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California Department of Public Health

A MODERN EPIDEMIC OF AN ANCIENT DISEASE: SILICOSIS AMONG ENGINEERED STONE FABRICATORS

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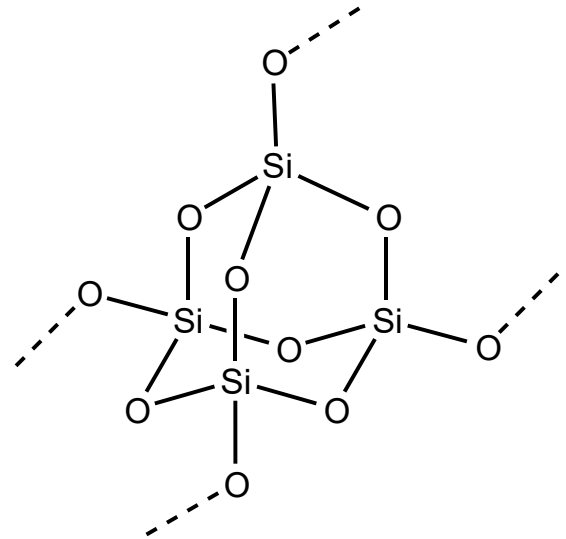
Occupational Health Branch
California Department of Public Health

https://publichealthwatch.org

Background

Silica

- Respirable crystalline silicon dioxide (SiO_2)
  - Quartz = 10% of earth's crust
- Rock, concrete, masonry, silica sand
- Drilling, cutting, sandblasting, demolition, mining



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NIOSH No. 1996-112.

Respirable Crystalline Silica (RCS)

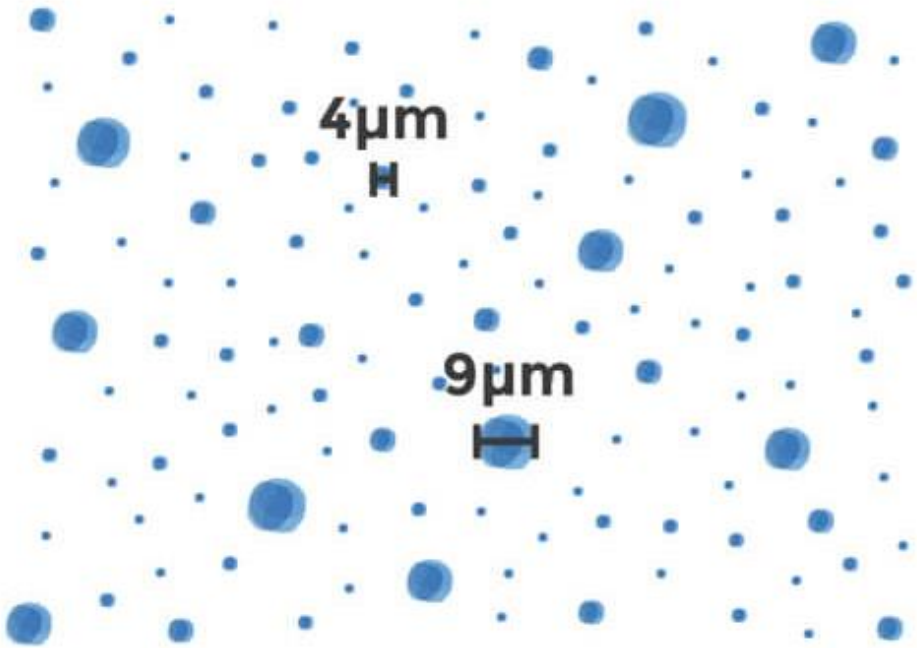
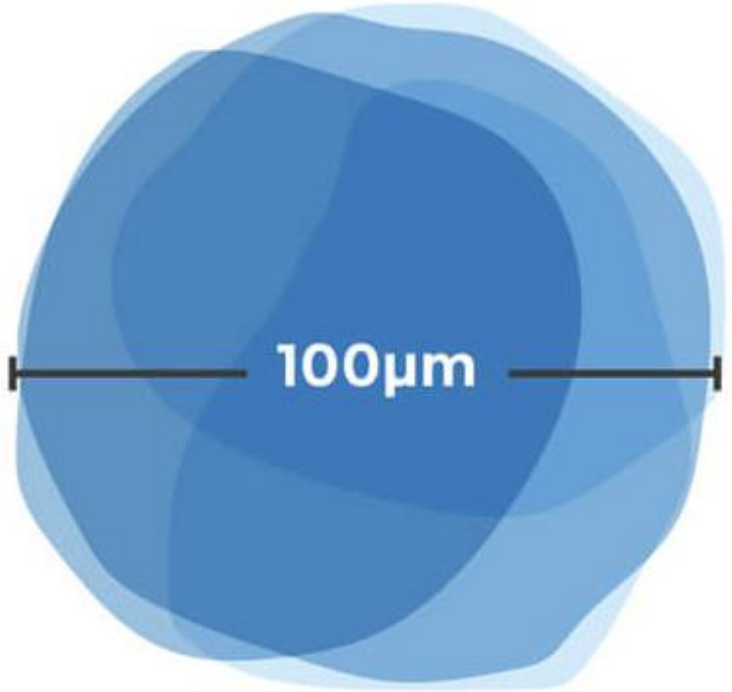
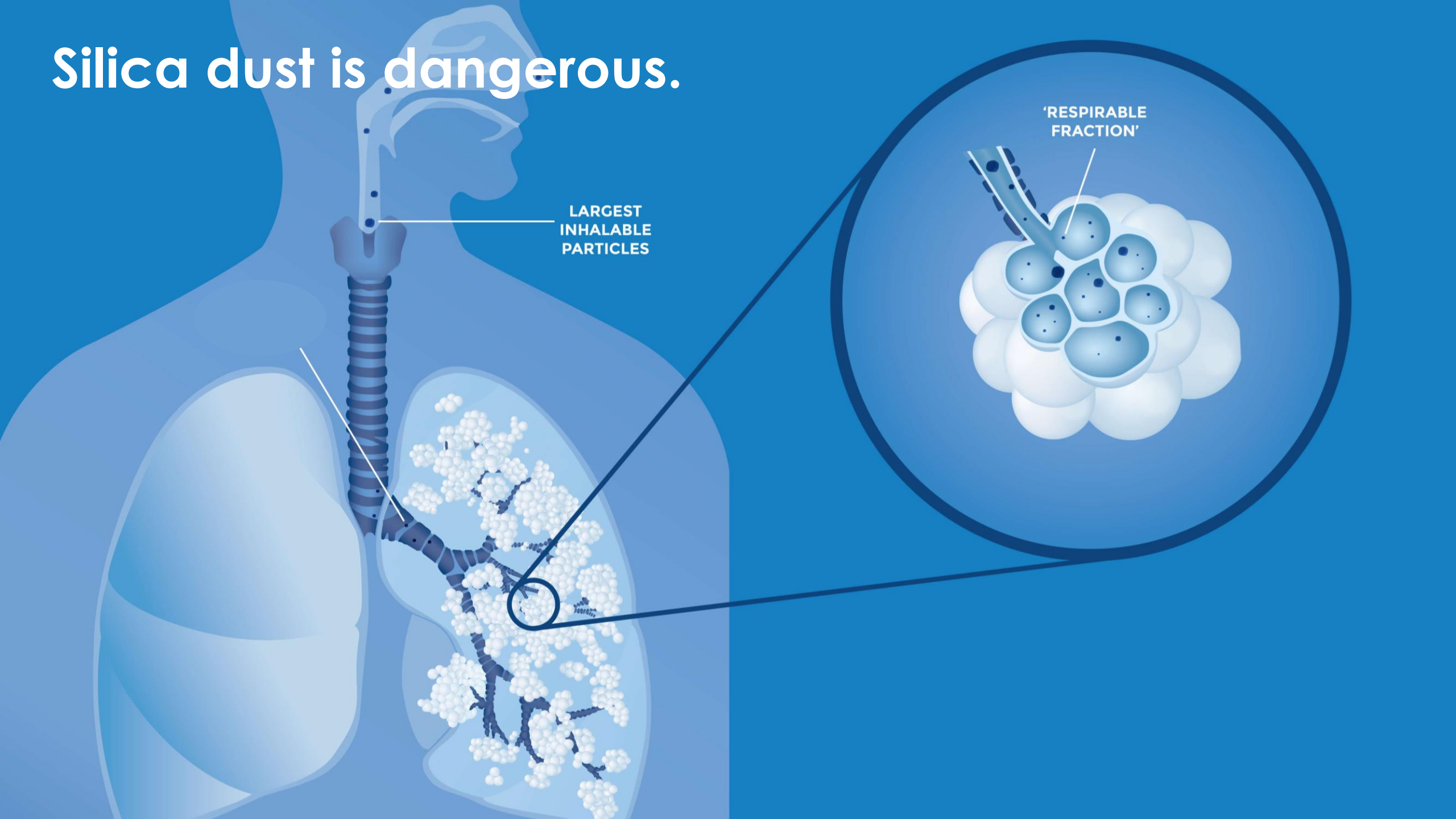


Table Salt



Silica dust is dangerous.



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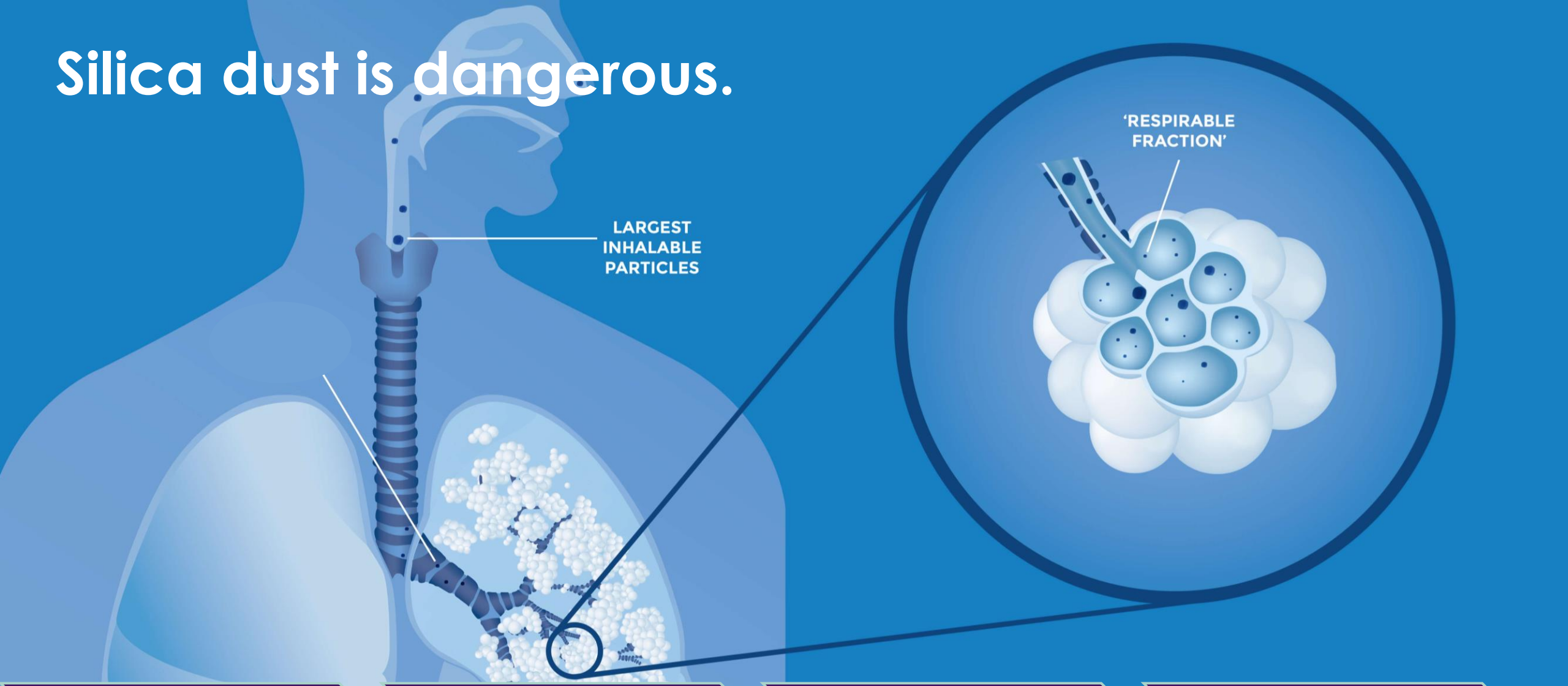
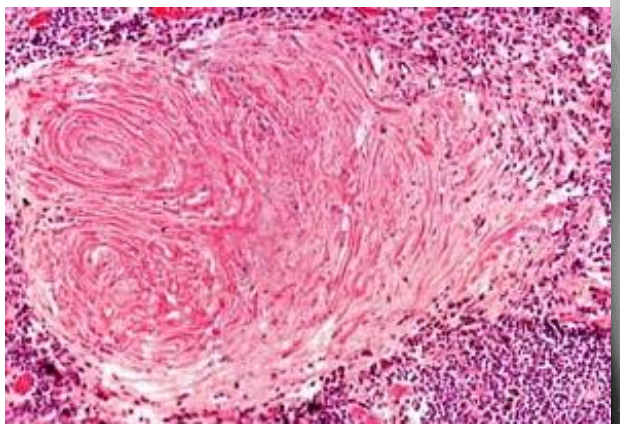
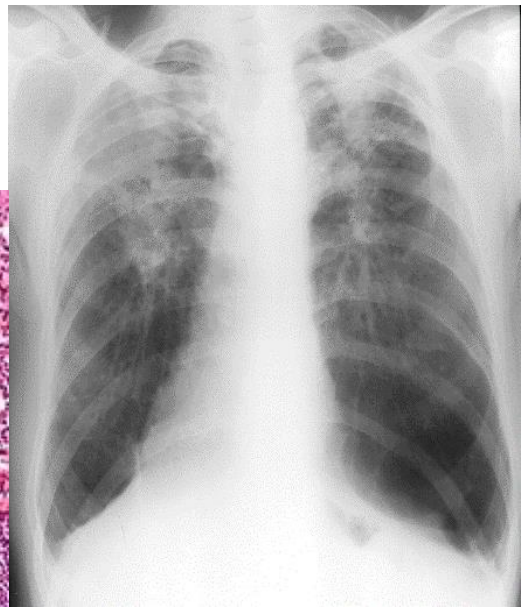


Respirable crystalline silica exposure → Lung inflammation → Lung scarring → Respiratory failure

Health Effects of Silica

- Silicosis
  - Chronic = after 10+ years, lower concentrations
  - Accelerated = after 5-10 years, higher concentrations
  - Acute = after weeks to years, highest concentrations
- Mycobacterial, fungal infections
- Lung cancer, COPD
- Autoimmune disease
- Chronic kidney disease





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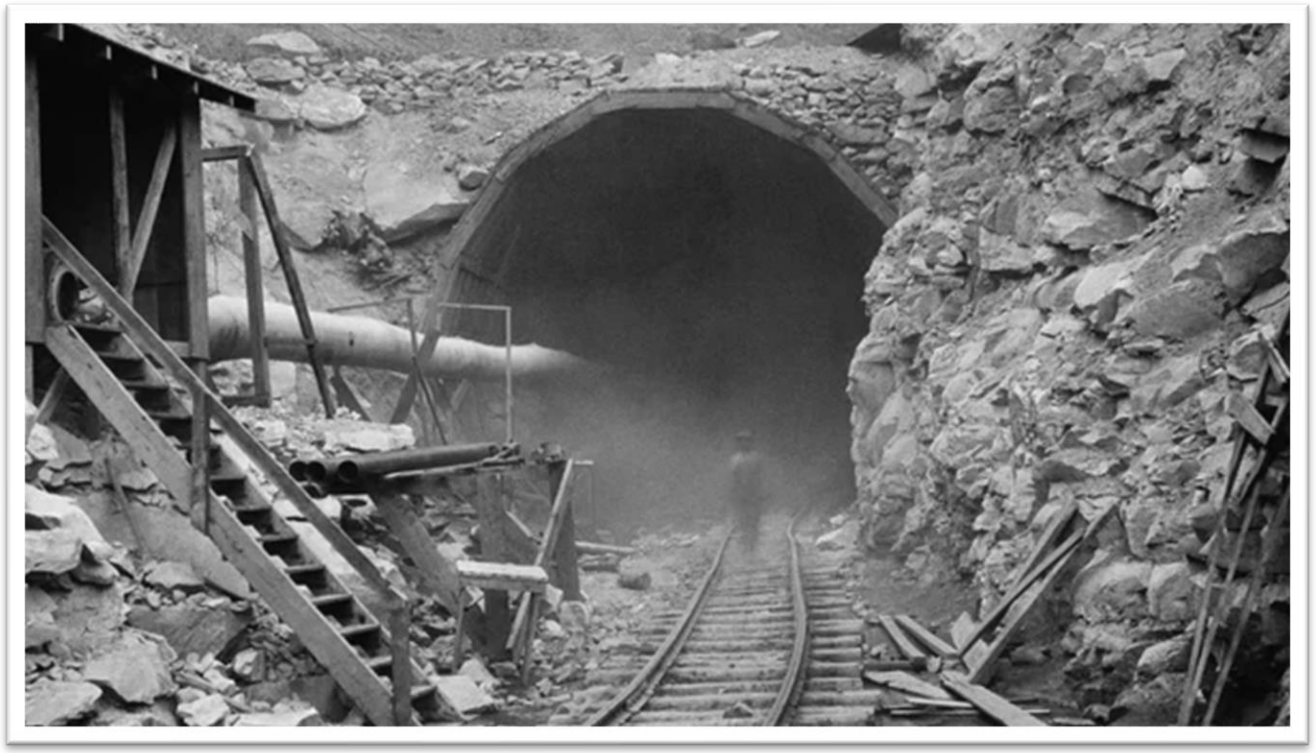
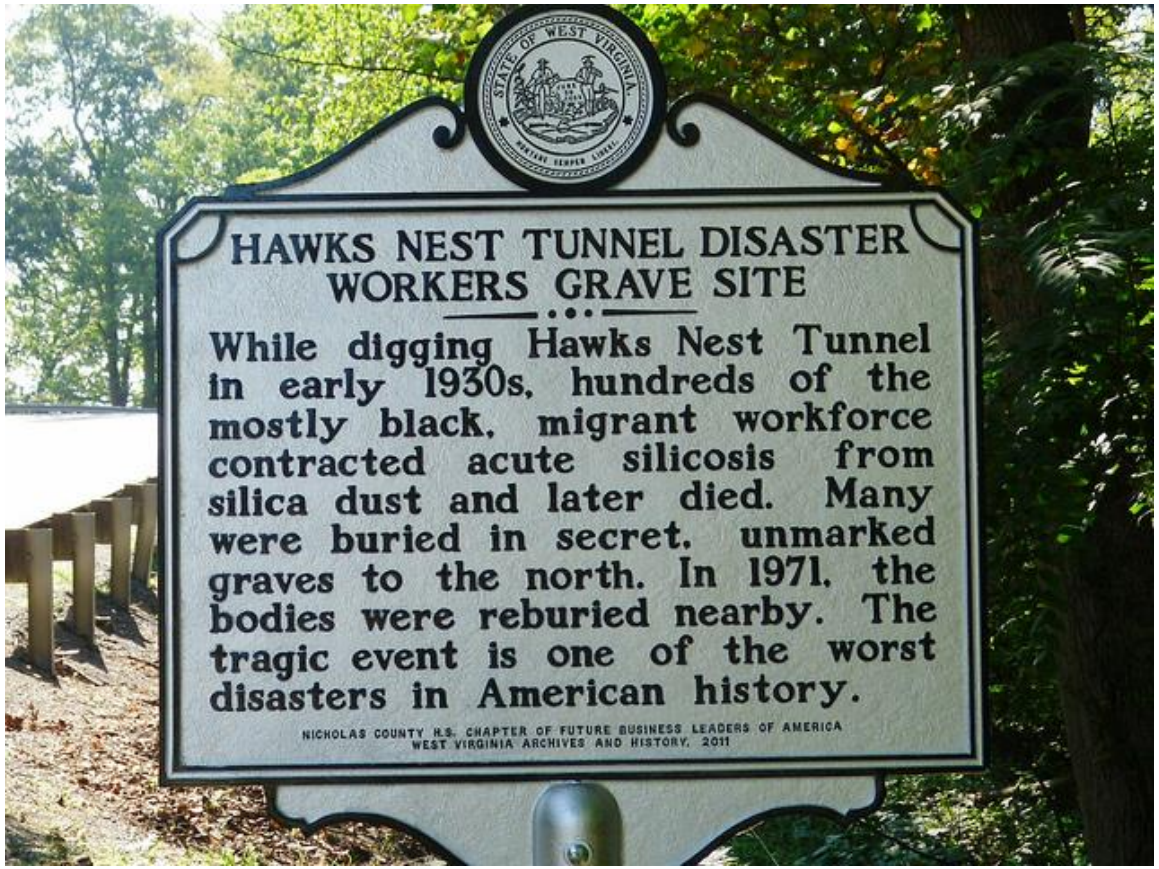
Hawks Nest Tunnel Disaster, 1930s





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New Risk: Engineered Stone

Engineered Stone and Silica

- Silicosis is a **severe, incurable** lung disease caused by inhaling silica dust particles.
- Engineered stone (artificial stone, quartz), material used for kitchen countertops, contains **especially high levels of silica (>90%).**
- Workers who **cut and grind engineered stone** (stone fabricators) can be exposed to **hazardous levels of silica dust**.

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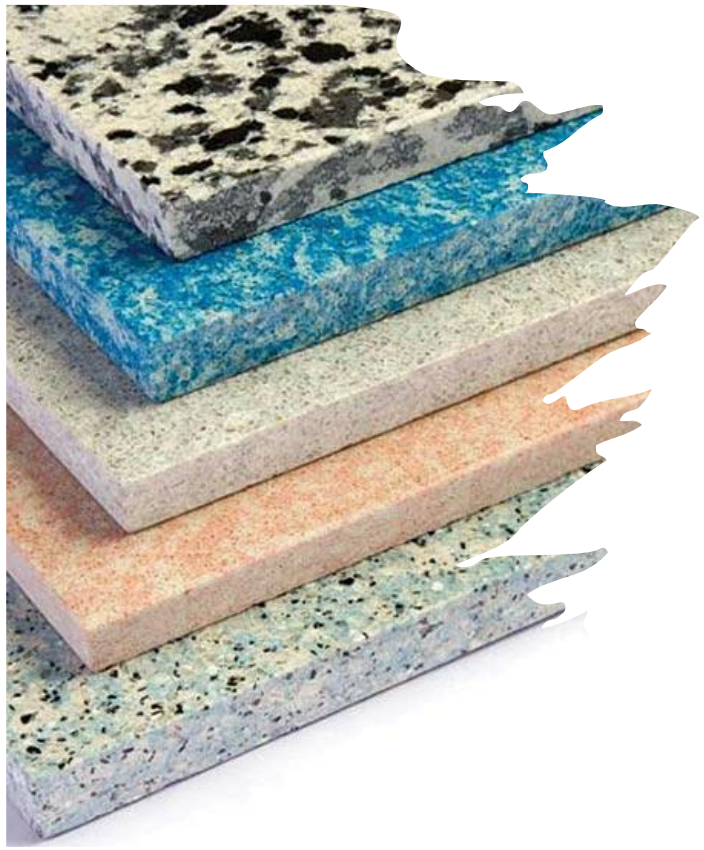
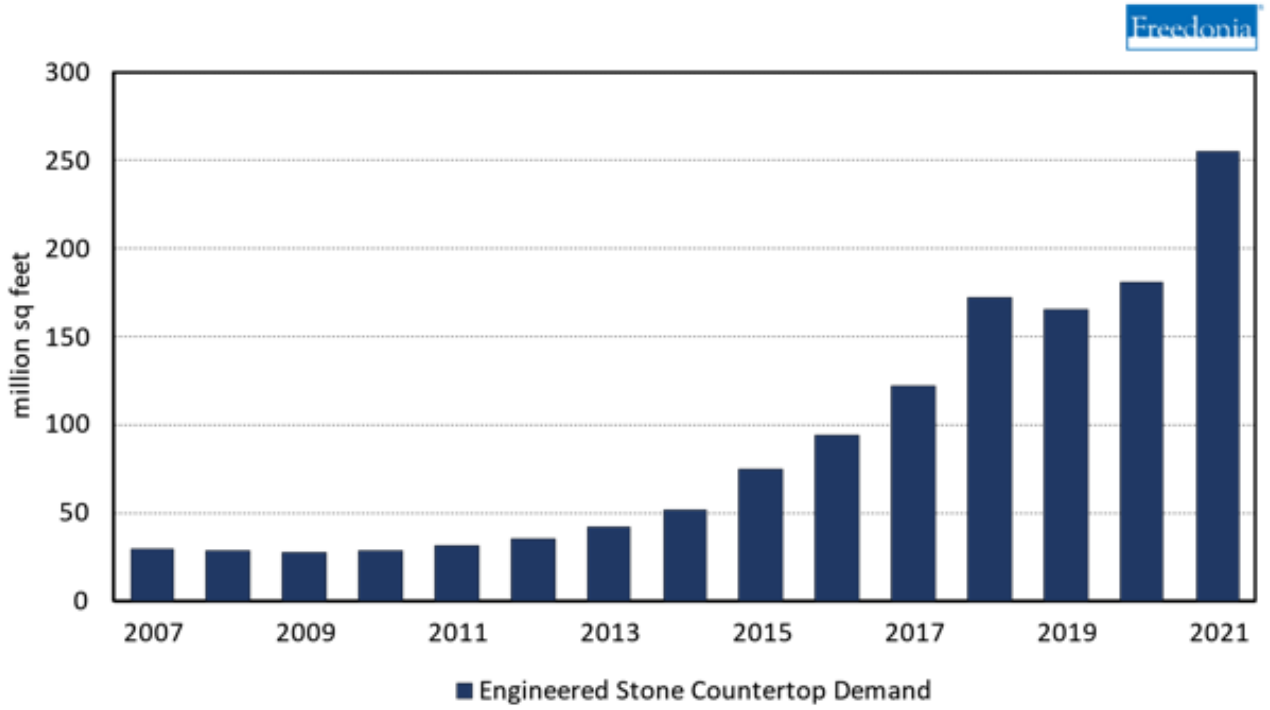
Photo credit: Earl Dotter

Engineered Stone: Growing Demand



U.S. Engineered Stone Countertop Demand, 2007-2021 (million square feet)



Source: The Freedonia Group

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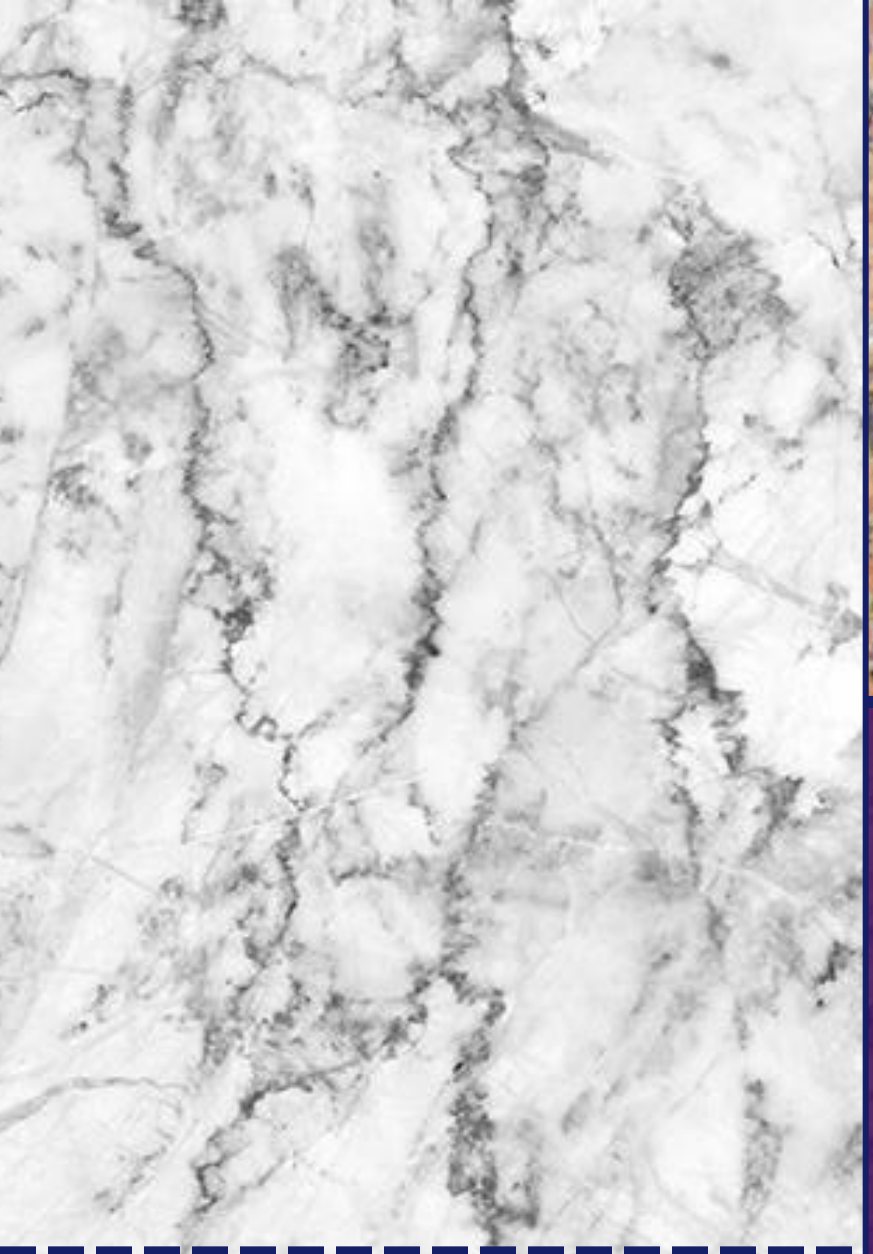

~45% silica

<5% silica

Marble

Granite

Engineered Stone

Dry Cutting is Hazardous

- Generates high silica exposures
- Associated with disease
- Can occur in workshop and onsite during installation

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Salamon et al. *JOEH* 2021.
Hoy et al. *OEM* 2023.

Global Epidemic of Silicosis

OCCUPATIONAL HEALTH BRANCH

OHB Home

What We Do

Publications & Videos

A–Z Index of Workplace Health Topics

Newsletter

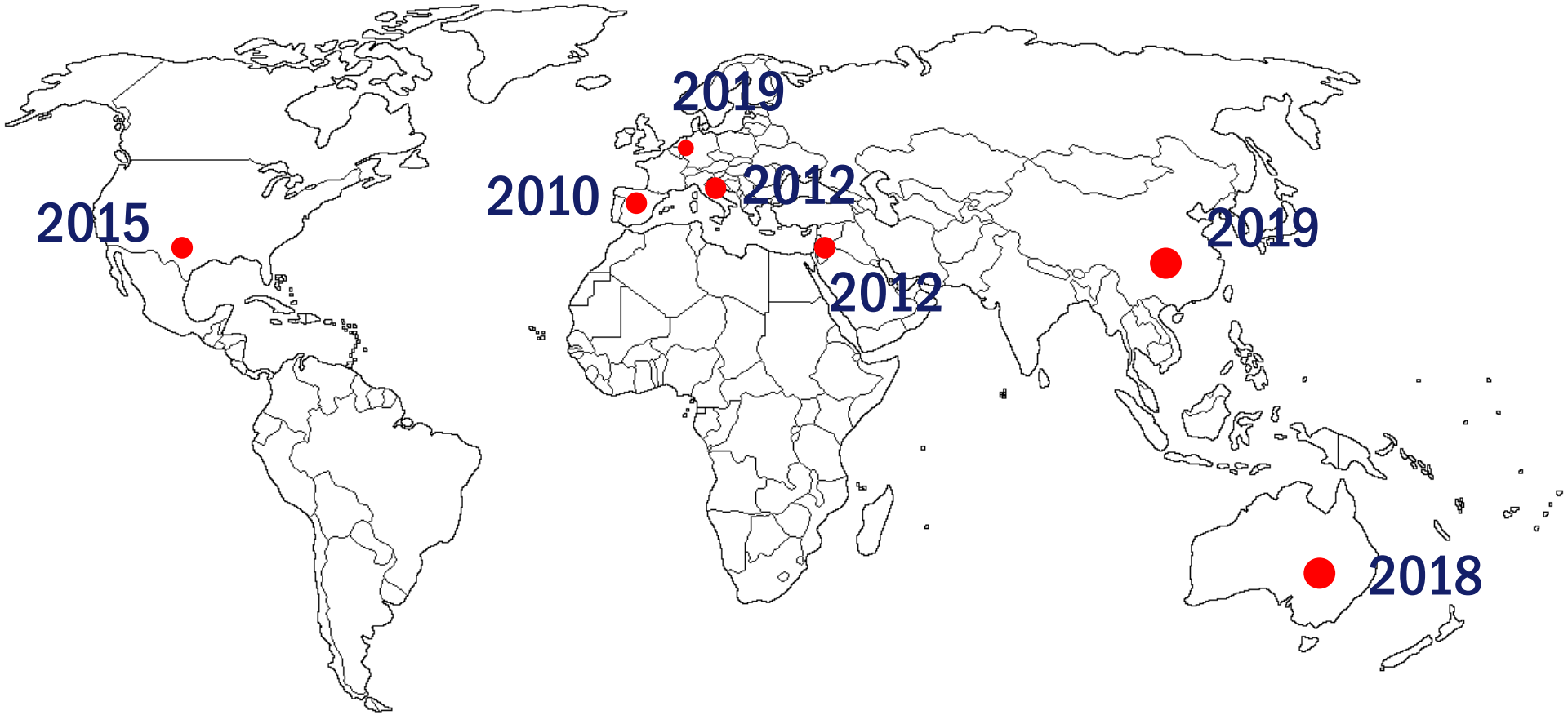
Workplace Health & Safety Resources

The Occupational Health Branch (OHB) promotes safe and healthy workplaces for all Californians.

What We Do

Publications & Videos

Silicosis Related to Engineered Stone



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California Index Case

- **37-year-old man hospitalized with silicosis in 2017**

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California Index Case

- **37-year-old man hospitalized with silicosis in 2017**
  - **2004-2013:** Worked at a countertop fabrication shop

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  - **2013:** Diagnosed with silicosis
  - **2014-2017:** Worsening symptoms, lung function

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California Index Case

- **37-year-old man hospitalized with silicosis in 2017**
  - **2004-2013:** Worked at a countertop fabrication shop
  - **2013:** Diagnosed with silicosis
  - **2014-2017:** Worsening symptoms, lung function
  - **2018:** Ineligible for lung transplant, died of silicosis

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Workplace Investigation

Hospital discharge records

Investigation with Cal/OSHA

All were Hispanic men

in their 30s at diagnosis.

Two cases were fatal.

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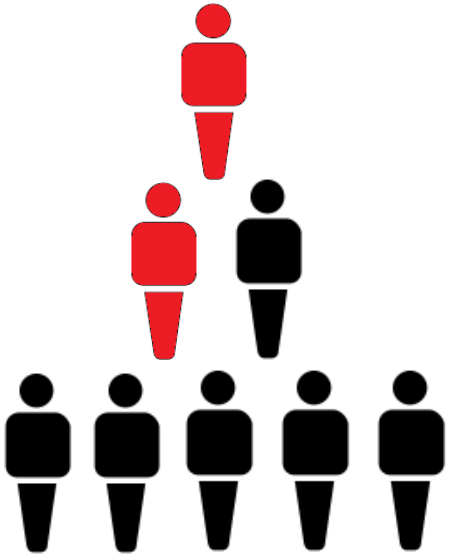
Rose, Heinzerling, et al. *MMWR.* 2019.

Workforce Screening

Silicosis by chest X-ray = 12%

Median age of cases detected by screening was 37.



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Heinzerling et al. *AJRCCM.* 2021.

Surveillance Methods

- **Tracking silicosis cases in California**
  - Hospital data (discharge and emergency)
  - Voluntary provider reporting
  - Electronic case reporting (eCR)
  - Coming soon: reportable condition
  - NIOSH surveillance case definition

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Surveillance Methods

- **Tracking silicosis cases in California**
  - Hospital data (discharge and emergency)
  - Voluntary provider reporting
  - Electronic case reporting (eCR)
  - Coming soon: reportable condition
  - NIOSH surveillance case definition
- **Enumerating countertop fabrication shops**
  - Business database
  - Web searches
  - Outreach

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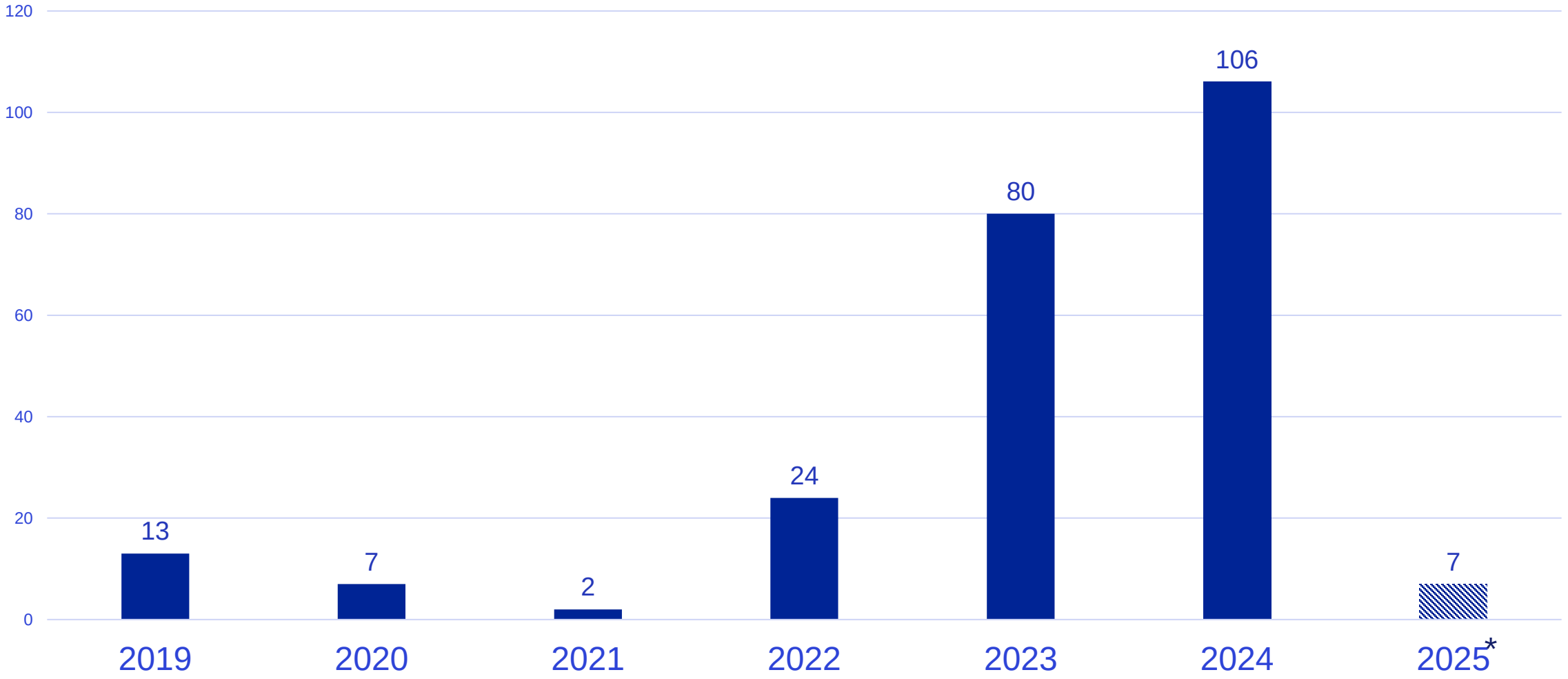
Cases Increasing in California

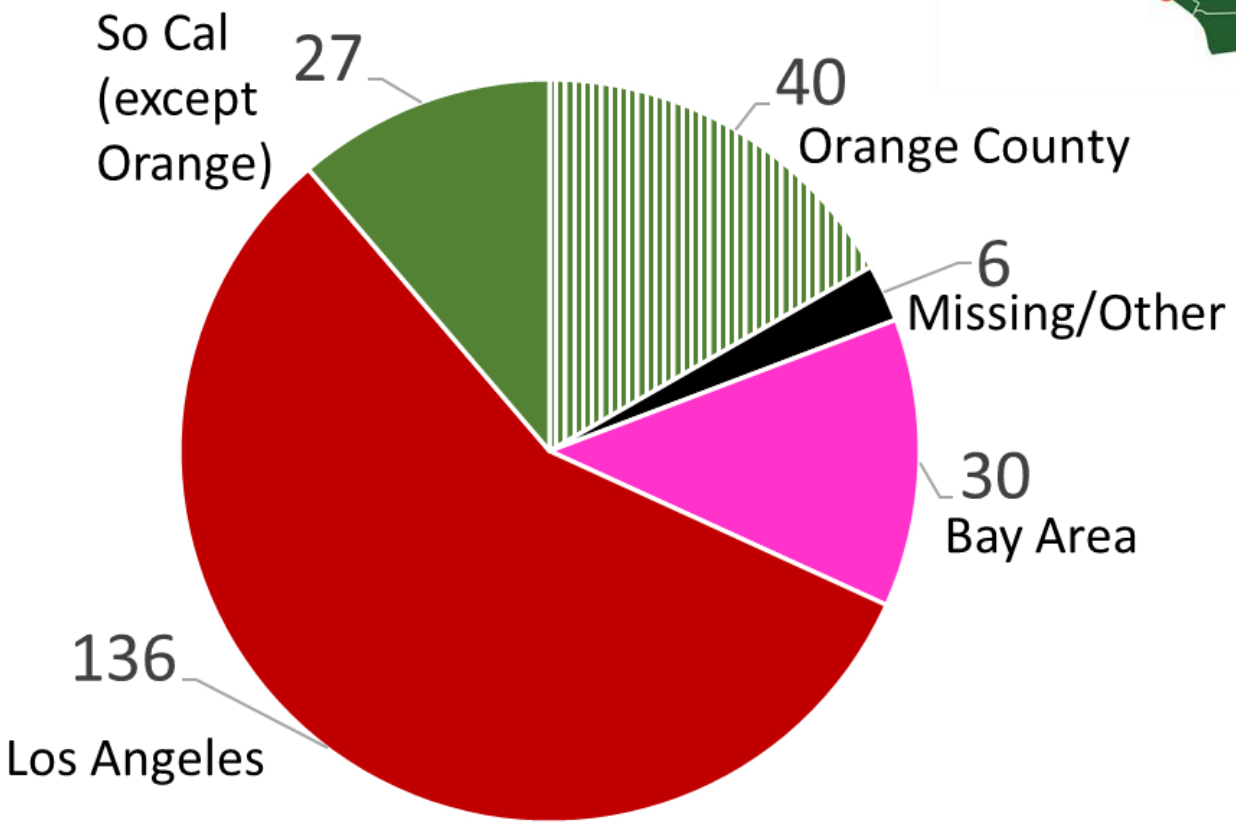


* through 1/17/2025

Year Identified by CDPH

Young Immigrant Workers Affected

- **239 fabrication workers with silicosis**
  - Many in their 30s and 40s
  - Immigrants from Latin America
  - Often under/uninsured
- At least **15 deaths**
- At least **29 lung transplants**



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Symptoms

Table 2. Clinical Characteristics and Outcomes of Patients With Engineered Stone–Associated Silicosis

Clinical characteristic (No. with data available)	Overall (n = 52), No. (%)
Presenting symptoms (52)	
Asymptomatic	7 (13)
Shortness of breath	45 (87)
Cough	38 (73)
Chest/back pain	25 (48)
Weight loss	18 (35)
Fevers	10 (19)
Wheezing	8 (15)
Pneumothorax	5 (10)

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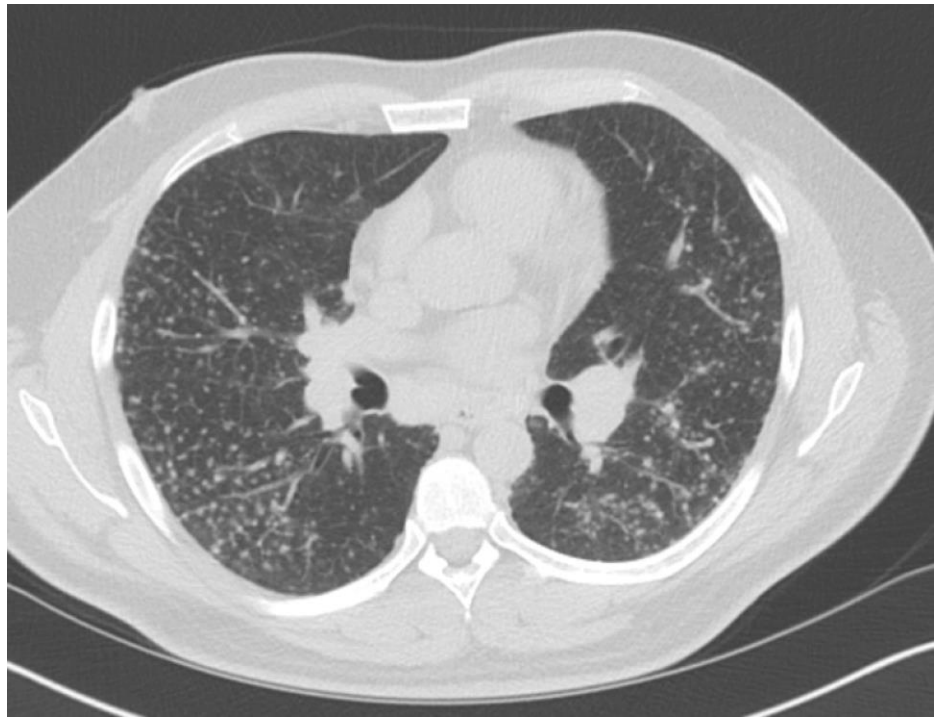
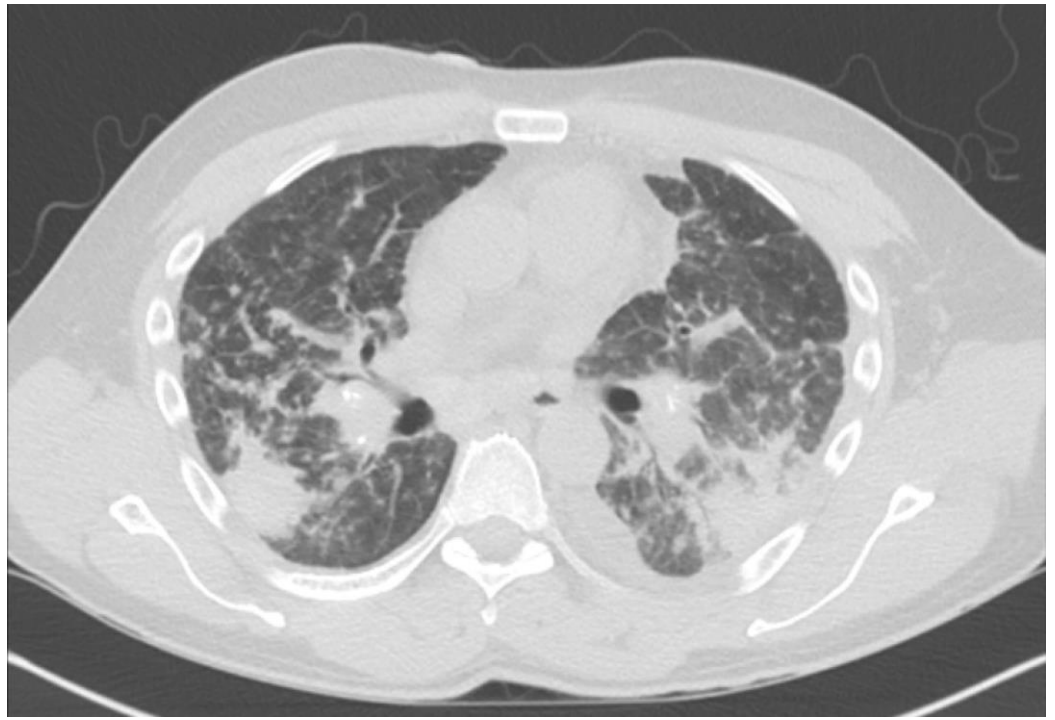
Fazio et al. *JAMA Int Med*. 2023;183(9):991-998.

Advanced Disease

Simple: 61%



Complicated: 38%



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Fazio et al. *JAMA Int Med*. 2023;183(9):991-998.

Occupational History

Years of work in engineered stone industry (51), median (IQR)	15 (10-20)
Continued working after diagnosis (52)	
Still working	25 (48)
Not working	18 (35)
Unknown	9 (18)
Engineering controls: water suppression methods (51)	23 (45)
Respirator use (47)	
Sometimes	35 (74)
Always	12 (26)
Type of respirator (37)	
N-95	33 (89)
Half-face respirator	17 (46)
Full-face respirator	2 (5)
No. of employees in workshop (35)	
<10	17 (49)
10-50	17 (49)
>50	1 (2)

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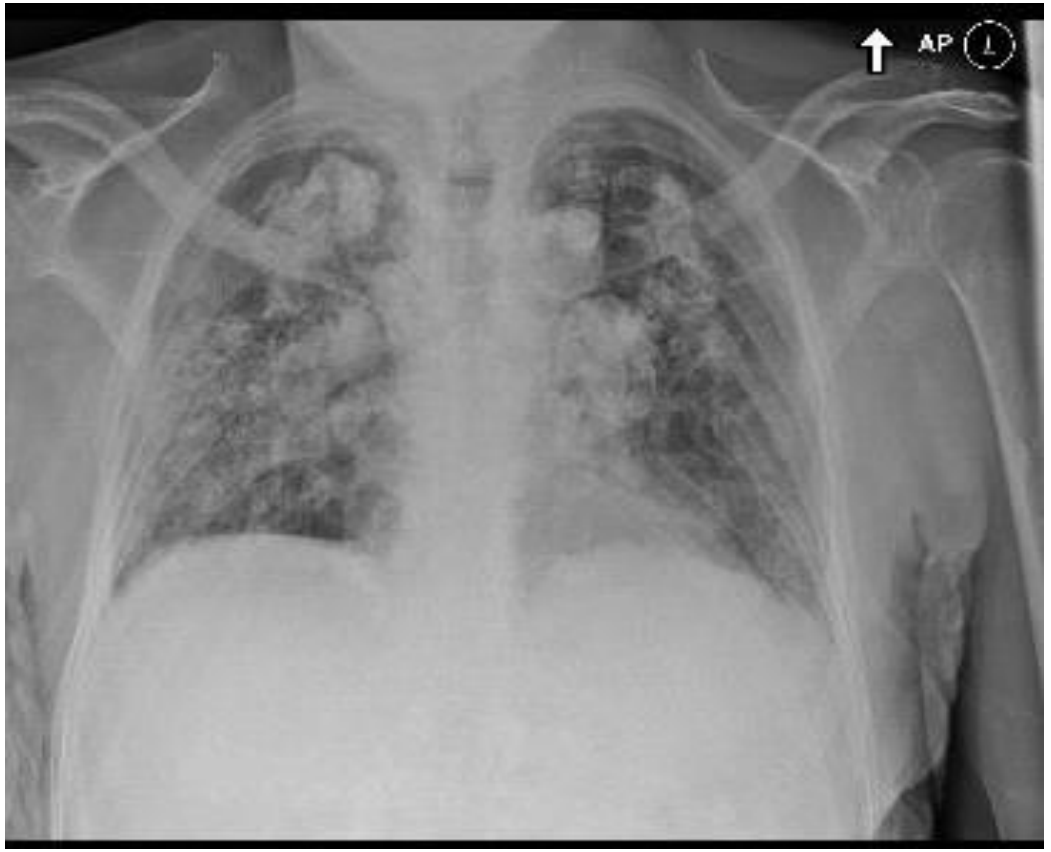
Fazio et al. *JAMA Int Med*. 2023;183(9):991-998.

Making the Diagnosis

- Characteristic imaging findings and occupational history are sufficient
- Biopsy when diagnosis is in question



Occupational History: Screening Questions for Respiratory Disease

- What kind of work do you do?
- Do you think your breathing problems are related to your work?
- Are your symptoms better away from work?
- Have you ever been exposed to dusts, fumes, or chemicals at work?

Gandhi et al. *Clin Chest Med*. 2023;44:635-649.

Occupational History: Assessing Engineered Stone Exposure

- **Industry**: stone countertop fabrication
- **Occupation**: countertop fabricator/installer
- **Specific materials**: engineered/artificial stone; “quartz,” “marble,” “granite”
- **Specific tasks**: cutting, grinding, polishing

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- **Specific materials**: engineered/artificial stone; “quartz,” “marble,” “granite”
- **Specific tasks**: cutting, grinding, polishing
- **Work tenure**: years spent doing this work
- **Engineering controls**: dry cutting vs. wet methods; ventilation
- **Respiratory protection**: type of respirator (disposable N95, half-face respirator); frequency of use; fit testing

California Engineered Stone (ES) Silicosis Surveillance Dashboard

Date last updated: 1/23/2025

239
Confirmed ES Silicosis Cases

15
Deaths

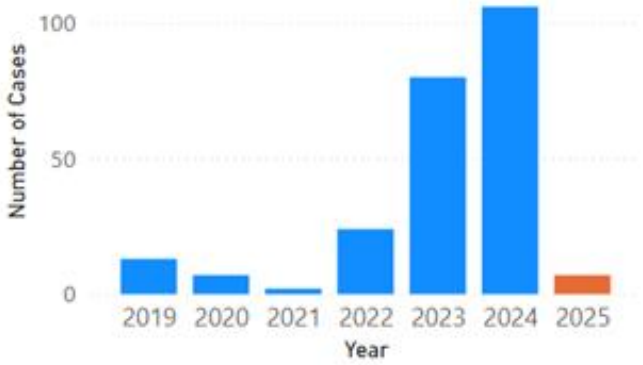
46
Median Age at Diagnosis

46
Median Age at Death

99.6%
Percent of all cases male

97%
Percent of all cases Latino

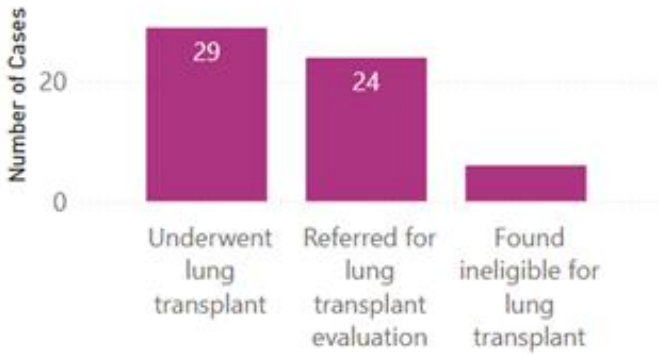
Year confirmed ES Silicosis cases identified by CDPH



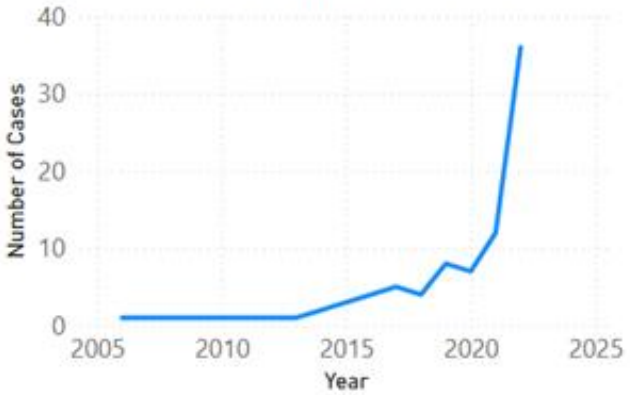
Cases identified in 2025 are expected to increase

Confirmed ES Silicosis cases have been identified in the following counties:

Last known transplant status for confirmed ES Silicosis cases



Year of diagnosis* for confirmed ES Silicosis cases



*Known years of diagnosis are displayed through 2022; data for more recent years are incomplete due to reporting lags. Diagnosis year is missing for some cases.

County of residence

All

County	Count
Alameda	11
Alpine	No known cases
Amador	No known cases
Butte	No known cases

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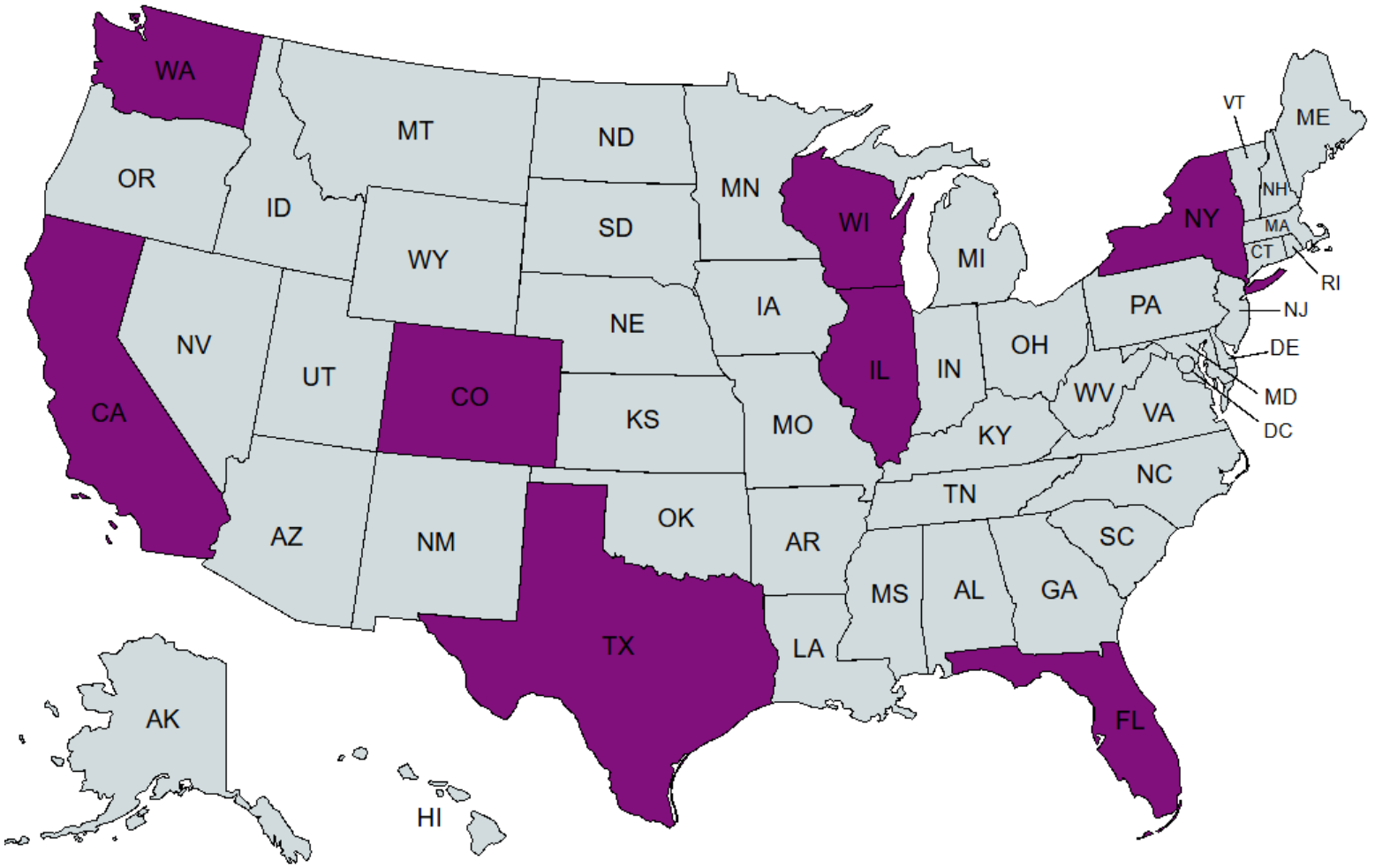
https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/Pages/essdashboard.aspx

Reported U.S. Cases



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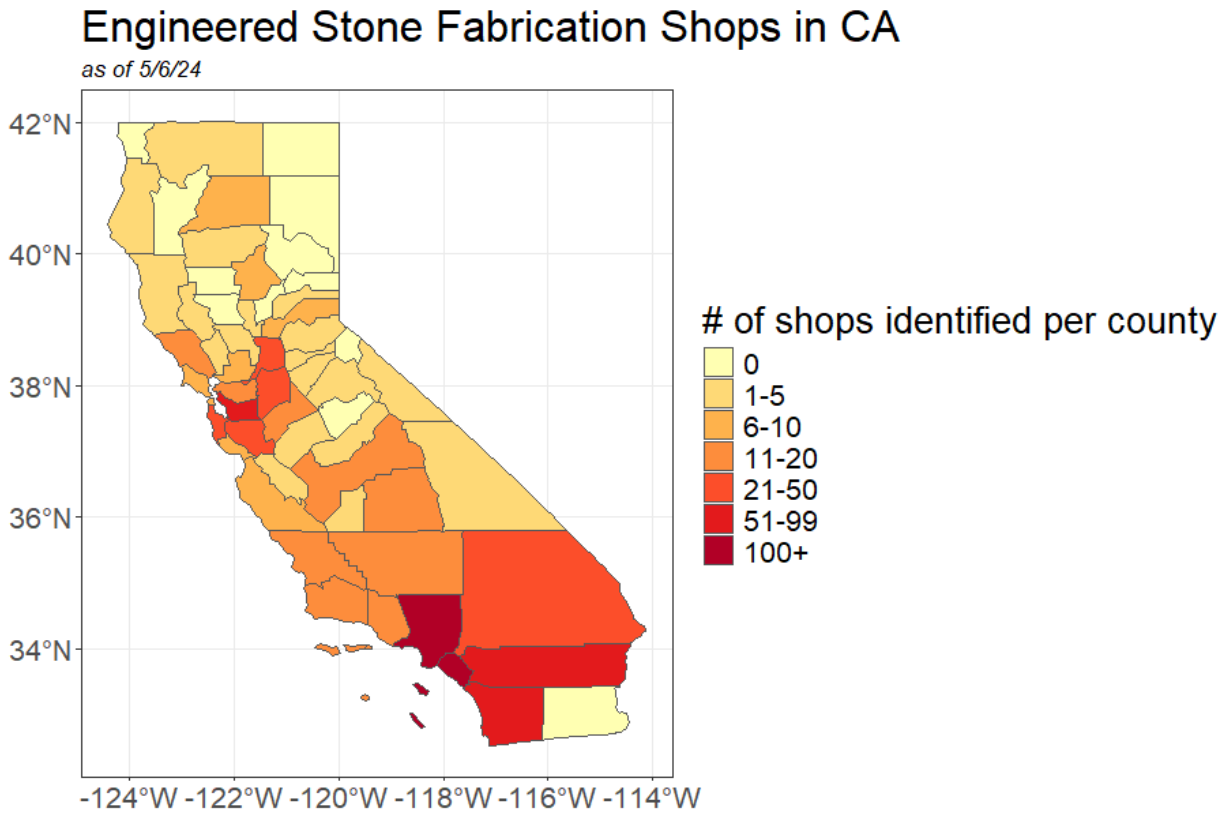
The Tip of an Iceberg?

- >800 shops in California
- 100,000 workers in US
- Silicosis prevalence estimates
  - 12% in one CA workplace
  - >20% in Australian screening programs
- Likely many unidentified cases in California and nationally



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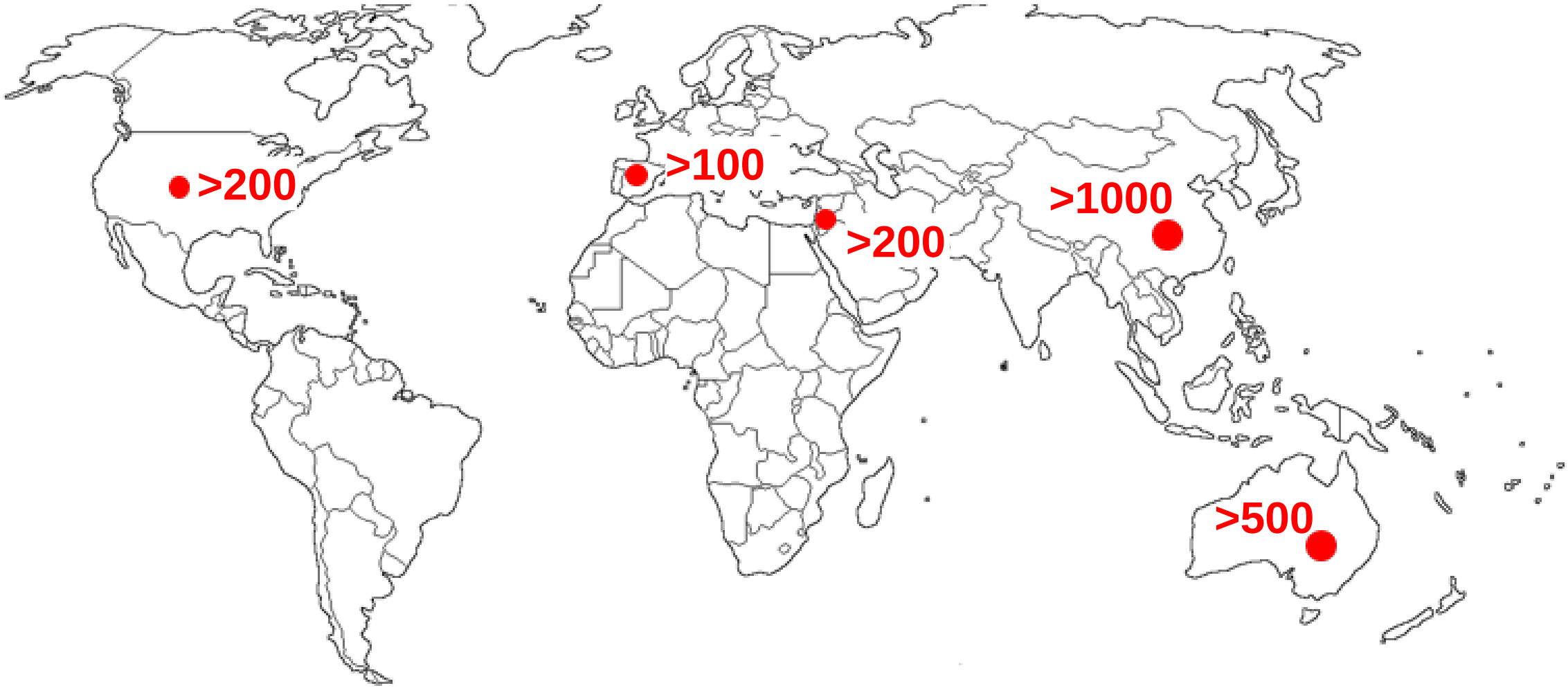
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>200
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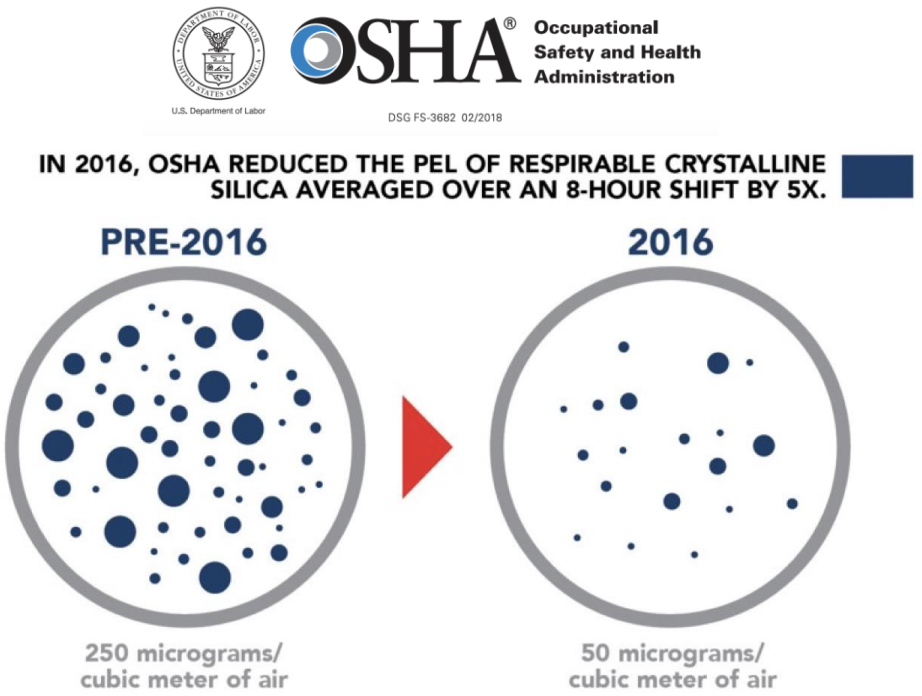
Exposure

OSHA Silica Standard for Employers (2016)

- **Determine** amount of **exposure**
  - Action Level: 25 µg/m^3
  - Permissible Exposure Limit: 50 µg/m^3
- Use **exposure controls**
- **Train workers** on health effects
- Offer **medical exams**
  - CXR, spirometry, TB test



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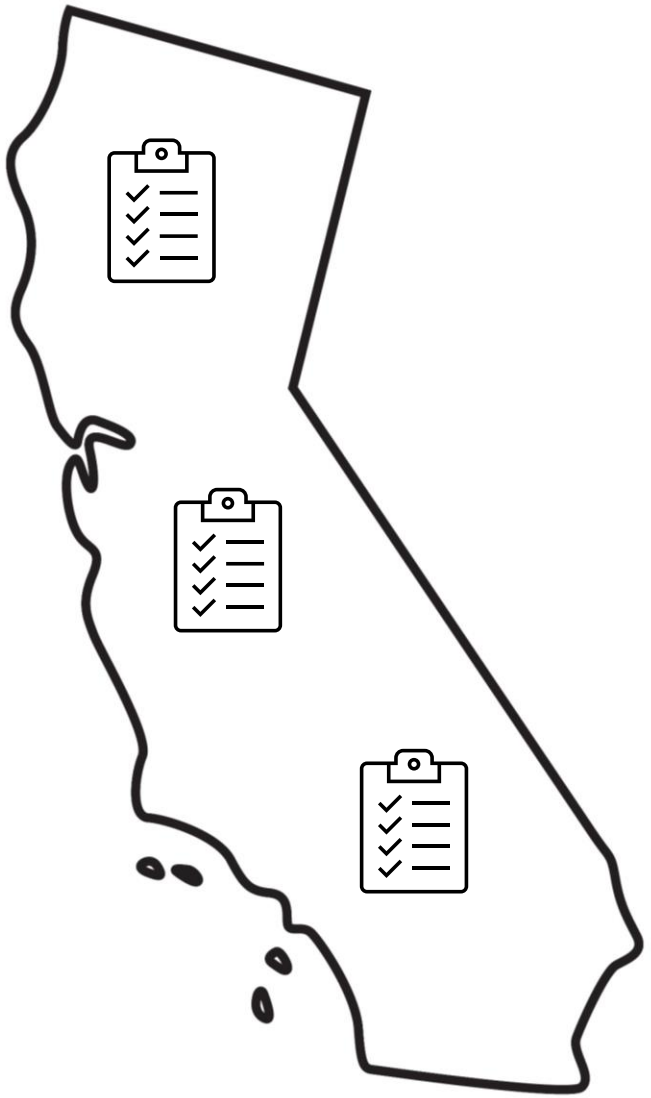
OSHA. Occupational Exposure to Respirable Crystalline Silica. Final rule. *Fed Regist*. 2016;81(58):16285-16890.

Cal/OSHA Special Emphasis Program (SEP)



Cal/OSHA Special Emphasis Program (2019-2020)

Inspections opened: 106

Air sampling performed: 47

Surasi et al. *AJIM.* 2022;65(9):701-7.

Respirable Crystalline Silica Standard

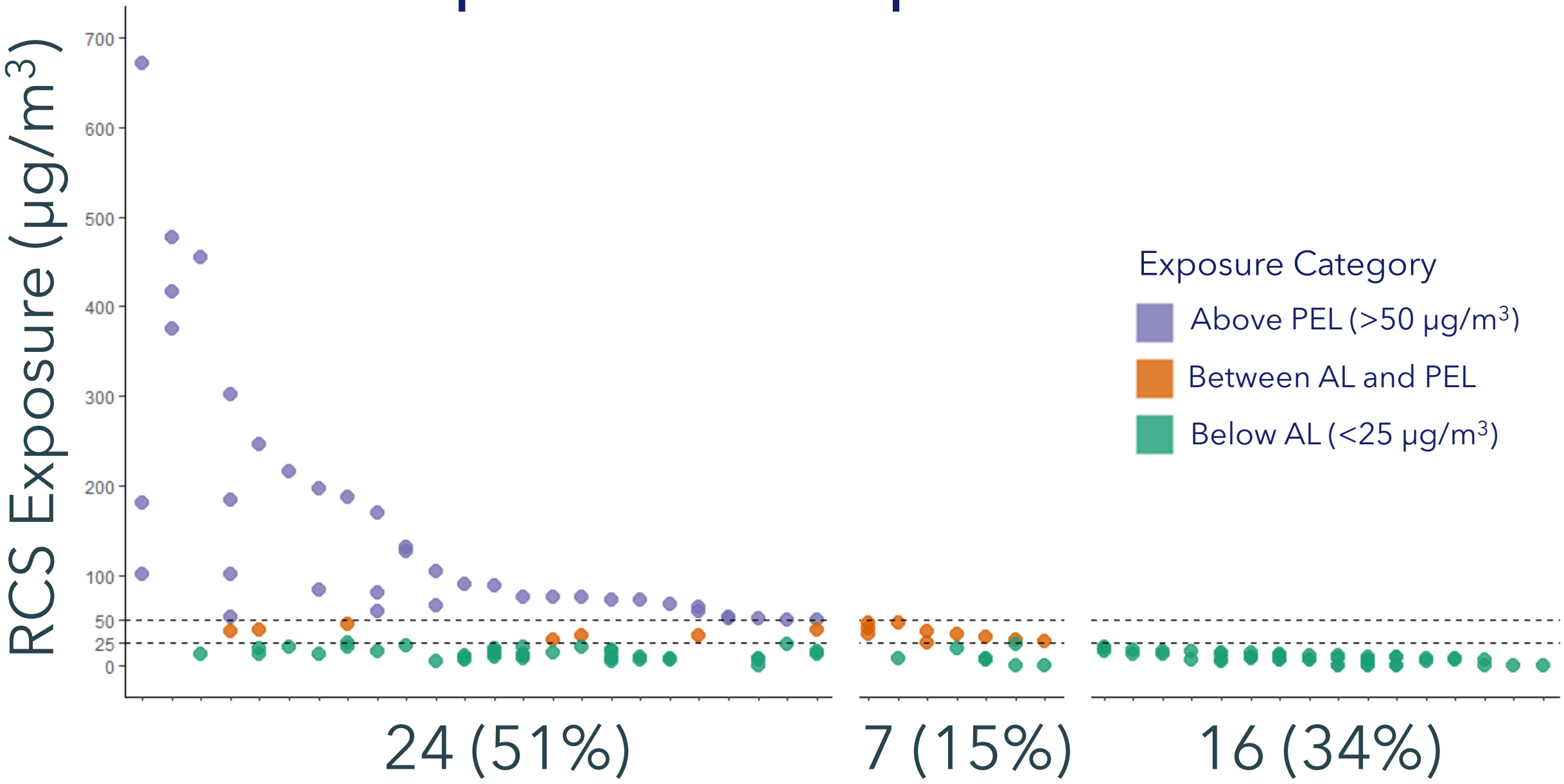
Permissible Exposure Limit (PEL) = 50 µg/m^3

No employee may be exposed to RCS above the PEL.

Action Level (AL) = 25 µg/m^3

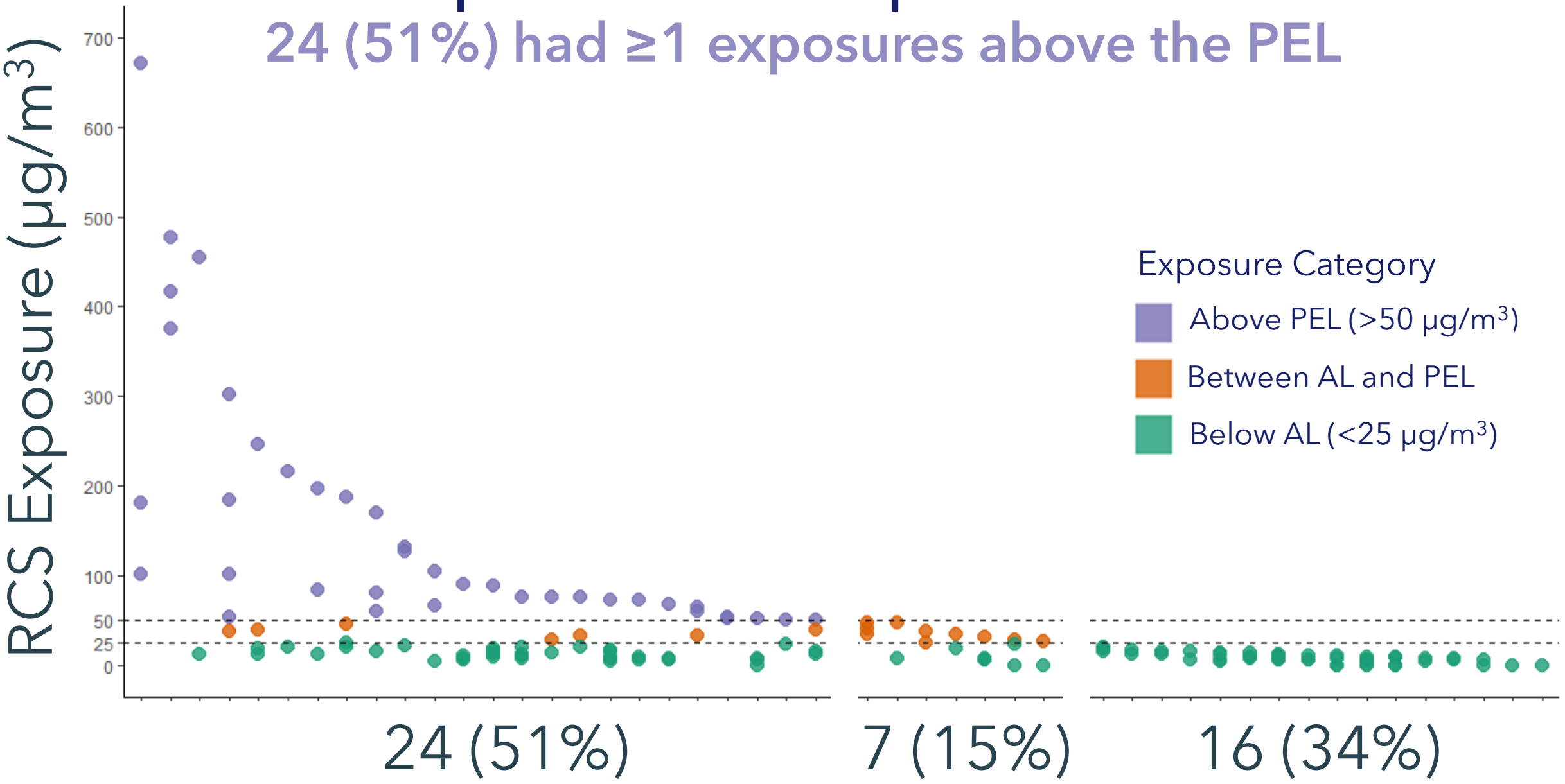
At or above AL, employers must monitor employee RCS exposure and perform medical surveillance.

47 companies with ≥1exposure measurements



47 companies with ≥1exposure measurements

24 (51%) had ≥1 exposures above the PEL



Worker Interviews (n=92)

- Young (median age 39)
- Short tenure (median 3.8 years)
- Many Spanish-speaking (39%)
- Performed dust-generating tasks (91%), using dry methods (26%)
- Most not informed of air sampling (68%)
- Few fit tested (20%) or offered medical examinations (5%)

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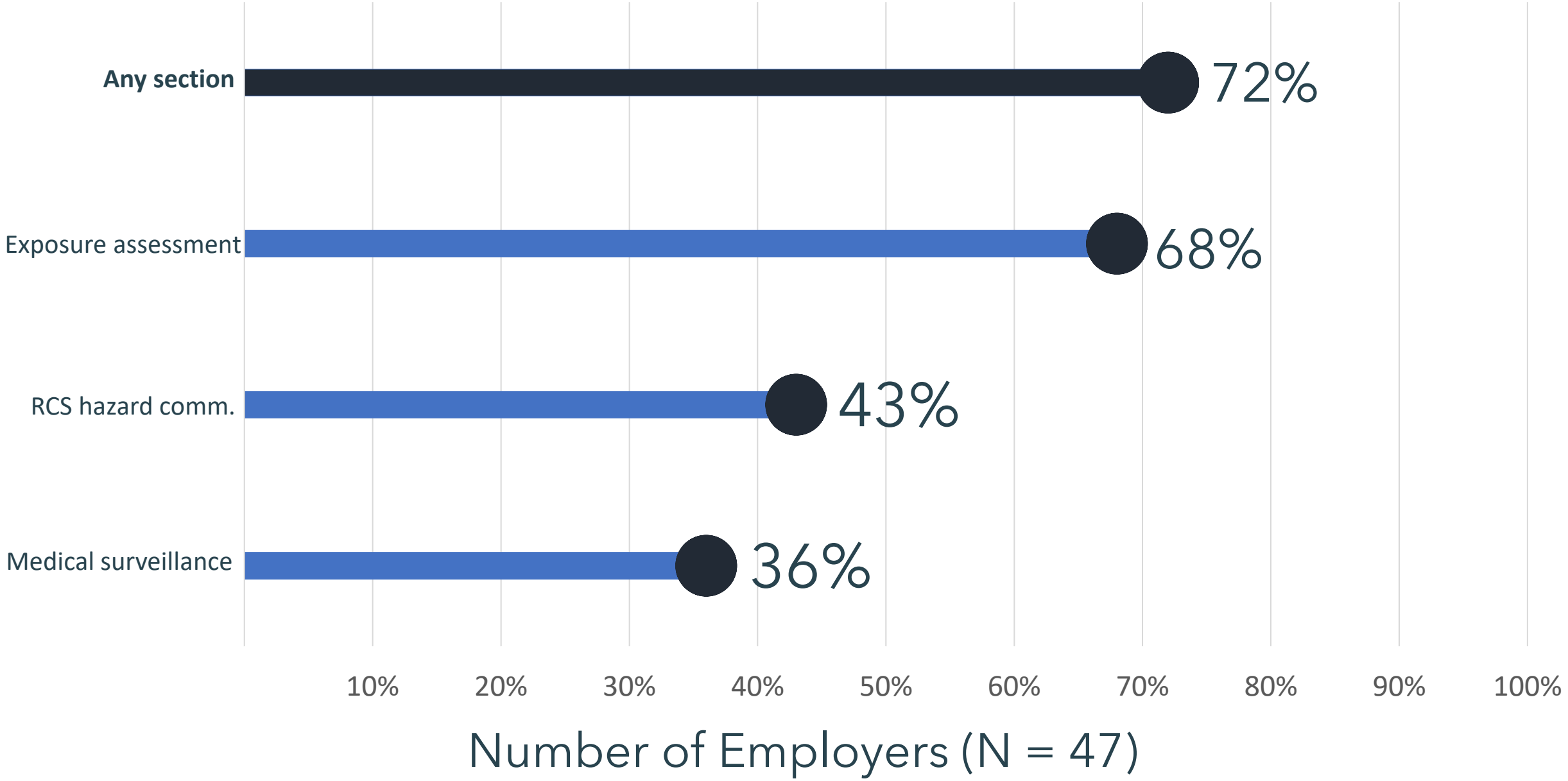
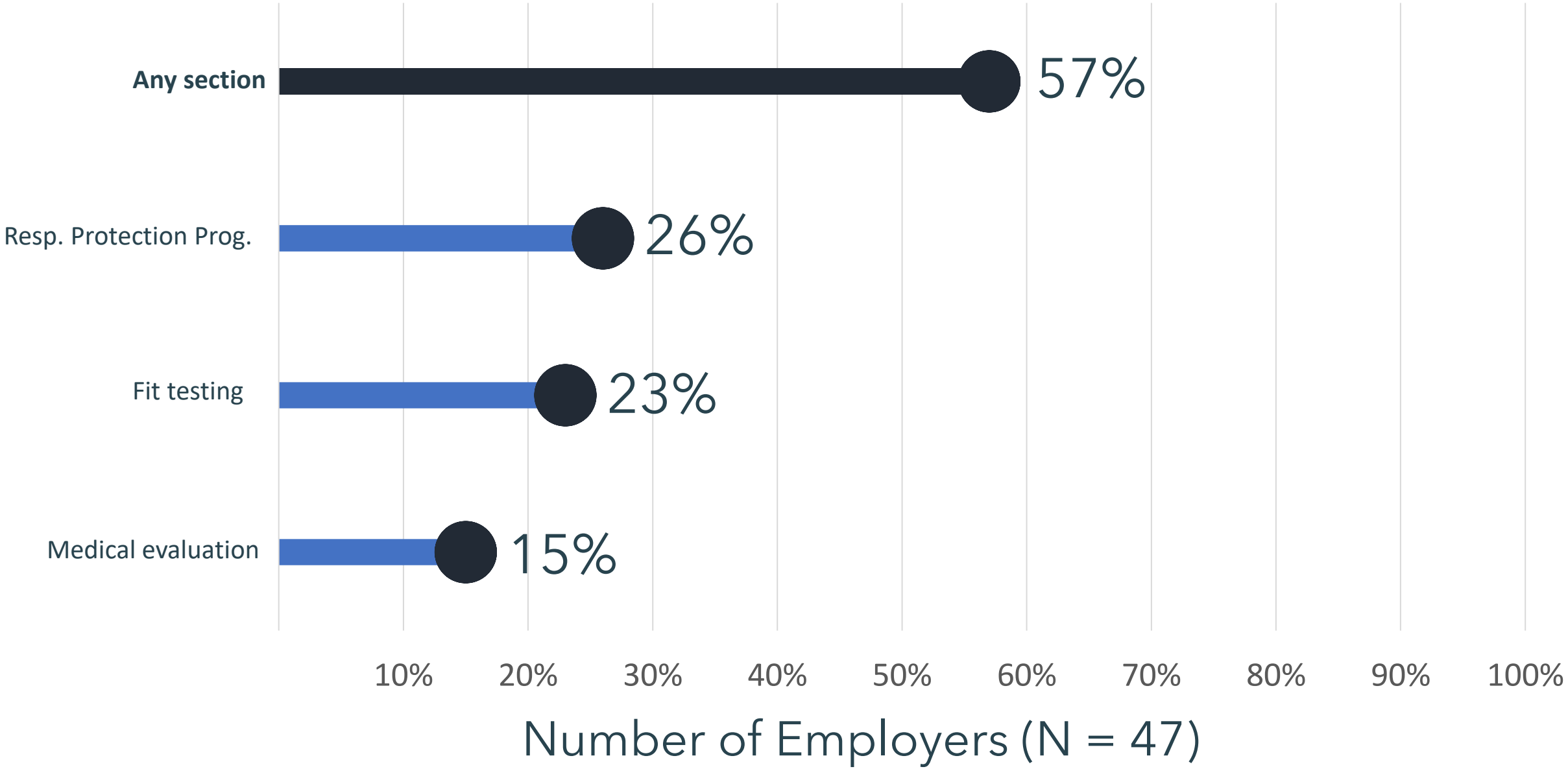
Spiegel et al. *AJIM.* 2022; 65(12):1022-1024.

RCS Standard Violation Citations



Respiratory Protection Standard Violation Citations



Prevention

Challenges

- **Product:** widely available, popular, toxic to fabricators not consumers
- **Industry:** global, decentralized, small shops
- **Workers:** not unionized, socioeconomically vulnerable

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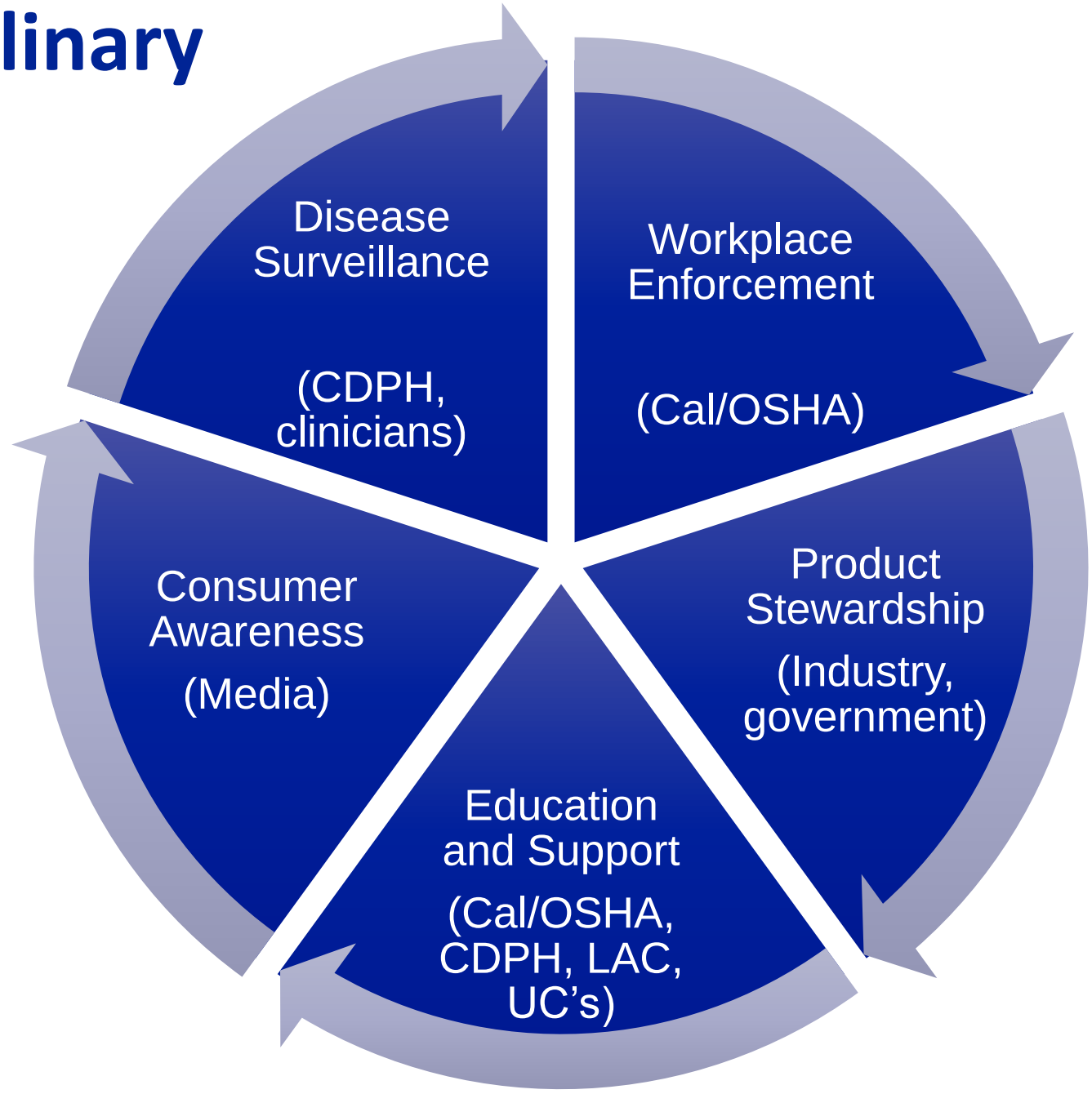
- **Industry:** global, decentralized, small shops
- **Workers:** not unionized, socioeconomically vulnerable
- **Clinicians:** unfamiliar with disease, reporting
- **Public health:** surveillance tools limited, outreach difficult
- **Regulators:** loopholes, enforcement complexities, citations have limited impact, no limits on sale or use

Multidisciplinary Approach



CA Artificial Stone and Silicosis (CASS) Project

Funded through the **California Labor Laboratory**,
a NIOSH Center of Excellence for Total Worker Health®

UCSF Philip R. Lee Institute for Health Policy Studies

healthyworkplaces
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LOHP Safe Jobs. Healthy Lives.
LABOR OCCUPATIONAL HEALTH PROGRAM
UNIVERSITY OF CALIFORNIA, BERKELEY

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SHIFT

California Department of PublicHealth

UCSF Occupational and Environmental Medicine
Department of Medicine

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CASS Project: 2021-2026

Workplace: Education

Medical system: Diagnosis

CDPH: Surveillance

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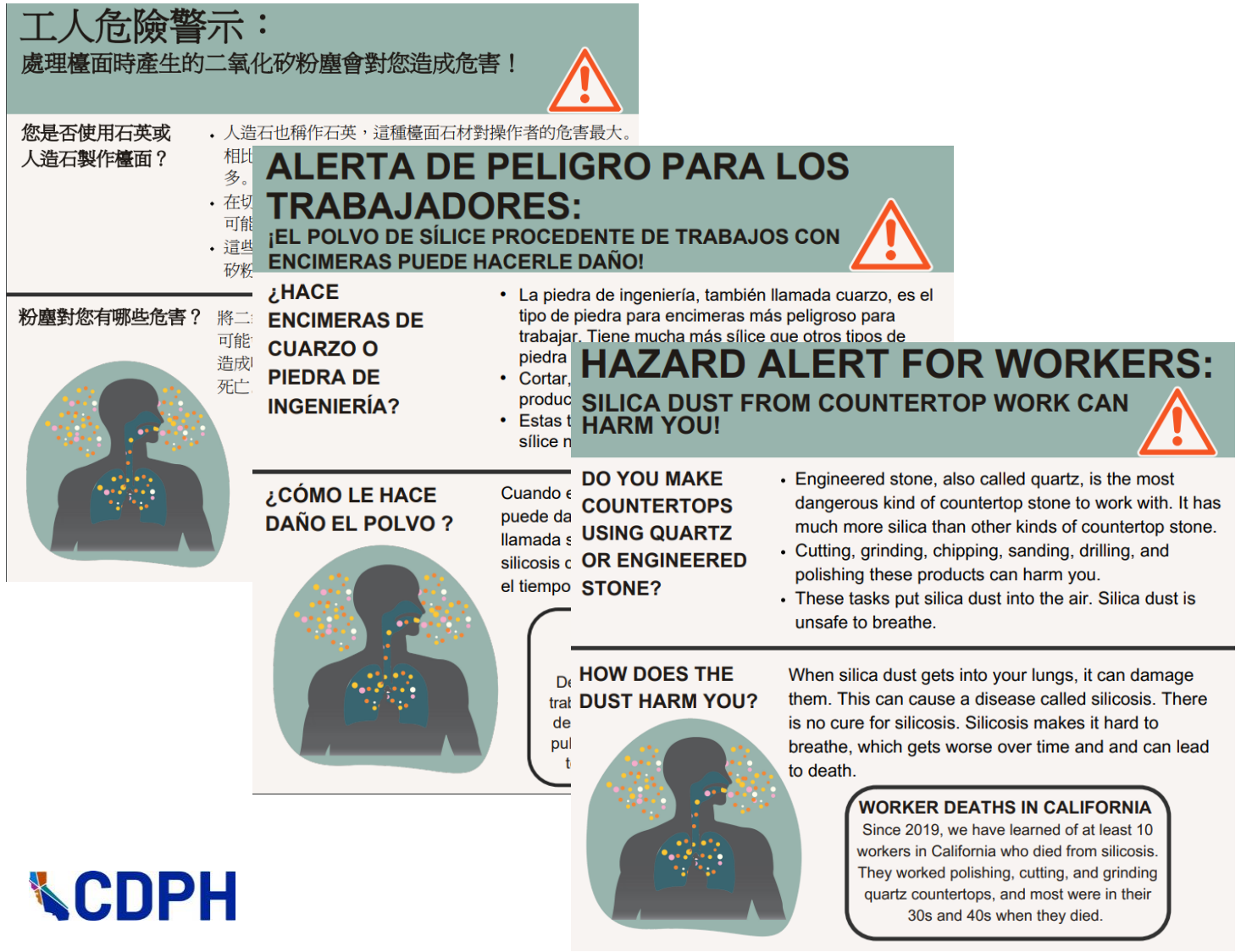
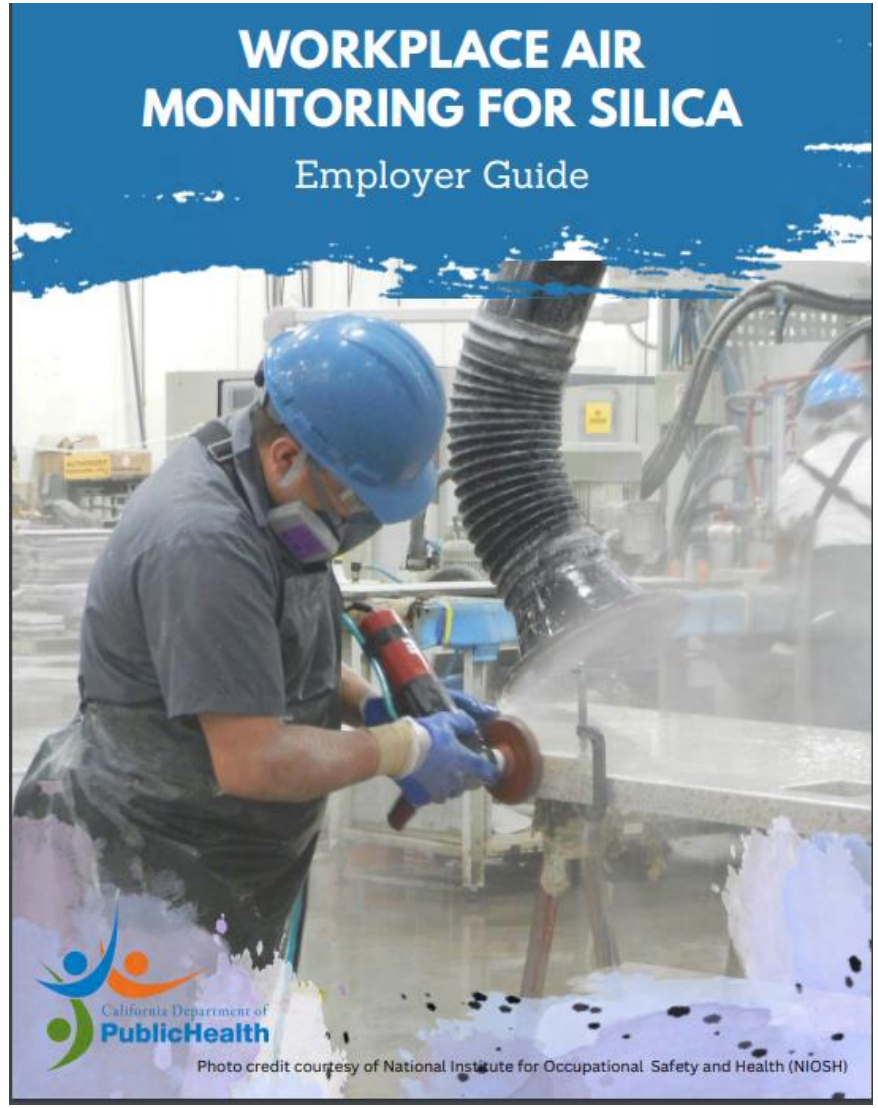
Educational Materials and Outreach





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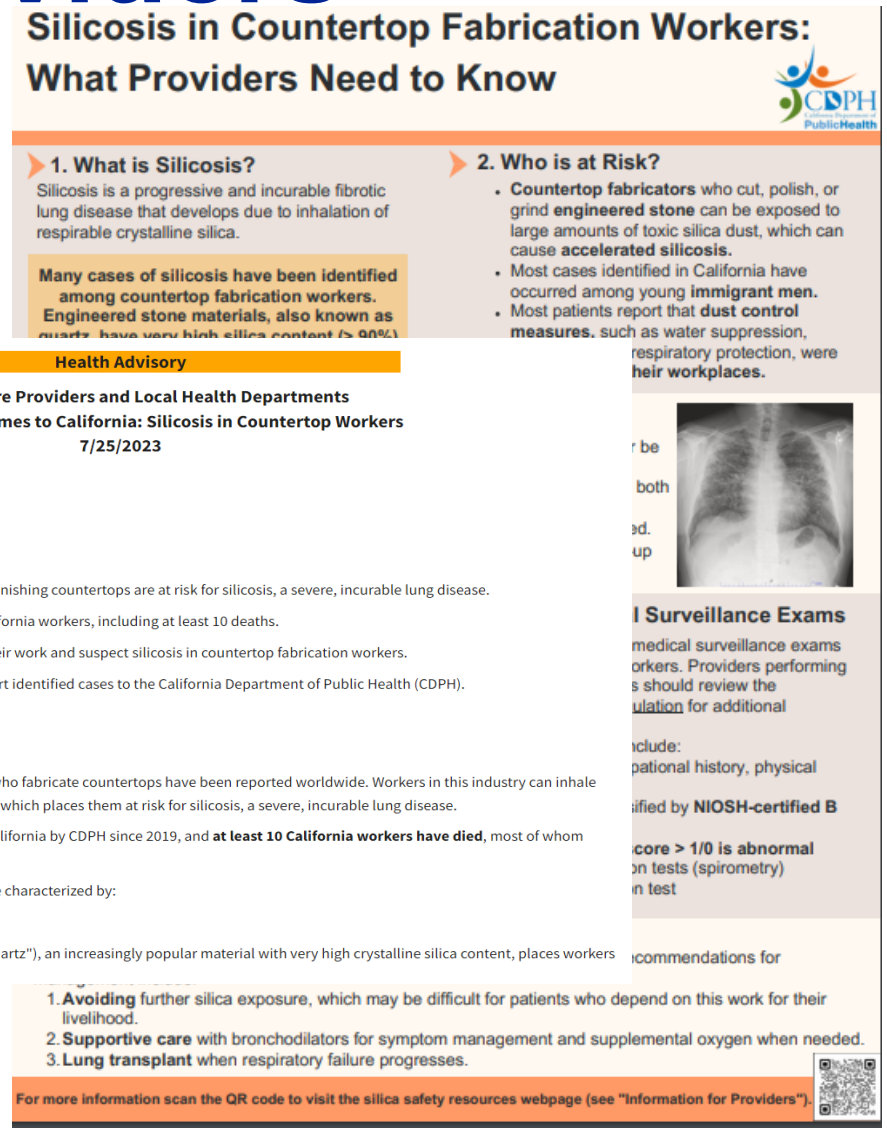
Resources for Providers

- **Fact sheet**
- **California Health Alert Network (CAHAN) advisory**
- **Continuing Medical Education (CME) course**
- **California Medical Association (CMA) Grand Rounds**



Silicosis in Countertop Fabrication Workers: What Providers Need to Know

1. What is Silicosis?

Silicosis is a progressive and incurable fibrotic lung disease that develops due to inhalation of respirable crystalline silica.

Many cases of silicosis have been identified among countertop fabrication workers. Engineered stone materials, also known as

2. Who is at Risk?

- **Countertop fabricators** who cut, polish, or grind **engineered stone** can be exposed to large amounts of toxic silica dust, which can cause **accelerated silicosis.**
- Most cases identified in California have occurred among young **immigrant men.**
- Most patients report that **dust control measures**, such as water suppression, respiratory protection, were **their workplaces.**

Health Advisory

To: Healthcare Providers and Local Health Departments
Global Epidemic Comes to California: Silicosis in Countertop Workers
7/25/2023

TOMÁS J. ARAGÓN, M.D., Dr.P.H.
State Public Health Officer & Director

Key Messages

- Individuals with a history of working in cutting and finishing countertops are at risk for silicosis, a severe, incurable lung disease.
- More than 70 cases have been identified among California workers, including at least 10 deaths.
- Providers should educate and ask patients about their work and suspect silicosis in countertop fabrication workers.
- Providers and local health departments should report identified cases to the California Department of Public Health (CDPH).

Background

Since 2010, more than 1,000 cases of silicosis in workers who fabricate countertops have been reported worldwide. Workers in this industry can inhale **crystalline silica dust** as they cut and finish countertops, which places them at risk for silicosis, a severe, incurable lung disease.

More than 70 cases of silicosis have been identified in California by CDPH since 2019, and **at least 10 California workers have died**, most of whom were in their 30s and 40s.

The workers with silicosis identified so far in California are characterized by:

- History of cutting and finishing stone countertops
  - Working with engineered stone (also called "quartz"), an increasingly popular material with very high crystalline silica content, places workers at particularly high risk.

l Surveillance Exams

medical surveillance exams orkers. Providers performing s should review the ulation for additional

nclude:
pational history, physical

ified by **NIOSH-certified B**

core > 1/0 is abnormal
n tests (spirometry)
n test

ecommendations for

1. **Avoiding** further silica exposure, which may be difficult for patients who depend on this work for their livelihood.
2. **Supportive care** with bronchodilators for symptom management and supplemental oxygen when needed.
3. **Lung transplant** when respiratory failure progresses.

For more information scan the QR code to visit the silica safety resources webpage (see "Information for Providers").

CDPH

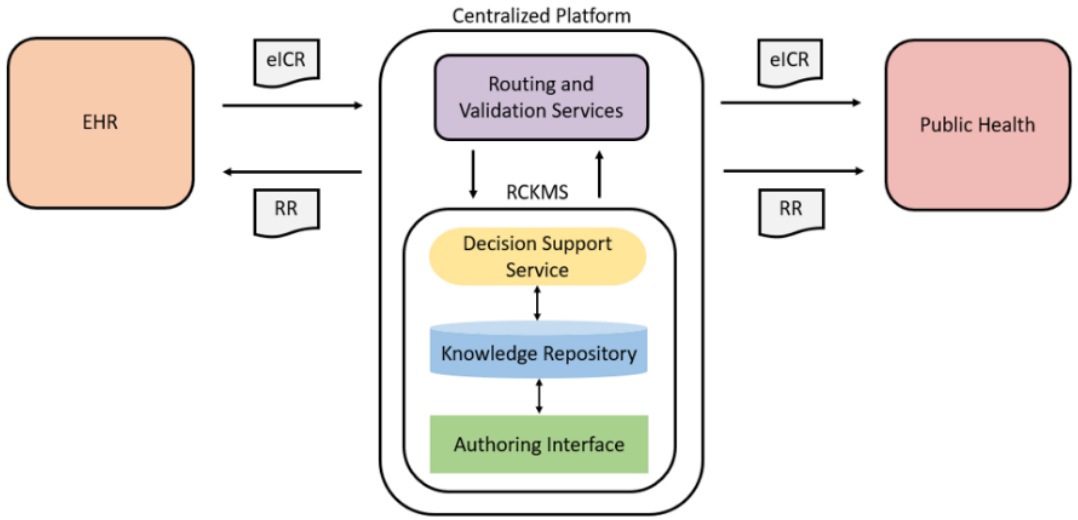
CASS Study

- In collaboration with Olive View-UCLA Medical Center
- Current countertop fabrication workers in LA County eligible
- Questionnaire
- Screening tests
  - Standard: CXR and spirometry
  - Enhanced: Chest CT and full PFTs
- Blood biomarkers

CDPH

New Surveillance Tools

- **Reportable Conditions Knowledge Management System (RCKMS)**



- **Title 17, Reportable Diseases and Conditions**

Title 17, California Code of Regulations (CCR) §2500, §2593, §2641.5-2643.20, and §2800-2812 Reportable Diseases and Conditions *

§ 2500. REPORTING TO THE LOCAL HEALTH AUTHORITY.

- **§ 2500(b)** It shall be the duty of every health care provider, knowing of or in attendance on a case or suspected case of any of the diseases or condition listed below, to report to the local health officer for the jurisdiction where the patient resides. Where no health care provider is in attendance, any individual having knowledge of a person who is suspected to be suffering from one of the diseases or conditions listed below may make such a report to the local health officer for the jurisdiction where the patient resides.
- **§ 2500(c)** The administrator of each health facility, clinic, or other setting where more than one health care provider may know of a case, a suspected case or an outbreak of disease within the facility shall establish and be responsible for administrative procedures to assure that reports are made to the local officer.
- **§ 2500(a)(14)** "Health care provider" means a physician and surgeon, a veterinarian, a podiatrist, a nurse practitioner, a physician assistant, a registered nurse, a nurse midwife, a school nurse, an infection control practitioner, a medical examiner, a coroner, or a dentist.

Hierarchy of Controls

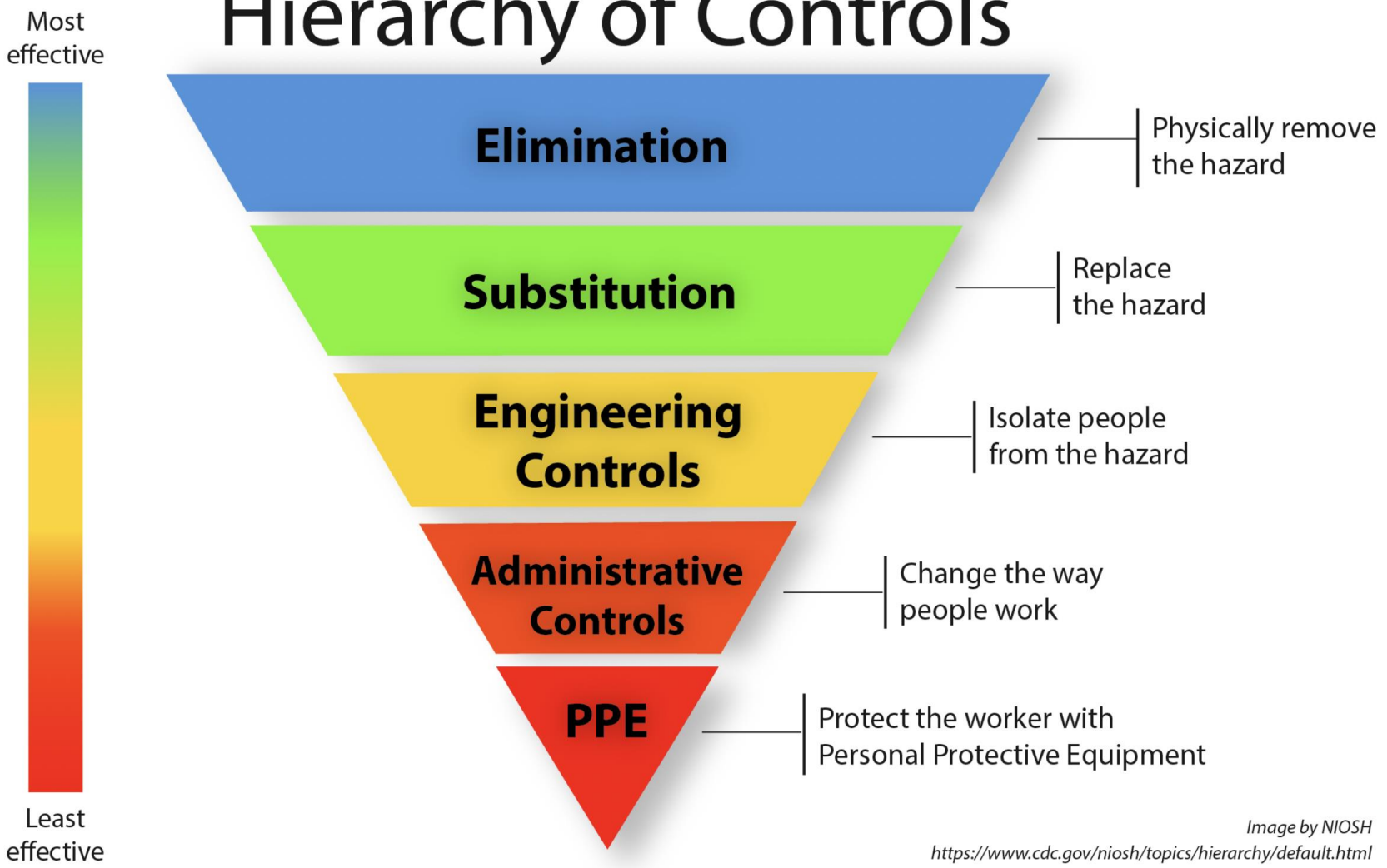


Image by NIOSH
https://www.cdc.gov/niosh/topics/hierarchy/default.html

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Workplace Controls

- **Engineering**: wet methods, ventilation
- **Administrative**: restricted areas
- **Personal Protective Equipment**: respirators

CDPH

Photo credit: Chaolong Xi, NIOSH

New Cal/OSHA Regulations

NEWS

California Fast-Tracks Rules to Protect Stonecutters From 'Horrible' Deaths

LISTEN

By Farida Jhabvala Romero Jul 22 Save Article

Leobardo Segura-Meza, 27, speaks to California workplace regulators via video on July 20, 2023, while his wife Mirian looks on. Segura-Meza, who requires an oxygen tank at all times to breathe, was diagnosed last year with silicosis after working for 10 years cutting engineered stone countertops. *(From Cal/OSHA meeting screenshot)*

- **Emergency Temporary Standard (12/23)**
  - Bans dry cutting
  - Requires higher level respirator
  - Includes Order Prohibiting Use
- **Revised Permanent Standard (12/24)**
  - Adds chest CT to medical screening
  - Requires all medical screening to be reported to CDPH

CDPH

https://www.dir.ca.gov/dosh/respiratory-silica-FAQ.html

2024 Silica ETS Inspections

- **85 silica inspections opened from 12/29/23 to 12/09/24**
- 56 of 85 (66%) silica inspections closed
- 29 of 85 (35%) silica inspections ongoing
- 53 of 56 (95%) silica inspections closed with violations
- 22 of 85 (26%) shops issued Orders Prohibiting Use (OPU)

Cal/OSHA data, courtesy of Dr. Michael Wilson

Hierarchy of Controls

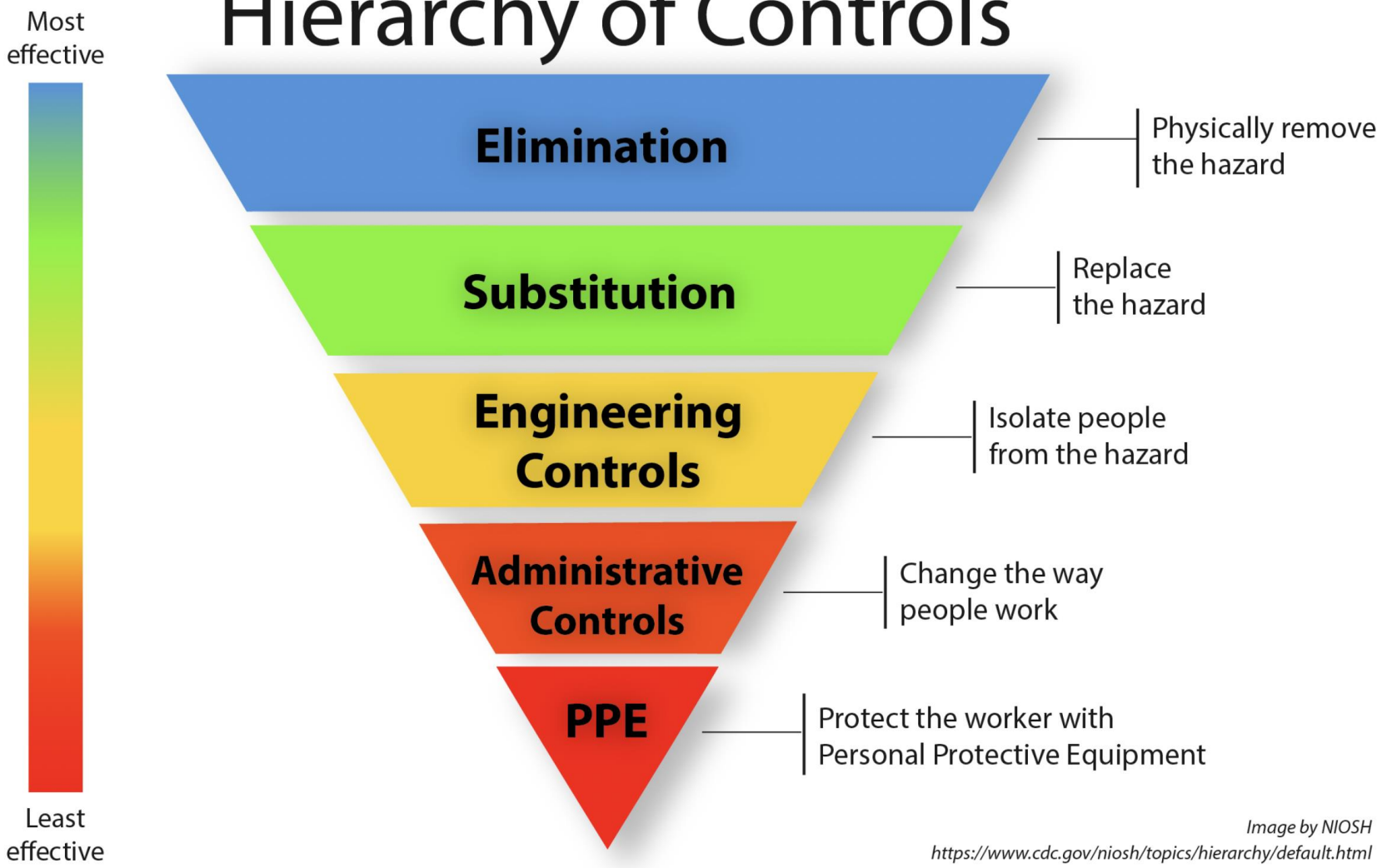

Image by NIOSH
https://www.cdc.gov/niosh/topics/hierarchy/default.html

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Substitution

- **Select products with lower or no silica content**

- Natural: marble, granite, wood
- Manufactured: ceramic, porcelain, concrete
- New engineered stone products

CDPH

Elimination

- **July 2024:** ban on engineered stone in Australia
  - Manufacture
  - Supply
  - Processing
  - installation

Safe Work Australia, 2024

Summary: Silicosis from Engineered Stone

- Large and growing problem
- Impacts young, immigrant workforce
- Burden of disease likely underestimated
- Prevention requires multifaceted approach

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CDPH

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