Sands of Time: A History of Occupational and Non-Occupational Silica Exposure

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- What is silica?
- Occupational exposure
- Non-occupational exposure
- Silicosis in the past
- Historical control methods
- Current control methods
- Exposures/limits
Silica – What is it?
Crystalline Silica

- Sand
- Quartz
- Silicon Dioxide
- Cristobalite
- Tridymite
- Tripoli
Amorphous Silica

Diatomaceous earth       Silica gel       Glass
Silica-containing Products

Glass

Beaches, Ballfields

Fillers

Abrasives
Occupational Exposure

Sand blasting

Mining

Construction
# Occupations Exposed to Silica

> 1.4 million U.S. workers

<table>
<thead>
<tr>
<th>Construction</th>
<th>Mining</th>
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<tbody>
<tr>
<td>Foundry work</td>
<td>Stone cutting</td>
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<tr>
<td>Ceramics, clay &amp; pottery</td>
<td>Glass manufacture</td>
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<tr>
<td>Agriculture</td>
<td>Shipyards</td>
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<tr>
<td>Soaps &amp; detergents manufacture</td>
<td>Abrasives manufacture &amp; use</td>
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Non-occupational Exposures

- Dust storms/wind erosions
- Unpaved roads
- De-icing activities
- Power plant emissions
- Nearby quarries, construction, or agricultural fields
Potential Health Effects

- Silicosis
- Lung cancer
- Renal damage
- Autoimmune disorders
- “Desert Lung” disease
- Podoconiosis
Ramazzini, 1713:

“...maladies that attack stone-cutters, quarrymen and other such workers...they often breathe in rough, sharp, jagged splinters ... hence they are usually troubled with cough and some of them contract asthmatic affections and become consumptive.”
Controls through Time
None

Virginia City, NV 1868

Italy, 1952 – “uniform” due to heat in mine
Masks

Miner in the Andes wears a special gas mask – 1950s

"Vest Pocket" Gas Mask Devised By Mine Bureau - 1922
Ventilation

Road Tunnel Ventilation Fan, 1934

Gold miners waiting for the cage, 1936
Wet Methods

Freight cars filled with coal are given a shower bath to stop the dust, 1932
Current Controls

Engineering Controls

Respirators
Ventilation/Isolation
Wet Methods
## Current Exposure Standards

**Respirable Silica**

*(mg/m³)*

<table>
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<tr>
<th>NIOSH/ACGIH</th>
<th>MSHA/OSHA</th>
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<tr>
<td>0.05/0.025</td>
<td>[\frac{10}{% \text{ quartz} + 2}]</td>
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Silica Exposures

Source: MSHA/OSHA data from www2a.cdc.gov/drds/WorldReportData/
Construction Exposure

Tuck point grinding
quartz
GM = 0.60 mg/m³

Heavy equipment
demolition
quartz
GM = 0.03 mg/m³

Flanagan, Occup Environ Hyg, 2006
Silicosis deaths and age-adjusted mortality rate* 1968-2002

*per million >/= 15 yrs old
Conclusions

- Silica is ubiquitous, occurring in crystalline and non-crystalline forms
- Exposure occurs in many trades
- Non-occupational exposures are common but not well studied
Conclusions

• Silica-containing dust has been described as occupational hazard for many years.

• Historical control methods were often non-existent, but sometimes ventilation, PPE, or wet methods were used.

• Current available dust control methods are more sophisticated.
Conclusions

• Health effects include silicosis; links to other diseases are suggested

• Exposures have been similar over the last 35 years, but silicosis-related deaths have declined steadily