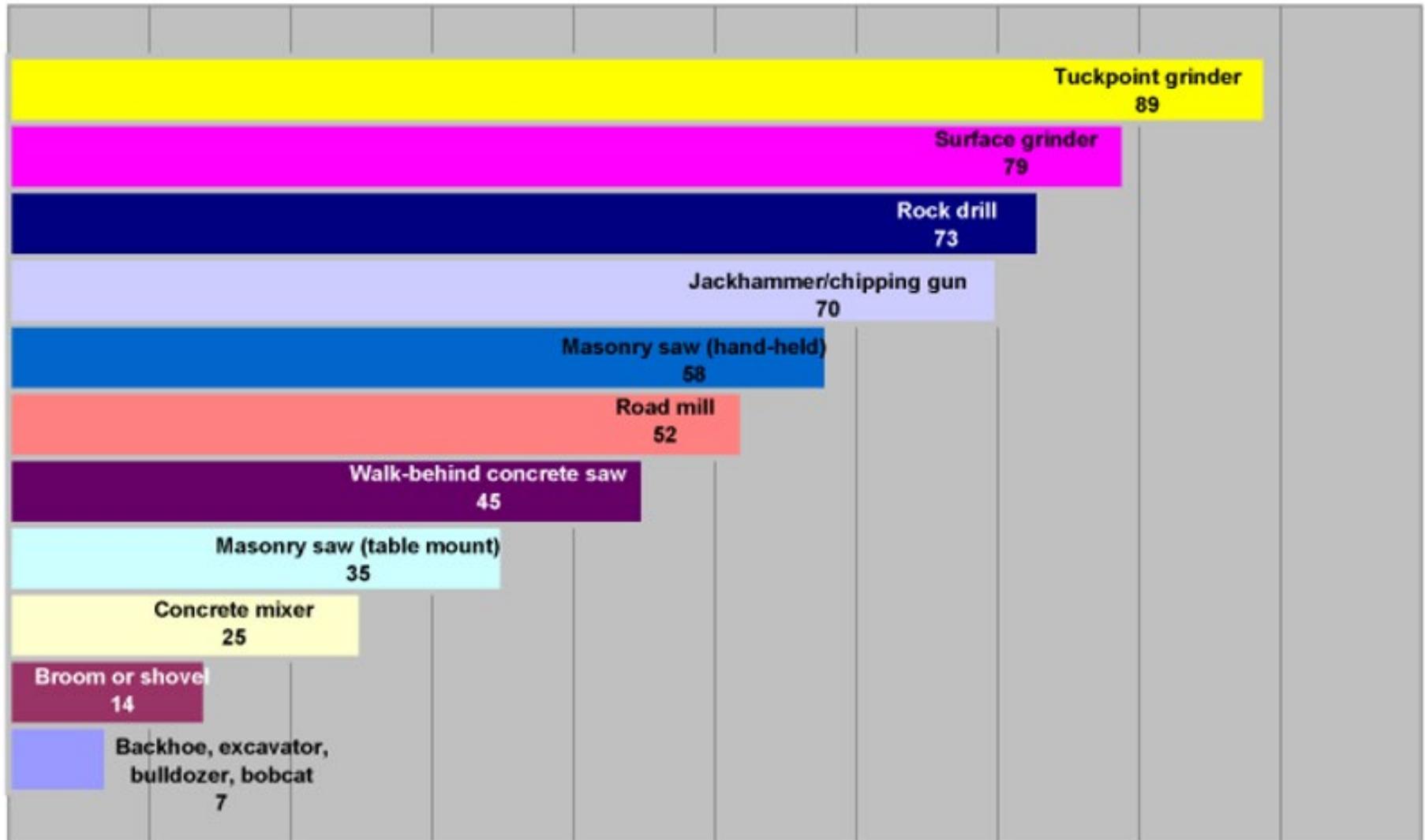
Silicosis Symptoms

- ❖ Shortness of breath
- ❖ Severe cough
- ❖ Weakness
- ❖ Fatigue
- ❖ Fever
- ❖ Loss of appetite
- ❖ Weight loss
- ❖ Night sweats
- ❖ Chest pains



What are your chances of being overexposed?

(Based on a Summary of University of Washington Studies)



The probability (in %) of being overexposed

(based on the Cal/OSHA PEL of 0.1 mg/m³ of air for respirable quartz silica)

Deadly Dust Video



<https://www.youtube.com/watch?v=DndAO32Bdvw>



OSHA has established two separate exposure levels for silica that employers need to be aware of:

1. **Action Level (AL) = 25** micrograms per cubic meter of air (25 $\mu\text{g}/\text{m}^3$)
2. **Permissible Exposure Limit (PEL) = 50** micrograms per cubic meter of air (50 $\mu\text{g}/\text{m}^3$)

If employee exposure is at or higher than the Action Level, OSHA's silica standard requirements apply.

If employee exposure is at or higher than the Permissible Exposure Limit, the employer is in violation of the law and further action is required to lower the level.

Make One Cut in A Paver



- Avg. person, works moderate pace, 8 hrs/day breathes 16.8m³ of air
- Make paver cut = 2.25" deep, 4" long with a 0.125 width saw blade
- Paver = 20% Silica content
- Cut releases 9,000,000 micrograms of respirable crystalline silica
- OSHA allows 50 µg/m³ for every m³ of air a person breathes
- Over 8 hours a person is allowed to inhale 840 micrograms
- If a person inhaled all 9,000,000 micrograms from this one cut, that is equal to 29 years worth of Silica exposure in OSHA PEL!

Occupational Exposure Levels

Employers must limit worker exposures to respirable crystalline silica

Employers have the option of using control methods spelled out by OSHA in “Table 1” of the standard; **OR**

They can measure workers’ exposure to silica and independently decide which dust controls work best to limit exposures



OSHA Inspection Approach?

Beginning in September, 2017 OSHA will have many opportunities to cite contractors for not complying with this standard, even without time consuming hygiene sampling

It will be easy for compliance officers to investigate and issue citations for the following potential violations:

- No Exposure Control Plan
- No Competent Person
- No employee training
- Improper housekeeping / cleaning
- Not fully following Table 1
- Incorrect respirator being worn
- Not having a Respiratory Protection program



OSHA Requirements

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

1. **Establish and implement a written exposure control plan** that identifies exposed tasks and methods used to protect workers
2. **Designate a Competent Person** to implement the written exposure control plan
3. **Restrict housekeeping practices** that expose workers to silica where feasible alternatives are available
4. **Offer medical exams** including chest X-rays and lung function tests, every 3 years for workers who are required by the standard to wear a respirator for 30 or more days per year.
5. **Train workers** on work operations that result in silica exposure and ways to limit exposure
6. **Keep records** of workers' silica exposure and medical exams.

#1 Written Exposure Control Plan



The employer shall establish and implement a written exposure control plan that contains at least the following elements:

- A description of the **tasks in the workplace** that involve exposure to respirable crystalline silica;
- A description of the engineering **controls**, work practices, and respiratory protection used to limit employee exposure to respirable crystalline silica for each task;
- A description of the **housekeeping measures** used to limit employee exposure to respirable crystalline silica; and
- A description of the **procedures used to restrict access** to work areas, when necessary, to minimize the number of employees exposed to respirable crystalline silica and their level of exposure, including exposures generated by other employers or sole proprietors.

Note: The employer shall make the plan available to employees, review and evaluate the effectiveness of it at least annually and update it as necessary.



Insert your Company's Silica Exposure Control Plan



Employer must designate a Competent Person to implement the written Exposure Control Plan

Competent person means an individual who is capable of identifying existing and foreseeable respirable crystalline silica hazards in the workplace **and** who has authorization to take prompt corrective measures to eliminate or minimize them. **The competent person must have the knowledge and ability necessary to implement the written exposure control plan required under the standard.**

Note: Slightly different definition of the Competent Person which is specific to the OSHA silica standard.

#2 – Designate a Competent Person (cont.)

In order to adequately manage a silica ECP, Competent Persons must:

- ❖ Make the **initial evaluation** of the site for potential worker silica exposures
- ❖ **Anticipate employee exposures** (observation, tasks performed, historical data, etc.)
- ❖ Select, implement and manage the appropriate **control strategies** in simple situations or recommend involving a silica Qualified Person for more complex situations
- ❖ Make frequent and regular **inspections** of job sites, materials and equipment
- ❖ Monitor the work site and take prompt **corrective action** to ensure safe work conditions are maintained

#3 – Restrict Housekeeping Practices

When cleaning up dust that can contribute to employee exposures to respirable crystalline silica, employers must:

- Not allow cleaning by dry brushing and sweeping, unless methods such as wet sweeping and HEPA-filtered vacuuming are not feasible;
- Not allow cleaning of surfaces or clothing with compressed air, unless the compressed air is used together with a ventilation system that effectively captures the dust cloud or no other cleaning method is feasible.



No dry sweeping of dust which
“could contribute to employee
exposure to respirable crystalline
silica.” - OSHA

#4 – Offer Medical Exams



- ❖ The employer shall make medical surveillance available at no cost to the employee for each employee who **will be** required under the silica standard to **wear a respirator for 30 or more days per year** in the upcoming year (the next 365 days)
- ❖ All medical examinations and procedures required by the silica standard must be performed by a physician or other licensed health care professional (PLHCP)
- ❖ “PLHCP means an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the particular health care services required” by the silica standard.
- ❖ If getting the medical examination requires the employee to travel away from the worksite, the employer is required to cover the cost of travel. The **employer must also pay employees for time spent traveling and taking medical examinations.**



You may want to include specific information on your company's medical exam arrangements here.

#5 – Train Workers



Employers must include respirable crystalline silica as part of their existing Hazard Communication program (labeling, SDS, training, etc.)

Employers must ensure each employee covered by the standard can demonstrate knowledge and understanding of at least the following:

- The **health hazards** associated with exposure to respirable crystalline silica;
- **Specific tasks in the workplace** that could result in exposure to respirable crystalline silica;
- Specific **measures the employer has implemented** to protect employees from exposure to respirable crystalline silica, including engineering controls, work practices, and respirators to be used;
- The **contents of OSHA's silica standard**;
- The **identity of the competent person** designated by the employer; and
- The purpose and **a description of the medical surveillance program** required by the standard

#6 – Keep Records



Employers must maintain three different sets of records:

1. **Air Monitoring Data** – All exposure measurements taken to assess employee exposure to respirable crystalline silica.
2. **Objective Data** – All objective data (industry air monitoring data or similar data resembling work operations) relied upon to comply with the silica standard.
3. **Medical Surveillance** – Records for each employee covered by medical surveillance under the requirements of the standard.

Table 1 Option

Table 1 matches common construction tasks with dust control methods that limit worker exposure

Employers who follow Table 1 correctly are not required to measure workers' exposure to silica and are not subject to the Permissible Exposure Limit ("PEL")

REVIEW OF TABLE 1 AS A CLASS

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

| Equipment/ Task | Engineering and Work Practice Control Methods | Required Respiratory Protection and Minimum Assigned Protection Factor (APF) | |
|---|---|--|----------------------|
| | | ≤ 4 hrs/ shift | > 4 hrs/ shift |
| Handheld power saws (any blade diameter) | Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. <ul style="list-style-type: none"> • When used outdoors. • When used indoors or in an enclosed area. | None APF 10 | APF 10 APF 10 |

Employers Who Choose the Table 1 Option Must:

1. For tasks performed indoors or in enclosed areas, provide a means of exhaust as needed to minimize the accumulation of **visible** airborne dust;
2. For tasks performed using wet methods, apply water at flow rates sufficient to minimize release of **visible** dust;

Table 1 continued

3. For measures implemented that include an **enclosed cab or booth**, ensure that the enclosed cab or booth:
- Is maintained as free as practicable from settled dust;
 - Has door seals and closing mechanisms that work properly;
 - Has gaskets and seals that are in good condition and working properly;
 - Is under positive pressure maintained through continuous delivery of fresh air;
 - Has intake air that is filtered through a filter that is 95% efficient in the 0.3-10.0 μm range (**MERV**-16 or better; "**M**inimum **E**fficiency **R**eporting **V**alue"); and
 - Has heating and cooling capabilities.

Alternative Exposure Control Methods Option

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

1. Protect workers from respirable crystalline silica exposures above the **PEL of 50 µg/m³**, over an 8 hour time weighted average
2. Measure the **amount of silica each worker is exposed to** if it may be at or above an “action level” of 25 µg/m³ by utilizing one of the options below:
 - **Performance Option:** The employer must assess the 8-hour TWA exposure for each employee on the basis of any **combination of air monitoring data or objective data** sufficient to accurately characterize employee exposures to respirable crystalline silica.
 - **Scheduled Monitoring Option:** **The employer must perform industrial hygiene monitoring** to assess the 8-hour TWA exposure for each employee on the basis of one or more personal breathing zone air samples that reflect the exposures of **employees on each shift, for each job classification, in each work area**. Where several employees perform the same tasks on the same shift and in the same work area, the employer may sample a representative fraction of these employees in order to meet this requirement. In representative sampling, the employer shall sample the employee(s) who are expected to have the highest exposure to respirable crystalline silica.

How Do You Measure Silica Concentrations?

1. Collect an Air Sample

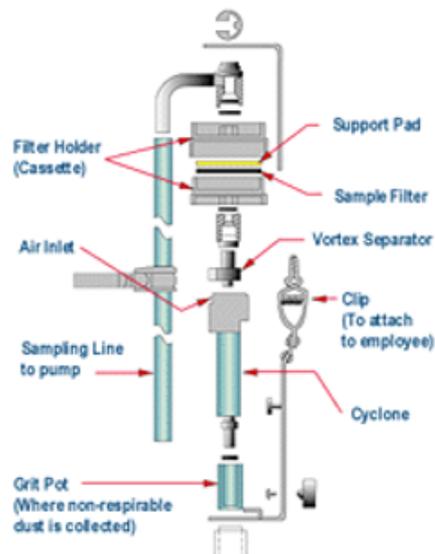
- A qualified person will use a combination device called a cyclone assembly and sampling pump to trap tiny respirable silica particles from the air in the work environment
- Assembly and pump placed on an employee(s) who will wear the device throughout their work shift for up to 8 hours (a.k.a. “personal sampling”)

2. Laboratory Analysis

- An accredited laboratory is chosen to perform an analysis of the sampled data
- The laboratory report is then used to compare concentration levels with the legal limit(s)

Personal Sampling

- ❖ Since the Occupational Exposure Limits for Crystalline Silica are low, a fairly large sample volume must be obtained.
- ❖ For this reason, it is recommended that the sample period be as close to full shift as possible.



Cyclone Filter Assembly

Hierarchy of Hazard Controls

Most Preferred

Least Preferred

1st: Engineering Controls

- Substitution with less harmful material
- Enclosure
- Isolation
- Ventilation



2nd: Administrative Controls

- Controlling employees' exposure by scheduling production and workers' tasks
- Or both, in ways that minimize exposure levels



3rd: Work Practice Controls

- Hygiene practices
- Housekeeping and maintenance
- Procedures and process changes



4th: Personal Protective Equipment

- Respirators
- Ear muffs
- Gloves
- Safety goggles
- Helmets
- Safety shoes
- Protective clothing



High Efficiency Particulate Air

- HEPA is a type of Air Filter
- Captures 99.97% of particles $0.3\mu\text{m}$ (microns) in diameter
- HEPA vacuums must be self cleaning



Typical shop vacuum does not meet the HEPA or self-cleaning requirements



This HEPA Vacuum meets the requirements

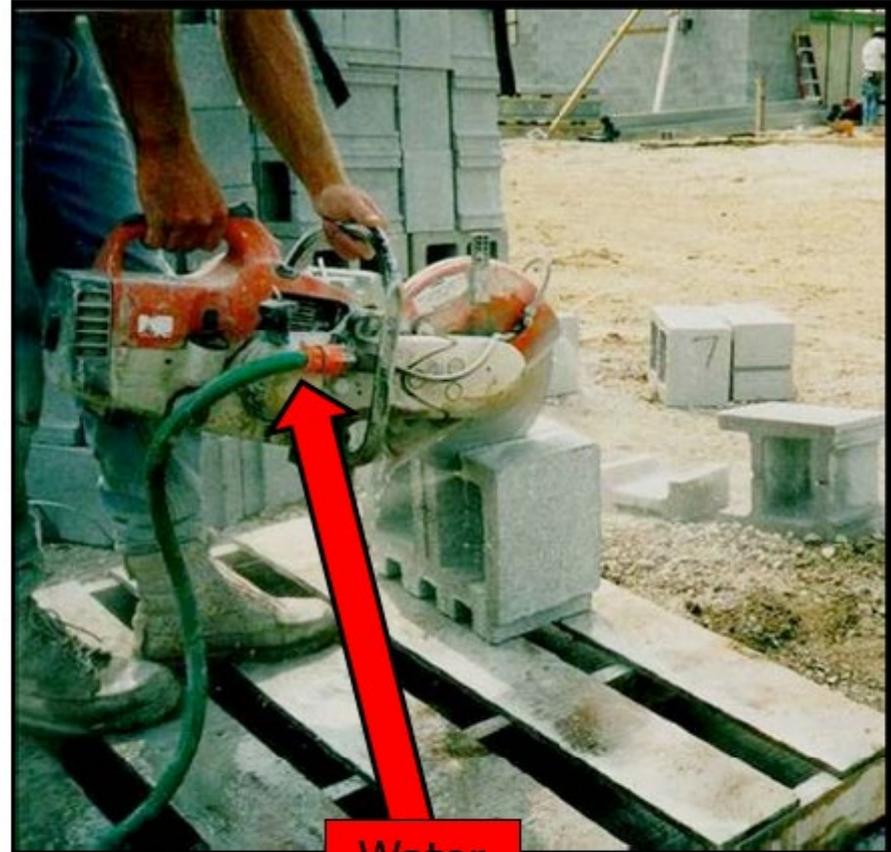
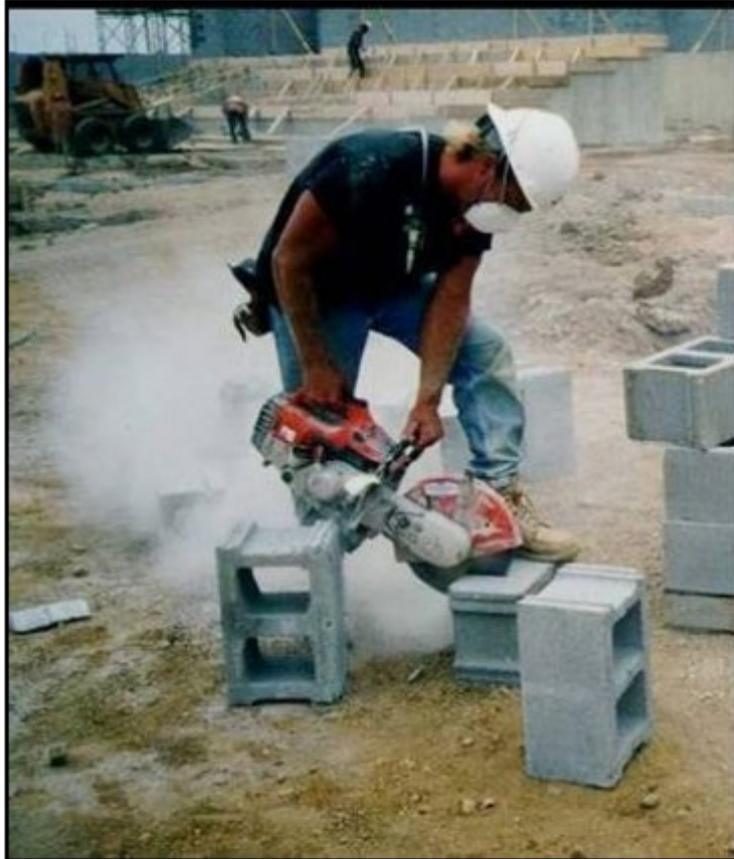


Wet Sawing



Before

After



Water
Supply
Line

Wet Sawing

In order to ensure wet sawing system effectiveness, the following items should be considered:

- Continuous water supply at point of generation
- Water flow rate
- Portable water supply
- Waste water





Respirator Requirements Overview

Respiratory Protection

Protects the lungs against

- Dust
- Mist
- Fumes
- Vapors

Prior to wearing a respirator individuals are required to complete a medical evaluation, fit testing and training.

Respiratory Protection

Single strap dust mask isn't regulated (not NIOSH Approved)

Any type of mask other than a single strap dust mask is considered to be a respirator by OSHA and requires medical clearance, fit testing, and training.



N95 Respirator Mask

Filters 95% of airborne particles that are not oil-based.

NIOSH approved a MUST!

Covers most wood shop dusts, allergens, and air borne diseases.

Filters for painting are often rated N95 to handle oil-based particles.

APF rating of 10. (Assigned Protection Factor)



Respirator Selection

- Several of the scenarios listed in Table 1 require respiratory protection and **“minimum assigned protection factor (APF)” of 10**
- One of the scenarios listed in Table 1 requires respiratory protection and **“minimum assigned protection factor (APF)” of 25** (Handheld grinder for mortar removal as shown below)
- All respirators have APF classifications, or protection capabilities, assigned to them by OSHA. The larger the number, the greater level of protection expected



1910.134(d)(3)(i)(A)

Assigned Protection Factors (APFs) Employers must use the assigned protection factors listed in Table 1 to select a respirator that meets or exceeds the required level of employee protection. When using a combination respirator (e.g., airline respirators with an air-purifying filter), employers must ensure that the assigned protection factor is appropriate to the mode of operation in which the respirator is being used.

Table 1. -- Assigned Protection Factors⁵

| Type of respirator ^{1, 2} | Quarter mask | Half mask | Full facepiece | Helmet/hood | Loose-fitting facepiece |
|---|--------------|-----------------|----------------|-----------------------|-------------------------|
| 1. Air-Purifying Respirator | 5 | ³ 10 | 50 | ..... | ..... |
| 2. Powered Air-Purifying Respirator (PAPR) | ..... | 50 | 1,000 | ⁴ 25/1,000 | 25 |
| 3. Supplied-Air Respirator (SAR) or Airline Respirator | | | | | |
| • Demand mode | ..... | 10 | 50 | ..... | ..... |
| • Continuous flow mode | ..... | 50 | 1,000 | ⁴ 25/1,000 | 25 |
| • Pressure-demand or other positive-pressure mode | ..... | 50 | 1,000 | ..... | ..... |
| 4. Self-Contained Breathing Apparatus (SCBA) | | | | | |
| • Demand mode | ..... | 10 | 50 | 50 | ..... |
| • Pressure-demand or other positive-pressure mode (e.g., open/closed circuit) | ..... | ..... | 10,000 | 10,000 | ..... |

“N95” filtering and elastomeric facepieces have an APF rating of 10



Notes:

¹Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.

²The assigned protection factors in Table 1 are only effective when the employer implements a continuing, effective respirator program as required by this section (29 CFR 1910.134), including training, fit testing, maintenance, and use requirements.

³This APF category includes filtering facepieces, and half masks with elastomeric facepieces.

⁴The employer must have evidence provided by the respirator manufacturer that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000. This level of performance can best be demonstrated by performing a WPF or SWPF study or equivalent testing. Absent such testing, all other PAPRs and SARs with helmets/hoods are to be treated as loose-fitting facepiece respirators, and receive an APF of 25.

⁵These APFs do not apply to respirators used solely for escape. For escape respirators used in association with specific substances covered by 29 CFR 1910 subpart Z, employers must refer to the appropriate substance-specific standards in that subpart. Escape respirators for other IDLH atmospheres are specified by 29 CFR 1910.134 (d)(2)(ii).

Respiratory Protection

Voluntary Use of Respirators (NIOSH)

Is there an atmospheric hazard that necessitates the use of respiratory protection?

Does the employer require the respirator use?

If the answer to either of these questions is “Yes” – then the OSHA Respirator Standard must be followed (i.e. – fit test, medical clearance and testing)

If the answer is “No” to both questions use of a respirator is considered to be “voluntary.” The employee would be required to complete the **Voluntary Respirator Use Form**.

OSHA REGULATIONS (STANDARDS - 29 CFR)

Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard.

You should do the following:

1. Read and follow all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.
4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.