

Instructions



Michigan Safety Conference 2025

HEALTH HAZARDS IN CONSTRUCTION

Asbestos, Silica, and Lead Risk and Prevention



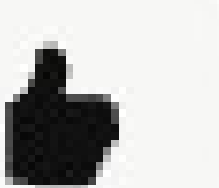
NICOLE ADAMS-GIBSON
CEO & Founder of
Occupational Care Services



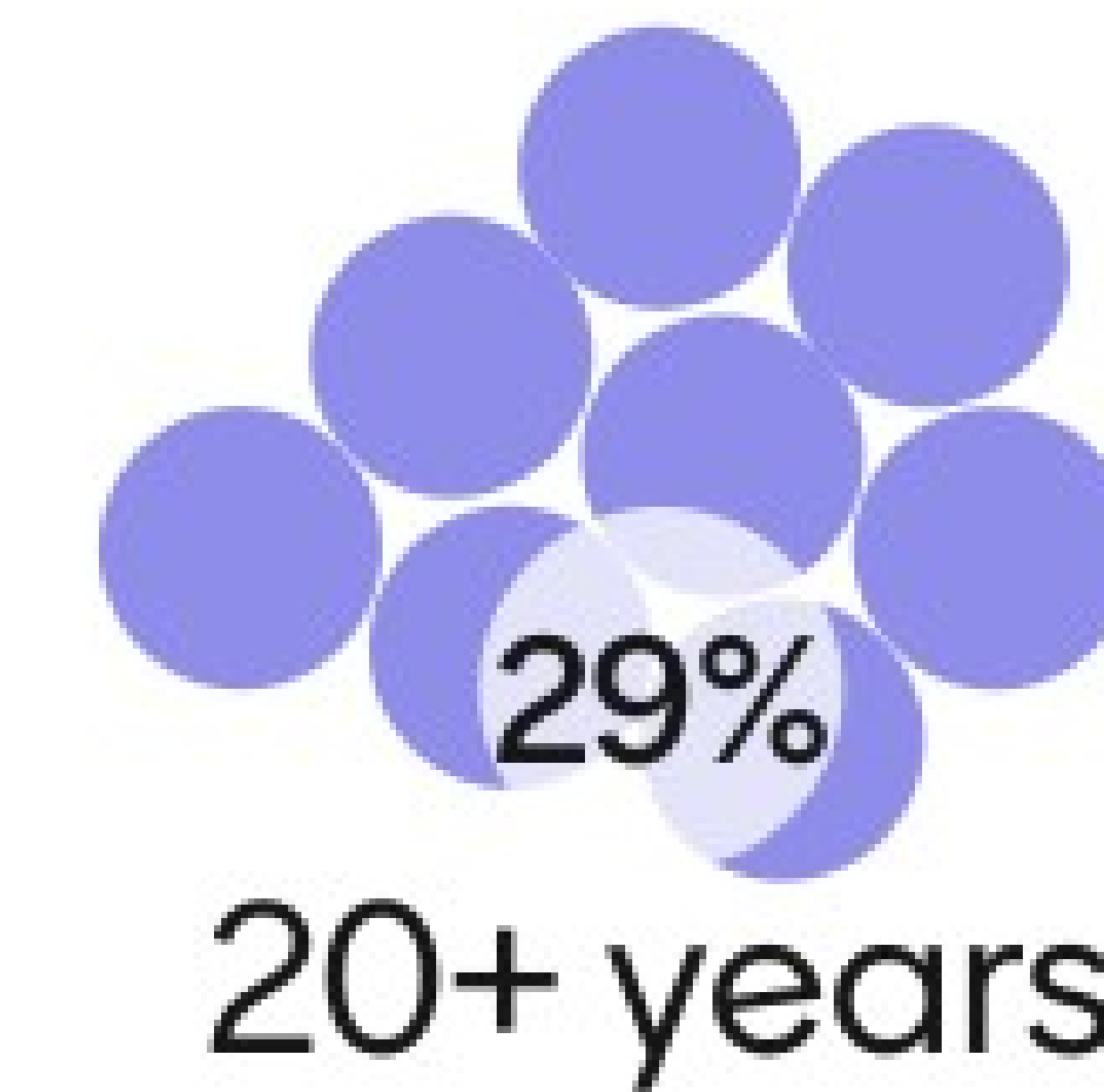
VALENCIA HIRMIZ, DNP
Doctor of Nursing Practice

MEET YOUR SPEAKERS

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How long have you been working in the trades?



PRESENTATION OUTLINE

01. **Introduction**
02. **Asbestos**
03. **Silica**
04. **Lead**
05. **Prevention**
06. **Surveillance**
07. **Closing Remarks & Questions**

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INTRODUCTION

Construction hides dangers: asbestos, silica, and lead. These materials, common in older buildings and some work processes, cause severe illnesses like mesothelioma, silicosis, and lead poisoning. We'll discuss these risks and how to stay safe.



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ASBESTOS: BACKGROUND

- Asbestos is a naturally occurring mineral that forms long, thin fibers.
- Historically used in various construction materials for insulation, fireproofing, and roofing because it's strong, heat-resistant, and fireproof.
- Severe health risks associated with exposure



Strong

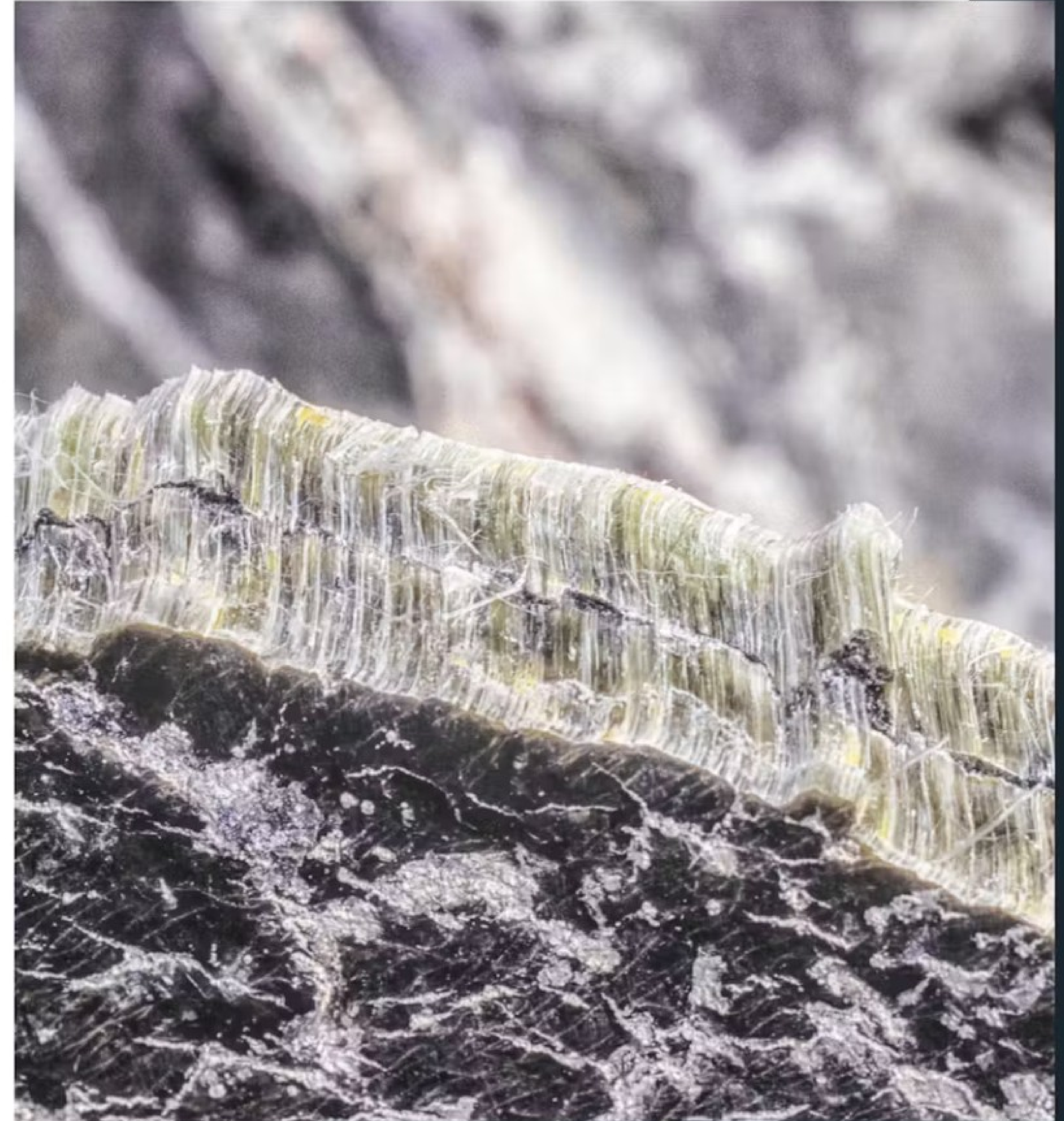


Heat-Resistant



Fireproof

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**INSULATION****FLOOR TILES****FIREPROOFING SPRAY****ROOF SHINGLES**

ASBESTOS: IDENTIFICATION

Insulation: Around pipes, boilers, ducts, attic and wall insulation (especially vermiculite insulation)

Ceiling/ Floor Tiles: Vinyl floor tiles and their adhesive, Sheet vinyl flooring backing

Roofing Materials: Shingles, felt, asbestos cement siding

Fireproofing Spray: Fireproofing materials

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ASBESTOS: AIRBORNE FIBERS



DISTURBANCE

- Disturbing asbestos containing materials through demolition, renovation, and repair work, poses a serious risk by releasing harmful fibers into the air.
- Damaging or deteriorating asbestos-containing products also releases fibers.

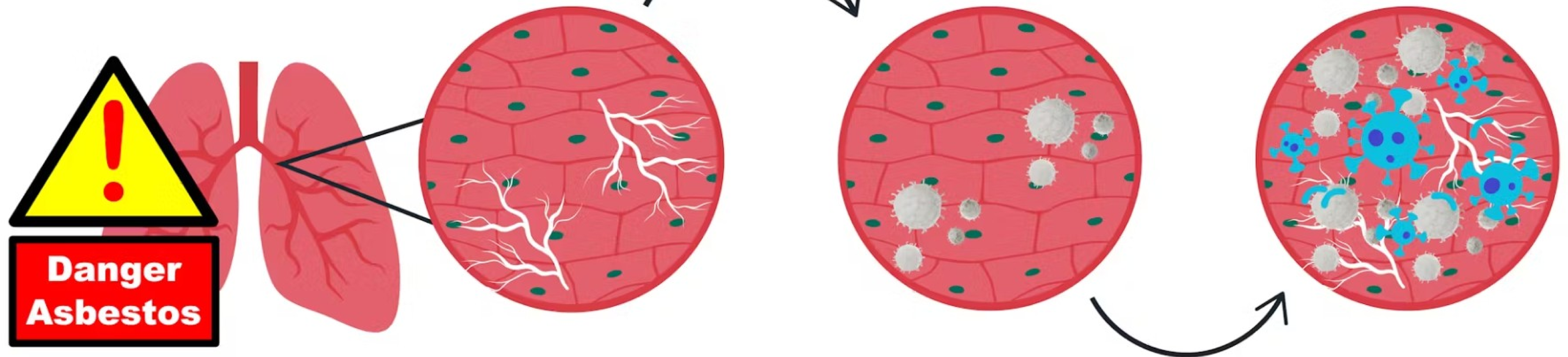
INHALATION

- These fibers are incredibly tiny and can easily be inhaled deep into your lungs.
- Over time, those trapped fibers can cause serious health problems.

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ASBESTOS: COMPLICATIONS



- When asbestos fibers are inhaled, they can penetrate deep into the lungs.
- The lungs' immune system recognizes asbestos fibers as foreign particles.
- Macrophages attempt to eliminate the fibers but are often unable to.
- This triggers an inflammatory response and the recruitment of other immune cells to eliminate the foreign particles.
- However, in the case of asbestos, it becomes a chronic cycle and this contributes to lung damage.

ASBESTOS:

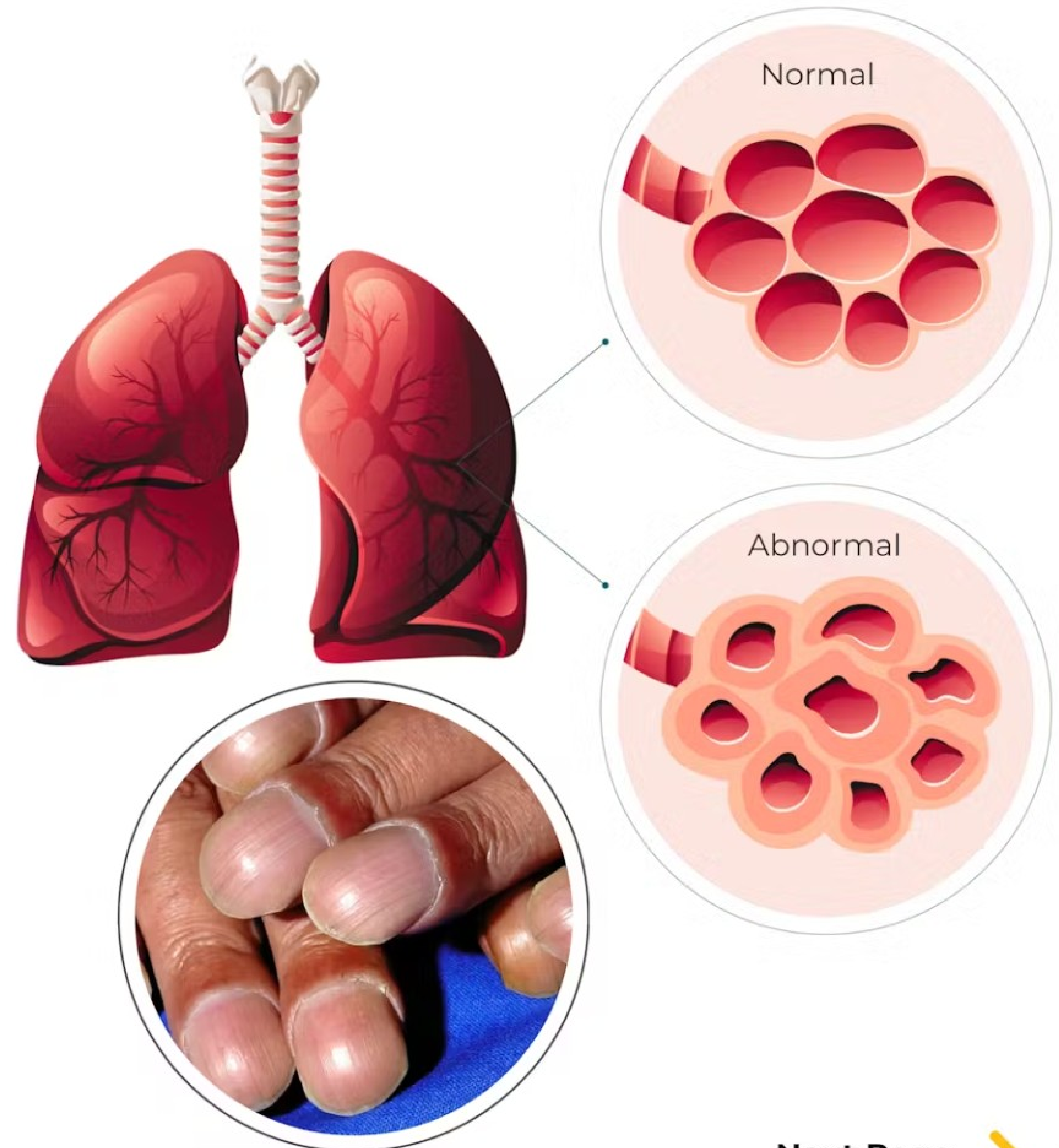
TYPES OF LUNG DISEASE

ASBESTOSIS

- Asbestosis is a chronic and progressive lung disease that causes scarring in your lungs.
- The persistent inflammation leads to the accumulation of fibroblasts (cells that produce collagen).
- Excessive collagen deposition results in the scarring and thickening of lung tissue.
- This reduces lung elasticity and impairs gas exchange.

SYMPTOMS

- Shortness of breath
- A persistent, dry cough
- Chest tightness or pain
- Dry and crackling sounds in your lungs when you inhale
- Fingertips and toes that appear wider and rounder (clubbing)



ASBESTOS:

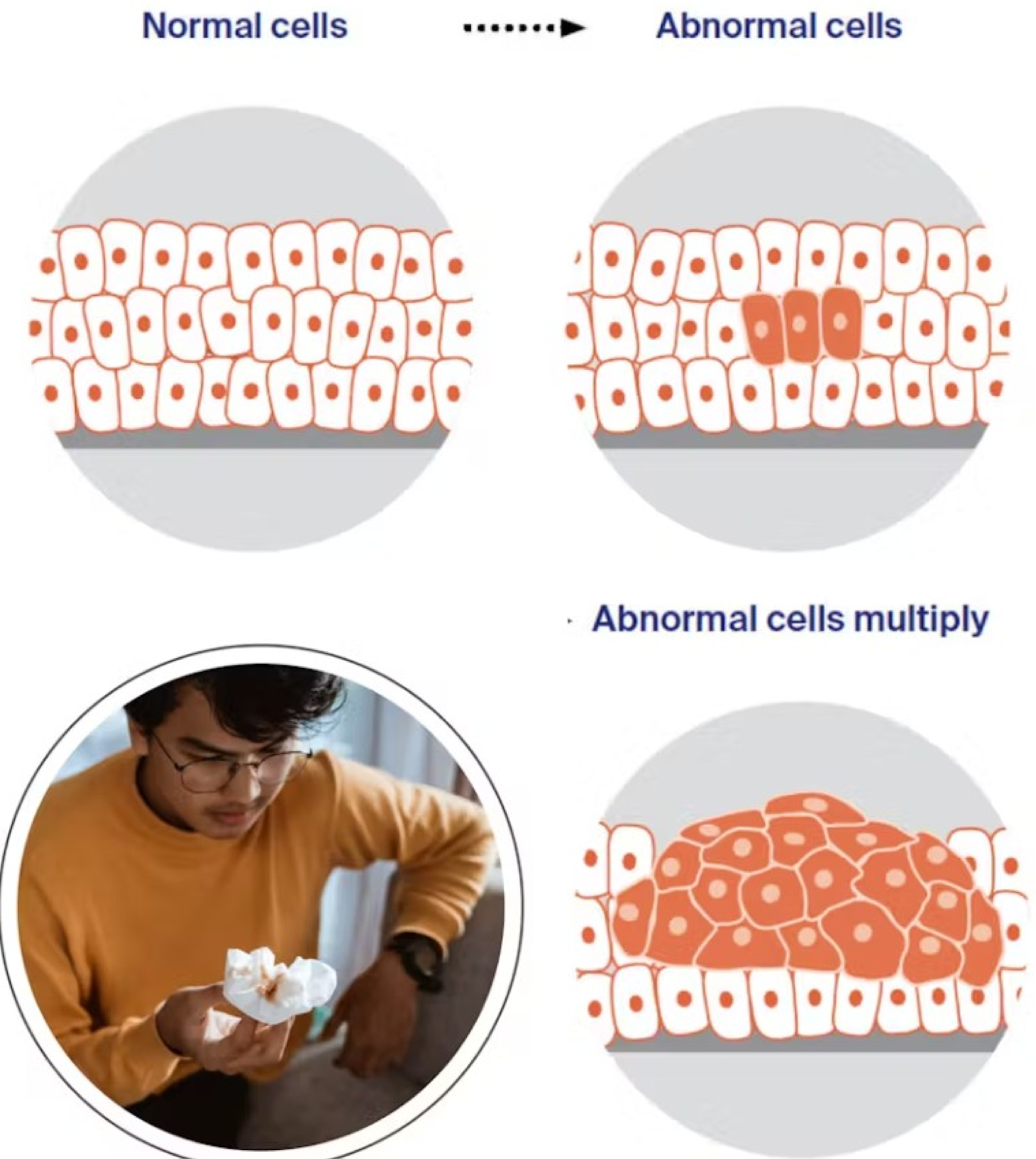
TYPES OF LUNG DISEASE

LUNG CANCER

- The ongoing inflammation and irritation can cause damage to the DNA in your lung cells, leading to mutations.
- These mutations can cause cells to grow out of control, forming tumors.
- Smokers/ Vapers = higher risk of lung cancer.

SYMPTOMS

- Shortness of breath or ongoing breathlessness
- A persistent, dry cough
- Chest tightness or pain
- Coughing up blood
- Unexplained weight loss
- Fatigue



ASBESTOS:

TYPES OF LUNG DISEASE

MESOTHELIOMA

- Mesothelioma is almost always caused by asbestos exposure.
- Mesothelium: thin membrane that lines the inside of the chest cavity, abdominal cavity, and the sac around the heart.
- The asbestos fibers irritate the mesothelium, causing chronic inflammation that leads to changes in the DNA of the mesothelial cells, leading to mutations leading to tumors.
- Very difficult to treat and poor prognosis

SYMPTOMS

- Mesothelioma symptoms can vary depending on where the cancer develops.
- Chest pain, shortness of breath, persistent cough
- Unexplained weight loss, fatigue, night sweats
- Abdominal pain or Abdominal swelling
- Nausea, vomiting, bowel changes

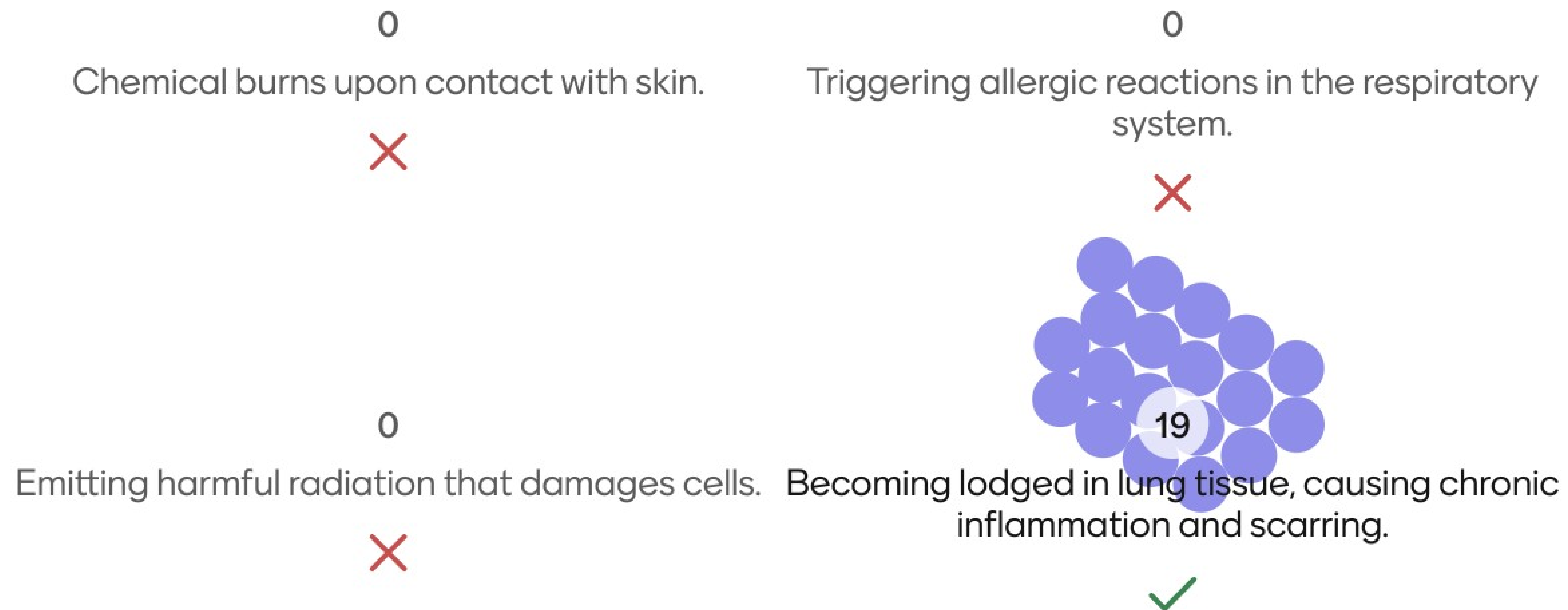
Mesothelioma

Pleura
Lining of lungs

Asbestos Fibers

Mesothelioma Cell

Once in your body, asbestos fibers primarily cause damage by..



SILICA: BACKGROUND

- When silicon reacts with oxygen, we have silica. Silica itself is not dangerous.
- Silica becomes dangerous when airborne.
- There are two forms of silica – crystalline and noncrystalline.
- The most common form of crystalline silica is quartz, which is found in sand, gravel, clay, granite, and many other forms of rock.
- While most airborne silica is too large to be inhaled deeply, workers in specific industries face high-level exposure risks.



**QUARTZ****ASPHALT****MORTAR AND GROUT****CONCRETE**

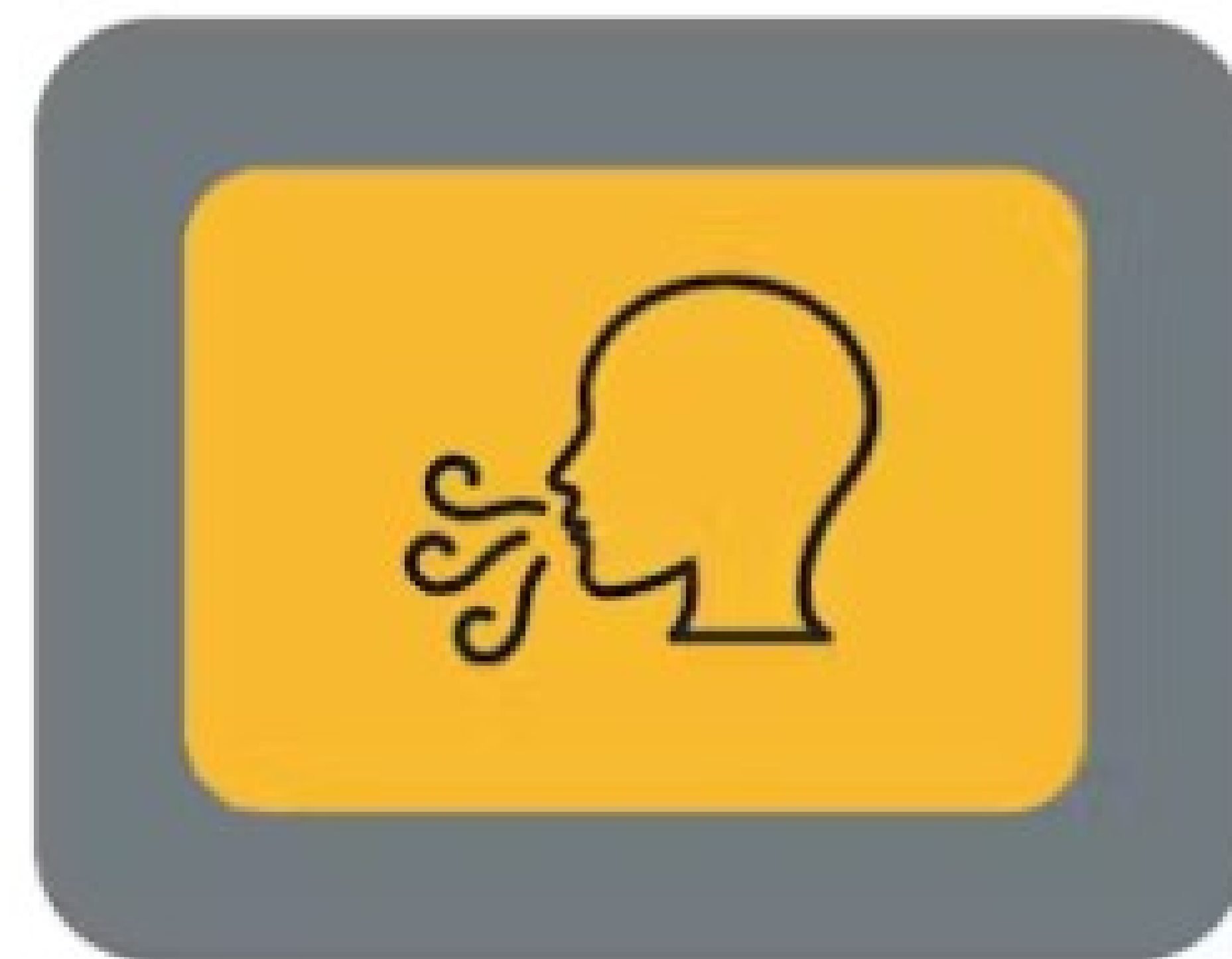
SILICA:

IDENTIFICATION

- Workers in certain industries are exposed to much higher levels of silica than the general population.
- Typical construction materials made from these natural ingredients include:
 - Ceramic and terracotta tiles
 - Concrete and concrete block
 - Manufactured stone
 - Roof tiles
 - Bricks and blocks
 - Grouts and mortar
 - Some joint compounds
 - Abrasive materials

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SILICA: AIRBORNE DUST



DISTURBANCE

Disturbing silica containing materials such as blasting, cutting, drilling or grinding materials can cause workers to breathe air containing small particles (respirable) of silica dust.

INHALATION

- These particles are so fine that you might not notice them, but they can be easily inhaled.
- They're small enough to bypass your body's natural defenses and travel deep into the lungs.
- Over time, it can cause serious health problems.

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SILICA:

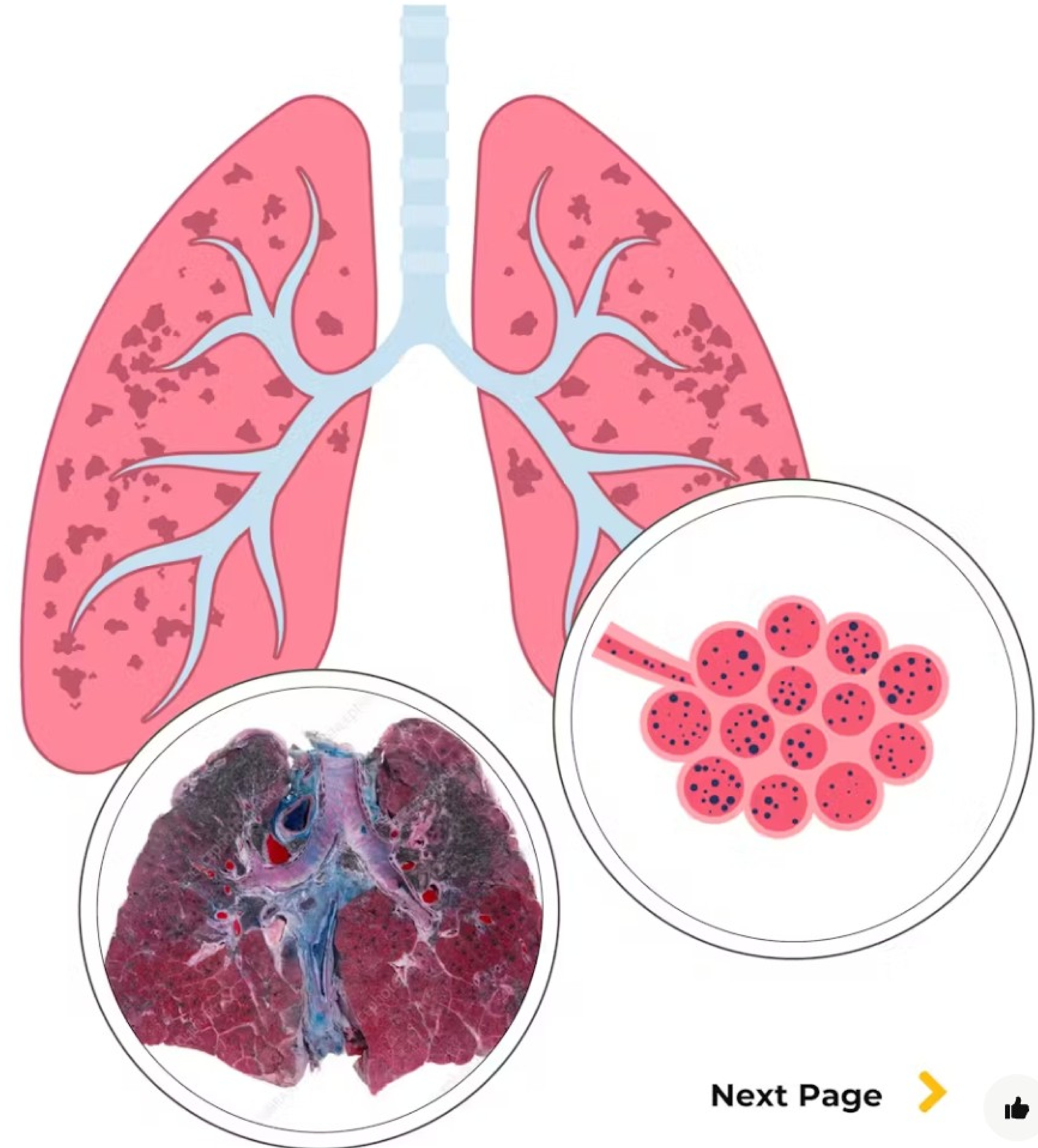
TYPES OF LUNG DISEASE

SILICOSIS

- Silicosis is a chronic and progressive lung disease that causes scarring in your lungs.
- The persistent inflammation leads to the accumulation of fibroblasts (cells that produce collagen).
- Collagen accumulates around the silica particles, forming characteristic fibrotic nodules that disrupt normal lung structure and function.

SYMPTOMS

- Shortness of breath
- Persistent cough
- Chest pain
- Unexplained weight loss
- Fatigue
- Respiratory failure



**LUNG CANCER****COPD****AUTOIMMUNE DISEASE****KIDNEY DISEASE**

SILICA:

SILIOCOSIS

Silicosis usually gets worse over time and increases your risk of:

- Lung infections
- Lung cancer
- COPD
- Kidney Disease
- Autoimmune Diseases:
 - Scleroderma
 - Rheumatoid arthritis
 - Systemic lupus erythematosus

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Besides silicosis, what other health problems can come from breathing in silica over time?

14
Autoimmune diseases like scleroderma and rheumatoid arthritis.
✓

0
Increased risk of skin cancer.
✗

0
Improved cardiovascular health.
✗

2
An increased resistance to respiratory infections
✗

LEAD: BACKGROUND

- Lead is a heavy metal that has been used in construction for centuries.
- The Romans famously used lead for water pipes, which is where the word "plumbing" originates (from the Latin "plumbum," meaning lead).
- Used extensively for its abundance, low melting point, and malleability before health risks were fully understood.
- By the late 19th and early 20th centuries, the dangers of lead poisoning were widely recognized.



**LEAD-BASED PAINT****PLUMBING****HOMES BUILT BEFORE 1978****ROOFING AND FLASHING**

LEAD: IDENTIFICATION

- Lead-based paint: Homes built before 1978 are particularly at risk.
- Lead pipes and lead solder were commonly used in older plumbing systems.
- Lead was used in roofing materials and flashing due to its durability and weather resistance.
- Lead can also be found in materials like:
 - Older electrical conduits.
 - Mortar in brick and stonework.
 - Stained glass windows.
 - Tank linings.
 - Certain types of mineral wool insulation.

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LEAD: DUST OR FUMES



DISTURBANCE

- Disturbance of older structures or materials could release what we call lead dust or fumes.



INHALATION

- The dust or fumes can enter the human body through inhalation.



HAND TO MOUTH

- Lead dust can settle on surfaces, including workers' hands.

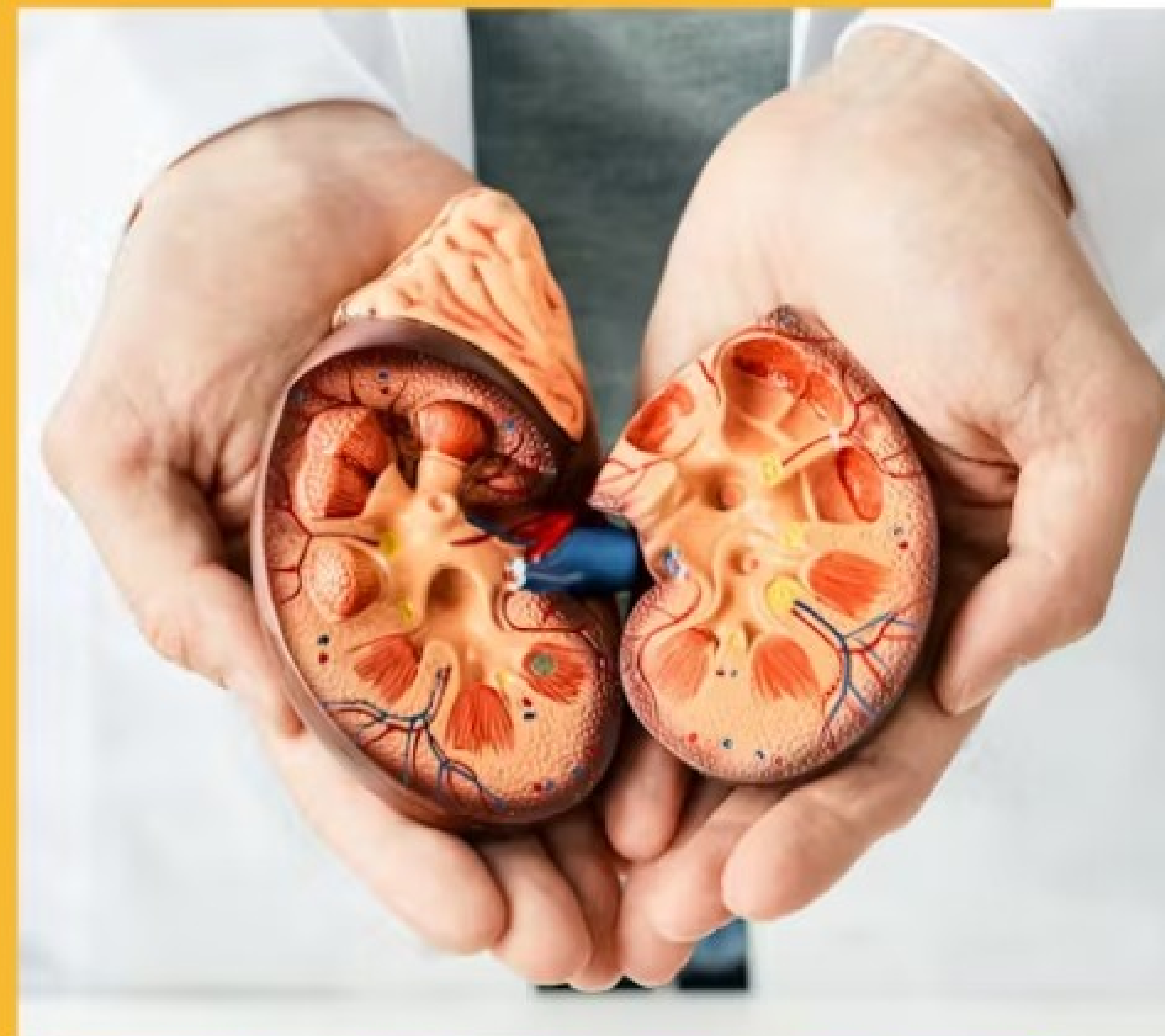


INGESTION

- If workers don't wash their hands thoroughly before eating, drinking, or smoking, they can ingest the lead.

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**NEUROLOGICAL****CARDIOVASCULAR****HEMATOLOGICAL****KIDNEY DISEASE**

LEAD:

COMPLICATIONS

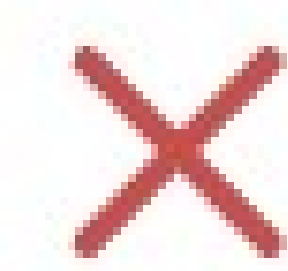
- Lead can damage the brain and nervous system, causing cognitive impairment
- Lead interferes with blood cell production and function.
- Lead exposure increases the risk of high blood pressure and heart disease.
- Lead can cause permanent kidney damage and dysfunction.
- In both men and women, lead can affect reproductive health, causing decreased fertility and other complications.

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Lead can enter the body through:

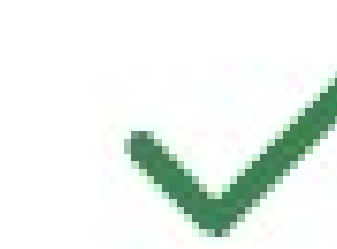
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Skin contact with solid lead



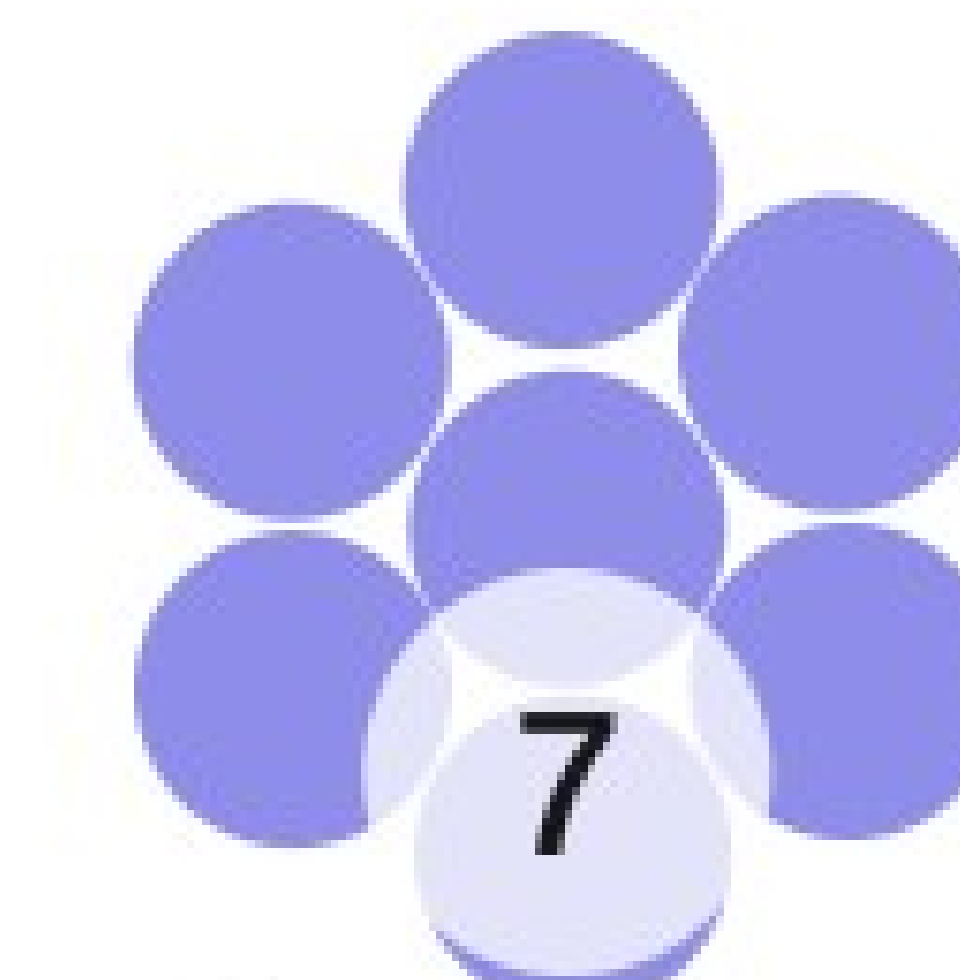
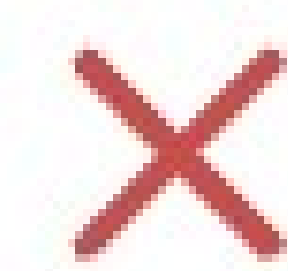
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Inhalation of lead dust or fumes



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Exposure to low-frequency electromagnetic fields



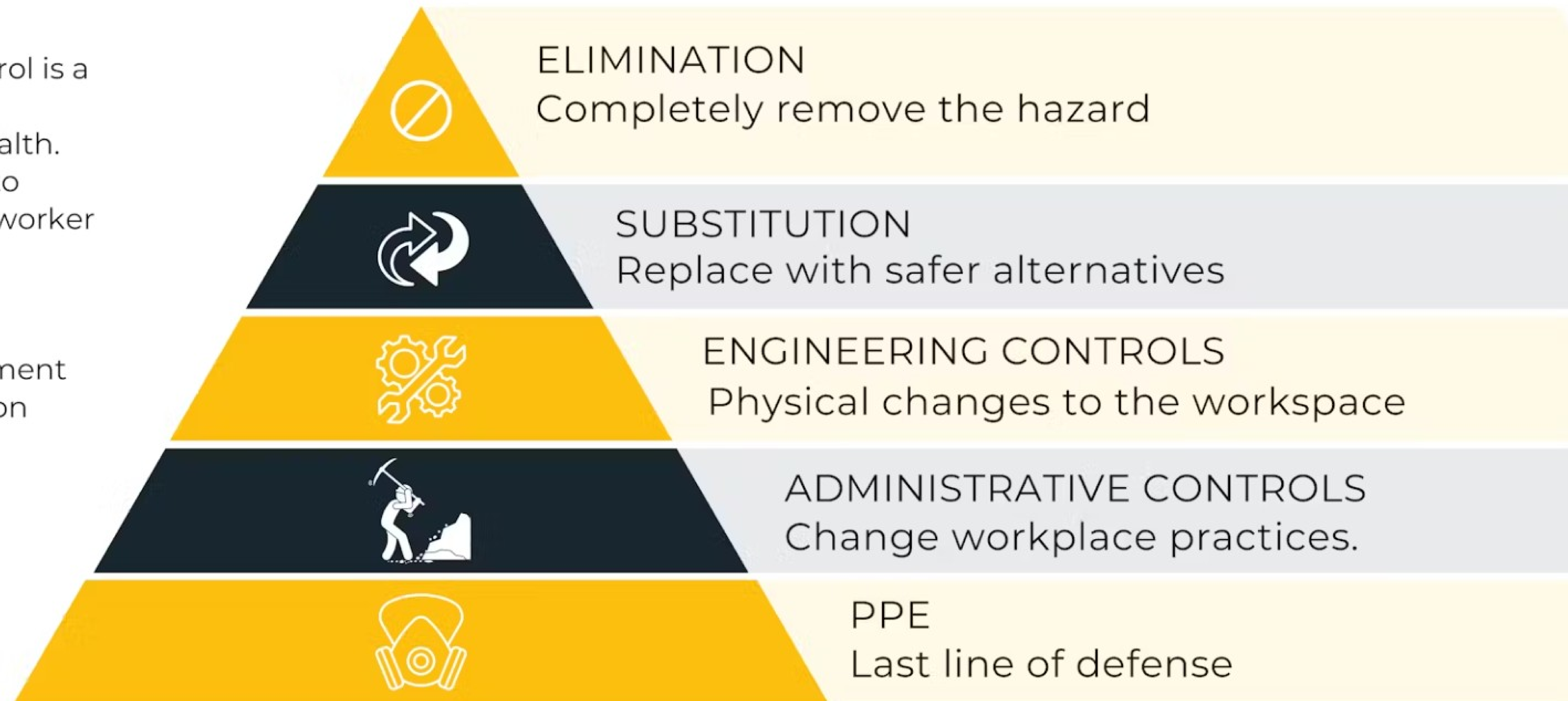
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Ingestion of lead contaminated surfaces



PREVENTION: EXPOSURE CONTROL

- Hierarchy of exposure control is a fundamental principle in occupational safety and health.
- It's a systematic approach to minimizing or eliminating worker exposure to hazardous substances or conditions.
- Following the hierarchy of controls ensures we implement the most effective protection measures first.



PREVENTION: ELIMINATION

- Elimination involves completely removing the hazard from the workplace.
- It's the most effective control because it eliminates the risk of exposure altogether.

ELIMINATION

CHALLENGES

ASBESTOS

- Demolition/Reno: Certified asbestos survey and removal required.
- Manufacturing ceasing the use of any asbestos-containing components.

- Often costly and disruptive.
- Not always feasible in older buildings where asbestos is deeply integrated.

SILICA

- Completely removing silica-containing materials from the workplace.

- Silica is a common component of many materials, but should be explored whenever possible.

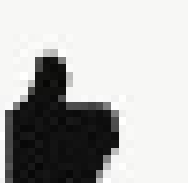
LEAD

- Completely removing lead-containing materials or processes from the workplace.
- Eliminating lead from manufacturing processes when possible.

- Lead is prevalent in older buildings and some industrial applications, making complete elimination difficult.

★ If complete elimination isn't possible, substitution becomes the next priority.

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PREVENTION: SUBSTITUTION

- This involves replacing a hazardous substance or process with a less hazardous one.
- It aims to reduce the risk by using a safer alternative.



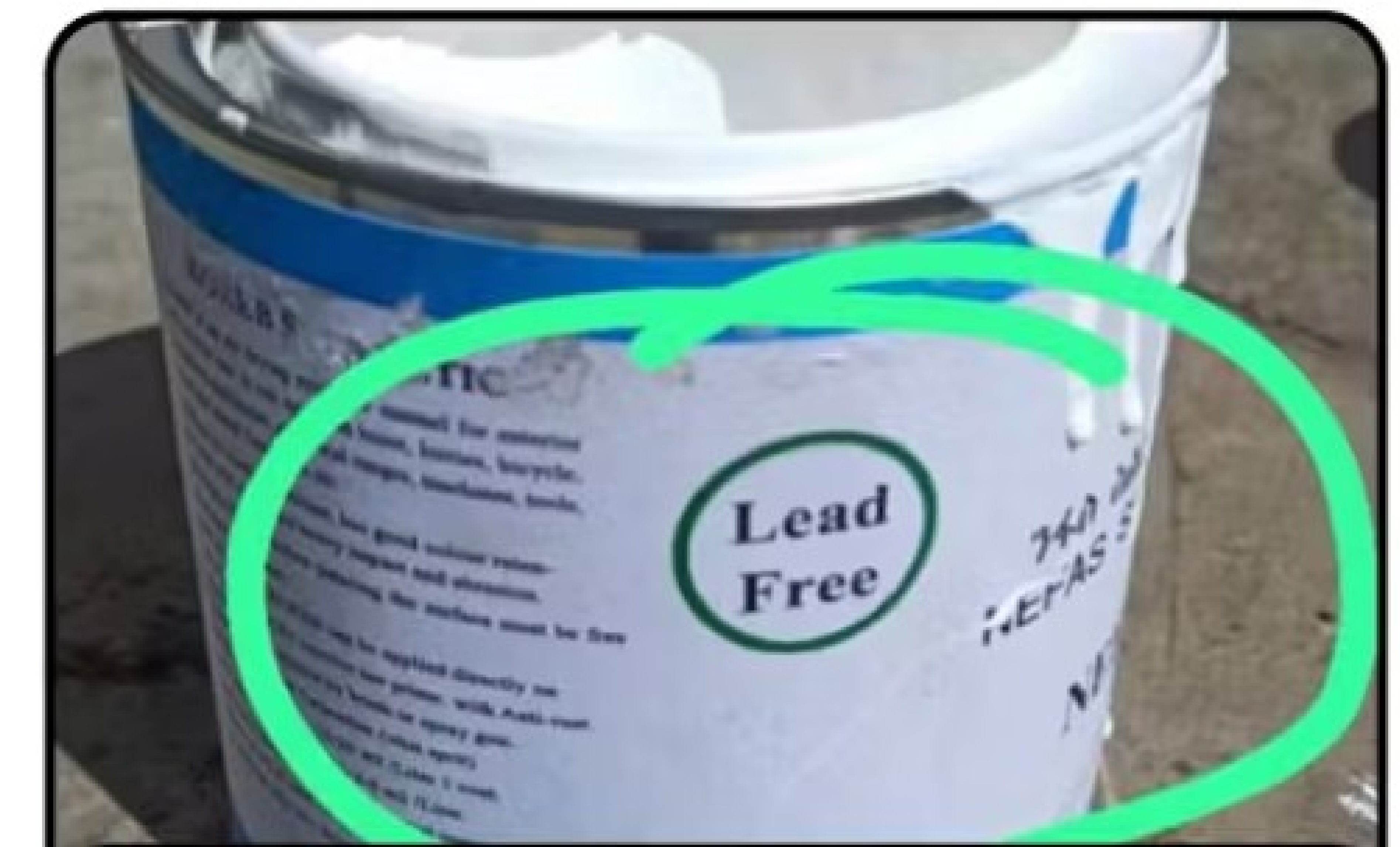
ASBESTOS ALTERNATIVES

- Replacing asbestos-containing products with non-asbestos alternatives.
- Using non-asbestos ceiling tiles, insulation, or brake linings.



SILICA ALTERNATIVES

- Replacing high-silica-content materials with those that contain less or no silica.
- Using abrasive blasting materials with less free silica.



LEAD ALTERNATIVES

- Substituting lead pipes with copper or other safe materials.
- Using lead-free solders, lead-free paints and coatings, or non-lead-based abrasives.

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PREVENTION: ENGINEERING CONTROLS

- Changes at the workplace to protect workers from the hazard.



CONTAINMENT

- Enclosing or isolating work areas to prevent silica dust, asbestos fibers, or lead fumes from spreading.



WET REMOVAL

- Wet methods to suppress dust.
- Wet sanding of lead based paint.



VENTILATION

- Installing local exhaust ventilation to capture fibers, fumes, and dust.
- HEPA filtration



EQUIPMENT

- HEPA-filtered vacuums for cleaning lead or asbestos dust.
- Tools with integrated dust collection systems

PREVENTION: ADMINISTRATIVE CONTROLS

- Implementing workplace protocols to further reduce risks.



WARNING SIGNS

- Posting clear warning signs.



AWARENESS

- Providing comprehensive awareness training.



LIMIT EXPOSURE

- Limiting worker exposure time
- Rotating workers to reduce individual exposure.



HYGIENE

- Implementing strict hygiene practices (handwashing, no eating in work areas).
- Implementing housekeeping practices to minimize dust.

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PREVENTION: PPE

- Final defense layer when other controls cannot fully eliminate exposure.



RESPIRATOR

- Using NIOSH-approved respirators with appropriate filters based on the hazard.
- Ensuring proper fit testing and maintenance of respirators.



PROTECTIVE CLOTHING

- Disposable or washable preferred.
- Gloves must be appropriate for the specific hazard (e.g., nitrile for lead).
- Clothing must be removed and cleaned or disposed of properly to prevent contamination spread.

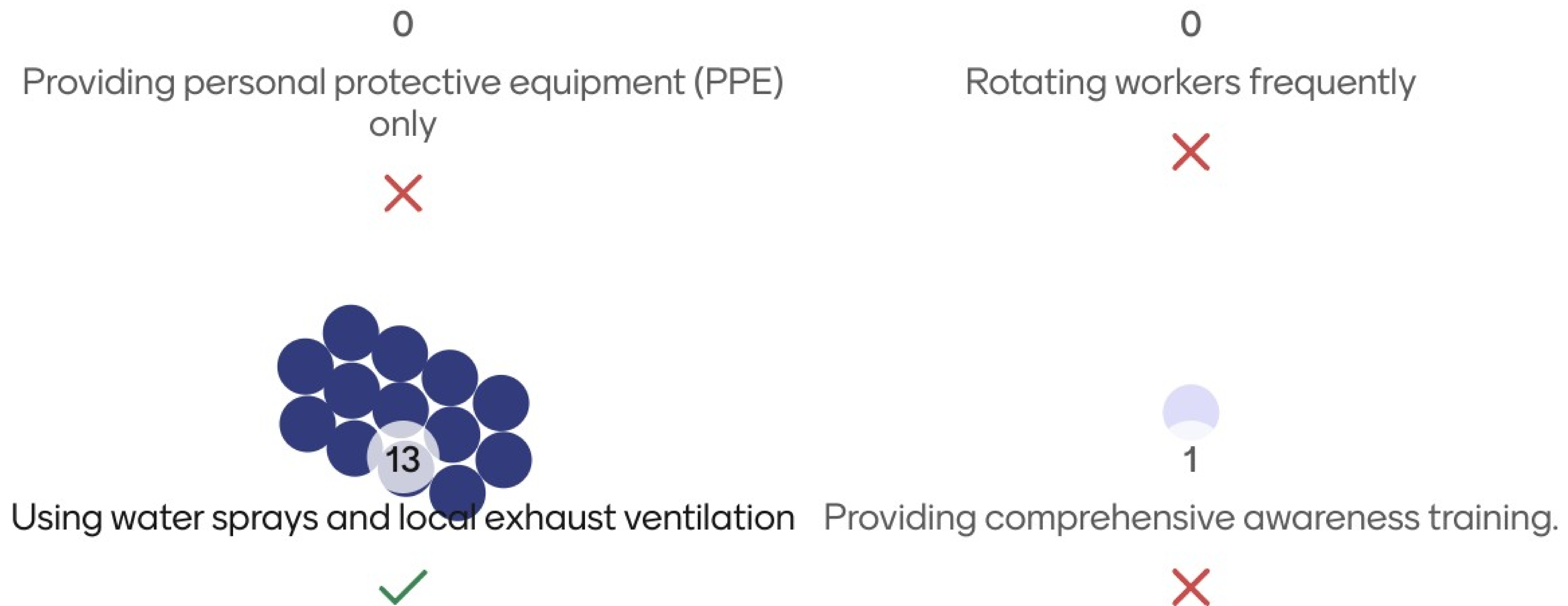


EYE PROTECTION

- Impact-resistant eyewear is often required.
- Eye protection is particularly important during activities that generate dust or fumes.

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An example of Engineering controls reducing silica exposure in the workplace is..



SURVEILLANCE: WORKPLACE AIR MONITORING



Workplace air monitoring surveillance is a crucial component of occupational health and safety programs for lead, asbestos, and silica.



EXPOSURE ASSESSMENT

To determine the level of worker exposure to lead, asbestos, or silica.



COMPLIANCE CHECK

To ensure that airborne concentrations are below permissible exposure limits (PELs) set by regulatory agencies.



EFFECTIVENESS

To evaluate the effectiveness of engineering and administrative controls in reducing exposure.



HAZARD IDENTIFICATION

To identify potential sources of exposure and areas of concern.



RECORD KEEPING

To document exposure levels and track trends over time.

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SURVEILLANCE: PERMISSIBLE EXPOSURE LIMITS

- PELs: Maximum airborne concentration to prevent adverse health effects.
- Legal limits set by OSHA (Occupational Safety and Health Administration).
- Expressed as an **8-hour time-weighted average (TWA)**.
- Employers are legally obligated to comply with OSHA PELs.
- Failure to comply can result in fines, penalties, and legal action.



LEAD PEL

- The OSHA PEL for lead is 50 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) as an 8-hour time-weighted average (TWA).
- There is also an action level of 30 $\mu\text{g}/\text{m}^3$ as an 8-hour TWA, which triggers certain requirements for employers.



SILICA PEL

- OSHA has set a PEL of 50 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) of respirable crystalline silica as an 8-hour TWA.



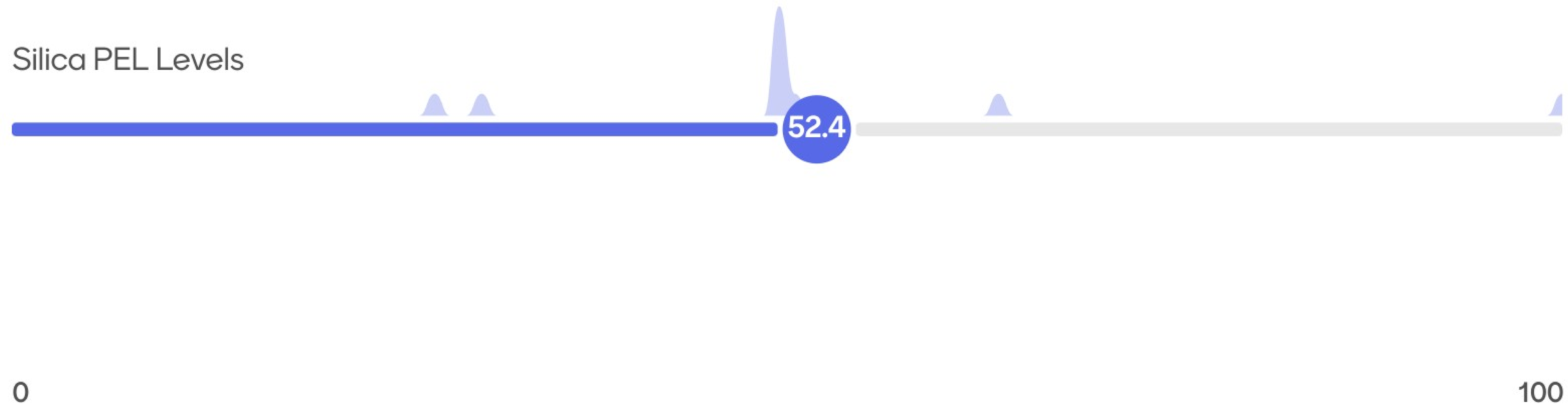
ASBESTOS PEL

- OSHA's PEL for asbestos fibers is 0.1 fiber per cubic centimeter of air (f/cc) as an 8-hour TWA.
- There is also an excursion limit of 1 f/cc as a 30-minute TWA.

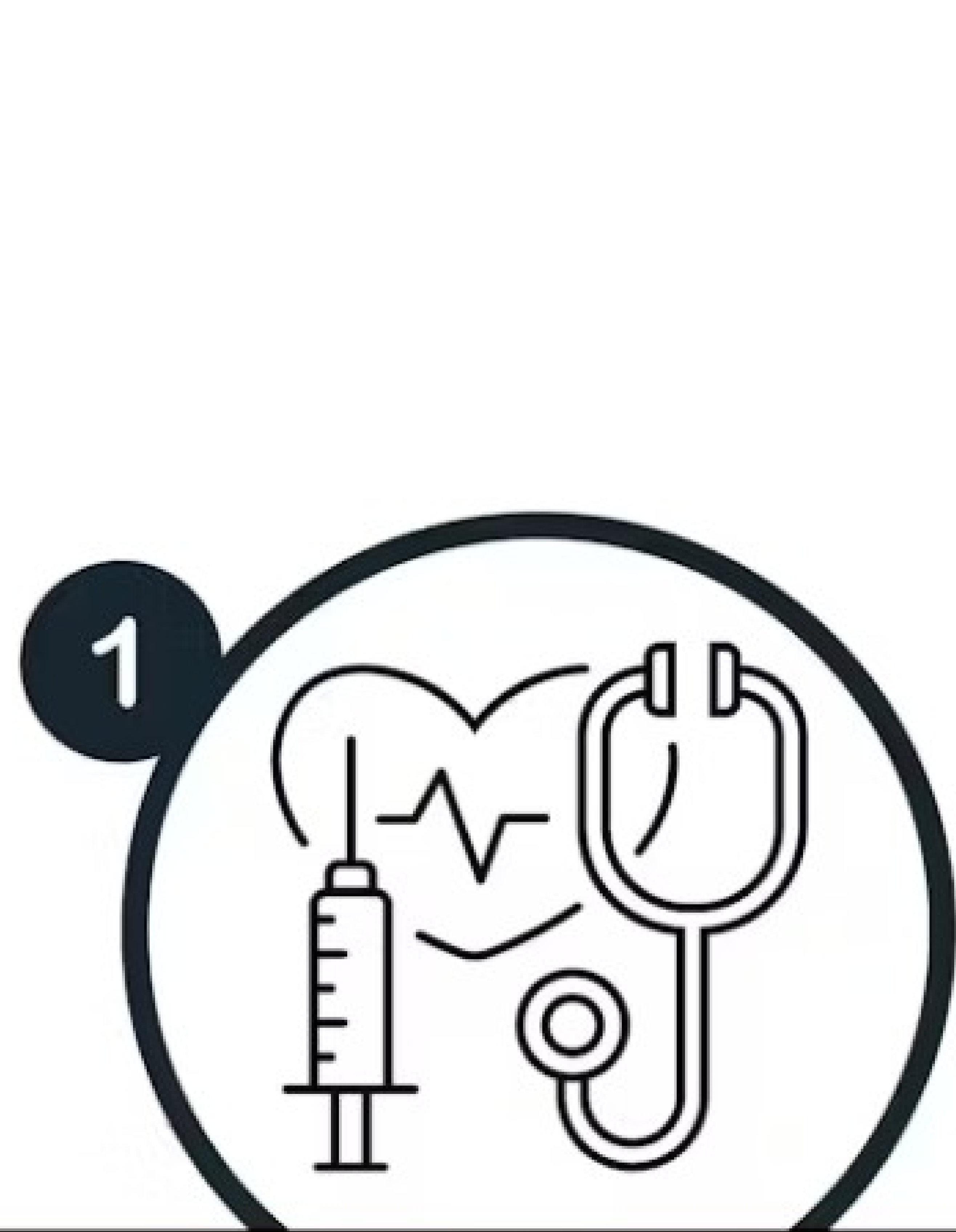
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Sliding Scale: What is the PEL level for Respirable Silica?



SURVEILLANCE: MEDICAL EXAMINATIONS



BASELINE ESTABLISHMENT

- Periodic medical exams allow for ongoing monitoring of worker health, enabling the detection of changes over time.



EARLY DISEASE DETECTION

- Early detection allows for timely intervention and treatment, potentially improving outcomes and preventing irreversible damage



LEGAL COMPLIANCE

- OSHA regulations mandate medical surveillance programs for workers exposed to these substances.



EXPOSURE CONTROL

- The results from medical exams can be used to evaluate the effectiveness of the current exposure controls in place.

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SURVEILLANCE: RESPIRATOR FIT TESTING

QUALITATIVE

- Subjective: Results depend on the wearer's perception.
- Pass/fail outcome.
- Generally used for half-mask respirators.
- Relatively inexpensive and easy to perform.



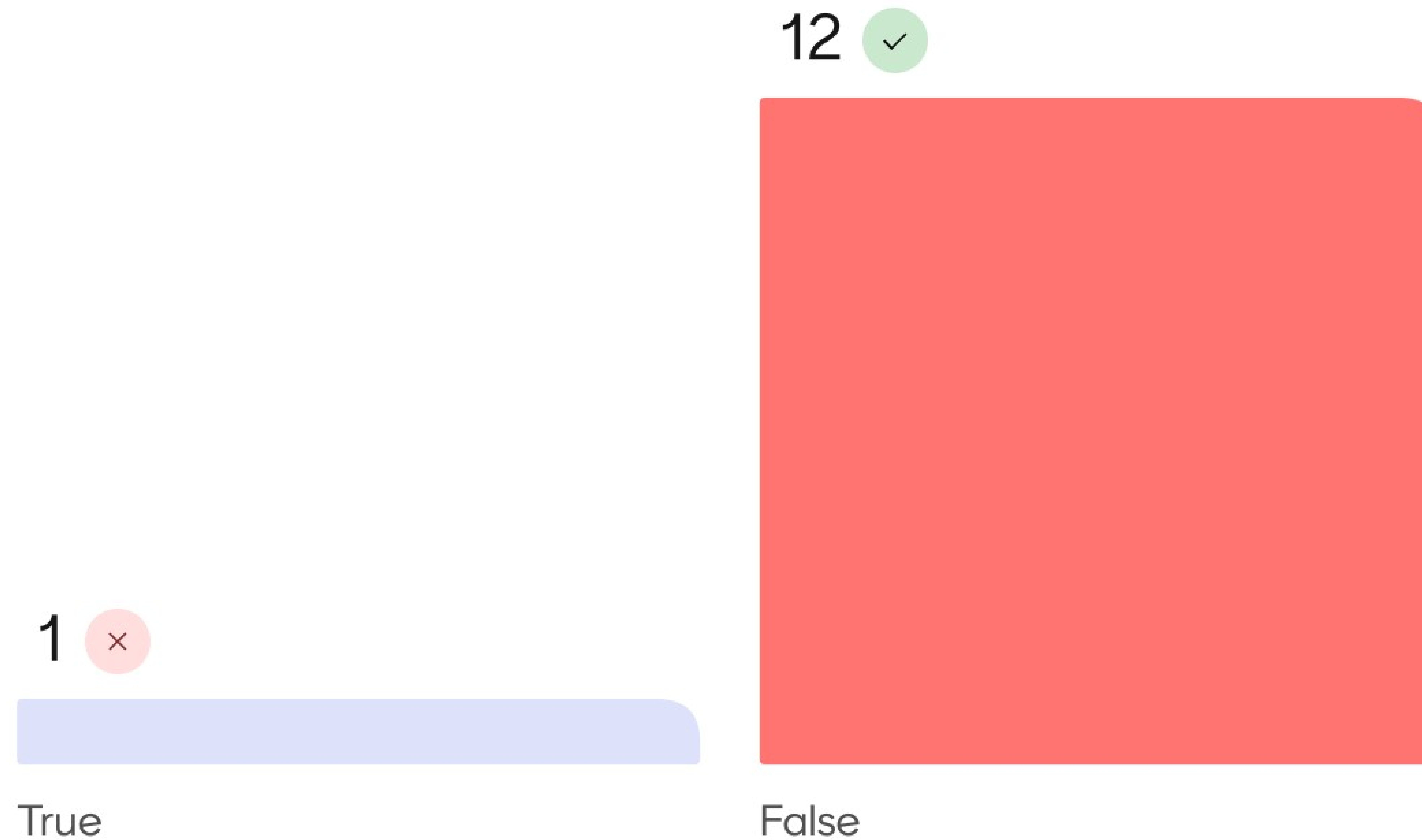
QUANTITATIVE

- Objective: Results based on measured data.
- Provides a numerical fit factor.
- Can be used for both half-mask and full-face respirators.
- More accurate and reliable.
- Requires specialized equipment.



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True or False : Qualitative Fit Testing provides OBJECTIVE results.



SURVEILLANCE: ASBESTOS

MEDICAL AND WORK HISTORY

- A detailed medical and work history, focusing on respiratory and asbestos exposure.
- OSHA Respirator Medical Questionnaire

PHYSICAL EXAM

- Initial Exam: Sets baseline health.
- Frequency: Varies by exposure level and medical history but OSHA recommends annual exams for significant asbestos exposure.

CHEST X-RAY

- OSHA standards: X-rays read by "B readers," physicians certified by NIOSH to interpret chest X-rays for pneumoconiosis.
 - Less than 10 years of exposure: Every 5 years.
 - After 10 years of exposure:
 - Every 5 years for employees aged 15 to 35.
 - Every 2 years for employees aged 35 to 45.
 - Every year for employees aged 45 and older.
- Termination of Employment: A chest X-ray is required upon termination of employment.

PULMONARY FUNCTION TESTING

- Crucial for detecting early signs of lung damage.
- FVC, FEV1

RESPIRATORY FIT TESTING

- OSHA regulations mandate that fit testing be conducted at least annually.
- OSHA Respirator Medical Questionnaire

SURVEILLANCE: SILICA

MEDICAL AND WORK HISTORY

- A detailed medical and work history, focusing on respiratory conditions and silica exposure.
- OSHA Respirator Medical Questionnaire

PHYSICAL EXAM

- Initial Exam: Sets baseline health.
- Frequency: Varies by exposure level and medical history but OSHA recommends exams every 3 years.

CHEST X-RAY

- OSHA standards: X-rays read by "B readers," physicians certified by NIOSH to interpret chest X-rays for pneumoconiosis.
 - Less than 15 years of silica exposure = Every 3 years
 - 15 to 20 years of exposure = Every 2 years
 - 20+ of exposure or X-ray evidence of silicosis = Every year

TB TESTING

- TB testing is often included in silica medical surveillance programs because silicosis increases the risk of TB,
- This could include skin tests or blood tests.

RESPIRATORY FIT TESTING

- OSHA regulations mandate that fit testing be conducted at least annually.
- OSHA Respirator Medical Questionnaire

PULMONARY FUNCTION TESTING

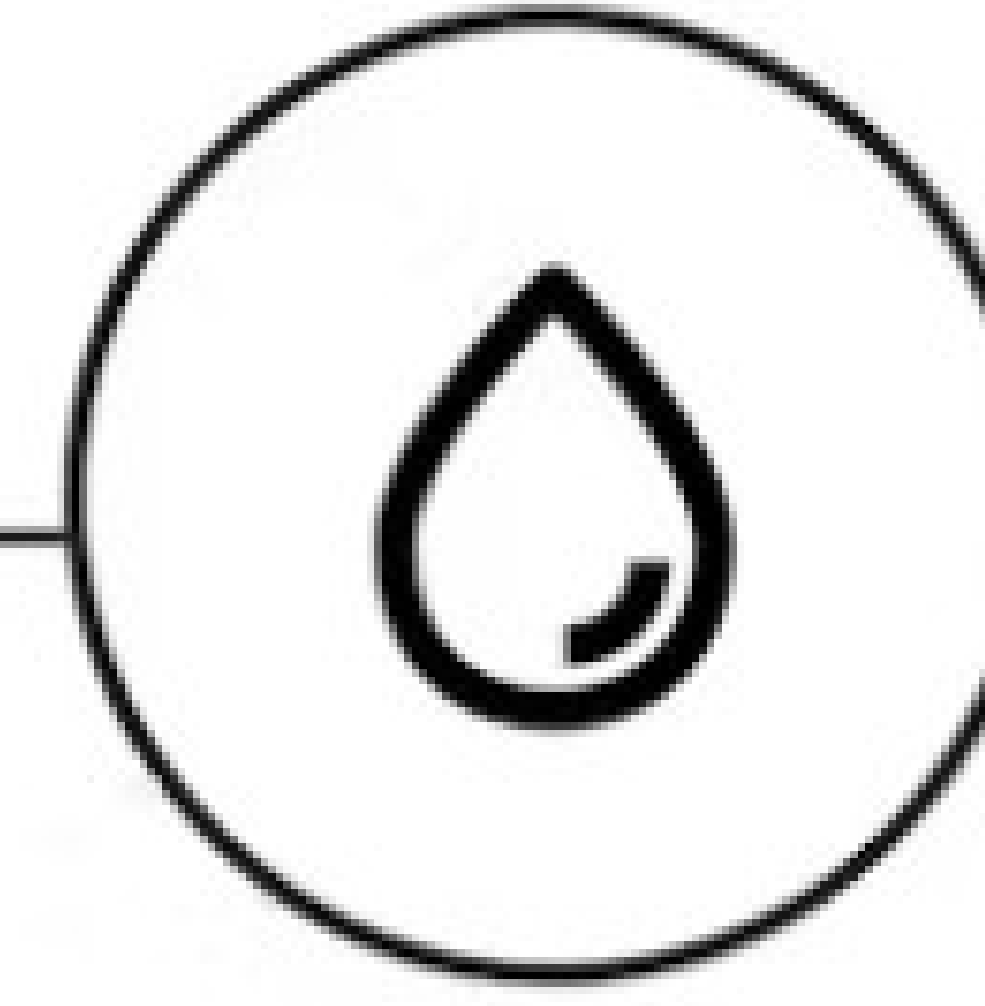
- Tests to measure lung capacity and airflow, crucial for detecting early signs of lung damage.

SURVEILLANCE: LEAD



PHYSICAL EXAM

- Construction does not require an initial physical exam however, still requires initial blood tests.
- Initial exam/ monitoring is triggered when employee exposure is at or above the action level.
- The frequency of follow-up monitoring is determined by the results of the initial and subsequent tests.



BLOOD TESTING

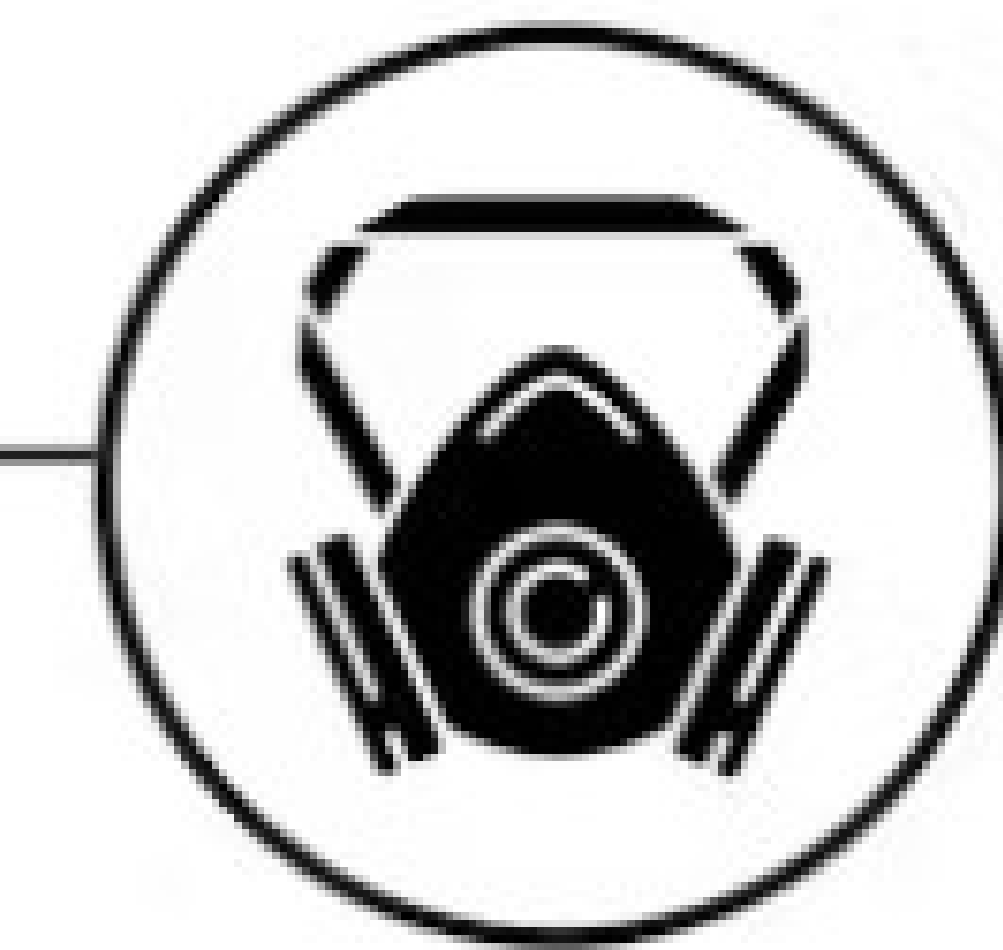
Blood Lead Level (BLL) testing is the cornerstone of lead medical surveillance.

BLOOD LEAD

- A blood lead test directly measures the amount of lead present in the blood at the time of the test.
- It primarily reflects recent or current lead exposure.

ZINC PROTOPORPHYRIN

- Zinc protoporphyrin (ZPP) increases in red blood cells when lead interferes with the production of heme (a component of hemoglobin)
- Therefore it is an indirect measurement of lead exposure.



RESPIRATOR FIT TESTING

- OSHA regulations mandate that fit testing be conducted at least annually.
- OSHA Respirator Medical Questionnaire

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MICHIGAN SAFETY CONFERENCE 2025

THANK YOU



Phone Number

+1-734-718-3654



Address

27544 Schoolcraft Rd, Livonia, MI 48150



Email

info@occupationalcareservices.com

