

## Webinar

# Respirable Crystalline Silica Standard

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# Respirable Crystalline Silica Standard - Overview

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# Topics to Be Covered

- Previous regulatory requirements
- Overview of crystalline silica, where is it found and what are the potential health implications
- What the new Standard requires
- Compliance strategies and approaches – Table 1 or Exposure Assessment via air sampling



# Respirable Silica – Regulatory History





# Past Regulatory History

- Prior to the Respirable Silica Standard, OSHA did not have a specific standard for silica
- There was a respirable particulate PEL in the OSHA Z-3 Table.
- There was a calculation that was then done on each sample based on the % silica to determine the PEL.
- This was prone to significant mistakes and errors.
- The standard was more than 45 years old and used units that are not even in use anymore.



# What Has Changed

- Now there is a comprehensive standard
- The Permissible Exposure Limit (PEL) has been reduced to about 1/5 of what it previously was.
- The new Standard focuses on engineering controls as compared to personal protective equipment.
- It requires that medical surveillance be offered to highly exposed workers





# What is Crystalline Silica?





# What is Silica?

- Silica
  - One of the two most common compound found in the earth's crust
  - Composed of the elements silicon and oxygen (aka "silicon dioxide")
- Occurs in two major forms
  - Amorphous Silica
  - Crystalline Silica



# Amorphous Silica





- Amorphous Silica – e.g. Diatomaceous Earth, Silica Gel – does not present the same health concerns
- It has a more random internal structure
- Has a NIOSH REL of 6 milligrams/m<sup>3</sup> and a PEL of 5 mg/m<sup>3</sup>

# Crystalline Silica



## Crystalline Silica

- Has an organized internal crystal lattice structure and is associated with specific health concerns
- It is the focus of the standard and what we are referring to as silica for the rest of this presentation



# Three Major Types of Crystalline Silica

- Quartz (aka “sand”) – the most commonly encountered form in construction work
- Cristobalite and Tridymite
  - less commonly found in concrete products
  - often used for high temperature applications (e.g. boiler block insulation, etc.)

# Respirable Crystalline Silica





# Dust Particle Size



# Dust Particle Size

- A visible “cloud” of dust is made up of particulates of various sizes.
- A very large portion of the cloud is too large to inhale into the lungs.
- Some portion of that dust will be the respirable portion ( $<10\text{ }\mu\text{m}$ ) that can be inhaled deeply into the lungs.
- Smaller particles tend to penetrate more deeply into lungs.





## Respirable Silica

The new standard focuses on these small particles that are less than 10 microns.

Five times smaller than the diameter of a human hair.

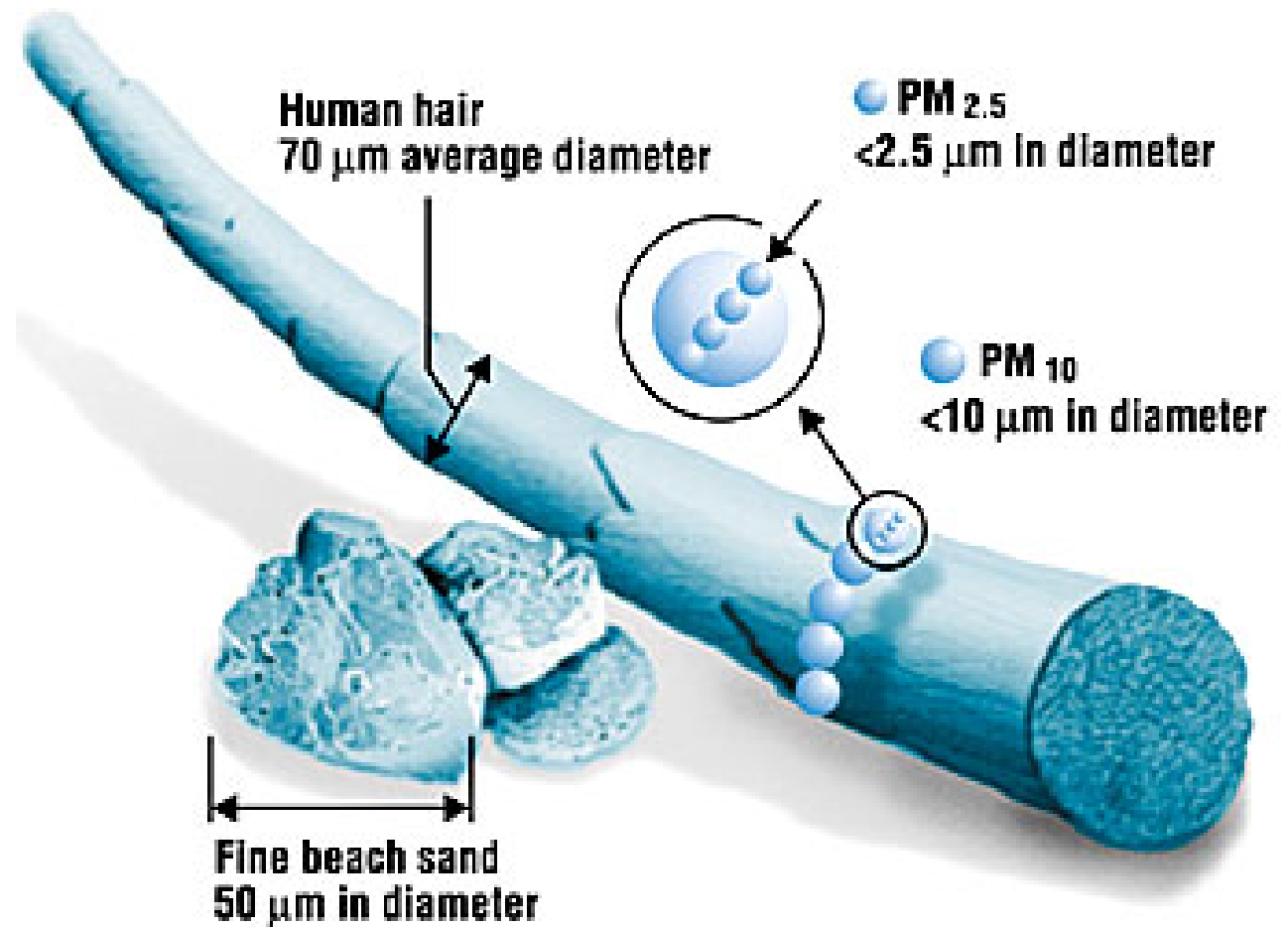


Image courtesy of EPA Office of Research and Development

# Where is Crystalline Silica Found?





Where is it found...

Silica is the main component  
of sand



Where is it found...

Naturally occurring granite



## Industrial and Commercial Occurrences

Any Products in which sand is a significant component...



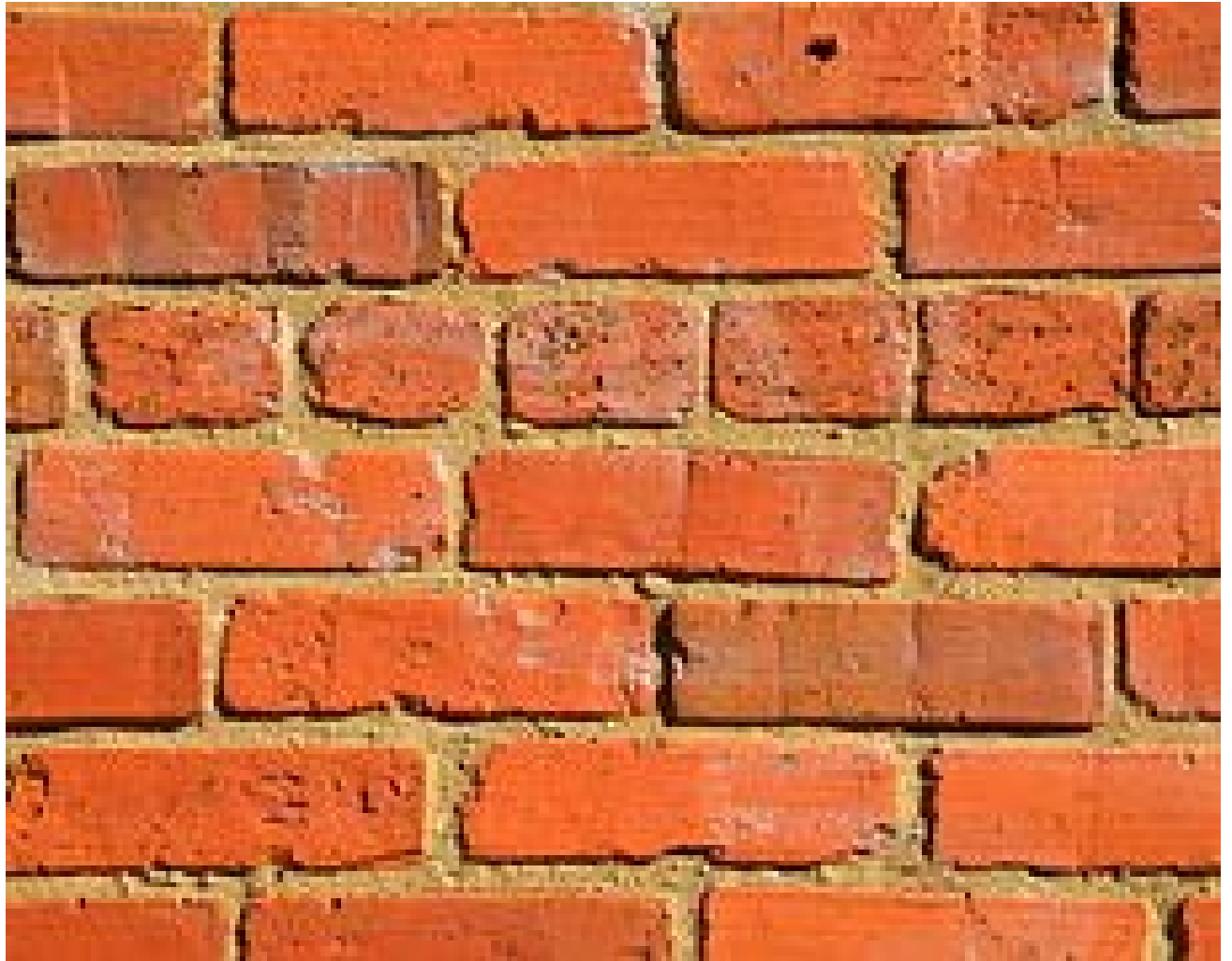
Any product that  
contains sand...

Concrete



Any product that  
contains sand...

Brick



Any product that  
contains sand...

## CMU Block





Any product that  
contains sand...

## Ceramic Tile



Any product that  
contains sand...

Mortar



Any product that  
contains sand...

## Grout



Any product that  
contains sand...

## Clay Tiles or Pipes



Any product that  
contains sand...

## Roadway Asphalt - Aggregate



Any product that  
contains sand...

## Terrazzo Floors



# Decorative Items



# Respirable Silica – Health Effects







# Scope of the Concern/Benefits

- About 2.3 million workers are exposed to crystalline silica containing dust
- 90% of these work in construction.
- OSHA estimates that new standard will prevent more than 900 cases of silicosis each year and save over 600 lives per year
- Worldwide, silica is a leading cause of death and disability in construction industry.



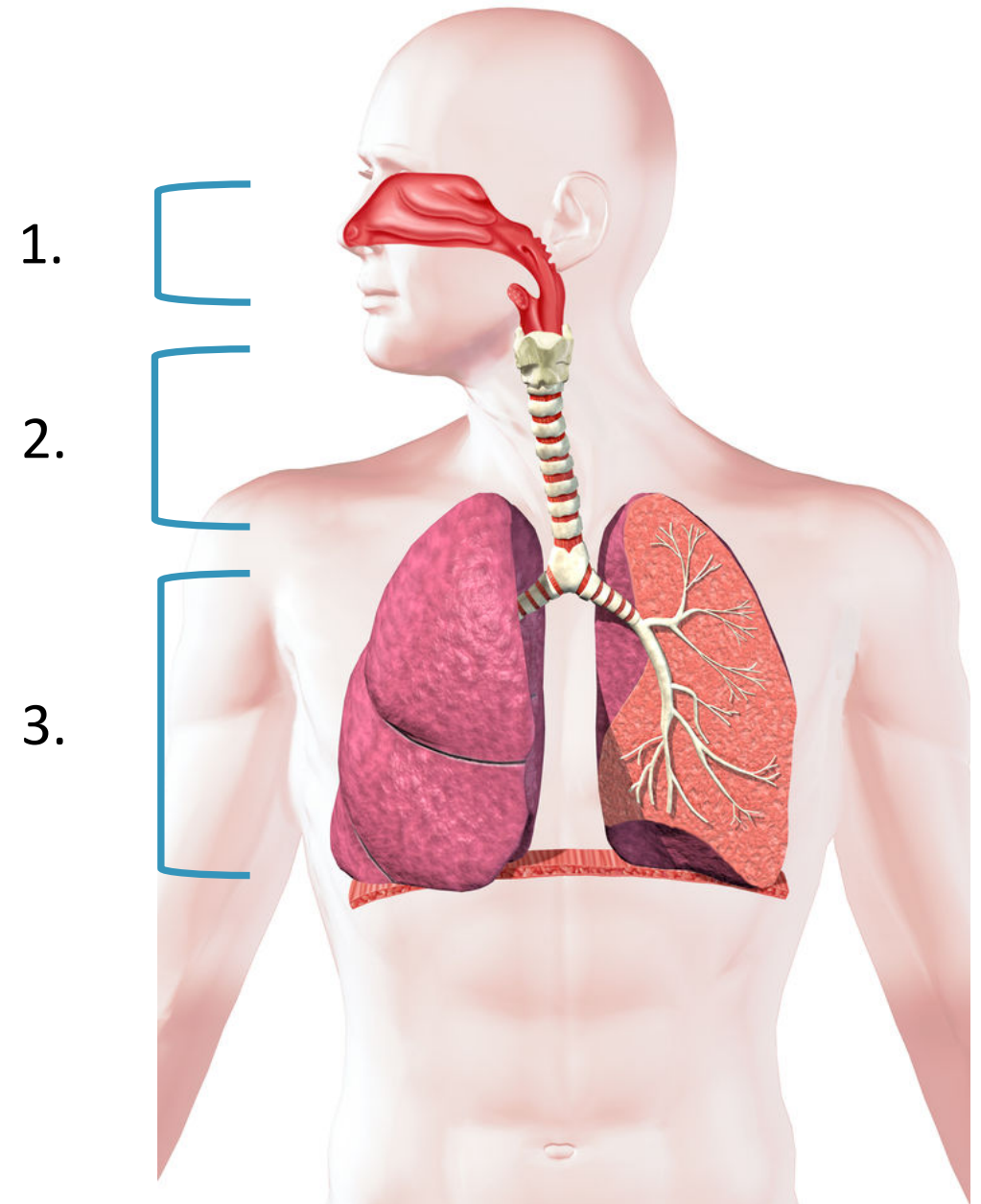
# How Does Exposure Occur?

- Mostly through inhalation of dust
- The body has protective measures to keep materials out
- These systems can be overwhelmed



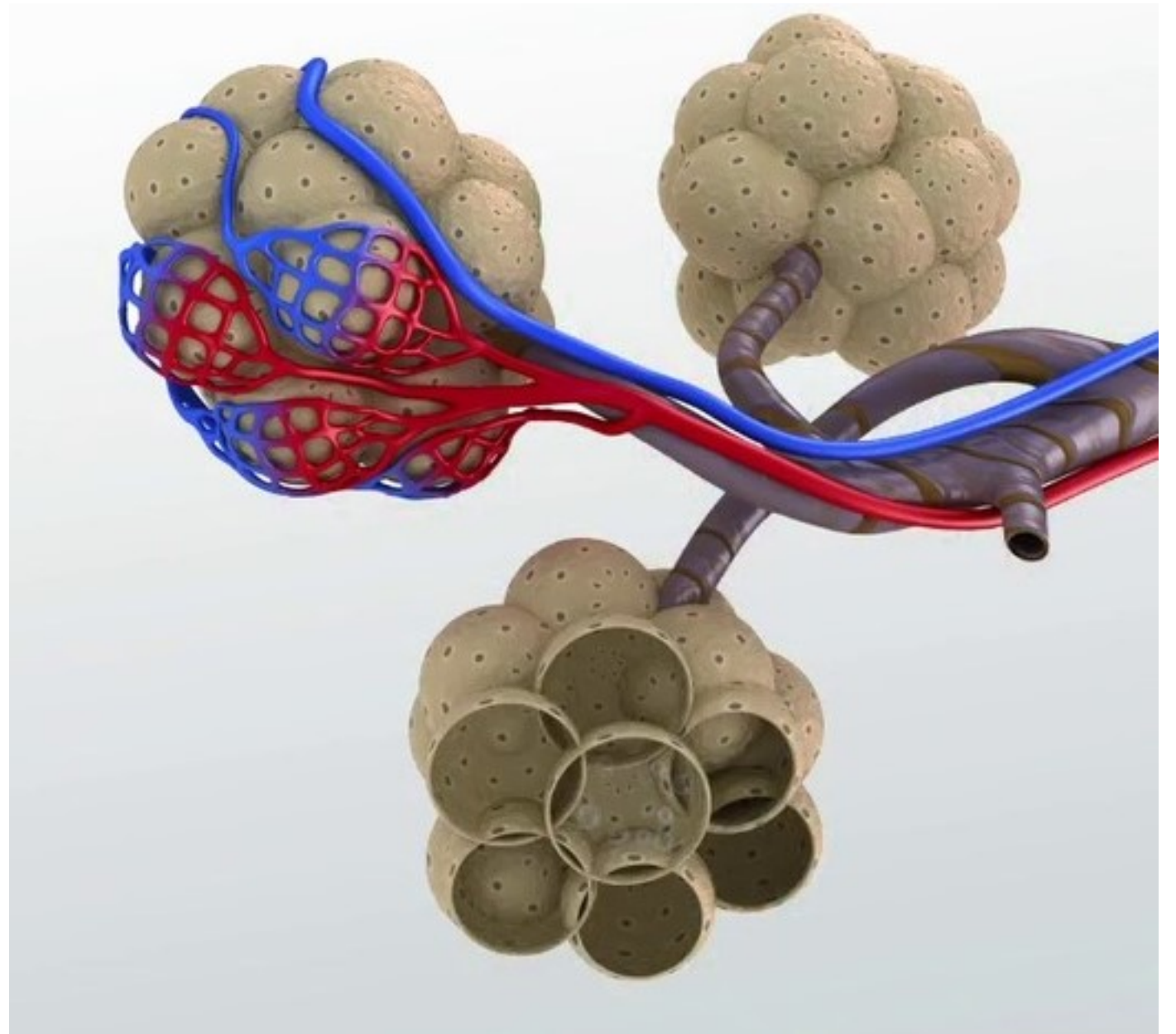
# Pulmonary System

- Large (Coarse) Particles that are inhaled are limited to area 1.
- Fine Particles can penetrate deeper into area 2.
- Respirable Particles can penetrate into area 3.



## Alveoli

- This is where gas exchange happens.
- About 300,000,000 sacs in an adult
- It's also where silica has its effect.





# Silicosis

- Sometimes referred to as Grinder's Disease
- Caused by inflammation and formation of scar tissue in the lungs
- It interferes with gas exchange between lungs and blood
- It is progressive
- It is irreversible

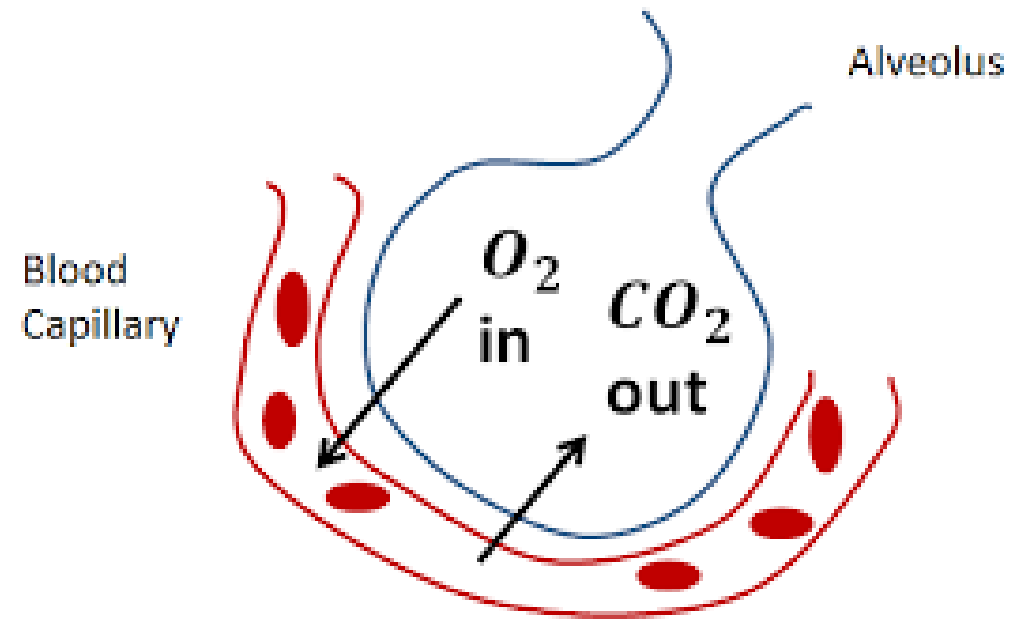
# Types of Silicosis

- Acute silicosis – happens quickly over weeks or a couple of years of high exposure. Causes extensive inflammation in lungs and fluid build up, causing cough, weight loss, and fatigue.
- Accelerated silicosis - causes swelling in the lungs which occurs within 10 years of high-level exposure.
- Chronic silicosis – Most common type. Appears 10 to 30 years after exposure. Causes extensive scarring, areas of swelling in the lungs and chest lymph nodes, making breathing difficult.

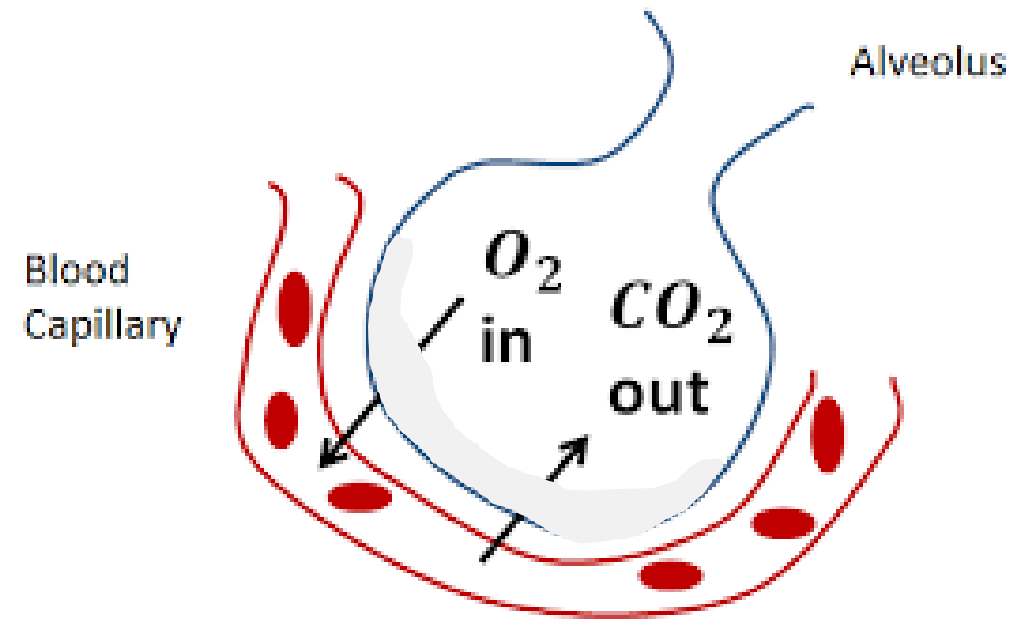
# Gas Exchange

Oxygen enters blood stream  
at alveoli

Carbon Dioxide leaves at  
alveoli

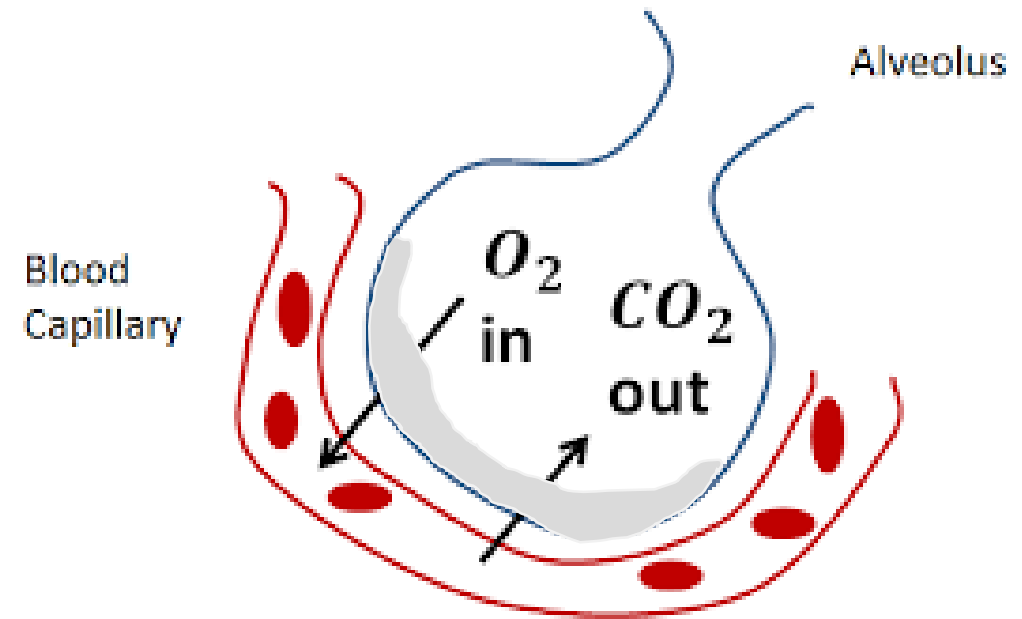


Inflammation causes scarring  
and decreased gas movement  
from and to blood

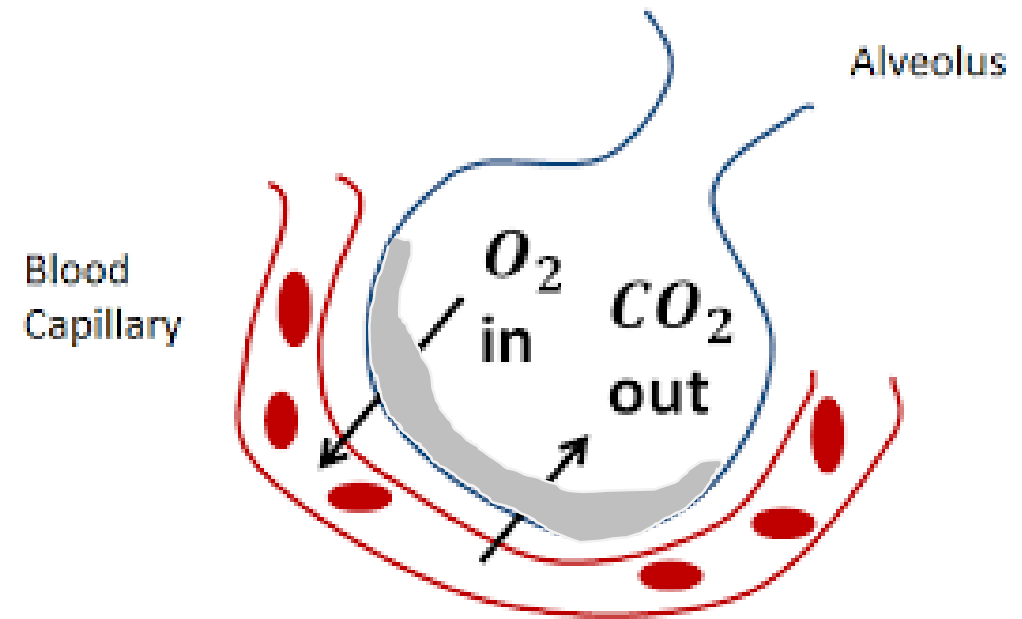




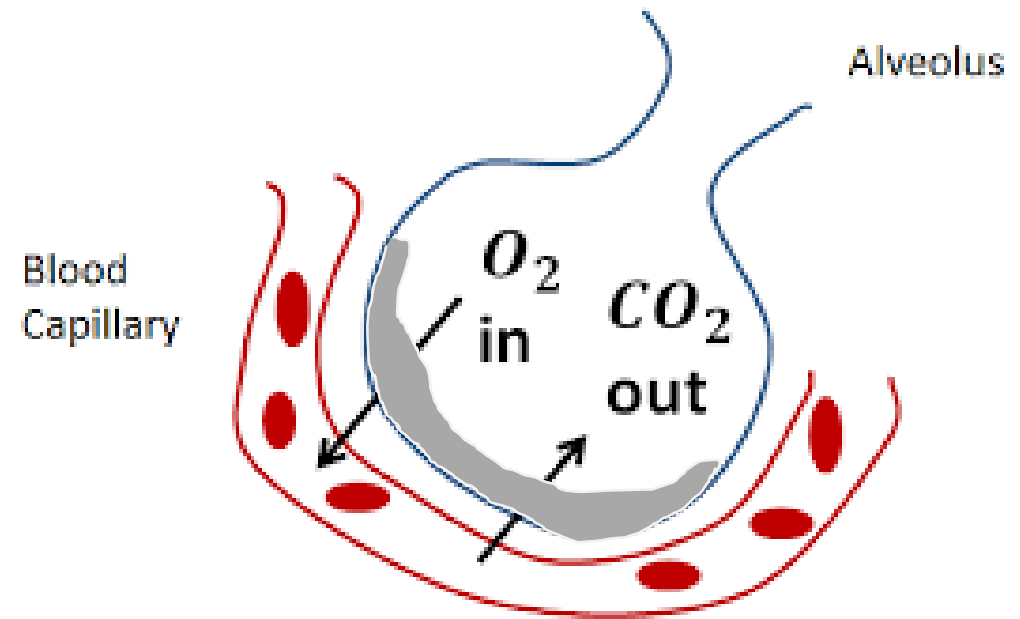
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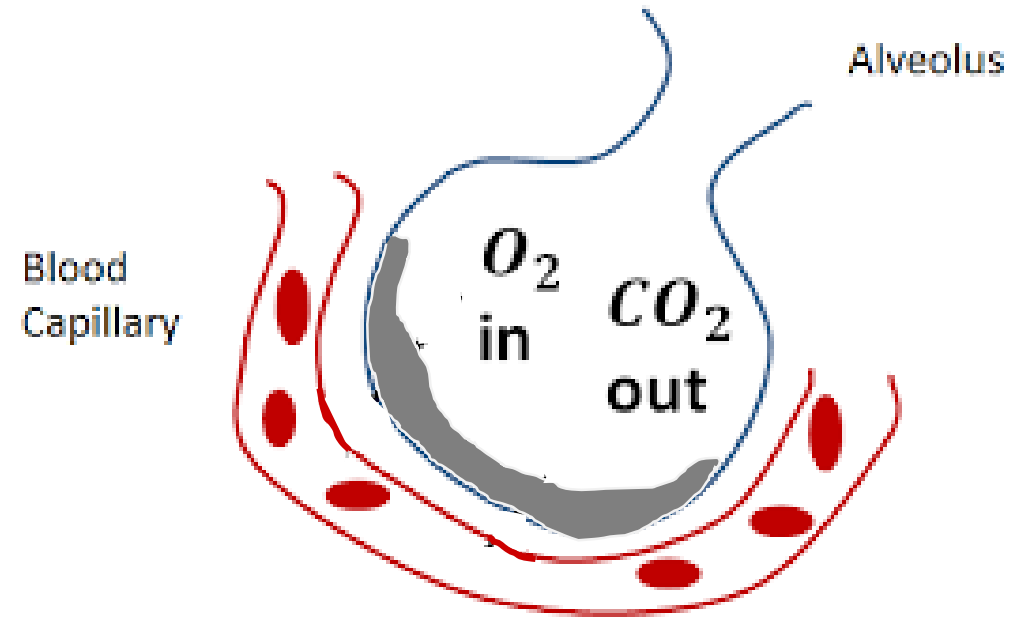
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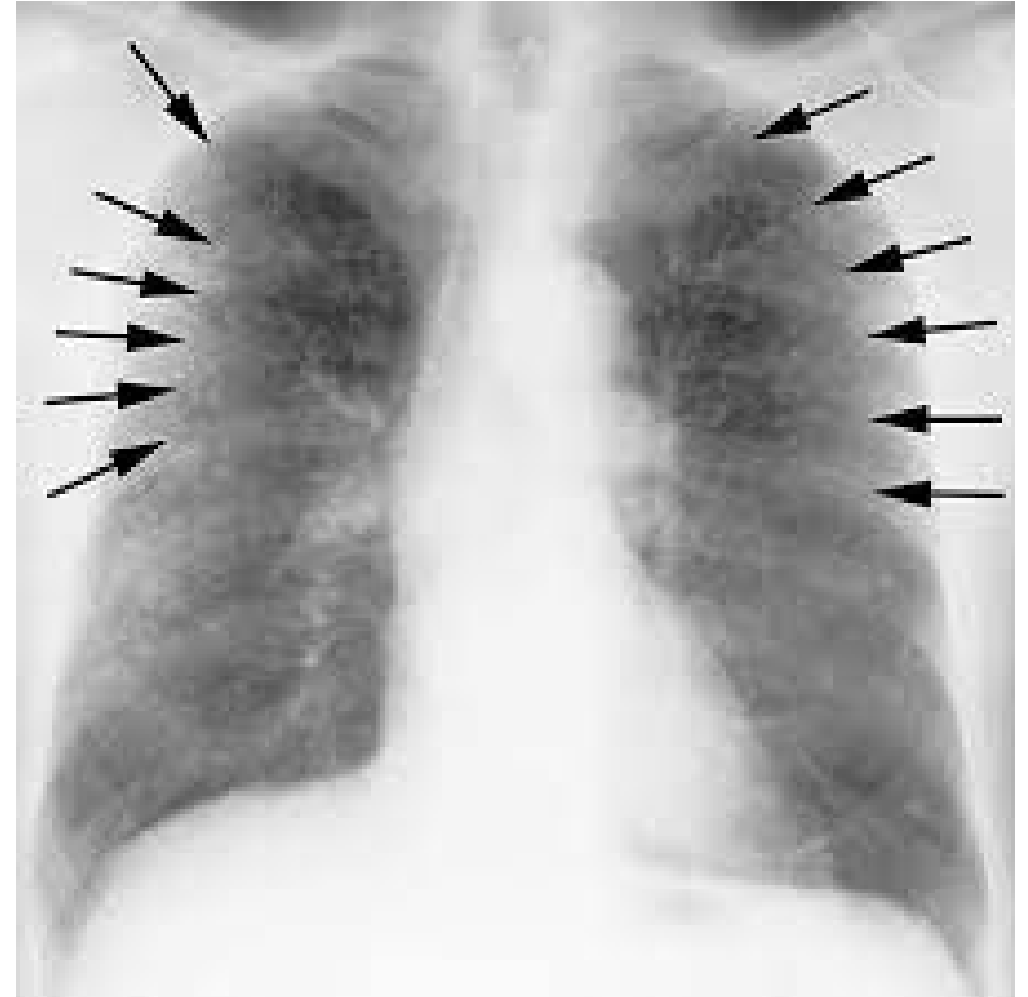
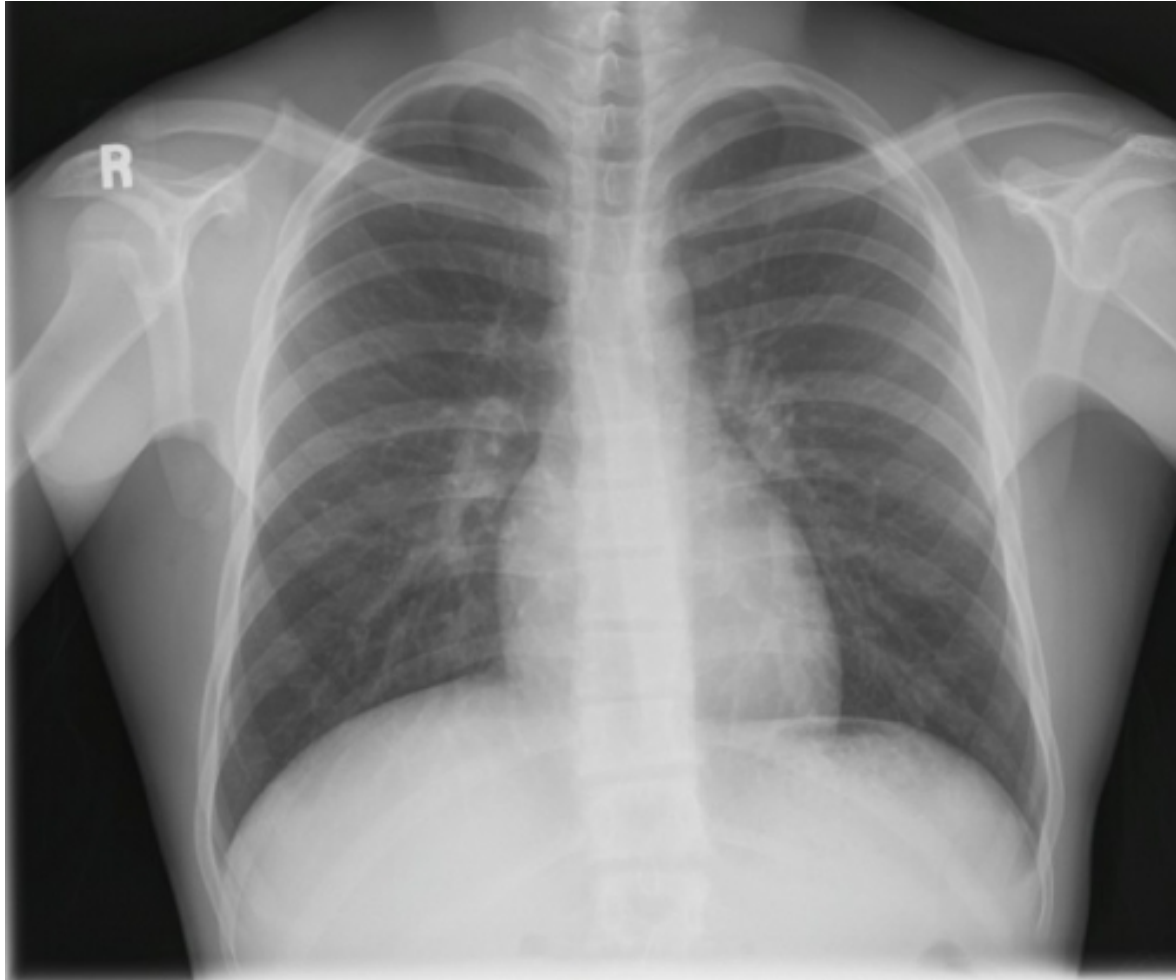


Scarring is progressive,  
ultimately resulting in little or  
no gas transfer.

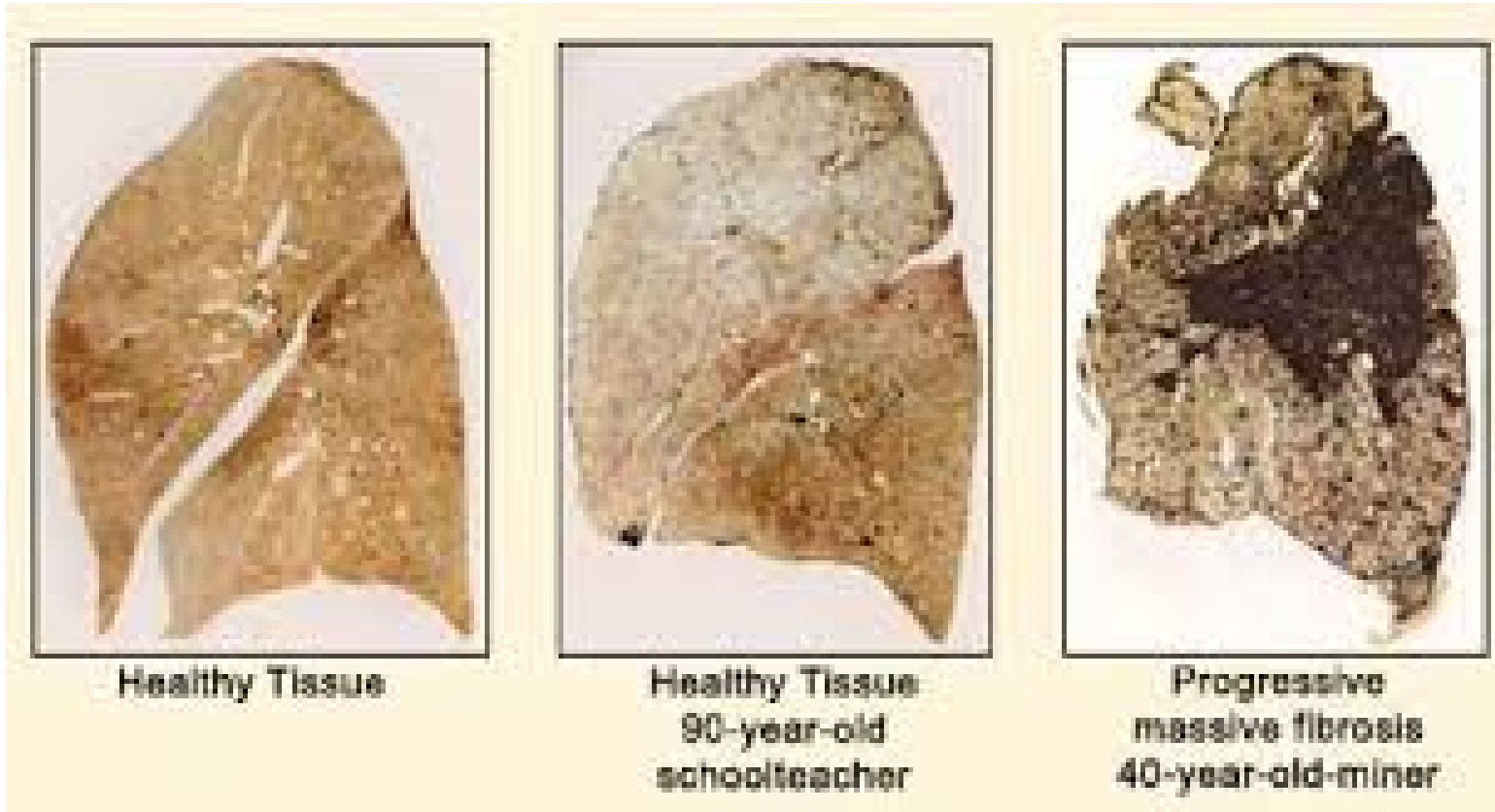




# X-rays of Healthy Lung vs Lung with Silicosis



# Silicotic Lung





# Lung Cancer

- Silica has been confirmed to be a human carcinogen by the World Health Organization.
- It appears that cigarette smoking can increase the potential risk of developing cancer in combination with silica exposure.

# Kidney Disease

- Silica exposure has been linked to kidney disease
- The inflammation response affects the kidneys.



# Increased Risk of Tuberculosis

- If TB bacteria is present, the presence of silica exposure and/or silicosis makes an individual more likely to become infected.

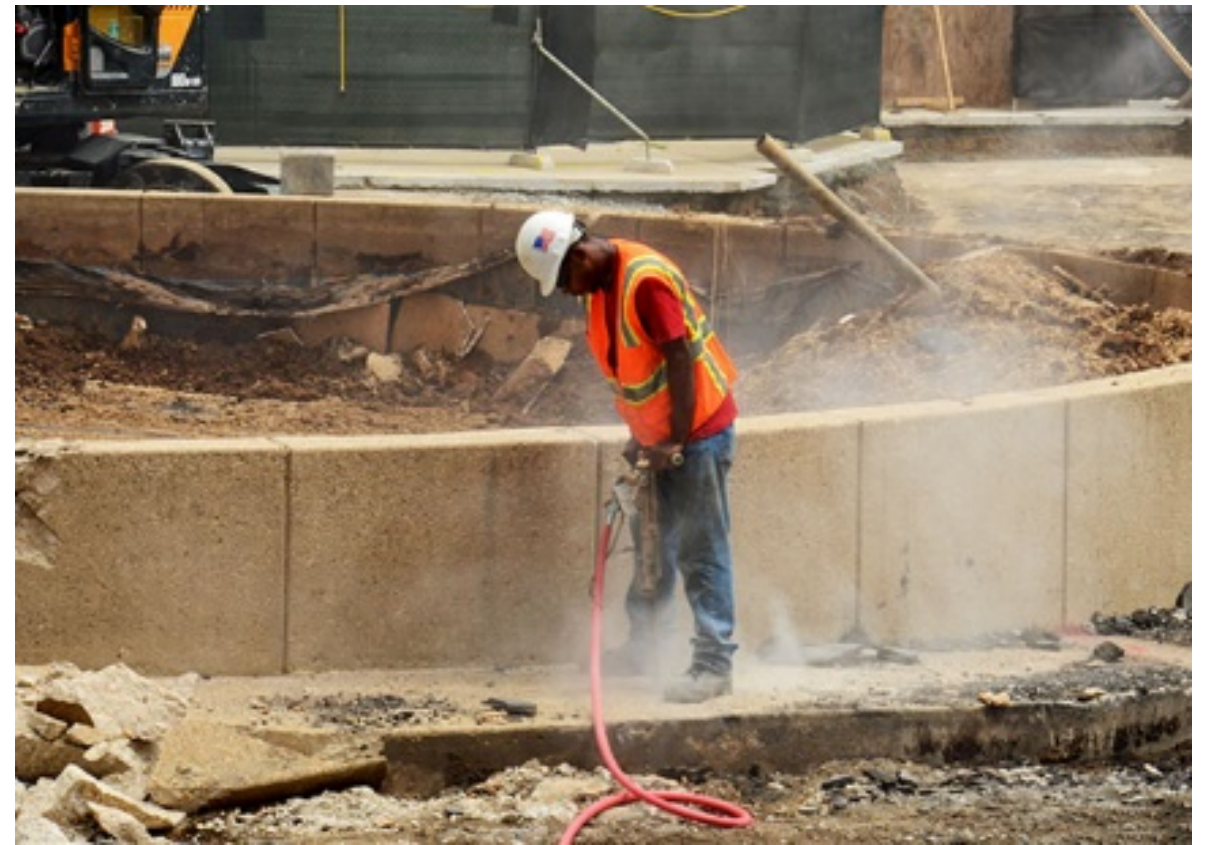


# Potential Health Effects

- NIOSH also states that there may be a link between silica exposure and autoimmune diseases
  - Scleroderma
  - Rheumatoid Arthritis
  - System Lupus Erythematosus

# What Type of Activities Can Lead to Exposure?

















# Exposure Prevention



# Where Do Exposures Occurs

- Construction
  - General Construction
  - Demolition Activities
  - Steelwork
  - Painting Steel Structures/Abrasive Blasting
  - Masonry Work
  - Concrete Products





Hazard = Toxicity X Exposure



# Respirable Silica – Employer Requirements





# §1926.1153 Respirable crystalline silica

- (a) Scope and application
- (b) Definitions
- (c) Specified exposure control methods
- (d) Alternative exposure control methods
- (e) Respiratory protection
- (f) Housekeeping
- (g) Written exposure control plan
- (h) Medical surveillance
- (i) Communication of respirable crystalline silica hazards to employees
- (j) Recordkeeping
- (k) Dates





# Step 1 – Designate a Competent Person

- Each employer is required to identify at least one Competent Person
- Responsible for frequent and regular inspections of materials, operations and equipment.



# Competent Person

Defined as:

- An individual who is capable of recognizing and assessing the potential hazards

**AND**

- Has the authority to take corrective action







## Step 2 - Review of Work Operations to Identify Silica related Activities

- Employer surveys company operations to identify where concrete dust is being generated.
- Review each operation to ensure that proper controls are being used.

# Step 3 - Develop Company Specific Exposure Control Plan (ECP)

- Once all tasks have been assessed and control methods/approaches established, employer must prepare a written Exposure Control Plan (ECP).
- ECP summarizes company's tasks and the engineering controls, work practices and respiratory protection required to minimize exposures.
- ECP also addresses more general issues including:
  - Controlling worker access to areas where dust is being generated
  - Housekeeping measures to follow to avoid re-suspending dust
- ECP shall be reviewed at least annually.
- It identifies the Competent Person



# Develop and Implement Engineering Controls

- Company can identify their own procedures or they can use a list of work procedures listed in the standard (Table 1).
- Tasks that aren't listed in the table need to be assessed on a case by case basis, typically requiring air monitoring.
- The standard emphasizes engineering controls over the use of personal protective equipment.
- PPE can be used when other methods are not adequate alone.



# Table 1 Tasks/Operations

1. Stationary Masonry Saws
2. Handheld Power Saws - Any Blade Diameter
3. Saws for Cutting Fiber Cement Board (blades < 8 inches)
4. Walk Behind Saws
5. Driveable Saws
6. Rig Mounted Core Saws or Drills
7. Handheld and Stand Mounted Drills
8. Dowel Drilling Rigs for Concrete
9. Vehicle Mounted Drill Rigs for Rock and Concrete
10. Jack Hammers and Handheld Powered Chipping Tools
11. Handheld Grinders for Mortar Removal
12. Handheld Grinders for Uses other than Mortar Removal
13. Walk Behinds Milling Machines and Floor Grinders

# Table 1 Tasks/Operations (con't)

- 14. Small Driveable Milling Machines  
( $<$  half a lane)
- 15. Large Driveable Milling Machines  
(greater than half a lane)
- 16. Crushing Machines
- 17. Heavy Equipment and Utility  
Vehicles Used to Abrade or  
Fracture Silica Containing  
Materials
- 18. Heavy Equipment and Utility  
Vehicles Used for Grading and  
Excavating

# Step 4 - Develop and Implement a Respiratory Protection Program

- If work tasks require it, the employer must develop a written Respiratory Protection Program.
- Ensure that workers are medically cleared to wear respirators.
- Conduct annual respirator fit tests.





# Step 5 - Control Access to High Exposure Work Areas

- The employer needs to ensure that non-essential workers are restricted from entering high exposure work areas.
- This can be by procedure, using warning tape and/or signs.

## Step 6 - Housekeeping

- Dry sweeping and dry brushing prohibited if it could contribute to worker exposures unless other methods are not feasible
- Compressed air can't be used to clean clothing or surfaces unless used with a ventilation system to capture the dust that is generated by the compressed air.



# Step 7 - Offer Medical Exams to Highly Exposed Workers

- The employer is required to offer medical exams every 3 years to workers who are required to wear respirators 30 or more days per year.
- This includes an initial baseline medical that includes:
  - Medical and work history
  - Physical examination
  - Chest X-ray
  - Pulmonary function test
  - Testing for latent TB infection
  - Any other tests deemed necessary by the physician



# Offer Medical Exams to Highly Exposed Workers (con't)

- The employer shall provide certain exposure related information to the Physician
- The employer must ensure that the physician provides the employee with the results of the exam.
- The employer must receive a written medical opinion that identifies any limitations that may apply.



# Step 8 - Train All Employees with Silica Exposure

- All workers need to be trained on the following:
  - The health hazards associated with respirable silica exposure
  - Specific tasks in the workplace that could result in exposure
  - Specific measures the employer has put in place to protect workers
  - A description of the standards requirements
  - The identity of the competent person
  - The purpose and description of the medical surveillance program
- Silica needs to be included in the company Hazard Communication Program





## Step 9 - Conduct Air Monitoring (as Needed)

- If the Company opts not to use Table 1, or the task is not listed there, worker air monitoring will likely need to be conducted.
- This air monitoring is conducted on specific tasks to characterize the exposure due to that operation.

# Step 10 - Record Keeping

## 1. Air Monitoring Data

- The employer is required to retain all information associated with air monitoring that is conducted.

## 2. Objective data relied upon to comply with the standard requirements.

## 3. Medical Surveillance Results and Opinions



# Standard Compliance Date

- The standard went into effect in June 2016.
- OSHA began enforcing the new silica standard in the construction industry on Sep 23, 2017





# Summary

- This is the first actual silica standard that OSHA has issued.
- The new Permissible Exposure Limit (PEL) has decreased by 5 times what it was to 50 ug/m<sup>3</sup>.
- The standard emphasizes engineering and administrative controls over personal protective equipment.
- Each employer is required to develop a written exposure control plan (ECP) that describes how they will perform silica related work.
- Compliance with the standard is an OSHA requirement and will likely become a contractual or required bid package component, regardless of the degree of enforcement on OSHA's part.

If you have any questions, comments or need other assistance, please feel free to email us at the following address

[info@respsilica.com](mailto:info@respsilica.com)

Thank you for your time.

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