PERRIN CONFERENCES

ARTIFICIAL STONE SILICOSIS LITIGATION CONFERENCE

JW Marriott Los Angeles | April 28, 2026

MEDICAL OVERVIEW

Moderator:
James Nevin, Esq.
Brayton Purcell LLP
San Francisco, CA

Jane C. Fazio, M.D., Ph.D.
Department of Pulmonary and Critical Care Medicine
UCLA Health
Los Angeles, CA

Andrew McClintock Greenberg, M.D., Ph.D.
Department of Pulmonary and Critical Care and Sleep Medicine, Oakland, CA

Allison Persing, CIH, CSP
RHP Risk Management
Chicago, IL

Silicosis Review

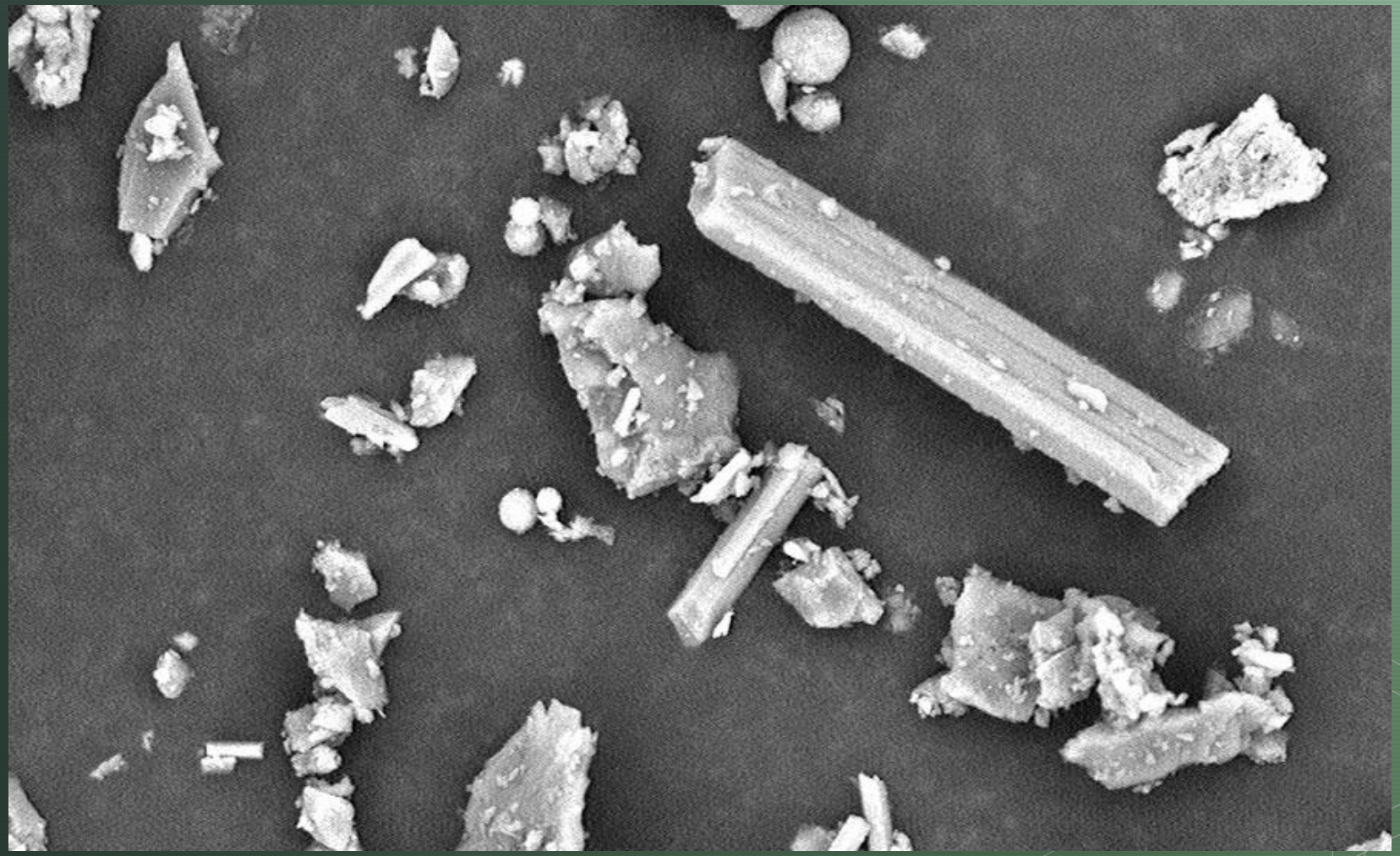
Andrew McClintock Greenberg, M.D., Ph.D.

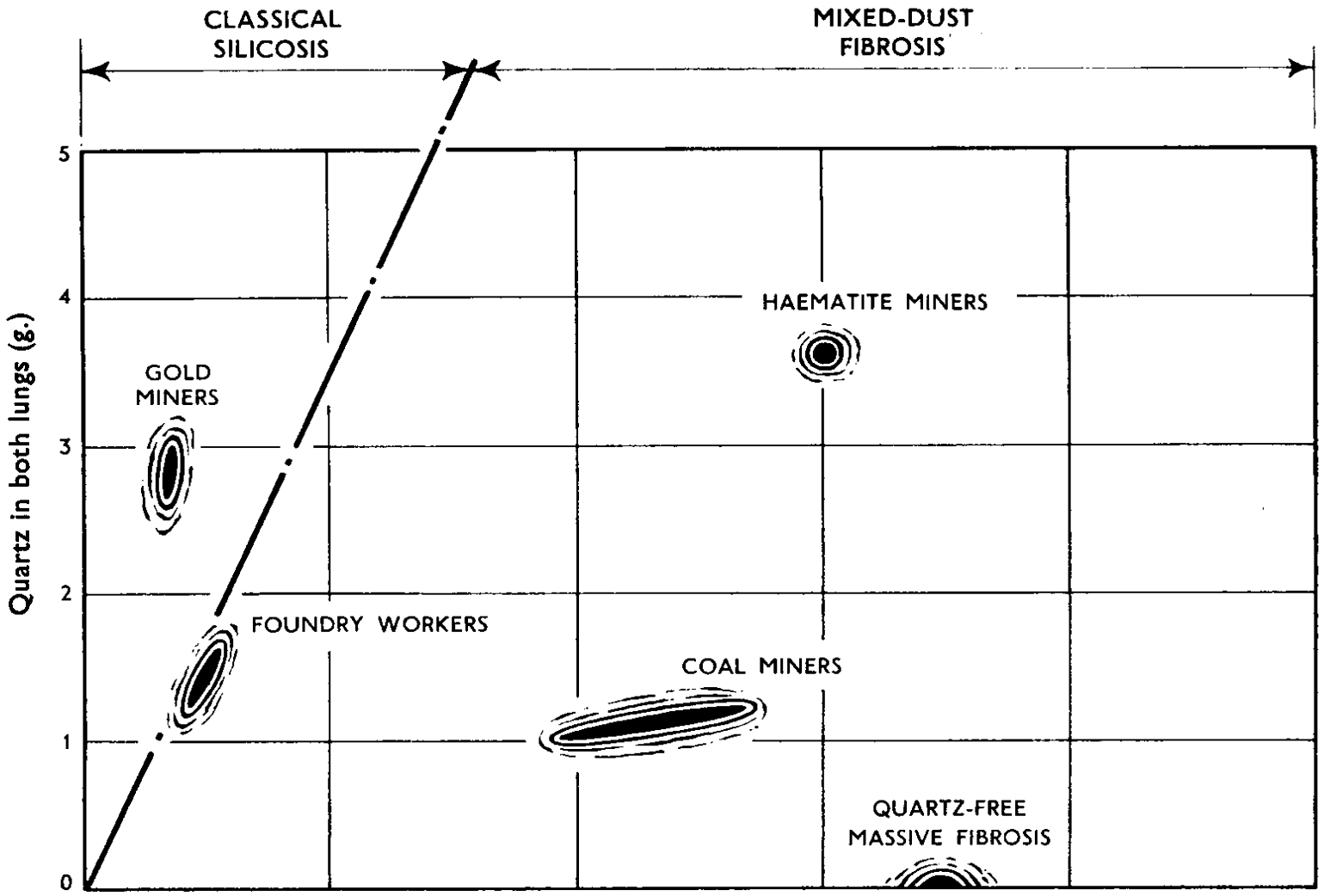
April 28, 2026

Objectives

- Overview of silicosis
- 2016 OSHA Permissible Exposure Limit Guidelines

Respirable Crystalline Silica





Nagelschmidt, G. Brit J. Industr Med, 1960, 17, 247.

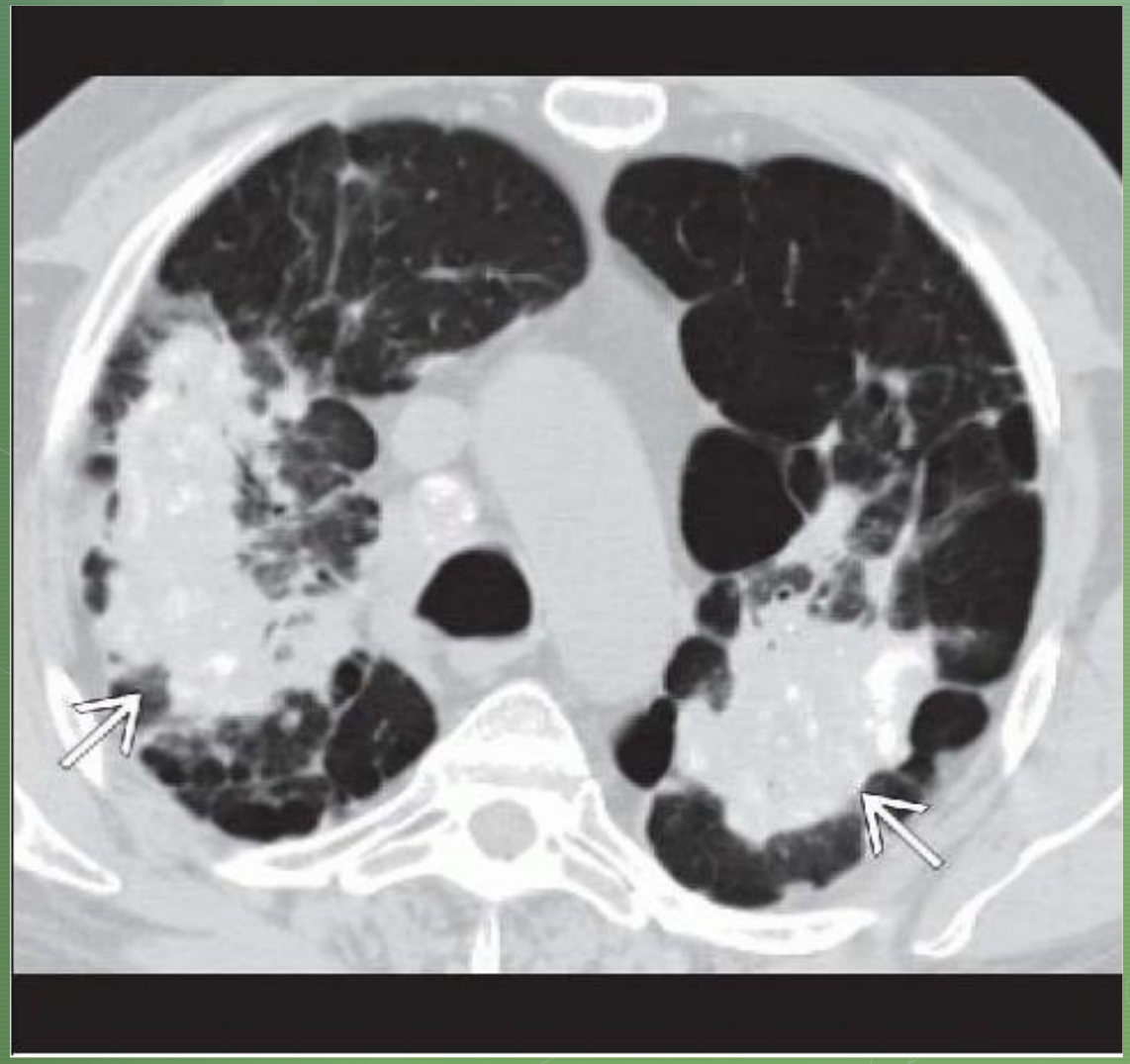
Acute Silicosis

- Acute silicosis
  - Develop symptoms within a few weeks to years after exposure to high concentration of RCS
  - Pathology shows alveolar proteinosis

Chronic silicosis

- Typically occurs 10-30 years following RCS exposure
- Progresses in the absence of further RCS exposure
- Simple versus complex (progressive massive fibrosis)

Chronic Silicosis: PMF



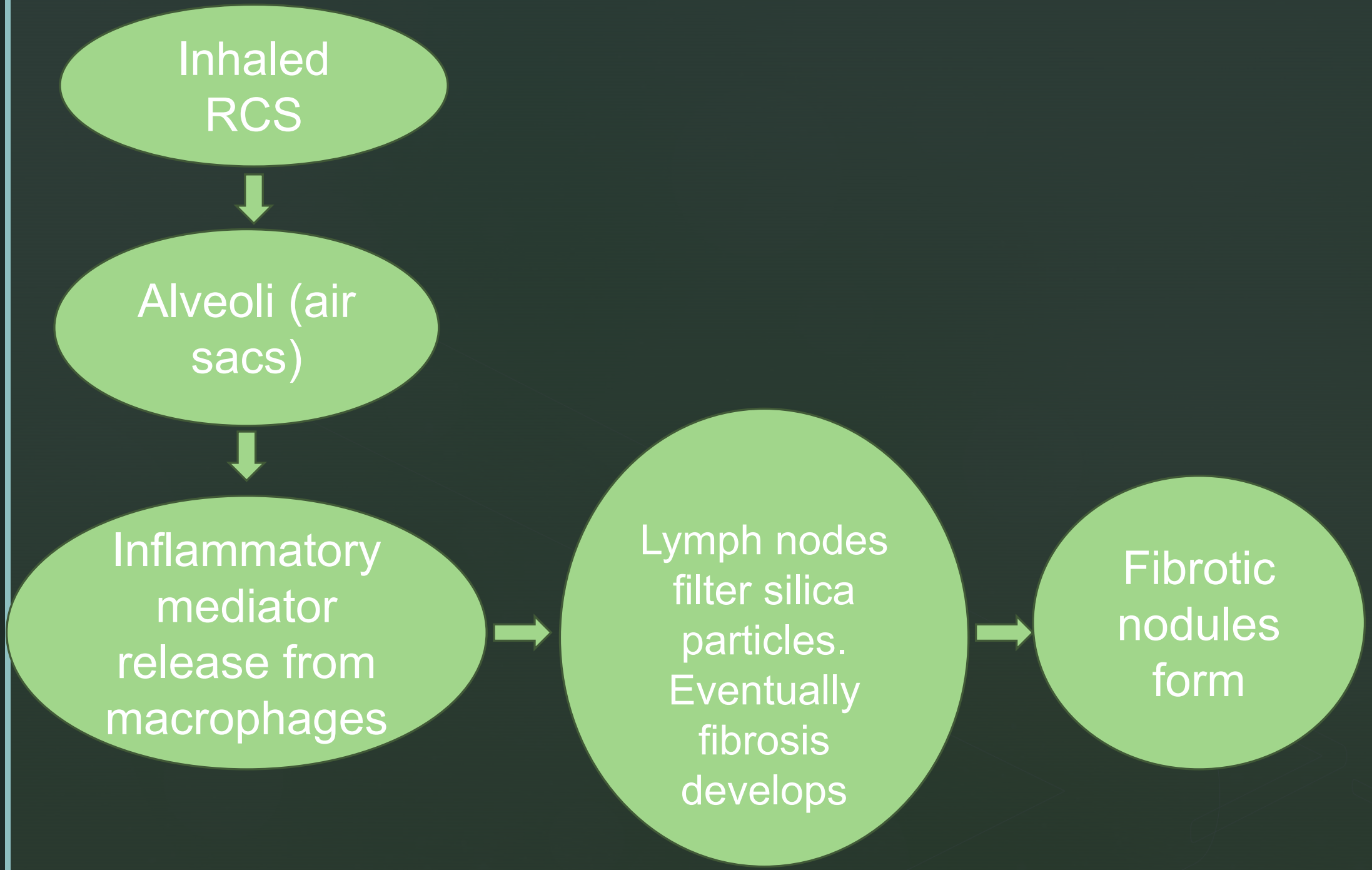
Progressive Massive Fibrosis (PMF)

- Risk of developing PMF depends on both cumulative RCS exposure and presence of underlying radiographic abnormalities
- Develops after cessation of RCS exposure
  - 10% of coal miners after 22 years of follow-up
  - 7.6% of gold miners after 17.9 years of follow-up
  - 36.9% of granite quarry workers after 7.5 years of follow-up

Maclaren, WM & Soutar, CA. Br J Ind Med 1985 Nov;42(11):734-40. Carneiro, AP, and colleagues. Am J Ind Med 2006 Oct; 49(10):811-8. Lee, HS and colleagues. Occup Environ Med 2001 Jul; 58(7):467-71

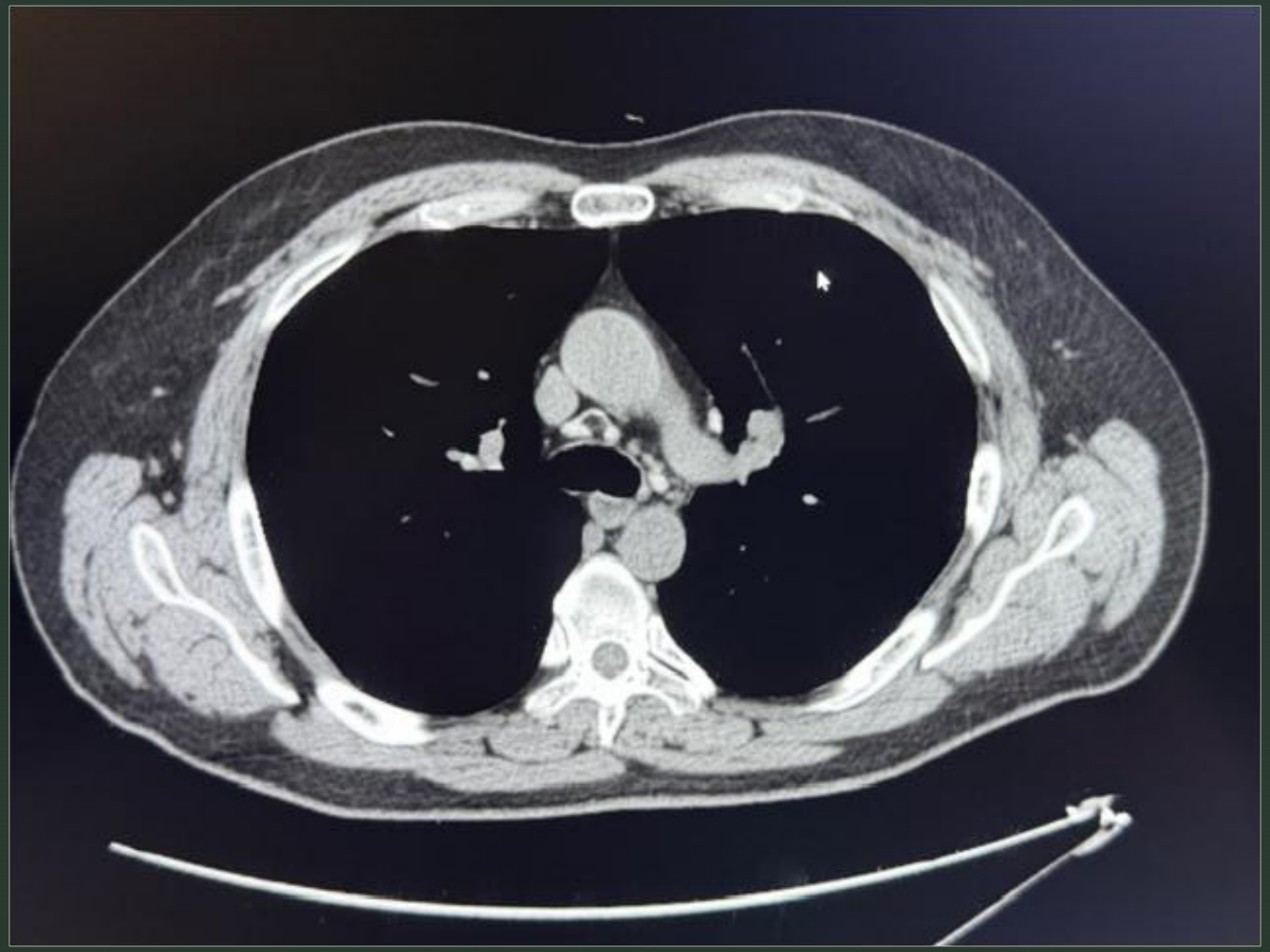
Accelerated Silicosis

- Occurs 5-10 years following RCS exposure
- Has pathologic features of both acute and chronic silicosis


Inhaled RCS
Alveoli (air sacs)
Inflammatory mediator release from macrophages
Lymph nodes filter silica particles. Eventually fibrosis develops
Fibrotic nodules form

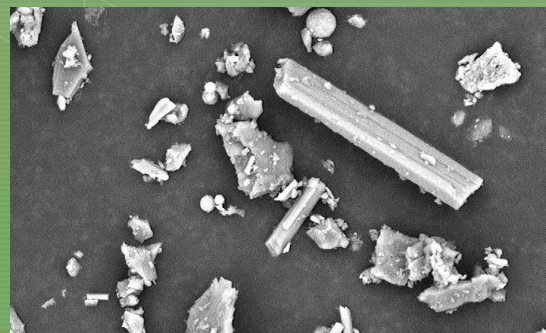
Lymph Node Silicosis

- Earliest radiographic finding of silicosis
- Occurs at lower and shorter cumulative RCS exposure
- Reasonably medically likely to precede development of chronic silicosis



Artificial Stone Silicosis

- Patients are younger, have more severe lung disease, and shorter durations of RCS exposure
- Continued loss of lung function following cessation of exposure to RCS
- 6.6% of patients with PMF→increased to 37.7% after 4 year follow-up



Leon-Jimenez, A., and colleagues. Chest 2020; 158(3): 1060-1068. Wu, N., and colleagues. Respirology (2020) 25:518-524.

2016 OSHA PEL

- OSHA PEL is not an established safe but rather a regulatory compromise between occupational health science and industry
- At a PEL of 50 $\mu g/m^3$ (per 1000 workers):
  - 5-23 deaths due to lung cancer
  - 32 deaths due to silica-induced renal disease
  - 7-44 deaths due to silicosis and nonmalignant lung disease
  - 20-170 cases of silicosis

Table VI–1, Federal Register, volume 81, number 58, Friday, March 25, 2016. Rules and Regulations, page 16386.

2016 OSHA PEL

- At a PEL of 25 μg/m^3 (per 1000 workers):
  - 3-21 deaths due to lung cancer
  - 4-22 deaths due to silicosis and nonmalignant lung disease
  - 25 deaths due to silica-induced renal disease
  - 5-40 cases of silicosis
- Risk of silicosis likely underestimated in 2016 OSHA Guidelines as studies used chest X-rays rather than chest CT scans

Table VI–1, Federal Register, volume 81, number 58, Friday, March 25, 2016. Rules and Regulations, page 16386.

Epidemiology and Non-silicosis conditions related to silica exposure and silicosis

Jane Fazio, MD PhD
Assistant Professor of Medicine
UCLA David Geffen School of Medicine

UCLA Health

Objectives

Provide an overview of global and California Epidemiology of Engineered Stone Silicosis

Describe other lung diseases associated with silica exposure and silicosis: COPD, Asthma, Pneumothorax

Understand non-lung comorbidities related to silica exposure: Infections, Autoimmune Disease

Global Counts

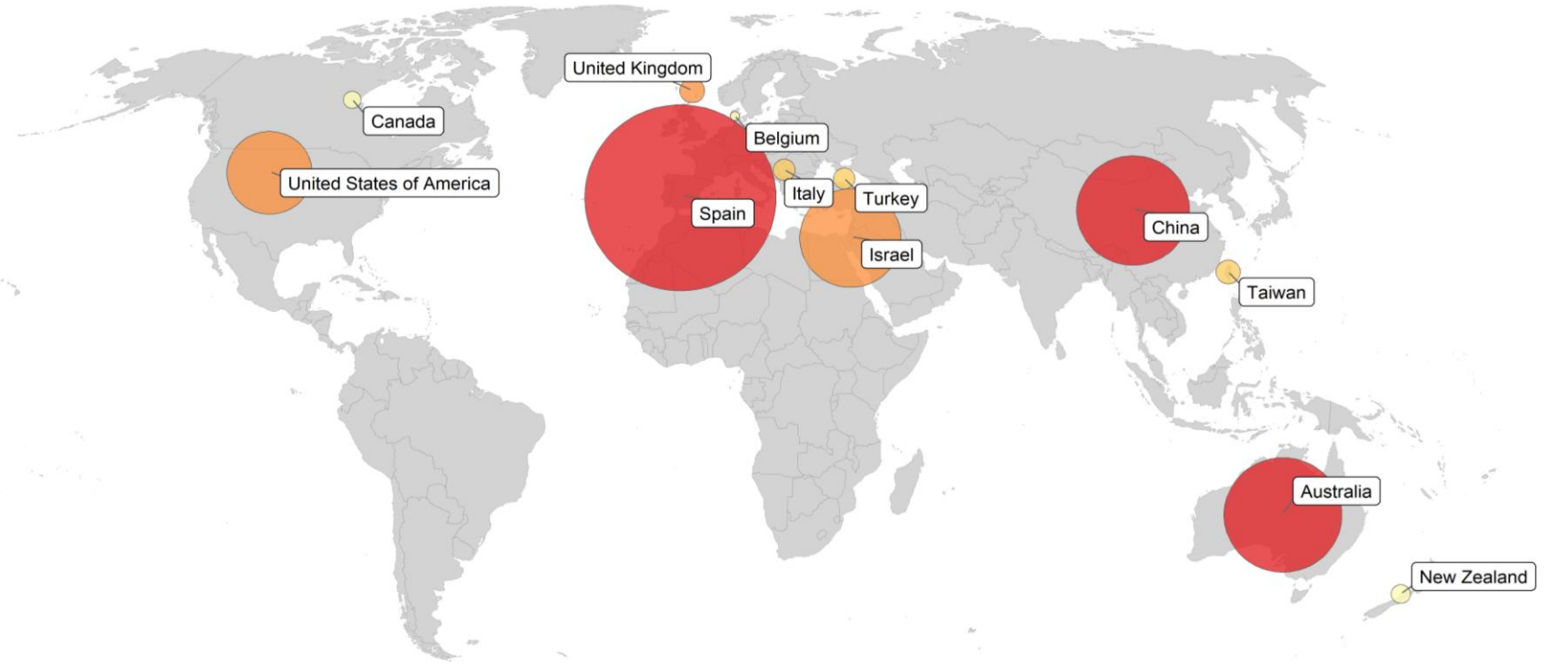


Figure 1. Quartile distribution of cases of silicosis attributed to artificial stone globally as of December 2025, by country. Circles are scaled to show the relative size of each country's case counts.

Estimated number of cases of silicosis attributed to engineered stone by country and type of report, as of December 2025

Country/State	No.
Australia	987
Belgium	6
Canada	22
China	902
Israel	730
Italy	34
New Zealand	26
Spain	2602
Taiwan	42
Turkey	33
United Kingdom	44
United States	509
TOTAL	**5937**

UCLA Health

California Case Counts

531
Confirmed ES Silicosis Cases

29
Deaths

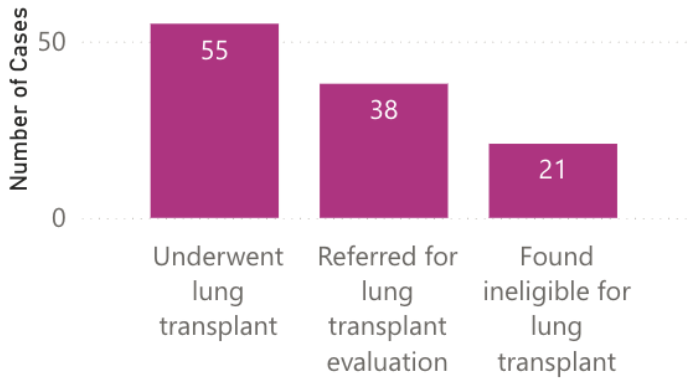
46
Median Age at Diagnosis

49
Median Age at Death

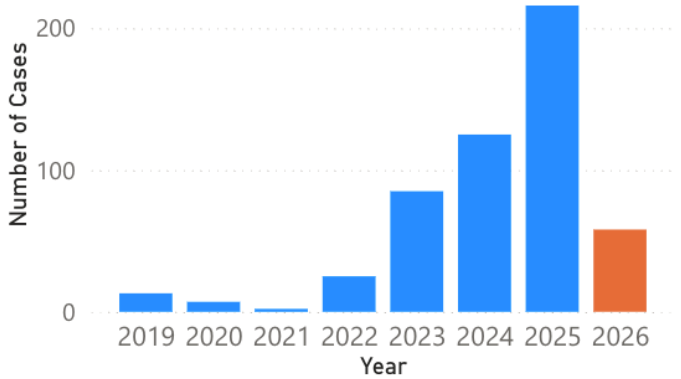
99.8%
Percent of all cases male

98%
Percent of all cases Latino

Last known transplant status for confirmed ES Silicosis cases

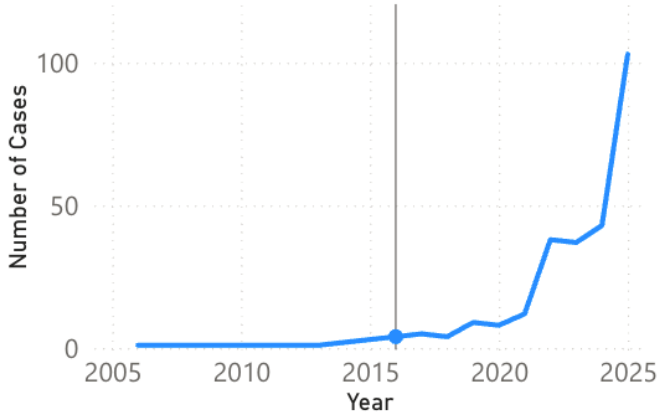


Year confirmed ES Silicosis cases identified by CDPH



Cases identified in 2026 are expected to increase

Year of diagnosis* for confirmed ES Silicosis cas

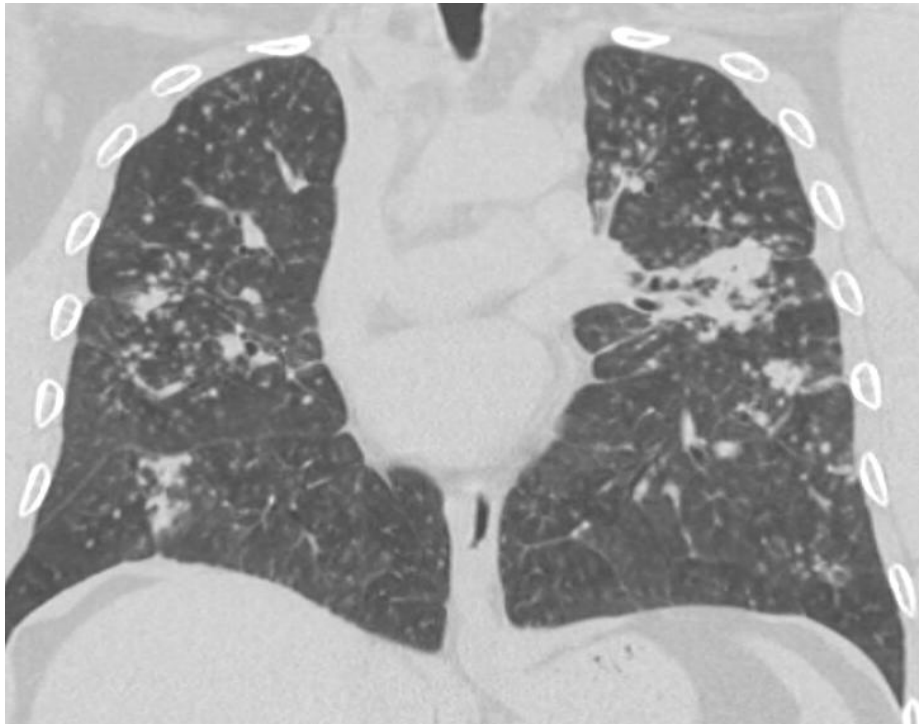


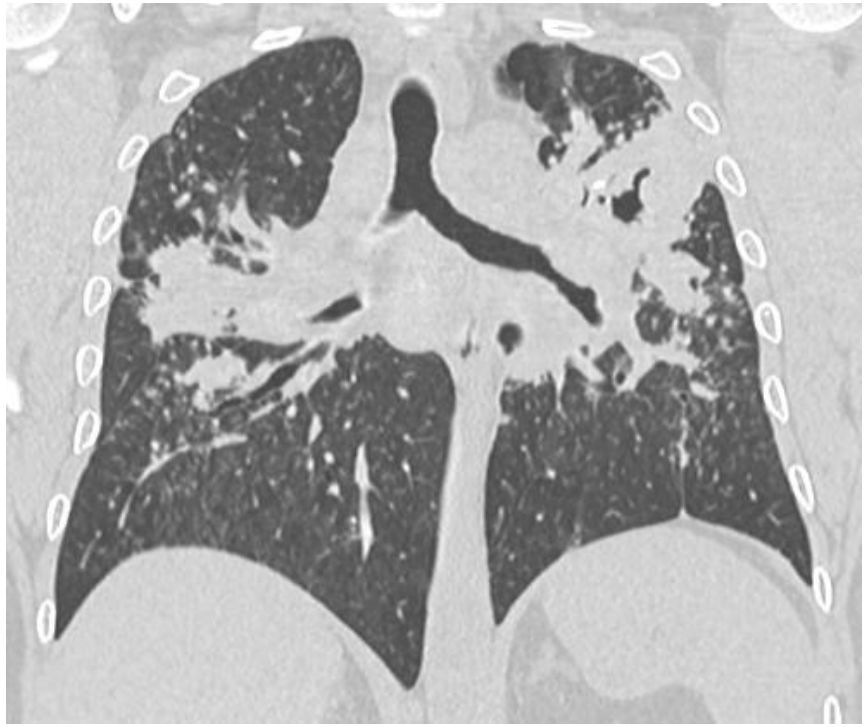
*Known years of diagnosis are displayed through 2025; data for more recent years are incomplete due to reporting lags. Diagnosis year is missing for some cases.

UCLA Health

Silico-Tuberculosis

- Silicosis can mimic Tuberculosis leading to mis-diagnosis.
- They can co-occur.





2 year progression

UCLA Health

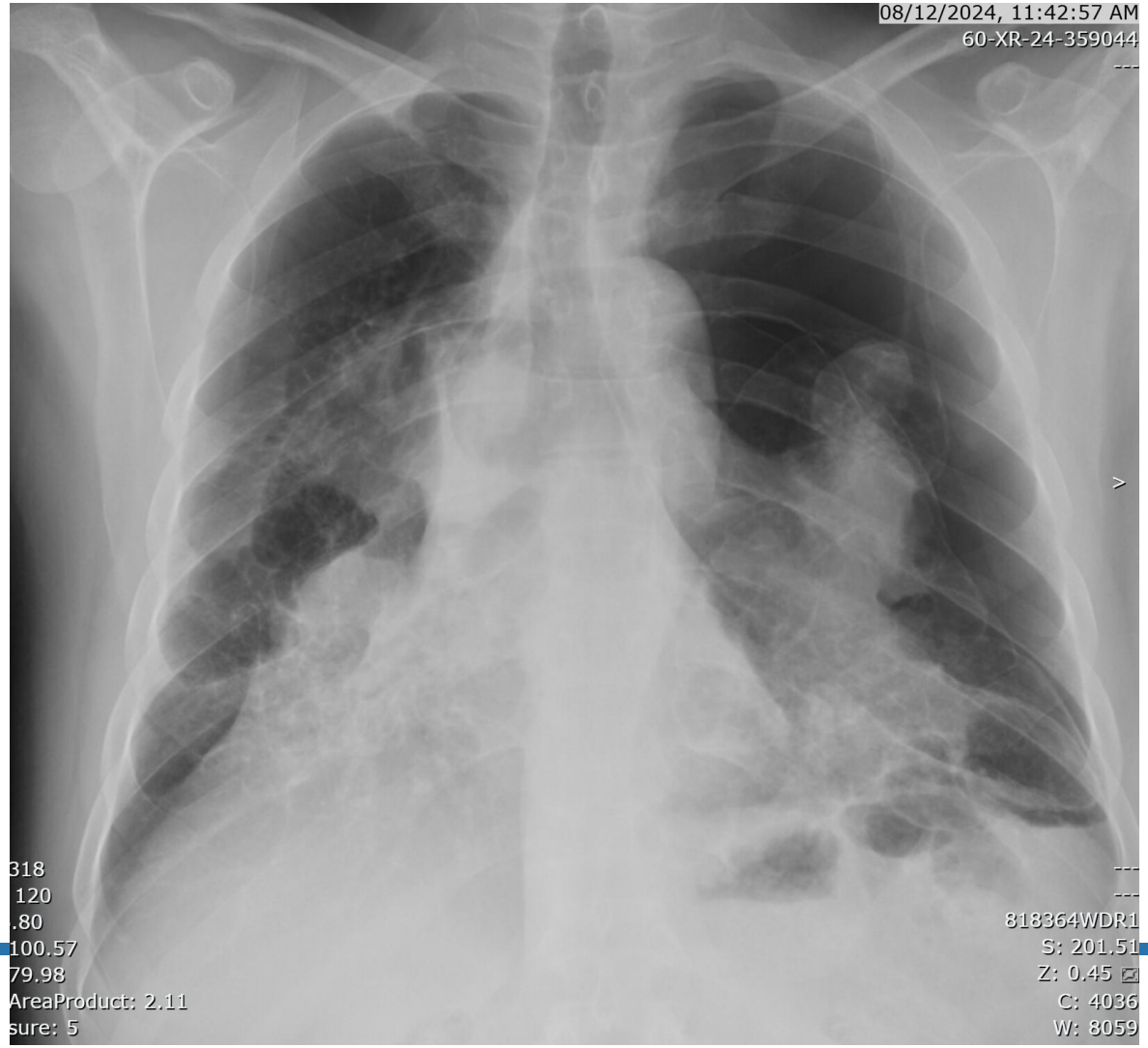
Non tuberculous mycobacterial disease (NTM)

- Cousins of tuberculosis (e.g. M. Kansasii, M avium intracellulare)
- Not contagious
- Dormant in the environment
- Chronic, significant symptoms (phlegm, weight loss)
- Affect already compromised lungs
- Treated with 1 year of three antibiotics. Poorly tolerated

UCLA Health

Lung Collapse (pneumothorax)

	Overall (n=73) N (%)
One Lung	7 (9)
Both Lungs	4 (5)
Total	11 (15)



UCLA Health

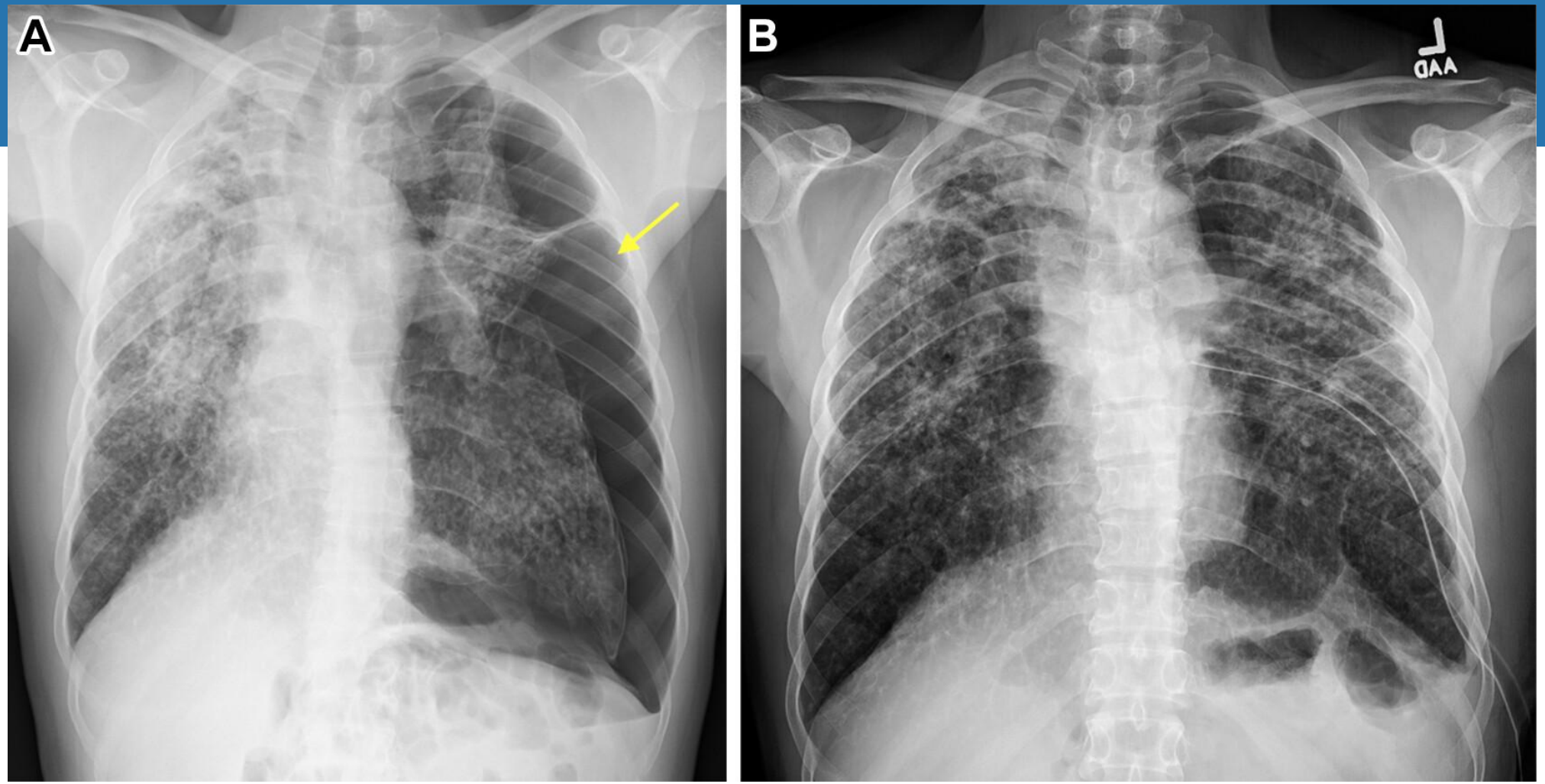
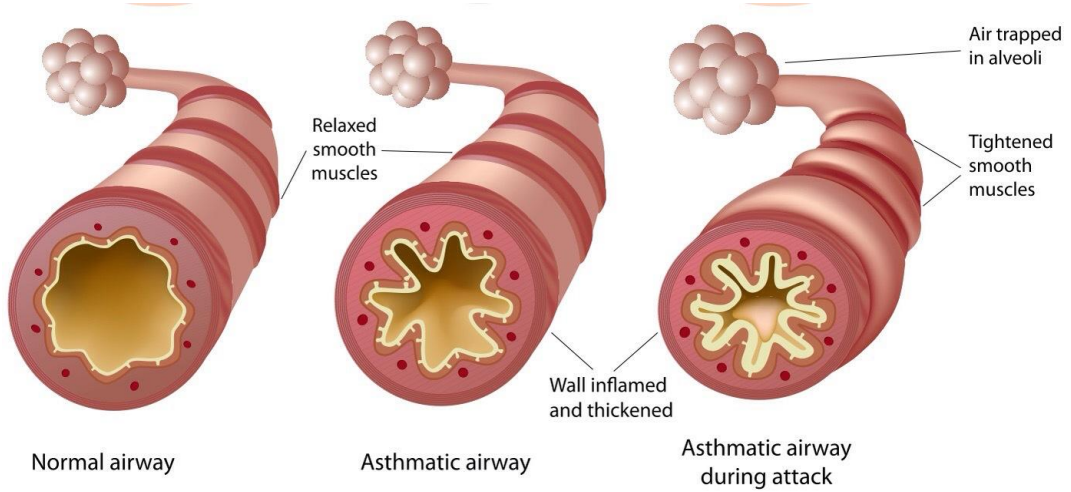


Figure 11. A 45-year-old man presented to the emergency department with acute-on-chronic shortness of breath. Posteroanterior chest radiographs show left tension pneumothorax (arrow in **A**) and resolution of pneumothorax after chest tube placement **(B)**.

Lateef S. Published Online: February 19, 2026
https://doi.org/10.1148/rg.250079

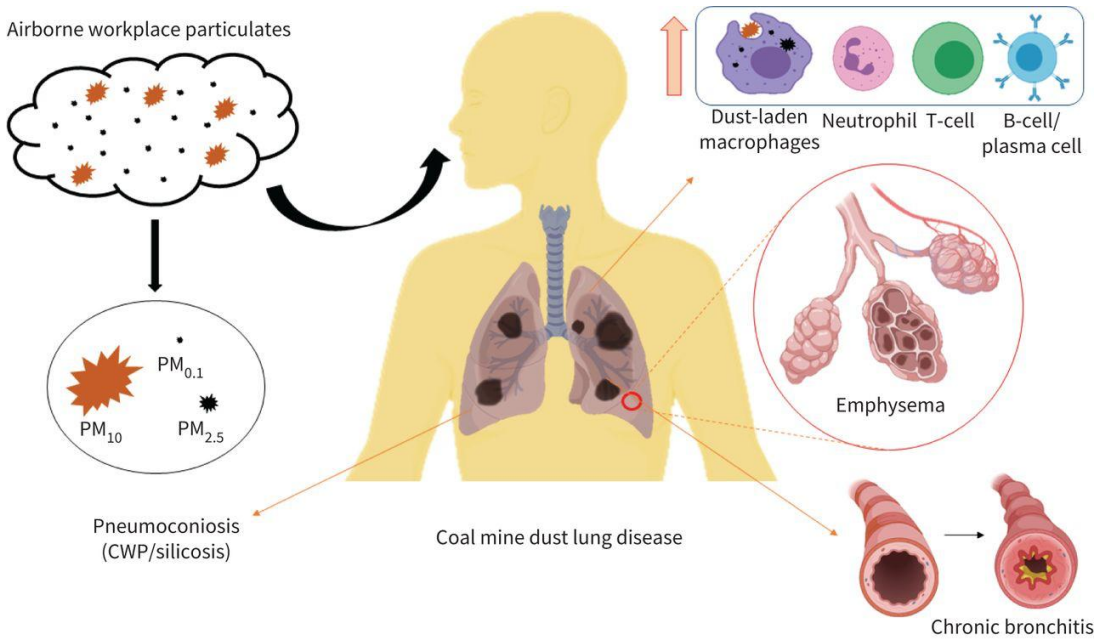
Asthma

- Normal lung function on Pulmonary Function Test
- Severe symptoms (cough, shortness of breath) – out of proportion to silicosis/imaging severity



COPD- Chronic Obstructive Pulmonary Disease

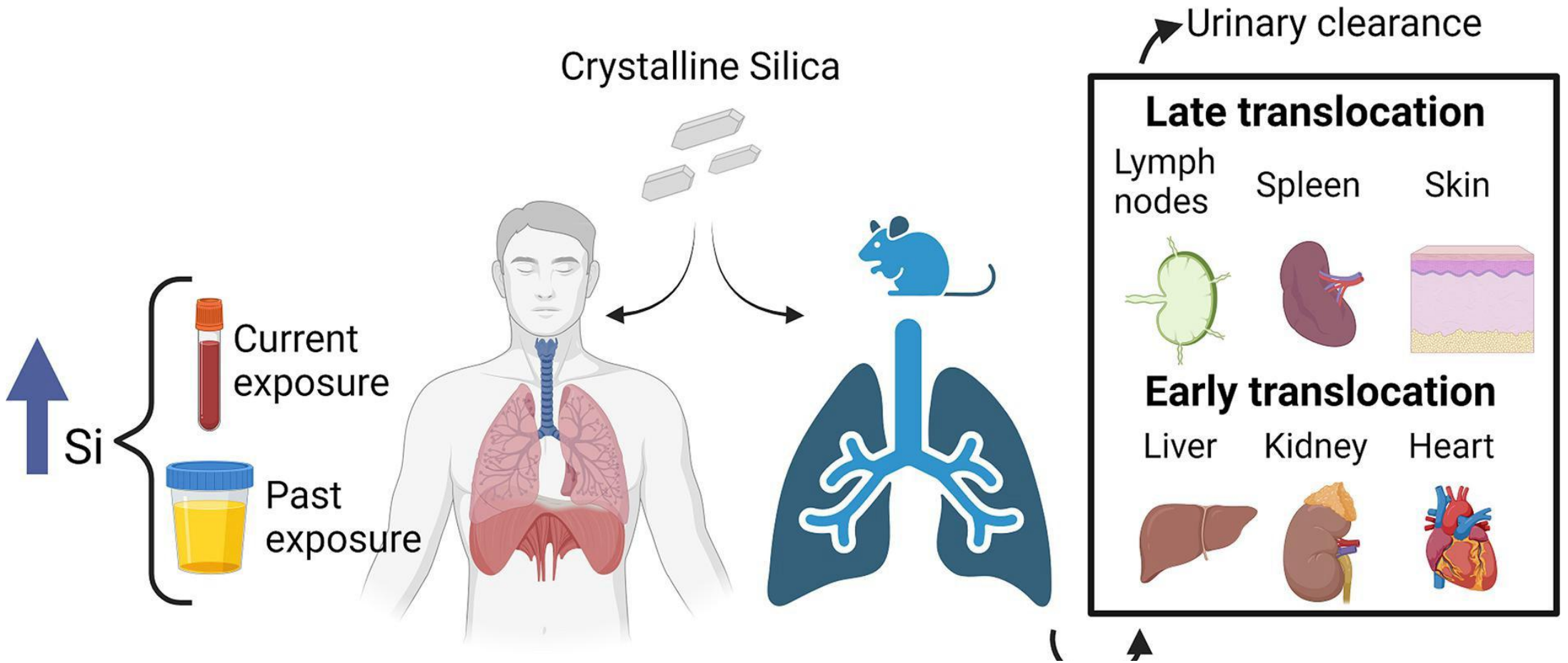
- Irreversible
- Chronic Bronchitis – inflammation of bronchi
- Emphysema- breakdown of air sacks (alveoli)



Others

- Lung cancer
  - Group 1 carcinogen by IARC
  - Dose-dependent response
  - Very difficult to differentiate from PMF, consider if asymmetric growth/cavitation/spiculated appearance
- Sarcoidosis
  - Significant pathological overlap – silicosarcoidosis
  - 41% with granulomas in California case series (Fazio et al.)

Silica Affects Organs Outside The Lungs

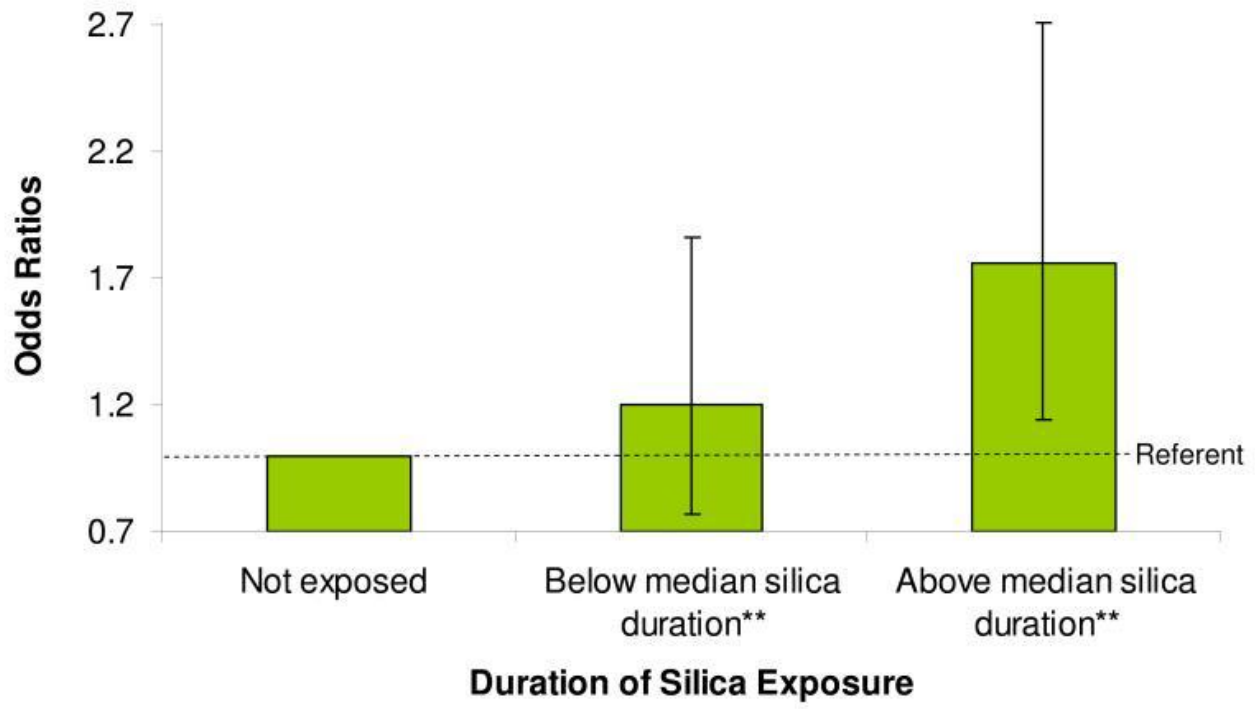


Autoimmune diseases

- Types
  - Scleroderma
  - Rheumatoid Arthritis (Caplan's Syndrome)
  - Myositis
  - Systemic Lupus Erythematosus
  - Vasculitis
- ~ 20% of ES workers
- Can occur WITHOUT silicosis
- Why? Silica potentiates the immune response.

Kidney (aka Renal) Disease

- **Renal Disease Risk:** Silica-exposed workers have an increased prevalence of kidney dysfunction, studies finding a two-fold excess of ESRD.
- **Mechanism:** Silica particles travel through the bloodstream, causing chronic, progressive renal damage (silica nephropathy).



* Weighted for certainty and intensity; 370 cases and 329 controls with non-missing silica duration data.
** Median silica duration = 13.0 years.

Silica as a Controlling Hazard during Engineered Stone Fabrication

Allison Persing, MS, CIH, CSP

RHP Risk Management

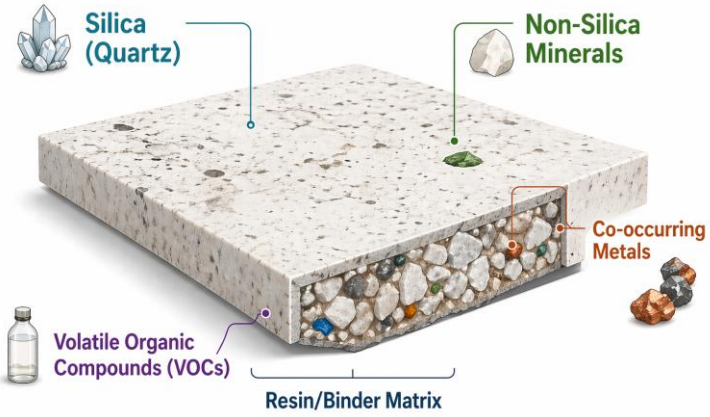
Chicago, IL

Informing Exposure Hypotheses on Non-Silica Hazards with Data

- Concerns have been historically focused on silica; there are other constituents found in natural and/or engineered stone, including:
  - Co-occurring metals (copper, nickel, iron)
  - Non-silica minerals (TiO_2, feldspar, zirconium silicate)
  - Volatile organic compounds (VOCs)

- Ramkissoon (2025) explores these non-silica constituents and discusses the potential hazards of alternative materials.

- There is a data gap of objective exposure data for non-silica hazards during slab fabrication.

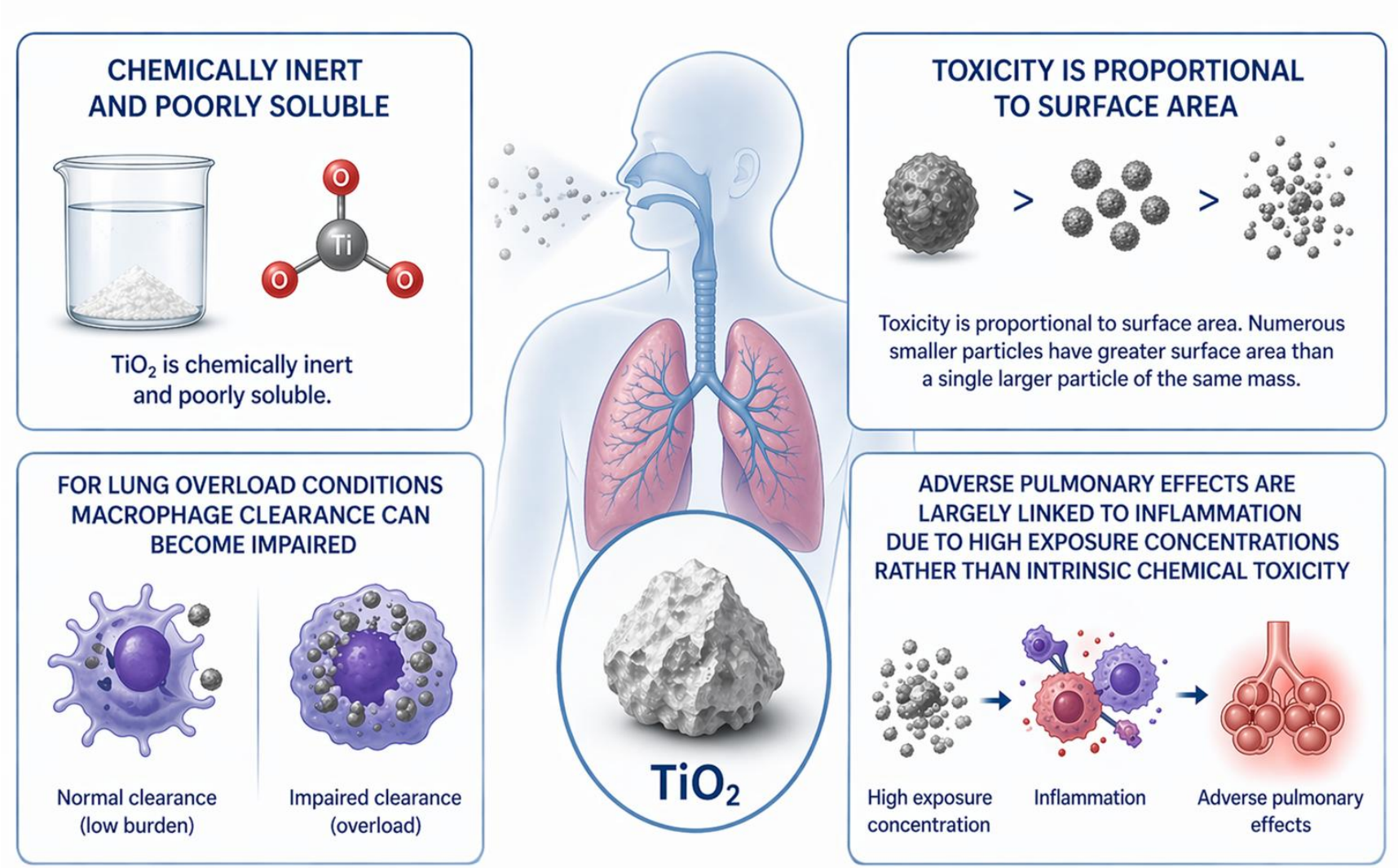


Premise of RHP's study design

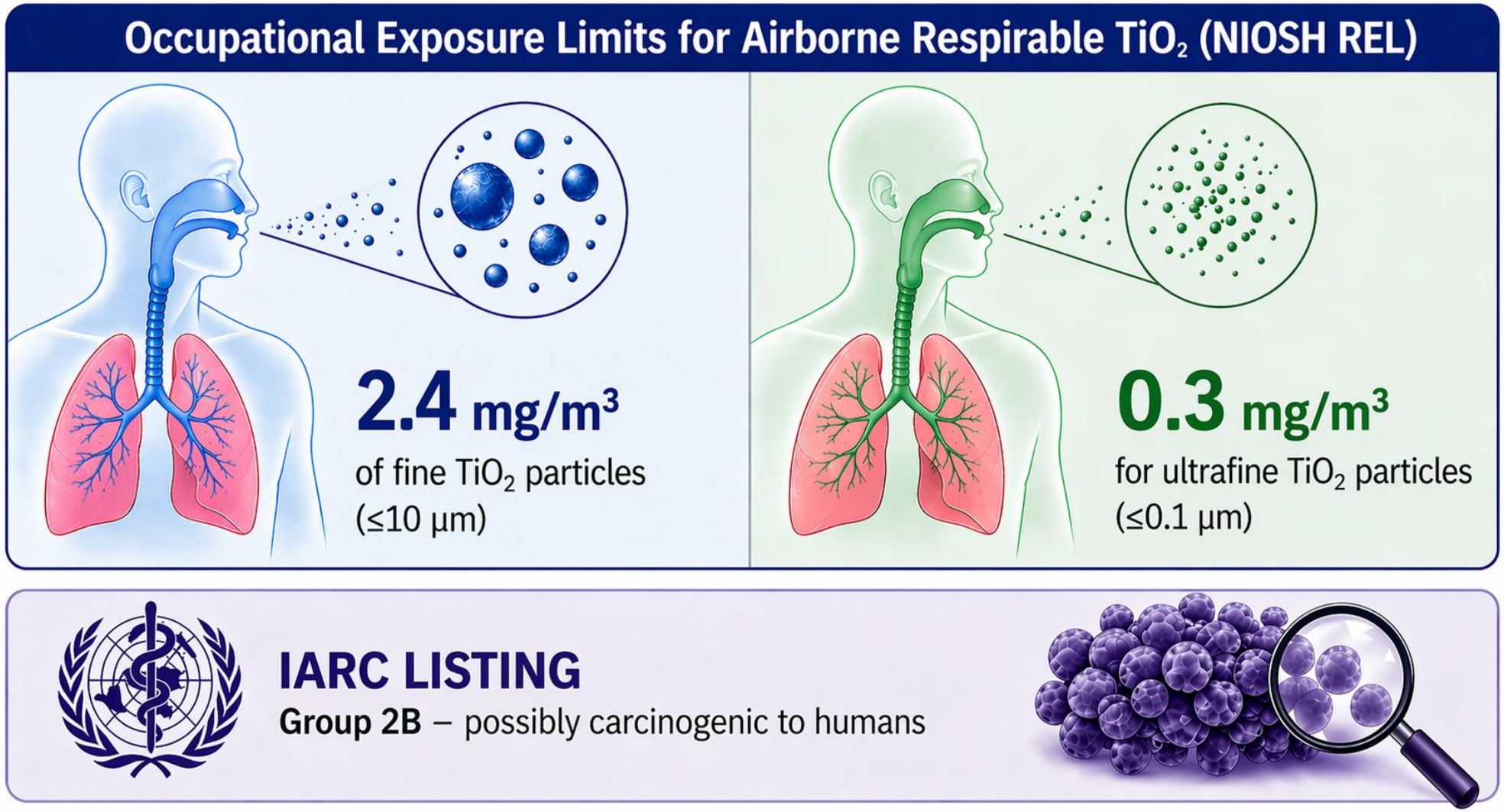
Literature Review

- A literature search was performed to understand the body of knowledge related to non-silica hazards in engineered stone.
- Ramkissoon (2025) used an angle grinder to dry cut 10 stone slabs. Settled surface dust was collected and analyzed for metals and non-silica minerals. TiO_2 was identified as present.
- Titanium dioxide is primarily used as a white pigment in engineered stone.

Toxicological Properties of TiO_2



Occupational Exposure Regulations



Study Hypothesis

RCS is the "controlling hazard"

By controlling for **RCS** lesser hazards such as TiO_2 are also adequately controlled

Study Design

Evaluated airborne exposures of silica and titanium dioxide during polishing of an engineered stone slab during wet and dry fabrication tasks

Particle size distribution as well as respirable dust mass were measured in the personal breathing zone

Measurements were conducted within a controlled setting designed to simulate workplace conditions

DRY FABRICATION TASK
(no water suppression)

WET FABRICATION TASKS
(with water suppression)

MEASUREMENTS

Personal breathing zone sampling using BGI GK2.69 cyclone

Data collected under controlled conditions that simulate workplace settings

Particle Size Distribution (PSD) Measurement

PSD measurements were collected using a Malvern Spraytec laser diffraction particle analyzer positioned at a height corresponding to the surrogate breathing zone of the operator across the workstation.

Bulk Material Composition

COMPONENT	SDS	BULK ANALYSIS
Silica (SiO_2)	**>87%** quartz	**49%** quartz
Titanium Dioxide (TiO_2)	**<5%**	**0.6%**

SDS (Safety Data Sheet)

Manufacturer-provided information on chemical composition.

Bulk Analysis

Laboratory analysis of the actual material sample as received.

Bulk analysis provides a more accurate representation of the material's actual composition.

Tool Use

Water fed center discharge

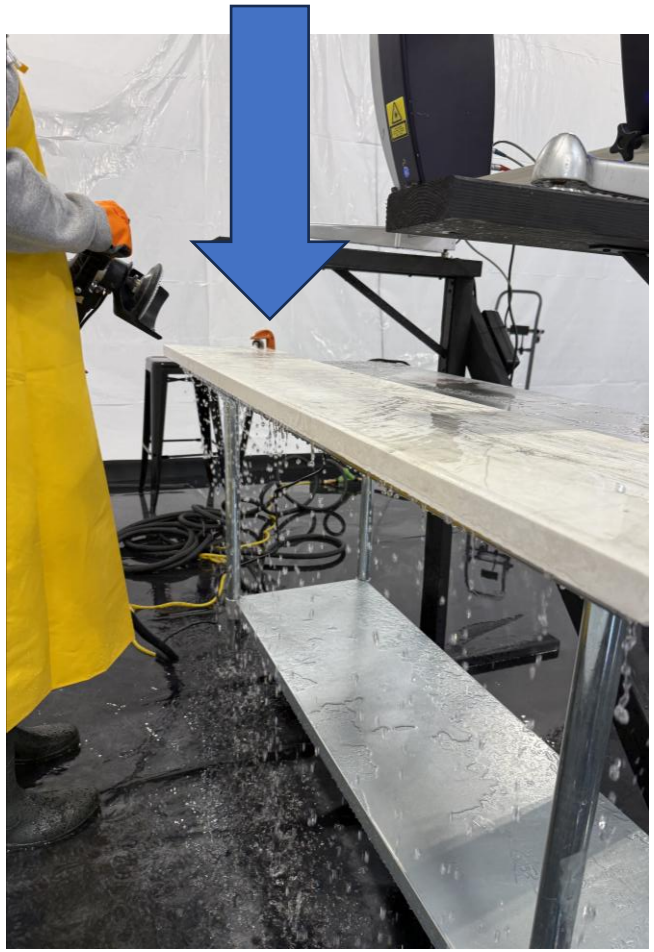
Image sourced from https://www.alpha-tools.com

Dry Work Practices

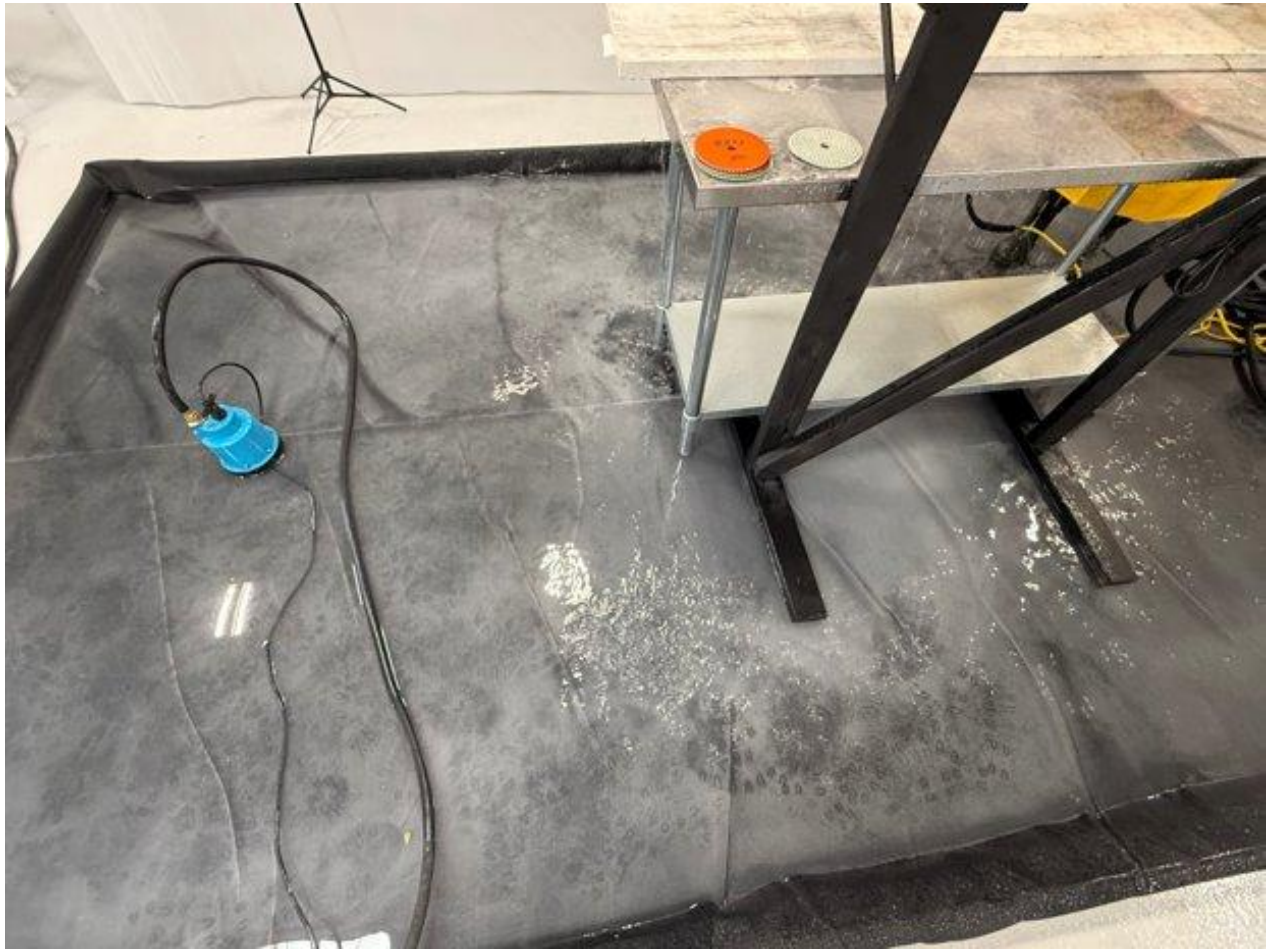
Wet Work Practices

On-tool
center discharge
nozzle

Sheet wetting



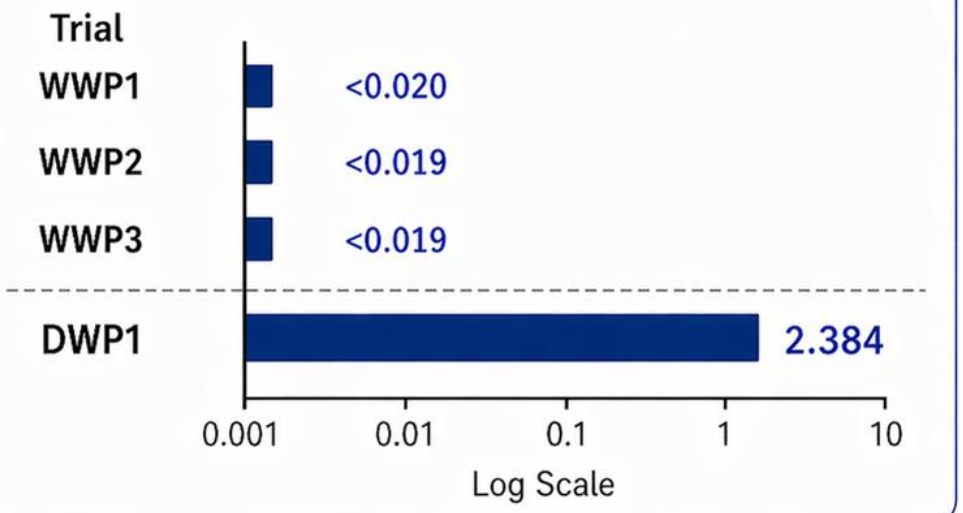
Wet Work Practices



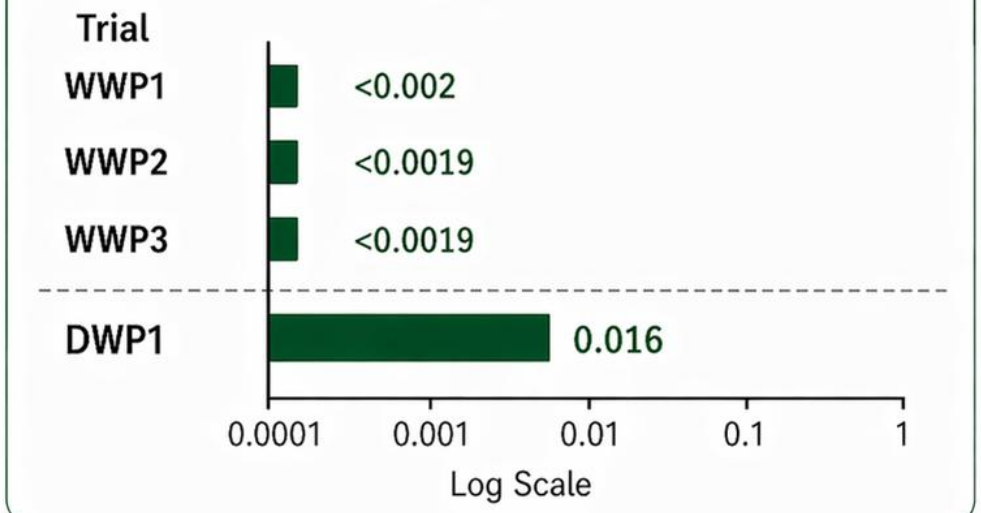
RESULTS

RCS concentration and Respirable TiO_2 concentration are statistically correlated.
Therefore, controlling for RCS effectively controls for TiO_2.

RCS Concentration (mg/m^3)



Respirable TiO_2 Concentration (mg/m^3)



CONCLUSIONS

For this slab, the ratio of RCS to TiO_2 in air was about 150:1. When RCS is controlled to the OSHA PEL of 0.05 mg/m^3, the corresponding TiO_2 concentration would be 0.0003 mg/m^3 which is more than 7,000 times below the NIOSH REL of 2.4 mg/m^3 for fine TiO_2 and 900 times below the NIOSH REL of 0.3 mg/m^3 for ultrafine TiO_2.

Future Direction

- We hypothesize that this study finding that controlling for RCS controls for TiO_2 can be extended to other non-silica hazards in engineered stone.

Research Needs

- Investigate multiple types of engineered stone with varying proportions of quartz and other non-silica hazards.

- Investigate multiple types of engineered stone with other non-silica hazards that have varying occupational exposure limits.

Thank You

Allison Persing, MS, CIH, CSP

apersing@rhprisk.com

www.linkedin.com/in/allison-persing

RHP RISK MANAGEMENT
Consulting Health Scientists

Questions?