

Training to Prevent Silicosis

OVERVIEW

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What is MIOSHA

- Michigan Occupational Safety and Health Act (P.A. 154 of 1974, as amended)
- Michigan State Program enforces occupational safety and health regulations, required to be as protective as the federal program (OSHA)



Definition “Employer”

- "Employer" means an individual or organization, including this state or a political subdivision, that employs 1 or more persons.
- If your business is organized as a sole proprietorship or partnership, the owner or partners are not considered employees for recordkeeping purposes.

Definition “Employee”

- Employee: “A person permitted to work by an employer”
- Definition of an employee includes: employees on your payroll, whether they are labor, executive, hourly, salary, part-time, seasonal, or migrant workers as well as:
 - ❖ Volunteers
 - ❖ Students
 - ❖ Interns
 - ❖ Temporary help (if you supervise on a day-to-day basis)

Employer's Responsibilities

- Furnish to each employee, employment and a place of employment, that is free from recognized hazards that are causing, or likely to cause, death or serious physical harm
- Comply with standards, regulations and orders issued pursuant to the Act



Employer's Responsibilities

- Post notices and use other appropriate means to keep employees informed of their protections and obligations under this act, including applicable rules and standards
- Provide personal protective equipment at employer's expense when required by a standard

Employer's Responsibilities

- Comply with standards and regulations covered under MIOSHA
- Never remove, displace, damage, destroy or carry off a safeguard furnished or provided for use in the workplace
- Cannot interfere in any way with the use of a safeguard by another person

Employer *Reporting* Requirements

- Physicians, hospitals, clinics and employers are required by law to report known or suspected cases of occupational disease to the Michigan Department of Licensing and Regulatory Affairs (LARA)

Employer *Reporting* Requirements

- Report to MIOSHA within 24 hours:
 - ❖ All work-related in-patient hospitalizations
 - ❖ Amputation (including fingertips)
 - ❖ Loss of an eye
- Report to MIOSHA within 8 hours
 - ❖ Work-related fatality

Employer *Recording* Requirements

- ❖ Work-related injury/illness involving:
 - ❖ Loss of consciousness
 - ❖ Restricted work activity or job transfer
 - ❖ Days away from work
 - ❖ Medical treatment beyond first aid
 - ❖ Those diagnosed by a PLHCP
 - ❖ Those meeting any specific recording criteria listed in Public Law of 1970 and MIOSHA

MIOSHA Forms

- MIOSHA Form 300: Log of Work Related Injuries and Illnesses
- MIOSHA Form 301: Illness and Injury Report within 7 days when have a recordable injury/illness

MIOSHA Forms

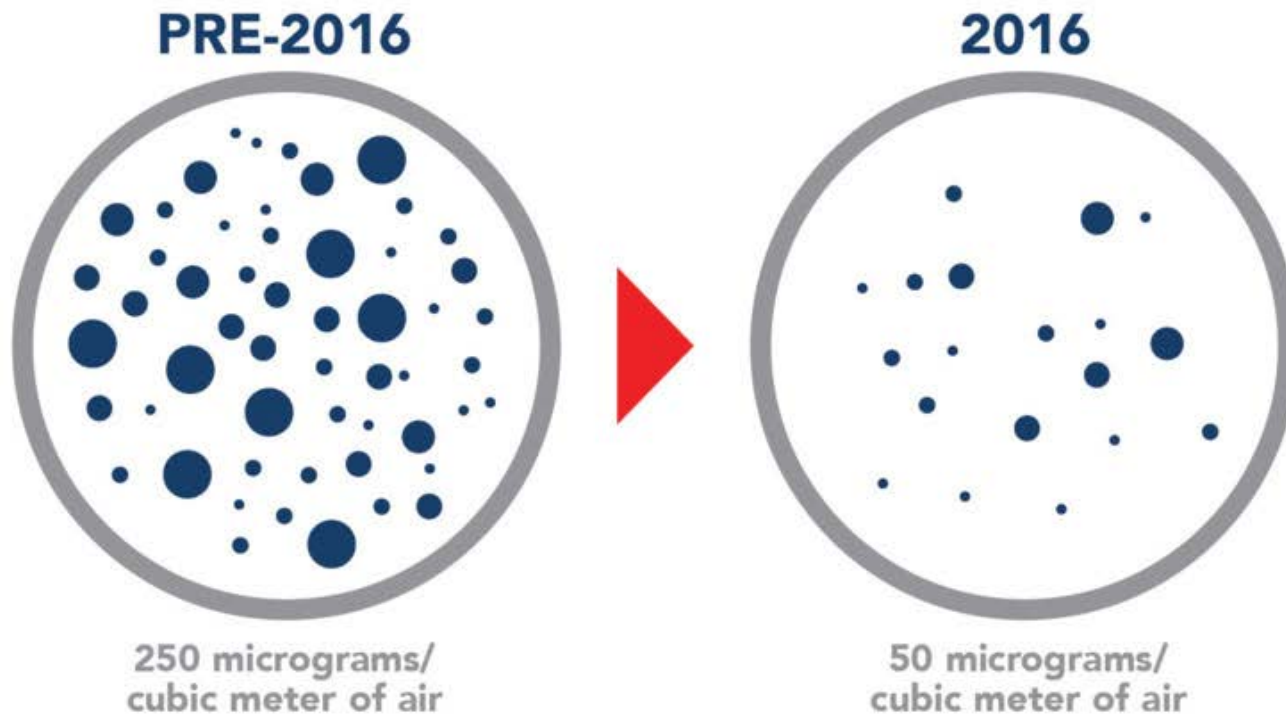
- MIOSHA Log 300A – Summary of Work-Related Injuries and Illnesses
 - ❖ 10 employees at any one time during the calendar year immediately before the current calendar year
 - ❖ Prominently post the 300A annual summary at the worksite from February 1 to April 30 of the year following the year covered by the form

Other Provisions Under MIOSHA

- Employer/Employee participation in compliance inspections/investigations
 - ❖ Inspections: survey to detect presence of hazards and compliance with Act
 - ❖ Investigations: detailed evaluation of working conditions
- Discrimination
- Imminent danger

Why You Are Here

IN 2016, OSHA REDUCED THE PEL OF RESPIRABLE CRYSTALLINE SILICA AVERAGED OVER AN 8-HOUR SHIFT BY 5X.



Why You Are Here

- MIOSHA General Industry Safety and Health Standard, Part 590 – Silica in General Industry
- MIOSHA Construction Safety and Health Standard, Part 690 – Silica in Construction
- Questions RE: Which Standard do I fall under??

Call MIOSHA CET

Silica Substitutes

CHAPTER 1



What is Abrasive Blasting?

- Operations where an abrasive is forcibly applied to a surface by pneumatic or hydraulic pressure or by centrifugal force
 - ❖ Does not apply to steam blasting or steam cleaning or hydraulic-cleaning methods where work is done without the aid of abrasives
- Frequently used for:
 - ❖ cleaning sand from foundry castings
 - ❖ cleaning and removing paint from metal surfaces
 - ❖ finishing tombstones
 - ❖ etching and frosting gl

Silica Substitutes: Appendix I

SILICA SUBSTITUTES

Abrasive Type	Price*	Special Equipment	Properties	Applications	Advantages	Limitations
Aluminum Oxide	\$422-2,500/ton	None required Usually used in cabinets or rooms with recycling equipment	Closely sized Very hard (MOH 8.5-9)	Cleaning hard metals (e.g. titanium) Removing metal Etch glass Carve granite	Recyclable	Must be reclaimed and reused for economy
Baking Soda	\$800-900/ton	Yes, meters less product/minute and dries air	Natural (flow and rinse agents added) Water soluble Non sparking Non flammable	General paint removal Stripping aircraft skins Cleaning surfaces in food processing plants Removing paint from glass	Less material used Less cleanup Low nozzle pressures (35-90 PSI) Non sparking Water soluble	May damage soft brick
Coal Slag	\$50-400/ton	None required	Hard (MOH 6-7) Angular Uniform density Low friability	General paint, rust and scale removal from steel Paint removal from wood Exposure of aggregates	Less than 1% free silica Inert Fast cutting Creates anchor profile	Tendency to embed in mild steel May contain toxic metals
Copper Slag	Market price may vary	None required	Hard (MOH 7-8) Blocky Sharp Edged	General paint, rust and scale removal from steel Paint removal from wood	Rapid cutting	Tendency to embed in mild steel May contain toxic chemicals
Corn Cob Granules	\$520-560/ton	Special ventilation may be required in enclosed areas to control combustion	Medium hardness (MOH 4.5) Non sparking	De-burring Paint and rust removal from wood and metal	Low consumption Low dust levels Bio-degradable	Does not create an anchor pattern
Dry Ice (CO ₂)	\$560/ton	Dry air required	Natural gas in solid state	Cleaning aircraft parts Cleaning exotic metals	No residue remains Minimal cleanup	
Garnet	\$61-480/ton	None required Additional components required in order to recycle media	Very hard (MOH 8) Very heavy (SG 4.1) Sub angular	General paint, rust and scale removal from steel	Lower nozzle pressures (60-70 PSI) Low dust levels Fast cleaning rates Can be recycled 6-7 times Low free silica	
Glass Beads	\$600-800/ton	None required Usually used in blast cabinets with recycling equipment	Manufactured of soda lime glass	Cleaning Polishing De-burring	Uniform size and shape Recyclable Provides high luster polished surface	Does not create an anchor profile
Nickel Slag	Market price may vary	None required	Very hard (MOH 7-8) Blocky Sharp edged	General paint, rust and scale removal from steel	Rapid cutting	Tendency to embed in mild steel Poor visibility May react w/corrosion inhibitors used in wet blasting May contain toxic metals
Nut Shells	\$560-1,020/ton	Special ventilation may be required in enclosed areas to control combustion	Soft Non sparking	Cleaning soft materials (e.g. aluminum, plastic, wood) Cleaning surfaces in the petroleum industry	High removal speed Non sparking Low consumption	Non-etching Potential fire hazard
Olivine	Market price may vary	None required	Natural mineral Hard (MOH 6.5-7) High specific gravity Angular	Clean light mill scale and rust from steel 2.5MIL profile and finer	Low chloride ion level Low conductivity	
Plastic Media	\$3,500/ton	None required Additional components required in order to recycle media	Soft Non abrasive Polyester, urea, melamine varieties	Cleaning soft metals and composites Cleaning metal fabric screens	Inert Recyclable Does not damage metal surfaces Low nozzle pressures (20-40 PSI)	Anchor profile limited to soft substrates (e.g. aluminum and plastic)
Staurolite	\$560/ton	None required Additional components required in order to recycle media	Rounded grains Hard (MOH 6.5-7) Irregular shape	Cleaning corroded, pitted, weathered steel Creating anchor profile on new steel	Does not embed Good feathering Low dust levels Recyclable 3-4 times	May contain up to 5% free silica
Steel Grit and Shot	\$456-1,000/ton	None required Additional components required in order to recycle media	Uniform size Uniform hardness Can be manufactured to various specifications	Paint, rust and scale removal from steel Surface preparation of structural steel in centrifugal wheel units	Can be recycled 100-200 times Low dust levels Superior visibility Portable blast rooms available Creates anchor profile	
Silicon Carbide	\$600-2,400/ton	None required Additional components required in order to recycle media	Very hard (MOH 13) Originally produced by a high temperature electro-chemical reaction of sand and carbon	Glass engraving Stone etching	Can be recycled 60-100 times Low density High strength Low thermal expansion	Must be reclaimed and reused for economy

*Prices will vary by distributor.

Health Hazards of Abrasive Blasting

CHAPTER 2

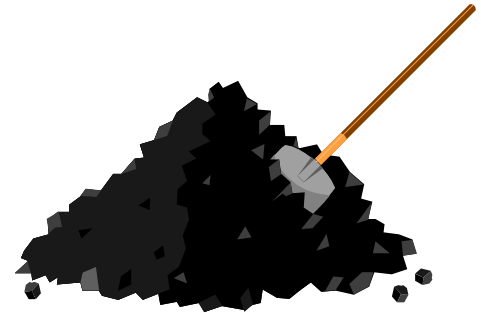


Health Hazards of Abrasive Blasting

- Silica
- Noise
- Metals
- Other Hazards

What is Silica?

- “Crystalline Silica” and “Quartz” refer to the same thing
- Major component of sand, rock, granite and mineral ore
- Toxic and less/nontoxic forms



Types of Silica

Harmful

Silica, Crystalline (as dust)

Trade Names

Quartz

Cristobalite

Tridymite

Tripoli

Common-Sandblasters

Less Harmful

Silica, Amorphous

Trade Names

Diatomaceous earth

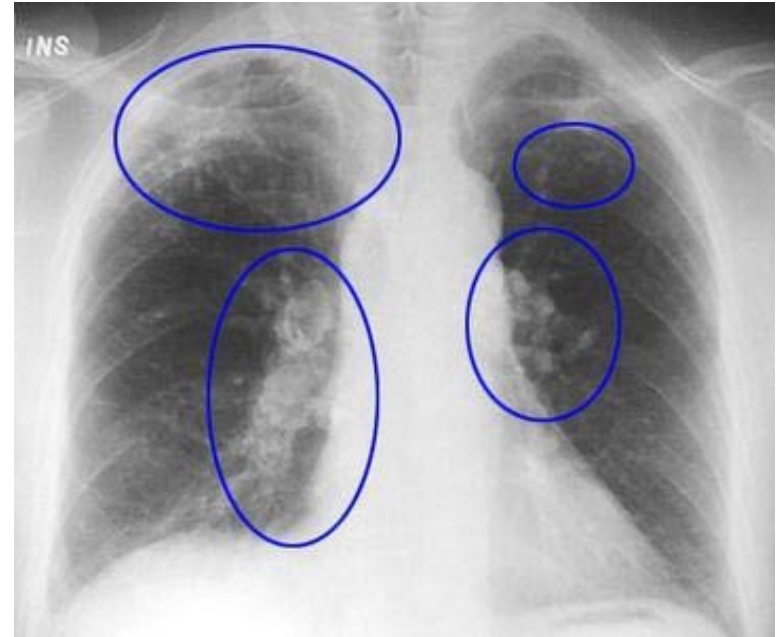
Diatomite

Silica gel

Silicon Dioxide (amorphous)

What is Silicosis?

- Progressive Lung Disease
 - ❖ disabling
 - ❖ non-reversible
 - ❖ sometimes fatal
 - ❖ NO CURE



- Cause: Inhalation of respirable crystalline silica

Who is at Risk?

- Abrasive Blasting
 - ❖ With silica sand
 - ❖ On silica-containing substrates
- Working without adequate protection
- Workers near the blast areas
 - ❖ Cleaners
 - ❖ Pot tenders
 - ❖ Painters
- **Silicosis is preventable**

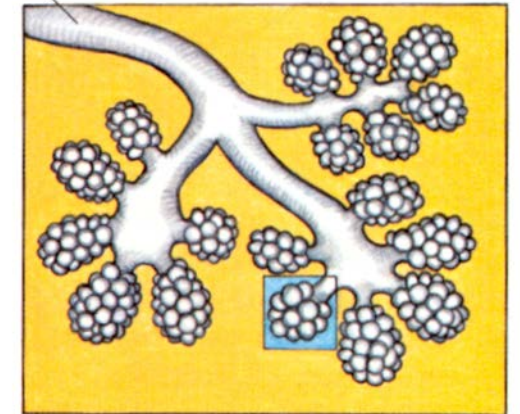
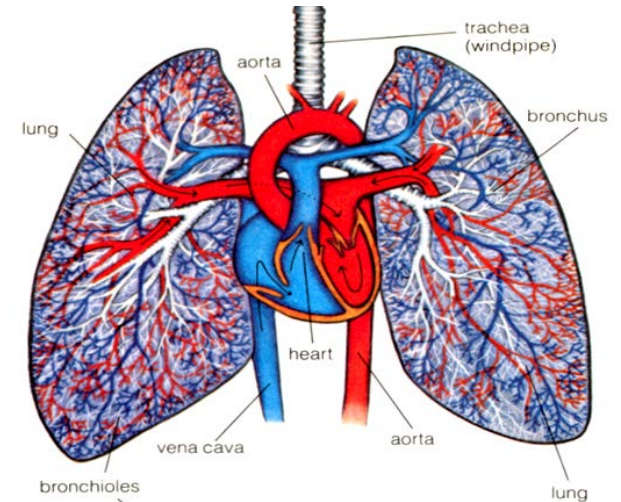
Why & What We Breathe

Inhalation and Exhalation

- ❖ Oxygen/Carbon Dioxide Exchange
- ❖ Air & Particulates
- Small fraction of inhaled particles are deposited
- Remainder are exhaled or removed
- Particle size determines what stays in lung

Your Bronchial Tree

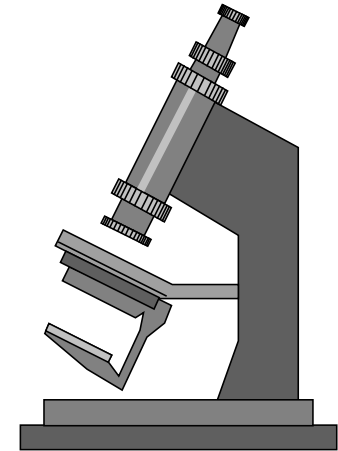
- Resembles the branches on a tree
- Divided into smaller and smaller branches
 - ❖ Bronchi
 - ❖ Bronchioles
- Business end
 - ❖ Alveoli



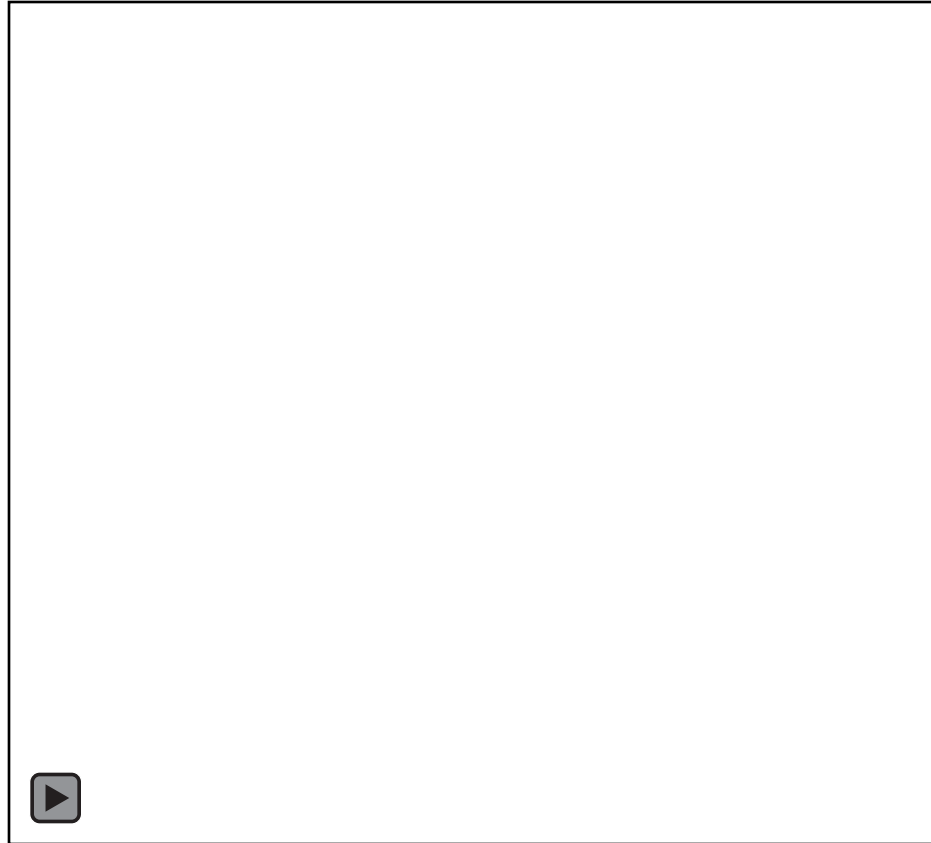
bronchioles with clusters of alveoli (enlarged)

Respirable Dust

- Less than 10 microns (μ) in diameter
- WHAT'S A MICRON?
 - ❖ 1/24,000 of an inch
- Human air
 - ❖ 40-150 μ in diameter
- **Respirable Silica that causes silicosis:**
 - ❖ **0.2-5.0 μ**



Particle Size Matters



How Does Exposure Occur?

- During blasting, silica sand fractures into very fine particles and becomes airborne



Let's look at how silica enters the lung



What are the Health Effects?

- **Early stages – may not notice any health effects**
- As condition worsens, nodules become larger, making breathing more difficult
- Lungs can't get enough oxygen from the air
- May be complicated by emphysema (COPD) and/or Tuberculosis

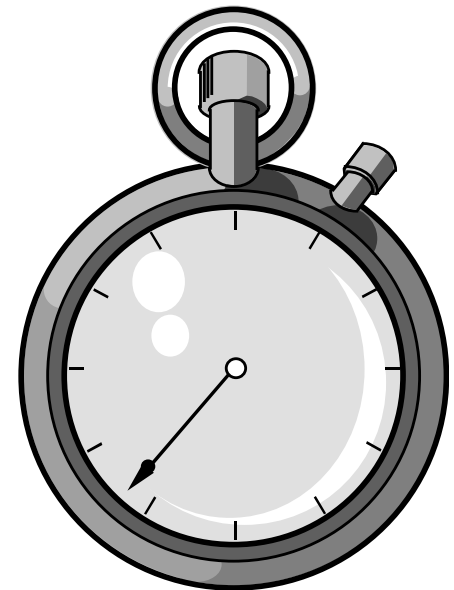
Forms of Silicosis

- Acute
- Accelerated
- Chronic
 - ❖ Simple
 - ❖ Complicated



Acute Silicosis

- Symptoms develop within a few weeks to months years after initial exposure
- Very high exposure concentrations
- Fluid accumulations in lung
 - ❖ Severe shortness of breath
 - ❖ Low blood oxygen levels



Accelerated Silicosis

- Occurs after 3-10 years of exposure
- High exposure conditions
- Onset of symptoms longer than acute form
- Symptoms:
 - ❖ Severe shortness of breath
 - ❖ Weakness
 - ❖ Weight loss

Form described most often in sandblasters

Chronic Silicosis

Simple Silicosis

- 15-20 years after exposure
- Nodules are small (approx. 1 cm)
- Limited scarring

Complicated Silicosis

- 15-20 years after exposure
- Another name: Massive Pulmonary Fibrosis
- Nodules in lungs increase in size and grow together encompassing blood vessels and airways

Symptoms

- Dry, productive cough
- Breathlessness
- Loss of appetite
- Pain in chest
- Malaise
- Weight loss
- Fatigue

Advanced Disease:

- Chronic Obstructive Pulmonary Disease (COPD)
- Tuberculosis
- Respiratory failure
- Congestive heart failure

Tuberculosis (TB)

- Silica affects the cells that control TB infection (macrophages)
- People with silica exposure are more likely to get TB infections
- Symptoms:
 - ❖ Coughing
 - ❖ Coughing up blood
 - ❖ Fever
 - ❖ Shortness of breath
 - ❖ Loss of appetite

Silica and Other Disease

- Respirable crystalline silica has been classified as a Group 1 “known human carcinogen”
 - ❖ **LUNG CANCER**
- Silica exposure linked to autoimmune diseases”
 - ❖ Scleroderma
 - ❖ Rheumatoid arthritis
- Kidney failure requiring dialysis or transplant

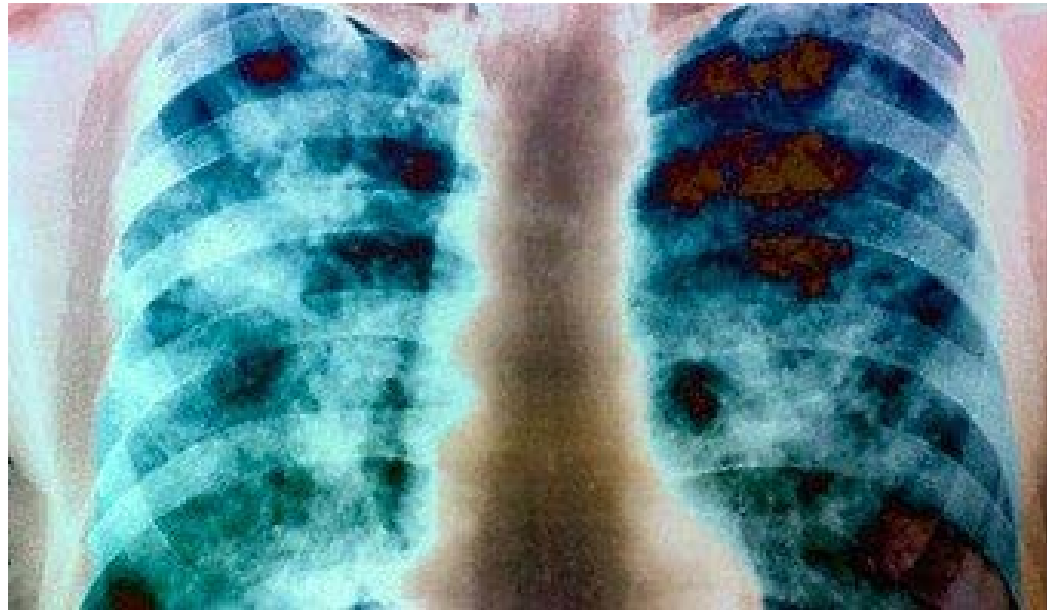
Lung Cancer

International Agency for Research on Cancer (IARC) has classified respirable crystalline silica:

KNOWN CANCER CAUSING AGENT

- Lung Cancer Symptoms:
 - ❖ Coughing up blood
 - ❖ Chest pain
 - ❖ Shortness of breath

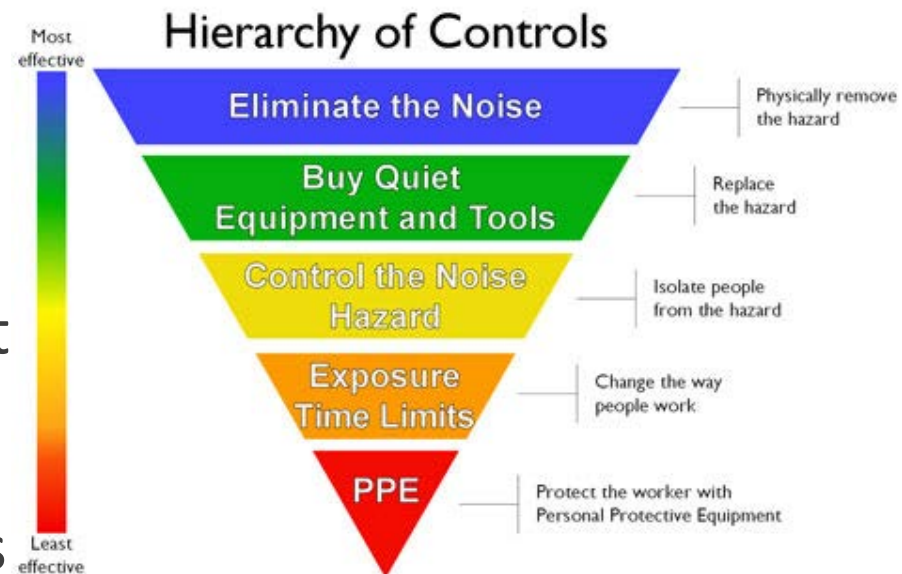
NO CURE FOR SILICOSIS



Noise

Noise: Unwanted sound

- When noise exposure is too intense or prolonged, may cause harmful effects:
 - ❖ Temporary or permanent hearing loss
 - ❖ Fatigue, irritability, tension, circulatory effects
 - ❖ May not be able to hear warning signals



Noise Rules

Exposure Monitoring

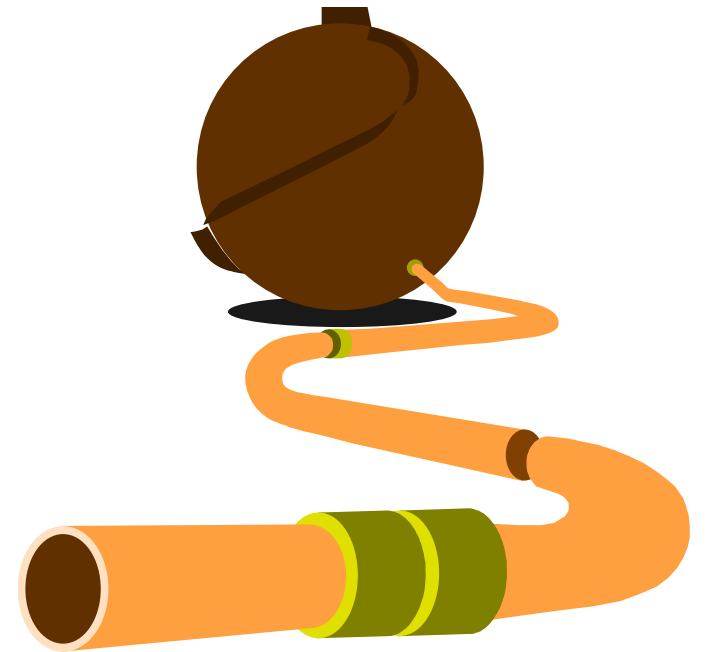
- PEL = 90 dBa (General Industry and Construction)
- AL = 85 dBA (General Industry Only)
 - ❖ AL = Action Level.
 - ❖ When employee's exposure equals or exceeds the AL, employer shall develop and implement a noise-monitoring program
- **Assess hose noise**

Metals

- Lead
 - ❖ Long term exposure may result in damage to your nervous system, reproductive system, kidney and blood forming system
- Cadmium
 - ❖ Long term exposure may result in kidney damage, increased risk of prostate and lung cancer
- Inorganic arsenic
 - ❖ Skin irritant, damage to your nervous system, liver damage, may cause lung cancer

Other Hazards

- Media ricochet
- Being “shot” by another blaster
- Jammed hose
- Fall from height
- Fatigue
- Carbon Monoxide exposure



Getting Organized

CHAPTER 3

Safety & Health Management System (SHMS)

Construction: Accident Prevention Program (APP) Required

- 5 primary elements of SHMS
 - ❖ Management Commitment
 - ❖ Employee Involvement
 - ❖ Workplace Analysis
 - ❖ Hazard Prevention and Control
 - ❖ Safety and Health Training

Why a SHMS?

- Supports organizational philosophy
- Communication of H&S goals
- Accountability
- **Long term solutions implemented rather than one-time or short-term fixes**
- Evaluation over time promotes improvement
- Positive bottom line

Getting Started

- Create a health and safety vision statement
- Place one person in charge
- Develop health and safety policy statement
- Develop Health and Safety Committee
- Get records in place

❖ Appendix VI: MIOSHA Safety and Health Management System

H&S Vision Statement Example

We embrace these five fundamental beliefs:

1. The health and safety of people are valued above all else.
2. All occupational injuries and illnesses can be prevented.
3. Excellence in safety is compatible with excellence in other business parameters such as quality, productivity and profitability; they are mutually supportive. Safe, healthy employees have a positive impact on all operations and customers, and enhance credibility in the community.
4. Safety must be made an integral part of everything we do.
5. Good Safety is the result of attitudes and beliefs of people. Most injuries and safety incidents occur because of lack of attention to proper engineering controls and work practices.

H&S Policy Statement (Example)

A H&S policy statement should provide a clear indication of the company's objectives and plans for health and safety.

Corporate Health and Safety Policy Statement

[Company Name] is committed to preventing the accidental loss of any of its resources, including employees and physical assets.

In fulfilling this commitment to protect both people and property, management will provide and maintain a safe and healthy work environment, in accordance with industry standards and in compliance with legislative requirements, and will strive to eliminate any foreseeable hazards which may result in property damage, accidents, or personal injury/illness.

We recognize that the responsibility for health and safety are shared. All employees will be equally responsible for minimizing accidents within our facilities and on our work sites. Safe work practices and job procedures will be clearly defined in the company's Health and Safety Manual for all employees to follow.

Accidental loss can be controlled through good management in combination with active employee involvement. Safety is the direct responsibility of all managers, supervisors, employees, and contractors.

All management activities will comply with company safety requirements as they relate to planning, operation and maintenance of facilities and equipment. All employees will perform their jobs properly in accordance with established procedures and safe work practices.

I trust that all of you will join me in a personal commitment to make safety a way of life.

Air Sampling

CHAPTER 4

Permissible Exposure Limit (PEL)

- PEL – Permissible Exposure Limit: CANNOT be exposed to an airborne concentration of respirable crystalline silica in excess of $50 \mu\text{g}/\text{m}^3$, calculated as an 8-hour TWA
- Time-weighted average (TWA) means the employee's average airborne exposure in any 8-hour work shift of a 40-hour workweek that shall not be exceeded

Action Level (AL)

Action level – AL: concentration of airborne respirable crystalline silica of $25 \mu\text{g}/\text{m}^3$, calculated as an 8-hour TWA



<https://www.irmi.com/articles/expert-commentary/silica-the-next-environmental-issue>

Assess Employee Exposure

- When performing abrasive blasting using silica sand or blasting on a silica-containing substrate:

Exposure assessment required when an employee is or may reasonably be expected to be exposed to respirable crystalline silica **at or above the action level (25 μ g/m³)**

Assess Employee Exposure

- 2 Options to assess employee exposure:
 - ❖ Performance Option
 - ❖ Scheduled Monitoring



Assess Employee Exposure

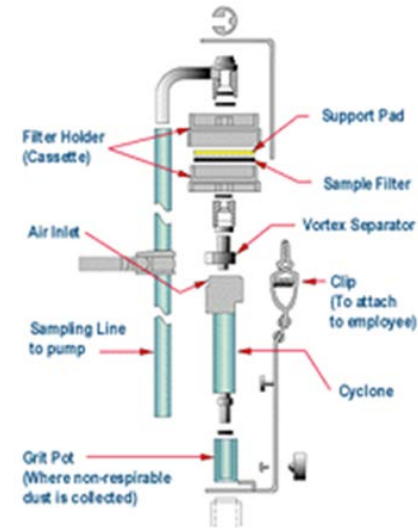
- **Performance Option:** Assess the 8-hour Time Weighted Average (TWA) using combination of air monitoring data or objective data
 - ❖ Objective data: air monitoring data from industry-wide surveys
 - ❖ Calculations based on substance composition and task
 - ❖ Must reflect workplace conditions closely resembling or with a higher exposure potential

Assess Employee Exposure

- **Scheduled Monitoring Option:**
 - ❖ **Initial Monitoring:** Perform 8-hour personal breathing zone air samples that reflect the exposures of employees on each shift, for each job classification, in each work area
 - If several employees perform same task in same work area, may sample employee(s) who are expected to have the highest exposure

Personal Breathing Zone

- Breathing zone samples provide the best indication of the concentration of contaminants in the air the employee is actually breathing.
- Cyclone filter assembly and sampling pump
- Place filter assembly on worker throughout work shift for up to 8 hours near face (usually within 6-9 inches). Sampling pump usually worn at belt level.



Additional Monitoring

- Within 6 months: exposures are \geq AL ($25\mu\text{g}/\text{m}^3$) and \leq PEL ($50\mu\text{g}/\text{m}^3$).
- Within 3 months: exposures are $>$ PEL ($50\mu\text{g}/\text{m}^3$), repeat monitoring of the most recent monitoring.

Additional Monitoring

Most recent (non-initial) exposure monitoring:

- ❖ Exposures $< AL$ ($25\mu\text{g}/\text{m}^3$) - repeat monitoring within 6 months of the most recent monitoring until 2 consecutive measurements, taken 7 or more days apart, are $< AL$
- ❖ May discontinue monitoring for employees represented by the monitoring if 2 consecutive measurements, taken 7 or more days apart, are $< AL$

Additional Monitoring

- Employers must reassess exposures whenever:
 - ❖ Change in the production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional exposures \geq AL
 - ❖ When employer has any reason to believe that new or additional exposures \geq AL have occurred

Other Requirements

- **Employer must ensure** that air samples are analyzed by a laboratory meeting the requirements of Appendix A of the Silica standard
- Employee notification
 - ❖ Within 15 working days
 - ❖ If > PEL ($50 \mu\text{g}/\text{m}^3$) – in writing must include corrective action being taken to reduce exposure

Other Requirements

- Must keep specific records of air monitoring data and if using objective data, specific records relating to that decision



Specific Air Monitoring Records

- The date of measurement for each sample taken;
- The task monitored;
- Sampling and analytical methods used;
- Number, duration, and results of samples taken;
- Identity of the laboratory that performed the analysis;
- Type of personal protective equipment, such as respirators, worn by the employees monitored; and
- Name, social security number, and job classification of all employees represented by the monitoring, indicating which employees were actually monitored.

Specific Objective Data Records

- The crystalline silica-containing material in question;
- The source of the objective data;
- The testing protocol and results of testing;
- A description of the process, task, or activity on which the objective data were based; and
- Other data relevant to the process, task, activity, material, or exposures on which the objective data were based.

BOTH air monitoring and objective data records must be maintained and made available in accordance with MIOSHA Occupational Health Standard, Part 470 – Employee Medical Records and Trade Secrets

Minimizing Airborne Silica

CHAPTER 5



Minimizing Airborne Silica

- **#1: Substitute Alternative Blasting Media**
 - ❖ Aluminum oxide
 - ❖ Coal slag (watch out for arsenic)
 - ❖ Steel shot and grit (low toxicity)
 - ❖ Specular hematite (low toxicity)
 - ❖ Corn cob
 - ❖ Garnet
 - ❖ Glass beads
 - ❖ Copper slag (watch out for arsenic)

Minimizing Airborne Silica

- **#2: Engineering Controls**

- ❖ Substitution (alternative blasting materials, wet abrasive blasting, water jetting, sponge jet blasting, other cleaning techniques)
- ❖ Isolation & Containment: barriers, curtain walls, blast rooms, blast cabinets, restricted areas
- ❖ Ventilation: Exhaust ventilation
 - Exhaust ventilation **MUST** be maintained to manufacturer specifications to control exposures to below the PEL

Minimizing Airborne Silica

- **#3: Administrative Controls**

- ❖ Work Practice: clean using wet methods, Job rotation, written operating procedures, task scheduling

- ❖ Personal Hygiene Practices: Prohibit eating/drinking in blasting areas, wash stations, vacuum work clothing before eating/drinking and before leaving for home, etc

- ❖ Post Warning signs to mark areas contaminated by silica

- **Administrative Controls may not control exposures to below the PEL!**

Minimizing Airborne Silica

- **#4: Silica Exposure Control Plan**
- Must contain:
 - ❖ Description of tasks in workplace that involve exposure
 - ❖ Description of the engineering controls, work practices, and respiratory protection used to limit employee exposure
 - ❖ Description of the housekeeping measures used to limit employee exposure
 - ❖ Description of 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

Silica Exposure Control Plan

- **Construction Employers:** designate a competent person to conduct job site inspections and to implement written exposure control plan
 - ❖ **Competent Person:** individual capable of identifying existing & foreseeable respirable crystalline silica hazards in the workplace and who has authorization to take prompt corrective measures to eliminate or minimize them

Competent Person - Construction

- By way of training and/or experience, a competent person is **knowledgeable** of applicable standards, is **capable** of identifying workplace hazards relating to the specific operation, and has the **authority** to correct them.
- There are currently no specific standards regarding competent person requirements.

Regulated Area – General Industry

- Silica standard requires GI employers to establish a “regulated area” 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.

Regulated Area – Required For General Industry Only

- Employers shall:
 - ❖ Demarcate areas from the rest of the workplace in a manner that minimizes the number of employees exposed to silica within the regulated area.
 - ❖ Post signs at all entrances to regulated areas that bear the following legend
 - ❖ Limit access to regulated areas to:
 - Persons authorized and required by work duties to be present.
 - Designated representatives exercising the right to observe
 - Any person authorized by the Occupational Safety and Health Act



Regulated Area - Construction

- Silica in Construction standard does not have a written requirement to establish a “regulated area”
- Should construction employers demarcate, post signage and limit access to areas where silica PEL is exceeded? **YES**

Respiratory Protection and Personal Protective Equipment

CHAPTER 6



Personal Protective Equipment

- Engineering (substitution, isolation, ventilation) and Work Practice Controls reduces/eliminates the hazard and should be used first!
- PPE: Remember...
 - ❖ PPE does nothing to reduce or eliminate the hazard
 - ❖ Failure to use correctly means immediate exposure to the hazard

Respiratory Protection

- Silica Standard For General Industry (Part 590) and Construction (Part 690)
- Occupational Health Standard, Respiratory Protection, Part 451
- Occupational Health Standard, Abrasive Blasting, Part 523

Respirators MUST BE NIOSH CERTIFIED

- All NIOSH-certified respirators have an approval number
 - ❖ Approval # ***May or May Not*** be on the respirator
 - ❖ May have a separate NIOSH approval label which is found on, or within the packaging

Silica Standard: Respiratory Protection Required

- Where exposures exceed the PEL during periods:
 - ❖ Necessary to install or implement feasible engineering and work practice controls
 - ❖ When the employee is in a regulated area (General Industry only)

Silica Standard: Respiratory Protection Required

- Where exposures exceed the PEL during tasks:
 - ❖ Certain maintenance and repair tasks, for which engineering and work practice controls are not feasible
 - ❖ For which an employer has implemented all feasible engineering and work practice controls and such controls are not sufficient to reduce exposures to or below the PEL

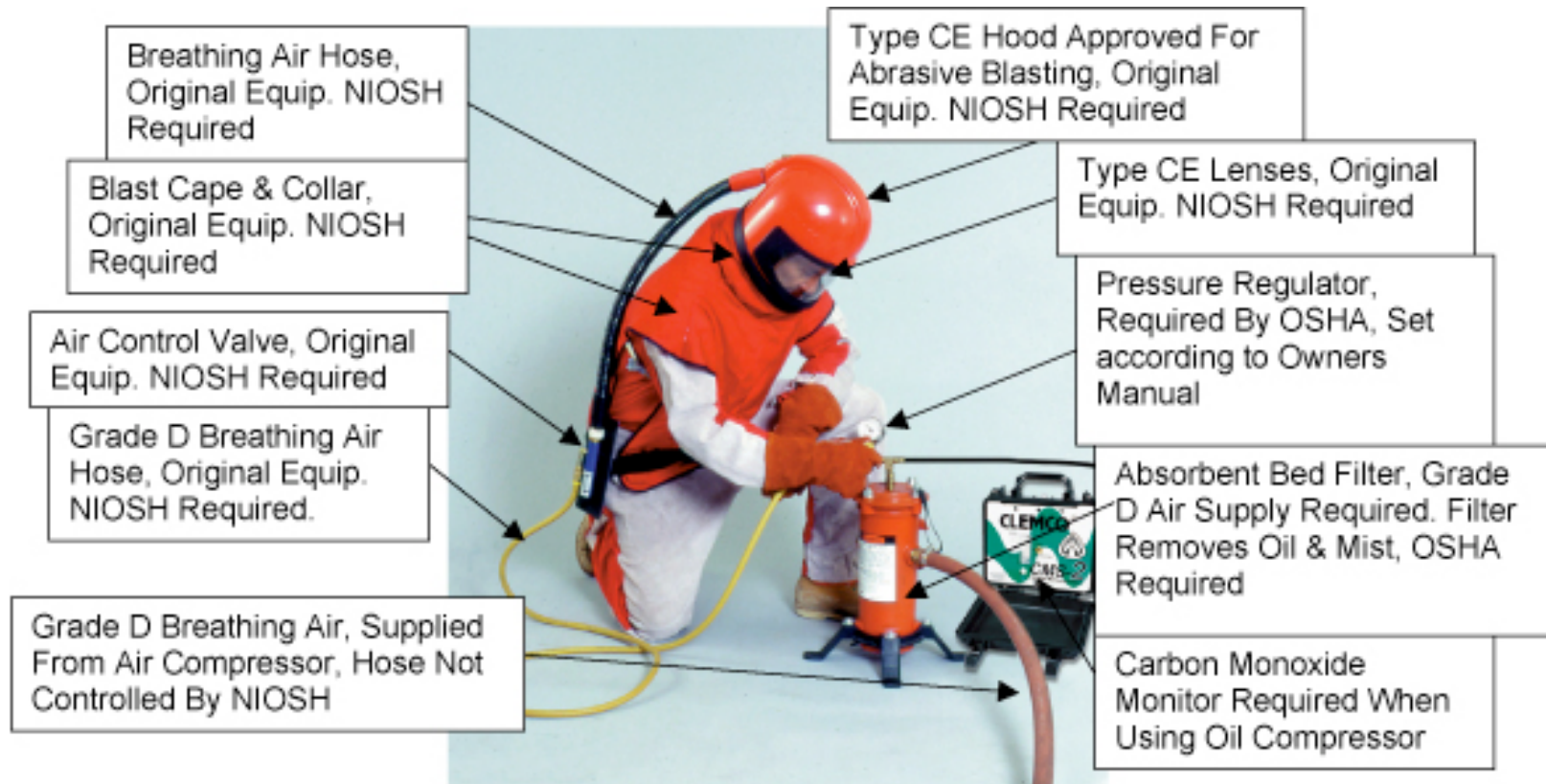
Abrasive Blasting (Part 523)

- Only approved respirators may be used
- Employees must wear abrasive-blasting respirators when:
 - ❖ Working inside blast-cleaning rooms
 - ❖ Using silica sand in manual blasting operations where operator is not physically separated from blasting operation
 - ❖ When above PEL and operator not physically separated from blasting operation
- Employees should wear respirators:
 - ❖ During clean-up operations

Abrasive Blasting Respirators

- Type CE: supplied air respirator equipped with additional devices designed to protect the wearer's head and neck against impact and abrasion from rebounding abrasive material, has shielding material to protect the window, shielding material does not obstruct vision and permits easy access to clean window

Type CE Respirator Components



Respirator Terminology

Assigned Protection Factor (APF):

- ❖ The workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program

Maximum Use Concentration (MUC):

- ❖ The maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the APF of the respirator or class of respirators and the exposure limit of the hazardous substance.

Respirator Terminology

- Maximum Use Concentration (MUC): Math Equation
 - ❖ $APF \times \text{Exposure Limit} = \text{MUC}$
 - ❖ When no MIOSHA exposure limit is available for a hazardous substance, an employer must determine an MUC on the basis of relevant available information and informed professional judgment.

NIOSH Approved Abrasive Blasting Respirators

- Continuous flow, loose hood, APF = 25
- Continuous flow, tight-fitting facepiece, APF = 50
- Positive Pressure, tight-fitting half-mask facepiece, APF = 1000
- Pressure demand or positive pressure, tight-fitting full face piece, APF = 2000

Respirator APF 1910.134(d)(3)(1)(A)

TABLE 1.—ASSIGNED PROTECTION FACTORS⁵

Type of respirator ^{1,2}	Quarter mask	Half mask	Full face-piece	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	

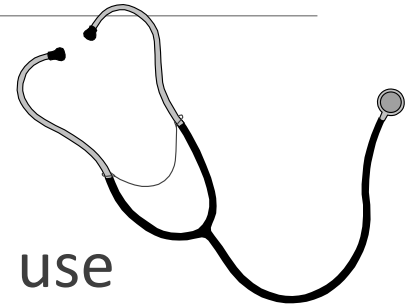
See Handout

Respirator – Medical Exams

- Consists of medical questionnaire
- Physician or licensed health care professional (PLHCP) reviews questionnaire, recommends follow-up examination if medically necessary
 - ❖ Frequency is at the discretion of the PLHCP.
 - ❖ Factors that can change frequency include change in job tasks, type of respirator and/or individual having medical issues when using.

Medical Evaluations

- Required:
 - ❖ When wear any type or respirator
 - ❖ Prior to respirator fit test and before first use
- PLHCP determines:
 - ❖ Whether individual is medically able to wear the respirator
 - ❖ Tests in the follow-up medical exam (as needed)
 - ❖ Restrictions

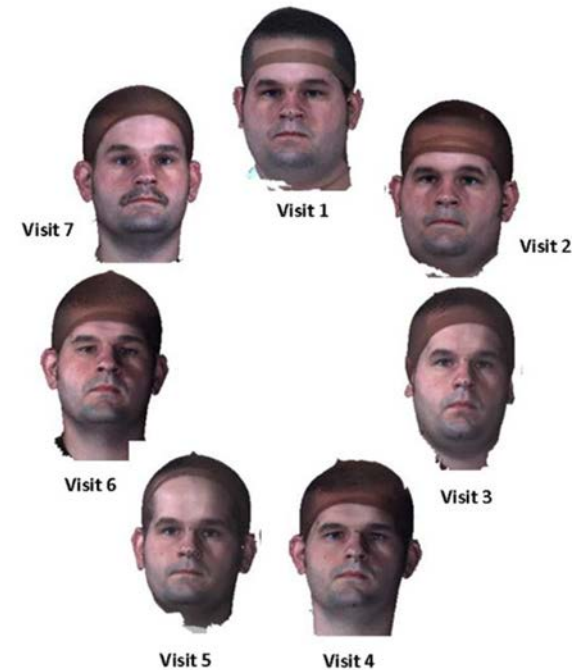


Respirator Fit Testing

- Fit testing is required for all negative or positive pressure tight-fitting face piece respirators
 - ❖ Different sizes and models
 - ❖ Pick size/model to fit person's face
 - ❖ **Required annually when a respirator is required to be worn**
- Type CE abrasive blasting respirators that are loose-fitting (hoods, helmets) DO NOT need to be fit tested
- Types of fit tests:
 - ❖ Qualitative
 - ❖ Quantitative

Why Fit Test? NIOSH Research

- 3-year study: 10% of subjects failed a fit test after 1 year, 20% after 2 years, 26% after 3 years using the same make, model and size respirator
- 24% of subjects who lost \pm 20lbs no longer maintained an acceptable fit
 - ❖ Facial changes requiring fit testing: extensive dental work, scarring, aging, cosmetic surgery.
- Other factors:
 - ❖ Improper storage and maintenance of respirator
 - ❖ Respirator straps losing their elasticity



The Importance of Fit

- Respirator fit is important because it involves several major issues:
 - ❖ Seal
 - ❖ Compatibility with other PPE
 - ❖ Stability



Fit Test Protocol

- Individual wears respirator
- Series of exercises
- Test atmosphere
- Recommended Protocol – Appendix A of the Respiratory Protection Standard

Types of Fit Tests

- **Qualitative**

- ❖ Test agent directed around head of the respirator wearer
- ❖ Subjective test: If user can detect agent, test failed



- **Quantitative**

- ❖ Test atmosphere
- ❖ Quantifies respirator fit using instrumentation to determine the amount of leakage into the respirator face piece



Fit Tests

- **Qualitative Fit Test**

- ❖ Banana oil
- ❖ Irritant smoke
- ❖ Saccharin challenge
- ❖ Bitrex solution

- **Quantitative Fit Test**

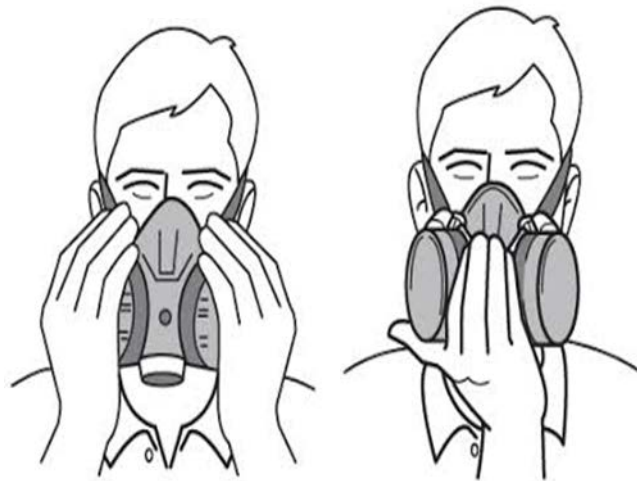
- ❖ Expensive machinery
- ❖ Fit factors
 - Outside air concentration compared to inside the respirator air concentration

Standard prohibits facial hair which interferes with face - to - face piece seal or valve function

User Seal Checks

- Assures a proper fit
- Face to face piece seal
- Recommended protocols in Appendix B-1 of Respirator standard
- User Seal Check
 - ❖ Positive Pressure Check
 - ❖ Negative Pressure Check
- **NOT a substitute for Fit Tests!**

User Seal Check vs. Fit Test



Negative & Positive
Pressure User Seal Checks



Qualitative Fit Test

Respirator Maintenance & Care (Appendix B-2 of 1910.134)

- Clean and disinfect as often as necessary to maintain a sanitary condition
- Inspect before and after each use and after cleaning
- Store away from heat, cold, light, moisture, dusts and chemicals
- Store respirator in a clean area/plastic bag not in work exposed area

Written Respiratory Protection Program

- Must have trained program administrator
 - ❖ Respirator selection
 - ❖ Medical evaluation
 - ❖ Fit testing
 - ❖ Proper use (emergency)
 - ❖ Maintenance program
 - ❖ Respirator air supply monitoring
 - ❖ Employee training
 - Respiratory hazards
 - Proper use of respirator
 - ❖ Program evaluation



<https://www.soph.uab.edu/DSC/respiratory-protection-program>

Compressors

- Locate so contaminated air cannot enter
- Low moisture content
- Inline air-purifying sorbent bed & filter maintained
- Tag showing maintenance kept at compressor
- Pressure reducing valve

Compressors

- Oil Lubricated:
 - ❖ Alarm for overheating
 - ❖ Carbon Monoxide monitor
 - ❖ or both
- Non oil lubricated:
 - ❖ Assure carbon monoxide not more than 10 ppm

Personal Protective Equipment

- Hazard Assessment
 - ❖ Selection
 - ❖ Communication
 - ❖ Fit
- Safe, reliable, sanitary
- Clean, inspect and maintain
- **MUST NOT use defective or damaged PPE**

Hazard Assessment

- Written Certification Required (General Industry only)
 - ❖ Assess workplace for hazards
 - ❖ Certifier
 - ❖ Date of workplace hazard assessment
- Construction: employer shall require each employee to wear PPE according to manufacturer and where there is an exposure to hazardous conditions or are required to wear by health/safety standard(s)

PPE for Abrasive Blasters

- Disposable or washable work clothes (abrasive blasting suit as appropriate)
- Heavy canvas or leather gloves (with gauntlets as appropriate)
- Heavy canvas or leather apron
- Protective head, neck and shoulder gear
- Safety shoes/boots
- Hearing protection (if needed)
- Supplied air respirator

Protective Clothing

- Employee: DO NOT take home! Leave at worksite!
- Employer should launder or dispose of clothing

Hearing Protection

- Selection (formable plugs, pre-molded plugs, earmuffs)
- **Noise Reduction Rating (NRR)**
 - ❖ Amount of decibels that a given device will reduce noise exposure in a *laboratory test*
 - ❖ For most wearers, the NRR significantly overestimates the protection of the hearing protector in the workplace

Using the Noise Reduction Rating

$$\text{Protected dBA} = \text{Unprotected dBA} - [\text{NRR} - 7]$$

Example:

Unprotected Workplace Exposure dBA = 95

Ear Protection NRR = 19

Protected dBA: $95 - [19 - 7] = 95 - [12]$

Protected dBA = 83

Hearing Conservation Program

- **Construction**

- ❖ Required if sound levels exceed values shown in Table D2 of MIOSHA Part 680
- ❖ No specific program elements required by Part 680
 - Recommend incorporating General Industry hearing conservation requirements

TABLE D-2
PERMISSIBLE NOISE EXPOSURES

Duration per day, hours:	Sound Level dBA Slow Response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

Hearing Conservation Program

- **General Industry**

- ❖ Required if sound levels exceed 85 dBA (Action Level)

- ❖ Program elements

- Noise exposure monitoring
 - Noise control process
 - Hearing protection
 - Education and notification
 - Audiometric evaluation
 - Recordkeeping

Remember:

Part 380 (Noise Standard) must be posted if hearing conservation program required

Safety Training

CHAPTER 7

Silica Standard

- Health hazards of exposure
- Specific tasks in workplace = exposure
- Employer protective measures
- Contents of education and training section of silica standard
- Purpose and description of medical surveillance program

Respirator Training

- Annual training (and retraining when required)
- Topics
 - ❖ Why respirator is necessary
 - ❖ How improper fit, usage or maintenance may compromise the protective effect
 - ❖ Use in emergency including situations where respirator malfunctions
 - ❖ Limits/capabilities of respirator
 - ❖ Maintenance and storage
 - ❖ How to inspect, put on, remove, use and check seals of respirator
 - ❖ How to recognize medical signs & symptoms that may limit/prevent effective use of the respirator
 - ❖ General requirements of respirator standard

Hazard Communication

- Training must be performed at time of their initial assignment, and whenever a new chemical hazard the employees have not previously been trained about is introduced into their work area
- Topics
 - ❖ Operations in work area where hazardous chemicals are present
 - ❖ Location/availability of written hazard communication program
 - ❖ Methods/observations used to detect presence of hazardous chemical
 - ❖ Chemical hazards
 - ❖ Protective measures workers can take (PPE, work practices, etc.)
 - ❖ Details of employer's written program including:
 - Labels
 - Safety data sheets, including the order of information and how employees can obtain and use the appropriate hazard information

Personal Protective Equipment

Construction

- **No specific training requirement in Construction PPE standard, Part 6**
- Part 6 does require: An employer shall require each employee to wear personal protective equipment as prescribed by the manufacturer when required by any Michigan occupational safety and health act (MIOSHA) rule.

Personal Protective Equipment

General Industry

- Topics
 - ❖ When, why and what personal protective equipment is necessary
 - ❖ How to wear
 - ❖ Limitations
 - ❖ Care and maintenance
 - ❖ Disposal
 - ❖ Certify with:
 - Employee's name
 - Date of training
 - Subject of training

Noise (General Industry)

- Effects of noise
- Noise controls in workplace
- Purpose of hearing protection
- Instructions on hearing protection use
- Purpose and procedures of audiometric testing

NOISE (Construction)

- If a hearing conservation program is required to be implemented:
- Recommended Topics
 - ❖ Effects of noise on hearing,
 - ❖ Work activities requiring hearing protection
 - ❖ Purpose of hearing protection, t
 - ❖ Advantages, disadvantages and attenuation of various types of hearing protection,
 - ❖ Selection, fitting, use and care of hearing protectors

Medical Records/Trade Secrets

- Initial and annual training
- Existence, location and availability of any record to which the rule applies
- Person responsible for maintaining and providing access
- Employee's right of access to records

Cleaning Up

CHAPTER 8

Housekeeping

- Minimize dust exposure
 - ❖ Wet methods, HEPA-filter vacuum, sweeping compounds, other dust suppression
- Prohibited: compressed air, dry sweeping, dry brushing (unless above methods not feasible)
 - ❖ Employer bears burden showing why wet methods, HEPA, dust suppression infeasible

Why Do I Need a HEPA-Filter Vacuum

- High Efficiency Particulate Air (HEPA)
- Air filter removes from the air that passes through it: 99.97% of particles that have a size greater than or equal to $0.3\ \mu\text{m}$
- Remember!
 - ❖ Respirable dust: $<10\ \mu\text{m}$ diameter
 - ❖ Respirable silica that causes silicosis: $0.2\text{-}5\ \mu\text{m}$

Personal Hygiene

- Vacuum clothing using a HEPA vacuum
- Shower after work
- Wash hands & face before eating, drinking or smoking
- No food, drink or tobacco in blast area – set up separate eating space
- Park cars downwind and/or away from area
- Wear Disposable Clothing

Remember: Silica on
your work clothes and
body becomes silica in
your vehicle and then
silica exposure for
your family

Medical Monitoring

CHAPTER 9



Medical Surveillance

- Required by silica standard
- Reasons for medical surveillance
 - ❖ ID silica-related disease
 - ❖ Determine if employee may have pre-existing condition which may make employee more sensitive to silica exposure
 - ❖ Ability to wear a respirator

Remember: medical surveillance is not a substitute for good dust control in the workplace

Medical Surveillance: Construction

- Required to wear respirator 30 or more days/year
 - ❖ Wearing a respirator anytime during the day counts as one day
- Employer must estimate how often respirator will be used
- If estimate was <30 days and looks like employee will wear the respirator 30+ days, make medical surveillance available

Medical Surveillance – General Industry

- Employees who will be exposed above the PEL for 30 or more days/year
- **June 23, 2020:** Employees who will be exposed above the AL for 30 or more days/year

Frequency of Medical Exams

- Initial exam: within 30 days of assignment
- Periodic exam: At least every 3 years from last exam OR more frequently if recommended by PLHCP

Medical Exam Tests

- In-depth medical and work history (past, present, anticipated – silica exposures, other respiratory agents, respiratory dysfunction, TB and smoking history)
- Physical exam – special emphasis on the respiratory system
- Chest x-rays – specific requirements see standard
- Pulmonary function test (spirometry)
- Testing for latent TB infection (initial exam only)
 - ❖ blood or skin test
- Any other tests deemed appropriate by the PLHCP

Chest X-Rays

- All chest x-rays **must** be interpreted by a licensed doctor who is specially certified by the federal government to review the x-ray. These doctors are called B readers. The list of all B readers in Michigan and the rest of the country can be found:

<https://wwwn.cdc.gov/niosh-rhd/cwhsp/ReaderList.aspx>

Employers Must Provide to PLHCP

- Ensure PLHCP has copy of relevant silica standard
- Description of employee's former, current, future duties related to silica exposures
- Employee's former, current, and anticipated levels of occupational exposure to respirable crystalline silica
- Description of PPE used or to be used, including when and how long it is used
- Information from records of employment-related medical exams previously provided to employee if possible (within the control of the employer)

PLHCP Must

- Write a *medical report*
 - ❖ PLHCP must explain written medical report to the employee
 - ❖ Provide the medical report to employee within 30 days (employer does not receive a copy)

Written Medical Report from PLHCP to Employee

- A statement indicating the results of the medical exam, any medical conditions that would place the employee at increased risk of material impairment to health from silica and any conditions that require further evaluation or treatment
 - ❖ Reportable Condition: 1/0 on chest film
- Any recommended limitations on the employee's use of respirators

Written Medical Report from PLHCP to Employee

- Any recommended limitations on the employee's exposure to silica
- A statement that the employee should be examined by a specialist if the chest X-rays is classified as 1/0 or higher by the B Reader, or if a referral to a specialist is otherwise deemed appropriate by the PLHCP

Employer Receives from PLHCP

- Written *medical opinion* within 30 days of the medical examination. The written opinion shall contain only the following:
 - ❖ Date of the exam
 - ❖ A statement that the exam has met the requirements of this section
 - ❖ Any recommended limitations on the employee's use of respirators

Employer Receives from PLHCP

- If employee provides written authorization, written opinion shall also contain either or both of the following:
 - ❖ Any recommended limitations on the employee's exposure to silica
 - ❖ A statement that the employee should be examined by a specialist regarding X-ray results or other specialist deemed appropriate

Employer Must Give to Employee

- The employer shall ensure that each employee receives a copy of the written *medical opinion* for the employer within 30 days of the exam

Keeping Family Safe

CHAPTER 10

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Keeping Family Safe

- Don't take silica dust home!
- Air regulations keep communities from inhaling respirable crystalline silica from abrasive blasting activities
- Water regulations and proper waste disposal minimizes exposure for animal and people to other heavy metal exposure from waste products resulting from abrasive blasting

Remember: Silica on
your work clothes and
body becomes silica in
your vehicle and then
silica exposure for
your family

Summary

ONLY YOU CAN KEEP YOUR FAMILY
SAFE - DON'T BRING SILICA HOME

What Precautions Can Reduce the Risk?

- Substitute alternative blasting medias
- Maintain dust control systems
- Blast in automatic blast cleaning machines or cabinets
- Conduct air monitoring
- Use proper respiratory protection

What Precautions Can Reduce the Risk?

- Worker training
- Practice good personal hygiene
- Wear disposable clothing
- Shower/change clothes
- No food, drink, tobacco in blast areas
- Provide medical monitoring
- Post warning signs to mark contaminated areas

Awareness



Planning



Communication



Prevent Silicosis