

CHAPTER 5 – MINIMIZING AIRBORNE SILICA

GENERAL COMMENTS FOR INSTRUCTORS:

This chapter outlines methods to minimize and control the amount of airborne crystalline silica dusts during abrasive blasting activities. When using a silica-based abrasive, emphasis should be placed on THE BEST method to minimize airborne silica: **SUBSTITUTE NON-SILICA ABRASIVES**.

The workers should come away from this section with a good understanding of engineered control methods, safer work practices and safer personal hygiene practices.

Workers should also understand the reasons why, importance of, and their involvement in creating a silica exposure control plan and a health and safety program and how these programs can help minimize their exposure to respirable crystalline silica.

AUDIO VISUAL AIDS:

- Literature and presentations on abrasive blasting rooms, alternative blasting technologies, environmental controls and recycling options for non-silica abrasives presented by abrasives salesman.
- PowerPoint® Chapter 5

APPENDICES:

- Appendix VI: MIOSHA Safety and Health Management System Resources
- Appendix VII: Job Safety Analysis Resources
- Appendix XI: MIOSHA Construction Safety Standard, Part 1 – General Rules
- Appendix XII: AIHA White Paper: Recommended Skills And Capabilities For Silica Competent Persons
- Appendix XIII: Sample Silica Exposure Control Plans
 - Appendix XIII-A: MIOSHA Sample Silica Exposure Control Plan
 - Appendix XIII-B: Zurich Sample Silica Exposure Control Plan – General Industry
 - Appendix XIII-C: MIA/BSI Sample Silica Exposure Control Plan – General Industry

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IF YOU USE SILICA SAND AS AN ABRASIVE OR YOU PERFORM ABRASIVE BLASTING ON A SILICA-CONTAINING SUBSTRATE:

- ⇒ Determine the airborne level of respirable crystalline silica. (See Chapter 4 – Air Sampling)
- ⇒ If employee exposures are at or above the AL ($25 \mu\text{g}/\text{m}^3$) under any foreseeable condition, YOU MUST:
 - ➔ Develop a Silica Exposure Control Plan
 - Construction Employers: YOU MUST designate a competent person
- ⇒ If employee exposures are at or above the PEL ($50 \mu\text{g}/\text{m}^3$), YOU MUST:
 - ➔ Use **engineering** and **work practice** controls to reduce and maintain employee exposure to respirable crystalline silica to or below the PEL
 - Wherever feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PEL, the employer must use them to reduce employee exposure to the lowest feasible level and must supplement them with the use of respiratory protection
 - ❖ **GENERAL INDUSTRY/MARITIME:** If employee's exposure to airborne concentrations of respirable crystalline silica is, or can reasonably be expected to be, in excess of the PEL, YOU MUST:
 - Establish a regulated area
- ⇒ **CONSTRUCTION** employers are required by Construction Safety Standard Part 1-General Rules (See Appendix Xi) to develop an Accident Prevention Program
 - ➔ General Industry employers are not required by law to have a written health and safety program but it is strongly recommended the employer does so.

***BEST METHOD TO REDUCE LEVELS OF AIRBORNE
RESPIRABLE SILICA - IF USING SILICA BASED ABRASIVE:
SUBSTITUTE NON-SILICA BASED ABRASIVE***

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SO ... YOU HAVE DECIDED TO DETERMINE IF YOU CAN ELIMINATE SILICA SAND AS AN ABRASIVE AND SUBSTITUTE A NON-SILICA ABRASIVE...

How do you proceed to switch from a silica to a silica-free abrasive?

<u>STEPS</u>	<u>WHAT TO DO</u>
1. Decide if you want help to transition to a non-silica-based abrasive.	Abrasive media salespersons, MIOSHA CET, and industrial hygiene consultants can assist you in the substitution process
2. Choose which brands and types of medias you will purchase.	Consider costs, recycling options, etc.
3. Decide where you will put dust collection systems and blast rooms/blast cabinets.	Use the outside consultants and your H&S Committee
4. List any work practices that need to be changed.	An employee training component will probably be necessary. New materials will be used and, perhaps, new work practices. The MIOSHA group and IH consultant can also assist you.
5. Make a schedule for buying and installing any new equipment you need.	Include in the schedule any other plans you have for making your workplace safer.
6. Put your silica substitution plan in writing, including the schedule for getting everything done.	If you decide to work with a third party (industry expert, industrial hygienist) carefully review any plans they prepare for you. Document the implementation steps you complete
7. Let your employees know what your plans are.	Post the plan and accomplishments for everyone to see. Have a safety meeting, or describe your plans.
8. Keep copies of your substitution plan for your records.	Post the plan and schedule so everyone can see the changes that are coming in the future.

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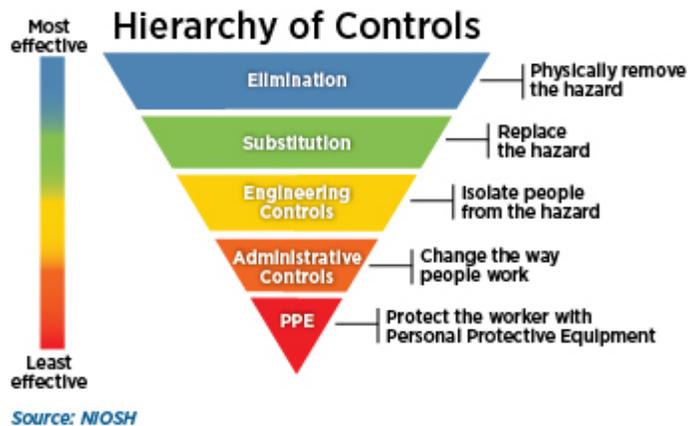
USING SILICA SAND AS AN ABRASIVE OR PERFORMING ABRASIVE BLASTING ON SILICA-CONTAINING SUBSTRATES

If your employees are exposed above the PEL, you MUST use engineering and work practice controls, if feasible, to lower their exposure to at or below the PEL. If engineering and work practice controls cannot lower the exposure to at or below the PEL, respiratory protection (PPE) must be used in addition to the engineering and work practice controls.

HAZARD CONTROL MEASURES

⇒ **Hierarchy of Control Measures**

Effective controls protect workers from workplace hazards; help avoid injuries, illnesses, and incidents; minimize or eliminate safety and health risks; and help employers provide workers with safe and healthful working conditions. The hierarchy is arranged beginning with the most effective controls and proceeds to the least effective.



Advantages of using engineering controls include:

- Control crystalline silica-containing dust particles at the source, thus minimizing exposures to all persons in the surrounding work area
- Reliability, predictability, and provide consistent levels of protection to a large number of employees
- Can be monitored
- Are generally less prone to human error than is the use of personal protective equipment.

Remember: Administrative control measures and PPE rely on human behavior and supervision, and used on their own, tend to be least effective in minimizing risks!

⇒ **Engineering Controls**

Engineering controls such as substitution, isolation, containment, and ventilation are the primary means of preventing or reducing exposures to airborne hazards during abrasive

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blasting operations. There are a variety of different means by which dust hazards can be effectively controlled. It should be noted that control of dust or its effects for health purposes also results in elimination of certain safety hazards. For example, if dust does not gather on a floor, the chance of slipping on the dust is eliminated. Likewise, if dust is exhausted properly from an enclosure, the vision impairment might otherwise would create is eliminated.

1. Substitution

- a. Use a less toxic abrasive blasting material
- b. Use a less hazardous surface preparation method
 - i. Wet Abrasive blasting - Use abrasives that can be delivered with water (slurry) to reduce dust
 - ii. Water Jetting (high and ultra-high pressure)
 - iii. Centrifugal wheel blasting (normally used where the work is of a consistent size)
 - iv. Vacuum blasting
 - v. Sponge Jet blasting (<https://www.spongejet.com/>)
 - vi. Other Cleaning techniques that do not involve blasting (especially smaller jobs). Examples, heat guns, power tools with dust collection systems, scraping

2. Isolation and Containment

- a. Use barriers and curtain walls to isolate the blasting operation from other workers
- b. Use blast rooms or blast cabinets for smaller operations
- c. Use restricted areas for non-enclosed blasting operations
- d. Keep coworkers away from the blaster

3. Ventilation

- a. Use exhaust ventilation systems in containment structures to capture dust.
 - i. Ensure the construction, installation, inspection and maintenance of exhaust system is performed. The air should be exhausted rapidly enough to maintain a slight negative pressure; outside air is then drawn in through any openings rather than having inside, contaminated air leak out. Make sure sufficient fresh air is circulated so that the dust level is reduced to enable good visibility for the operator.

⇒ Work Practice Controls

1. Administrative Controls

- a. Perform routine cleanup using wet methods or HEPA filtered vacuuming to minimize the accumulation of toxic dusts
- b. Do not use compressed air to clean

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- c. Making sure that nozzles spray water at the point of dust generation for wet method controls
 - d. Positioning local exhaust hoods directly over the exposure source and not opening windows near the local exhaust source
 - e. Job rotation
 - f. Creating written operating procedures
 - g. Clean and decontaminate tarps and other equipment on the worksite
 - h. Schedule blasting when the least number of workers are at the site
 - i. Avoid blasting in windy conditions to prevent the spread of any hazardous materials
 - j. Inspecting and maintaining controls to prevent or fix malfunctions that would result in increased exposures
- 2. Personal Hygiene Practices**
- a. Prohibit eating, drinking or using tobacco products in blasting areas
 - b. Provide wash stations so workers can wash their hands and face routinely and before eating, drinking or smoking
 - c. Vacuum or remove contaminated work cloths before eating, drinking or smoking
 - d. Provide accommodations for end-of-shift showers and change areas with separate storage facilities for street clothes, protective clothing and equipment
 - e. Keep contaminated clothing and equipment out of the clean change area

SILICA EXPOSURE CONTROL PLAN

A written exposure control plan is required if your employee exposure to respirable silica is over the action level ($25\mu\text{g}/\text{m}^3$). The exposure control plan provides a systematic approach for ensuring proper function of engineering controls and effective work practices that can prevent overexposures from occurring. Written exposure control plans describe workplace exposures and ways to reduce those exposures, such as engineering controls, work practices, housekeeping methods, and restricting access to areas where high exposures occur. The plans improve employee protections by making sure that employers identify all exposures and controls to prevent overexposures. Such plans are also useful for letting employees know what kind of protections they should expect to see on the job.

The written exposure control plan must contain *at least* the following four 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
- A description of the procedures used to restrict access to work areas, when necessary, to minimize the number of employees exposed to respirable crystalline

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silica and their level of exposure, including exposures generated by other employers or sole proprietors

Your written exposure control plan can also include anything else you think is important about keeping your employees safe from respirable crystalline silica at your worksite.

⇒ **Is there anything else the silica exposure plan must include?**

Yes. The silica standard requires the covered employer to:

- Review and evaluate the effectiveness of the written exposure control plan at least annually and update it as necessary
- Make the plan readily available for examination and copying, upon request, to each employee covered as well as their designated representatives, MIOSHA, and OSHA

SILICA CONTROL PLAN REQUIREMENT FOR CONSTRUCTION EMPLOYERS

In addition to the above requirements, the **Silica in Construction rule requires construction employers to designate a competent person** to make frequent and regular inspections of job sites, materials, and equipment to implement the written exposure control plan.

⇒ **What is a competent person?**

As defined by OSHA, a competent person is “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”. A competent person also must have the knowledge and ability to implement the written exposure control plan. The employer can designate any of his/her employees to be a competent person if the employee is qualified, including the employee who does the work on a jobsite.

The standard does not require specific training for a competent person. The employer is responsible for determining what training is necessary to provide the knowledge and ability for his or her competent person to implement the written exposure control plan.

The American Industrial Hygiene Association developed a document identifying the recommended skills and capabilities for silica competent persons. See Appendix XI for the AIHA document.

⇒ **Does the competent person need to be specifically named in the written silica exposure control plan?**

No. **BUT** the training requirements mandate that workers know the identity of the

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competent person designated by the employer. This could be as simple as announcing who the competent person is at the beginning of a work shift.

CPWR - The Center for Construction Research and Training – is the National Construction Center for the National Institute for Occupational Safety and Health (NIOSH). CPWR conducts research to identify the causes of and solutions for safety and health risks on construction jobs that can lead to injuries, illnesses and fatalities, publicizes the results, encourages the use of solutions, and trains instructors in general and specialized safety and health topics.

CPWR developed a website, [Working Safely With Silica \(https://www.silica-safe.org/\)](https://www.silica-safe.org/) to be a one-stop source of information to help contractors, workers, and other stakeholders prevent silica-related illnesses. The website includes tools and information to identify silica hazards, understand the health risk, and find equipment and methods to control the dust. Users will also find information on regulatory and voluntary efforts to minimize silica exposures. Included on the Working Safely with Silica website is a Create-A-Plan-To-Control Dust webpage, a fill-in-the-blank Silica Exposure Control Plan template.

See **Appendix XIII** for example silica exposure control plan templates for general industry/maritime and construction.

Remember: MIOSHA has a [Silica Resource Page!](https://www.michigan.gov/lara/0,4601,7-154-11407_15317-413123--,00.html)
https://www.michigan.gov/lara/0,4601,7-154-11407_15317-413123--,00.html

REGULATED AREAS

Regulated areas apply to General Industry/Maritime employers only.

Wherever an employee's exposure to airborne concentrations of respirable crystalline silica is, or can reasonably be expected to be, in excess of the PEL, the employer must establish a regulated area to minimize the number of employees exposed to respirable crystalline silica within the regulated area. The employer must post this sign at all entrances (see Figure 1) to the regulated area.

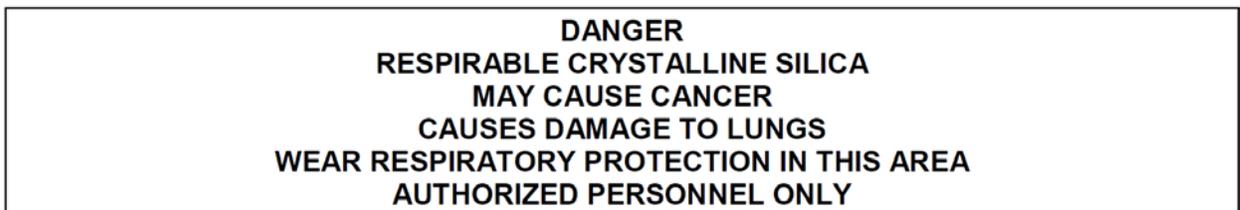


Figure 1

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Employers are required to limit access to the regulated area to the following individuals:

- Only those individuals authorized by the employer and required by work duties are permitted to be present in the regulated area
- A designated representative of employees for the purpose of exercising the right to observe monitoring procedures
- Any person authorized by the MIOSHA/OSHA to be in a regulated area

The employer is also required to provide each employee and the employee's designated representative entering a regulated area with an appropriate respirator and require each employee and the employee's designated representative to use the respirator while in a regulated area.

HEALTH AND SAFETY PROGRAMS

The reduction or elimination of health and safety hazards is the primary goal of a health and safety program. The importance of having a health and safety program utilizing the principles of a safety and health management system was discussed in Chapter 3. It is important for employers to conduct a worksite analysis - a comprehensive evaluation of the hazards and potential hazards in your workplace. Before your organization can effectively implement hazard prevention controls, a thorough understanding of these hazards must be explored

Construction employers in Michigan are required by law to have an Accident Prevention Program (APP).

⇒ Job Safety Analysis

A job safety analysis is one way for a company to determine potential hazards and identify methods to reduce exposure to the hazards, including exposure to respirable crystalline silica. A JSA is a process for employees and supervisors to observe and evaluate a job task to determine specific hazards and identify solutions to minimize or eliminate the hazards. A written procedure is then developed to provide safe operating instructions on how to perform the task safely and specify any personal protective equipment (PPE) necessary. It is recommended that JSAs be performed on all jobs, prioritizing the most hazardous jobs such as work with machines, equipment, and hazardous chemicals.

There are three parts to the JSA.

1. The first component of a JSA is breaking down a job or task into the specific steps it takes to complete the job. Although this can be done in small detail, typically only the major steps are listed. This often results in five to ten steps. The steps are listed in chronological order, listing the first thing that must be done, then what comes next, and so on.

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2. The second component of a JSA is to list all the hazards that are involved in each step. There may be many hazards that get listed next to some steps and may not be any associated with some steps.
3. The third step is to write down how each hazard will be eliminated or controlled. In other words, describe what needs to be done in order to perform that task safely.

A JSA for all activities involving abrasive blasting with silica and/or performing abrasive blasting on a silica-containing substrate will assist in developing your company's silica exposure control plan. MIOSHA CET developed a resource - Job Safety Analysis – which offers guidelines to employers to conduct a JSA for the job tasks performed by their employees and contains a sample of a completed job safety analysis and a blank job safety analysis form. See **Appendix VII**.

Appendix VI contains a sample health and safety program for General Industry and a Model Accident Prevention Program for Construction employers.

STEPS TO DEVELOP A HEALTH AND SAFETY PROGRAM

It can sometimes seem daunting to create a health and safety program from scratch. It does take some time, but is well worth the time and effort. Did you know that for every \$1 you invest in workplace safety and health, you will see a return of \$4 to \$6 dollars? Most likely you will see a decrease in your experience modification rate... which saves you money!

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Steps to Develop a Health and Safety Program

Develop **plan of action** that includes both Management and Employee involvement

Designate person to be responsible for the Health and Safety Program

Determine Health and Safety requirements for your facility

Conduct a Workplace Hazard Assessment

Correct/Control identified Hazards

What to Do

⇒ Write Health and Safety policy statement

⇒ Form Health and Safety Committee

⇒ Person selected must have:

- Authority to do the job
- Respect of both mgt and employees
- Knowledge of the facility and processes
- Time and resources to implement the program

⇒ Where to find Health and Safety Information:

- MIOSHA laws, regulations and standards
- Product Literature
- Industry Publications
- Safety Data Sheets
- Injury/Illness history

⇒ Identify and Evaluate:

- Existing and potential hazards which may affect worker health (JSA)
- Activities that are likely to expose workers and others (include maintenance, cleaning, etc)
- Employee routes of and exposure levels
- Use of personal protective equipment
- Existing control systems – are they working?

⇒ Look at control methods that can eliminate/minimize the hazard:

- at the source (substitution, ventilation, enclosure, wet methods)
- at the air path to the worker (housekeeping, maintenance, ventilation)
- at the worker (respiratory protection, personal protective equipment, education and training)

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Steps to Develop a Health and Safety Program

What to Do

Train Employees

- ⇒ New employee orientation
- ⇒ Train employees: check MIOSHA safety and health standard training requirements
- ⇒ Keep training records

Schedule periodic inspections

- ⇒ H&S Committee effective?
- ⇒ Work procedures developed?
- ⇒ Training effective?
- ⇒ Any new hazards?
- ⇒ Control methods effective?
- ⇒ Any changes in the workplace?

Re-evaluate program: Up-to-date and effective?

- ⇒ On a periodic basis, evaluate the written program and determine if any changes are necessary

REFERENCES:

Appendix VI: MIOSHA Safety and Health Management System Resources

Appendix VII: Job Safety Analysis Resources

Appendix XI: MIOSHA Construction Safety Standard, Part 1 – General Rules

Appendix XII: AIHA White Paper: Recommended Skills and Capabilities For Silica Competent Persons

Appendix XIII: Sample Silica Exposure Control Plans

- *Appendix XIII-A: MIOSHA Sample Silica Exposure Control Plan*
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Notes