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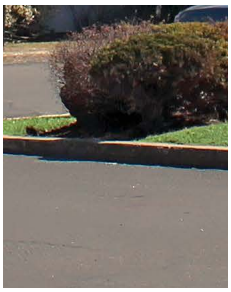
Best Practices for Safe Silica Dust Removal



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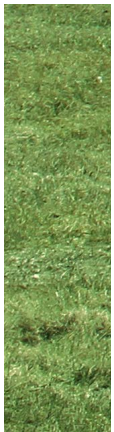
Air Pollution Solutions



2020 EDITION

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IMPORTANT: Diversitech provides this white paper as a means of educating the public about the dangers and health risks associated with exposure to silica dust and best practices for its handling as recommended by regulatory agencies in the United States (OSHA) and Canada (provincial jurisdiction). Diversitech is a manufacturer and supplier of compliant industrial air filtration solutions and is not a regulatory agency. Please refer any/all regulatory questions or concerns to the appropriate regulatory agency in your area.

Section 1 - Executive Summary

An abundant mineral found in the earth's crust, silica is used in a variety of products we use every day. Houses, cars, computers, phones as well as glass, pottery and ceramic all contain silica.

And while silica remains perfectly safe in these everyday items, when ground into dust form it can be extremely hazardous. The industrial processes of cutting, grinding, crushing and drilling silica create a very fine powder known as Respirable Crystalline Silica (RCS). If inhaled, this dust poses severe health consequences for workers. After years of exposure, RCS can lead to many deadly conditions including silicosis, tuberculosis, lung disease and even cancer.

Workers in numerous industries worldwide are exposed to silica dust on a daily basis. In the U.S. alone, approximately 2.3 million people are exposed to RCS each day. These workers have jobs in construction; glass, tile, microchip, concrete and artificial stone manufacturing; hydraulic fracking and mining to name a few. In Canada, it is estimated that 380,000 workers are routinely exposed to silica dust.

In 2016, the Occupational Health and Safety Administration (OSHA) set stricter standards for silica dust by cutting the permissible exposure levels (PELs) in half. Finding that the previous levels failed to adequately protect workers, OSHA imposed the rule change with the understanding that the new standard could potentially save hundreds of lives. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends an even lower PEL to protect workers.

This white paper provides solutions to help businesses protect their workers from the dangers of RCS exposure. While predominantly relevant for the glass, microchip, artificial stone and prefab cement industries, these recommendations can benefit all businesses dealing with silica dust.

Section 2 - The Health Effects of Long-Term Silica Dust Exposure

What is Crystalline Silica?

Made up of both oxygen and silicon, silica is an abundant raw material found on the planet. It is so common, in fact, that it makes up about 12% of all the earth's crust.

Two forms of silica exist: crystalline and noncrystalline silica. Noncrystalline is relatively benign and has little impact on human health. Crystalline silica, on the other hand, can be extremely detrimental when inhaled as dust.

Quartz is the most common form of crystalline silica and is found in sand, diatomaceous earth, gravel, clay, granite, metallic ore and many other types of rock. Because it is a hard substance that is chemically inert and has a high melting point, silica is a practical and valuable raw material in a number of industrial and manufacturing processes.

Common industrial materials that contain crystalline silica include:

- Brick
- Cement
- Asphalt (for paving)
- Concrete and concrete block
- Drywall
- Fiber cement products
- Grout
- Frac sand
- Gunite/ Shotcrete
- Mortar
- Paints containing silica
- Plaster
- Refractory Mortar/ Castables
- Refractory Units
- Rock
- Roofing tiles and pavers
- Sand
- Soil (fill dirt and topsoil)
- Stone (granite, limestone, quartzite, sandstone, shale, slate, cultured, etc.)
- Stucco/ Exterior insulation finishing systems (EIFS)
- Terrazzo
- Tile (clay, ceramic, concrete, etc.)
- Glass

In these concrete forms, crystalline silica poses no health risk. The problem comes when these materials are cut, drilled, ground or crushed into very fine dust by various industrial processes. If an industry employs any of the below applications on the above materials, then precautions need to be taken to protect worker health:

- Abrasive blasting
- Bushhammering
- Cutting/ sawing
- Demolishing/ disturbing
- Drilling
- Earthmoving
- Frac sand cleanup
- Frac sand mixing
- Frac sand offloading, onloading or transferring
- Jackhammering
- Grinding
- Milling
- Mixing
- Polishing
- Roofing
- Sacking/ patching
- Sanding
- Scabbling
- Scarifying
- Scraping
- Wet mixing/ pumping

It's important to note that size matters when it comes to silica dust. Anything between 10 and 100 microns in diameter is relatively harmless as it is large enough to be trapped and expelled through the body's natural defenses before causing damage. Dust under 10 microns in diameter, however, is another story.

Called Respirable Crystalline Silica (RCS), these fragments are small enough to bypass all of the body's defenses including the nose, throat and lungs. Penetrating the tiny vessels deep in the lungs, RCS can cause irritation and inflammation. After years of repeated exposure, RCS accumulation can lead to the irreversible disease silicosis and possibly even lung cancer.

Long-Term Health Consequences of RCS Exposure

Workers exposed to high levels of RCS without protection can develop chronic and even deadly conditions after months or years. In the case of silicosis, symptoms usually don't show up until after 10 years of exposure.

Silicosis

The disease silicosis is the result of damage due to the presence of silica dust in the lungs. Referred to as "the world's oldest known occupational disease", the association between silicosis and crystalline silica has actually been recognized for decades.

The most common symptom of the disease is shortness of breath, usually when exercising. The three main types of silicosis are:

- **Acute silicosis:** This type of silicosis is the result of exposure to extremely high concentrations of silica. Symptoms develop anywhere between a few months to 2 years and include: shortness of breath, fever, weakness, cough, weight loss and possibly death.
- **Chronic silicosis:** The result of 15-20 years of low to moderate RCS exposure, chronic silicosis is the most common form of the disease. Symptoms include: fatigue, extreme shortness of breath, chest pain, cough, darkening of the skin and respiratory failure.
- **Accelerated silicosis:** Accelerated silicosis manifests after 5-10 years of RCS exposure. Severe shortness of breath, weakness and weight loss are the resulting symptoms.

As there is no known cure for silicosis, prevention is the best way to conquer the disease

Lung Cancer

While silicosis is the primary risk, lung cancer can also develop as a result of RCS exposure.

Numerous studies have proven the link between occupational RCS and the disease. Research combining two studies from 1979 and 1996 conducted on Montreal workers concluded that the risk for developing lung cancer rose considerably with “substantial exposure” to silica dust.

In 1997, after an extensive review of published literature, the International Agency for Research on Cancer (IARC) found inhaled RCS to be a carcinogen for humans. They confirmed these findings in 2011.

Chronic Obstruction Pulmonary Disease

Chronic Obstruction Pulmonary Disease (COPD) is another disease of the lungs. The two forms of COPD include chronic bronchitis and emphysema. Chronic bronchitis is characterized by an ongoing cough with mucus. Emphysema is associated with long-term damage to the lungs. Patients suffering from COPD may have a combination of both conditions.

COPD is generally not reversible and often worsens over time.

A U.S study that evaluated the death certificates from 27 states found that crystalline silica exposure increased the risk of developing a number of various lung conditions including COPD and pulmonary tuberculosis.

Section 3 - OSHA Guidelines for Controlling Silica Dust in the U.S.

New Highlights for 2019 Edition

In 2016, OSHA cut their recommended PELs for silica dust exposure in half. Previously 100 micrograms per cubic meter (μ/cu.m) of air, OSHA lowered the PEL for RCS to 50 μ/cu.m as an 8-hour time weighted average (TWA). OSHA made this change as the old standards did not take into account recent scientific evidence proving the extensive risks associated with RCS exposure.

OSHA states that the new ruling could potentially prevent up to 600 deaths due to silica-related disease and 900 new cases of silicosis annually.

Failing to comply with these new standards could result in some hefty fines. OSHA has been known to issue fines up to hundreds of thousands of dollars to companies not up to code.

For more detailed information on how to comply with the new Silica Rule Standard, employers can consult OSHA's Fact Sheet or the agency's standard on worker exposure to silica dust (1910.1053).

Section 4 - Recommended Guidelines for Controlling Silica Dust in Canada

RCS regulations in Canada are a bit more complicated than in the United States. While the entire U.S. has one regulatory board (OSHA) to follow, Canada does not. Each province has its own occupational exposure limits (OELs) when it comes to RCS causing some confusion among contractors and employers.

Many provinces including Prince Edward Island, Manitoba, Newfoundland and Labrador and Nova Scotia adopt the American Conference of Governmental Industrial Hygienists (ACGIH) OELs. These standards are lower than OSHA's as the ACGIH recommends 25 µ/cu.m of air as an 8-hour TWA instead of 50 µ/cu.m.

Other provinces have a review process every year or every 5 years to determine levels. As of the beginning of 2019, the OELs according to each province are as follows:

Alberta - 25 µ/cu.m TWA
British Colombia - 25 µ/cu.m TWA
Manitoba - 25 µ/cu.m TWA
New Brunswick - 50 µ/cu.m TWA
Newfoundland and Labrador - 25 µ/cu.m TWA
Nova Scotia - 25 µ/cu.m TWA
Ontario - 50 µ/cu.m TWA
Prince Edward Island - 25 µ/cu.m TWA
Quebec - 50 µ/cu.m TWA
Saskatchewan - 50 µ/cu.m TWA
Northwest Territories - 50 µ/cu.m TWA
Nunavut - 50 µ/cu.m TWA

Yukon measures exposure limits in particles/ mL with a konimeter. Their limit is 150 particles/ mL.

Section 5 - Best Practices for Controlling Silica Dust

To best protect workers, OSHA recommends companies take these following action steps to reduce exposure to RCS as outlined in their Fact Sheet:

1. **Assess daily RCS exposure levels for workers.** Implement a plan to protect workers if it is determined that they are exposed to the action level of 25 µ/cu.m averaged over an 8-hour work day of silica dust.
2. **Employ dust control methods to limit RCS exposure.** These include:
   a. Using wet practices to reduce dust clouds at the point where silica dust is produced.
   b. Installing local exhaust ventilation that captures silica dust at source.
   c. Constructing enclosures to isolate the process and/ or worker.
3. **Offer respirators when other methods are inadequate to protect workers.**
4. **Restrict housekeeping practices.** Activities like dry sweeping and the use of compressed air can further expose workers to RCS.
5. **Provide medical exams to workers who are exposed to more than 25 µ/cu.m averaged over an 8-hour work-day for more than 30 days annually.**
6. **Offer training to workers on the dangers of RCS and how to limit exposure.**

Local Exhaust Ventilation Systems

As recommended by OSHA, local exhaust ventilation systems provide an effective means to protect workers from RCS as they capture the dust at source before it has a chance to contaminate indoor air.

When looking for a good ventilation system, employers will want to make sure it has the following criteria:

1. **Efficient Source Capture Extraction.** Be sure to choose a ventilation system that effectively collects the majority of the dust before it can escape into workers' breathing zones. Placement of these systems is also important, as employers will want to ensure the systems extract the majority of the contaminant at the source of silica dust production.
2. **High Capture Velocity.** To extract as much of the toxic dust as possible, choose a system with high capture velocity. Silica and other heavy dusts require a high velocity filtration system to effectively capture and pull the contaminants in and away from workers' breathing zones.
3. **Efficient Filter.** Employers will also want to choose a system that has an efficient filter for the best ventilation performance. OSHA recommends true HEPA filtration that filters 99.97% of dust particles @ .3 micron.

Section 6 - Diversitech Solutions

Since 1984, Diversitech has been committed to providing air filtration solutions to protect worker health in industrial settings. A leader in the industry, our products continue to meet and often exceed OSHA standards. Constantly striving to offer our customers the most innovative machines on the market, we work to deliver a customized solution to suit your needs.

Source Capture Products

Installing source capture is one of the best methods to protect workers from the dangers of silica dust. Diversitech offers a number of options for the safe collection of RCS.

Downdraft Tables

The trusted choice of North America's largest manufacturers, Diversitech's DD series of industrial downdraft tables are built to withstand the most demanding applications. Its ventilated work surface captures dust right at source, so indoor air quality remains uncompromised.

You can configure our downdraft tables to suit dozens of industrial applications. As standard, the table comes fitted with a multi-stage spark arrestance baffle for fire prevention and dual 10" exhaust silencers for noise reduction. An automatic reverse-pulse filter cleaning system reduces overall maintenance requirements.

The DD series of industrial tables can be built-to-order in almost any configuration. Visit our website for a complete list of available models and options.

Downdraft Booths

Diversitech's self-contained downdraft booths are the ideal solution for the collection of toxic dust. Able to withstand the toughest applications, these compact workstations capture airborne contaminants right at source to maintain indoor air quality.

Available in various sizes and dimensions, all clean air booths come standard with 48" high side and back walls, ventilated work surface, dust-proof light kit and a controllable backdraft hood to better contain contaminants and improve the performance of the table. The downdraft and backdraft suction removes dust high above the table surface, ensuring a cleaner air facility.

Whether you weld, grind, debur, cut, sand, finish, solder, paint or mix, the DD Downdraft Booth provides the perfect, flexible, all-in-one solution. You can go to our website for a complete list of available models and options.

Environmental Booths

Completely customizable to accommodate your specific application, Diversitech's environmental booths offer a turnkey solution for filtering dust, fumes, composite and metal finishing from large work pieces. Common options include various depth, width, height of the booth, dustproof light kits, custom backdraft hoods, crane slots, strip curtain and HEPA after-filters. One of Diversitech's engineers can work with you to determine which environmental booth is best suited for your application.

Be sure to check out our website to see our complete list of available models and options.

Ambient Air Filtration Products

For those applications where source capture is impractical, Diversitech offers a number ambient air filtration solutions. Use alongside source capture for an even cleaner air facility.

Filterhawk A-Series Ambient Air Cleaners

Diversitech's Filterhawk A-Series Ambient Air Cleaners are designed to collect dust, smoke and other airborne particulate. The T configuration of drawing dirty air in through the sides and exhausting clean air out, creates a circular airflow pattern to effectively purify the air in your facility. Easy-to-install, these air filters come equipped with powder coated steel frames and light-weight polyethylene plastic panels. The modular configuration of the A-Series allows units to be combined with multiple modules in a double or quad setup to increase the amount of filter media.

Ideal applications for Diversitech's Filterhawk A-Series Ambient Air Cleaners include: welding smoke and fumes, wood dust, oil mist and smoke from machining and dust from grinding. Visit our website for a complete list of available models and options.

Filterhawk Cartridge Dust Collectors

The Filterhawk Series from Diversitech features an innovative, modular design that effectively eliminates dust, smoke and other airborne contaminants. Its durable, heavy-duty, powder-coated steel construction can withstand continuous operation industrial applications.

The Filterhawk's vertical filter works with its reverse pulse cleaning system to separate dust from filters. It simultaneously prevents dust re-entrainment with baffles below, giving you a more cost-effective filter system to operate and maintain. The Filterhawk's powerful turbo-nozzle pulse-cleans each filter cartridge individually, blowing off the maximum amount of material.

Ideal applications for the Filterhawk Series includes: welding, sanding, deburring and grinding.
Check out our website for a complete list of Filterhawk models and options.

Section 7 - Conclusion

Implementing effective engineered solutions for the collection of RCS will give your workers longer, healthier lives, saving them from deadly diseases like silicosis and cancer. Providing a safe work environment is not only the right moral decision, it makes financial sense as well. Businesses who fail to implement the appropriate engineered controls to protect indoor air quality not only risk fines from government agencies, they also miss out on the benefits of a happy and healthy workforce.

When provided clean working conditions, workers are happier and far more productive. They are far less likely to use sick days or sick leave as well, saving the company considerably. Employers can rest easy knowing that they are making the morally and fiscally responsible decision for their business.

Questions about which filtration equipment is right for you? Please call one of Diversitech's experts. We will be happy to provide you with a complete assessment of your needs.

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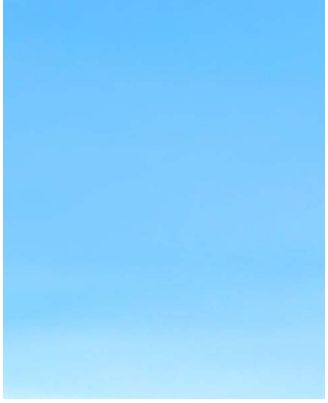

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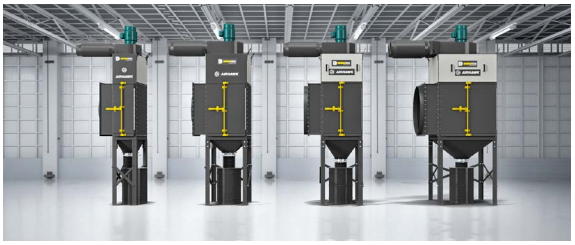



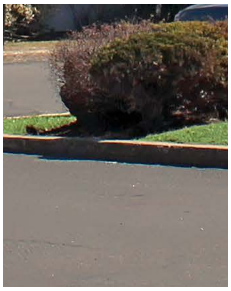








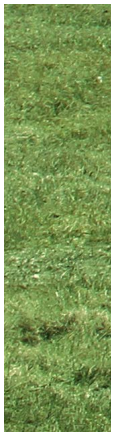


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