SILICOSIS STATISTICS

Silicosis directly causes more than 100 deaths each year.

Many more people die each year from indirect health effects of silicosis.

In the United States there are 3,600 to 7,300 new cases of silicosis annually.

Minimal surveillance requirements (until now) mean that many silicosis cases are not reported or diagnosed.

Silicosis is not curable, but it is preventable.

The only known treatment for advanced silicosis is a lung transplant. In 2011, this high-risk surgery would have cost you $500,000 to $800,000.

Sources: silica-safe.org & transplantliving.org.
Summary

• **All** LLE tasks with the potential to generate silica dust must follow a Silica Exposure Control Plan that has been approved by a designated competent person.

• Silica dust is hazardous when very small (respirable) particles are inhaled.

• Silica dust can penetrate deep into the lungs and cause disabling and sometimes fatal lung diseases.

• OSHA has new standards to control employee exposure to silica, including a new PEL = 50 µg/m³.
LLE has designated Competent Persons to review all silica dust generating tasks

All tasks with the potential to generate silica dust must follow a silica exposure control plan, and must be approved by a designated competent person listed below:

<table>
<thead>
<tr>
<th>Building construction, repairs &amp; maintenance</th>
<th>OMEGA Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Sawyer</td>
<td>Dan Neyland</td>
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<tr>
<td>Craig Carnahan</td>
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<thead>
<tr>
<th>EP Operations</th>
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<tbody>
<tr>
<td>Corey McAtee</td>
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<tr>
<th>ME Assembly &amp; Integration</th>
<th></th>
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<tr>
<td>Mark Romanofsky</td>
<td></td>
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</tbody>
</table>
Silica Sources

• Crystalline silica is an important industrial material found abundantly in the earth’s crust.

• Quartz, the most common form of silica, is a component of sand, stone, rock, concrete, brick, block, and mortar.

• Materials containing quartz are found in a wide variety of workplaces.

• Some other names for crystalline silica are silicon dioxide, quartz, cristobalite, and tridymite.
Silica Health Effects

• Silica found in beach sand, glass, and construction materials is not hazardous until reduced to very small particles.

• Silica dust is hazardous when very small (respirable) particles are inhaled.

• These respirable dust particles can penetrate deep into the lungs and cause disabling and sometimes fatal lung diseases, including silicosis and lung cancer, chronic obstructive pulmonary disease (COPD) as well as kidney disease and immune system effects.
Silicosis

- Silicosis is caused by very small particles containing crystalline silica getting inhaled deep into lung
- Usually resulting from long-term exposure (10 years or more) to relatively low concentrations of silica dust
- Usually appearing 10–30 years after first exposure
- Early on, patients may have no obvious signs or symptoms of disease, but abnormalities may be detected by x-ray.
- Chronic cough, shortness of breath, fatigue, chest pain, and bluish skin are common symptoms
How is crystalline silica made respirable?

- Work on concrete material that generates dust you can breathe
- Cutting, sawing, drilling, and crushing of concrete, brick, ceramic tiles, rock, and stone products
- Masonry saws, Grinders, Drills, Jackhammers
- Handheld powered chipping tools
- Processing or using large quantities of sand, such as foundries and the glass, pottery and concrete products industries
New OSHA Standards on Silica

- For Construction, the new standard became effective Sept. 2017
  - 29CFR 1910.1153
- For General Industry, the new standard became effective June 2018
  - 29CFR 1910.1053
OSHA Standard requirements

• Limit worker exposure to respirable crystalline silica

• The new OSHA Permissible Exposure Limit (PEL) for silica is 50µg/m³

• Can use control methods listed in 29CFR 1910.1153 Table 1, or measure workers exposure to control exposure below the exposure limit

• Standard does not apply where exposures will remain low, such as mixing mortar, pouring concrete and removing concrete framework
OSHA Standard requirements continued…

• Written exposure control plan
• Competent person to implement exposure control plan
• Medical exam required every 3 years for those workers required to wear a respirator for >30 days per year, which includes chest x-ray, lung function test and physical exam
• Train workers on work operations that results in silica exposure and ways to limit exposure
• Keep records of air monitoring data, “objective data” taken to assess exposure, medical surveillance (contact Karen Cera or Doug Jacobs-Perkins for assistance)
Silica Sources at UR

- Masonry work
- Work on concrete material that generates dust you can breathe (i.e. using masonry saws, grinders, drills, jackhammers, handheld powered chipping tools)
- Cutting, sawing, drilling, and crushing of concrete, brick, ceramic tiles, rock, and stone products
- Drywall work

If you think silica could be present, use methods that minimize dust generation and tools designed to capture silica dust
How to protect workers from silica dust exposure

• Use engineering controls listed in Table 1 (handout)
• Integrated water delivery system
• Shroud and dust collection system
• Respirators required when dust controls can not limit exposures to below the PEL or if mandated in Table 1 of OSHA Construction Standard
• Select materials (e.g. spackling compound) with low silica/quartz content
Review product SDS’s

Example: Compare silica/quartz content in two spackling pastes:

• United Galsonite Labs, 222 Spackling Paste, Quartz= 40-70%
• DAP Spackling Paste, Quartz= <1%
• Which one would you use?
Table 1 Example: Handheld masonry saw without dust controls creates silica dust while cutting cinder blocks

- Workers are required to wear a respirator in this situation
- General population must be excluded from the affected areas
Table 1 Example: Handheld masonry saw using water for dust control while cutting cinder blocks

- If this work is performed outdoors for <4 hours, respiratory protection is not required
- If this work is performed indoors, or for >4 hours, respiratory protection is required

Photo courtesy of New Jersey Department of Health
Users must inspect and maintain equipment before use

- Check that all hoses (water, vacuum, etc.) are securely connected and are not cracked or broken
- Adjust nozzles so that water floods the cutting area and cools the blade
- Maintain saws and dust-control equipment based on the manufacturer’s recommendations and maintenance schedule
- Follow recommended filter change out schedule for dust collectors and HEPA vacuum

Do NOT use deficient equipment!
Return it to the responsible supervisor for repair or replacement.
Respiratory Protection

- APF = Assigned Protection Factor
- Amount the type of respirator is expected to reduce your exposure
- For example, APF=10 indicates concentration inside respirator is 10X lower than concentration outside the respirator
- Persons required to wear a respirator MUST have a medical evaluation and fit-test before using any respirator (See G_002, LLE Safety Zone)
  - Tight-fitting (sealing) respirators also require the wearer to be clean-shaven and have a fit-test
  - A Powered Air-Purifying Respirator (PAPR) may be used in situations where a respirator can’t form a proper seal
Respiratory Protection

Table I: Assigned Protection Factors

<table>
<thead>
<tr>
<th>Type of Respirator¹,²</th>
<th>Quarter mask</th>
<th>Half mask</th>
<th>Full facepiece</th>
<th>Helmet/Hood</th>
<th>Loose-fitting facepiece</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Air-Purifying Respirator</td>
<td>5</td>
<td>10³</td>
<td>50</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2. Powered Air-Purifying Respirator (PAPR)</td>
<td>—</td>
<td>50</td>
<td>1,000</td>
<td>25/1,000⁴</td>
<td>25</td>
</tr>
<tr>
<td>3. Supplied-Air Respirator (SAR) or Airline Respirator</td>
<td>—</td>
<td>10</td>
<td>50</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>• Demand mode</td>
<td>—</td>
<td>10</td>
<td>50</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>• Continuous flow mode</td>
<td>—</td>
<td>50</td>
<td>1,000</td>
<td>25/1,000⁴</td>
<td>25</td>
</tr>
<tr>
<td>• Pressure-demand or other positive-pressure mode</td>
<td>—</td>
<td>50</td>
<td>1,000</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>4. Self-Contained Breathing Apparatus (SCBA)</td>
<td>—</td>
<td>10</td>
<td>50</td>
<td>50</td>
<td>—</td>
</tr>
<tr>
<td>• Demand mode</td>
<td>—</td>
<td>10</td>
<td>50</td>
<td>50</td>
<td>—</td>
</tr>
<tr>
<td>• Pressure-demand or other positive-pressure mode (e.g., open/closed circuit)</td>
<td>—</td>
<td>—</td>
<td>10,000</td>
<td>10,000</td>
<td>—</td>
</tr>
</tbody>
</table>
An annual medical evaluation is required for all UR/LLE personnel who are required to wear any kind of respirator to protect against respirable particulate.
# OSHA Table 1 Example

<table>
<thead>
<tr>
<th>Equipment / Task</th>
<th>Engineering and Work Practice Control Methods</th>
<th>Required Respiratory Protection and Minimum Assigned Protection Factor (APF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Stationary masonry saws</td>
<td>Use saw equipped with integrated water delivery system that continuously feeds water to the blade.</td>
<td>≤ 4 hours /shift: None  &gt; 4 hours /shift: None</td>
</tr>
<tr>
<td></td>
<td>Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust emissions.</td>
<td></td>
</tr>
<tr>
<td>(ii) Handheld power saws (any blade diameter)</td>
<td>Use saw equipped with integrated water delivery system that continuously feeds water to the blade.</td>
<td>≤ 4 hours /shift: None  &gt; 4 hours /shift: APF 10</td>
</tr>
<tr>
<td></td>
<td>Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust emissions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- When used outdoors.</td>
<td>APF 10</td>
</tr>
<tr>
<td></td>
<td>- When used indoors or in an enclosed area.</td>
<td>APF 10</td>
</tr>
<tr>
<td>Equipment / Task</td>
<td>Engineering and Work Practice Control Methods</td>
<td>Required Respiratory Protection and Minimum Assigned Protection Factor (APF)</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>(x) Jackhammers and handheld powered chipping tools</td>
<td>Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact.</td>
<td>≤ 4 hours /shift               &gt; 4 hours /shift</td>
</tr>
<tr>
<td></td>
<td>− When used outdoors.</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>− When used indoors or in an enclosed area.</td>
<td>APF 10</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use tool equipped with commercially available shroud and dust collection system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust emissions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>− When used outdoors.</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>− When used indoors or in an enclosed area.</td>
<td>APF 10</td>
</tr>
</tbody>
</table>
Exposure Control Plan

- Review UR Silica Exposure Control Plan (LLE Safety Zone Training, G_009 Related links)
- No dry sweeping or use of compressed air for cleanup. Use wet methods** and/or HEPA vacuum.
- Work area must have restricted access and partitions to control dust.

** Wet methods – e.g., wet-sweep or wet-vacuum slurry before it dries; wash affected areas with water hose, wipe surfaces with wet rag
## UR Tasks

<table>
<thead>
<tr>
<th>Equipment/Task</th>
<th>Control Method</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>≤ 4 hours/shift</strong></td>
<td><strong>&gt; 4 hours/shift</strong></td>
</tr>
<tr>
<td>Stationary masonry saws</td>
<td>Integrated Water Delivery System</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>None</td>
</tr>
<tr>
<td>Handheld power saws</td>
<td>Integrated Water Delivery System</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>-when used outdoors</td>
<td>APF 10</td>
</tr>
<tr>
<td></td>
<td>-when used indoors or enclosed area</td>
<td>APF 10</td>
</tr>
<tr>
<td>Rig-mounted core saws or</td>
<td>Integrated water delivery system</td>
<td>None</td>
</tr>
<tr>
<td>drills</td>
<td></td>
<td>None</td>
</tr>
<tr>
<td>Handheld and stand-mounded</td>
<td>Shroud with dust collection system</td>
<td>None</td>
</tr>
<tr>
<td>drills</td>
<td></td>
<td>None</td>
</tr>
<tr>
<td>Dowel drilling rigs for</td>
<td>Shroud with dust collection system. Use HEPA vacuum for cleaning holes.</td>
<td>APF 10</td>
</tr>
<tr>
<td>concrete</td>
<td></td>
<td>APF 10</td>
</tr>
</tbody>
</table>
### UR Tasks cont.

<table>
<thead>
<tr>
<th>Equipment/Task</th>
<th>Control Method</th>
<th>Required Respirator</th>
</tr>
</thead>
</table>
| Jackhammer and handheld chipping tools  | Shroud and dust collection system  
-when used outdoors  
-when used indoors or enclosed area | ≤ 4 hours/shift: None  
> 4 hours/shift: APF 10  
≤ 4 hours/shift: APF 10  
> 4 hours/shift: APF 10 |
| Handheld grinders for mortar removal    | Shroud with dust collection system (min 25 cfm per inch of wheel diameter)    | APF 10              |
| Handheld grinders for uses other than mortar removal | Integrated water delivery system | None  
> 4 hours/shift: APF 25 |
| Demolition of block wall with sledge hammer* | Wet methods                                                                 | APF 10              |

*Wet methods include water spraying or misting to suppress dust.
How to dispose of silica dust?

• Purchase and use disposable liner/bag for vacuums, if available
• If using a liner,
  – Remove liner and disposable filter (if necessary)
  – Place filter in liner
  – Gently expel excess air from liner and tie-wrap or tape closed
  – Discard liner in regular trash
• Reassemble the vacuum with a new liner and filter
  – Wipe the outer surfaces with a damp paper towel to remove dust
  – Discard paper towels in regular trash

Wear a respirator when emptying vacuums and handling equipment contaminated with silica
How to dispose of silica dust? (con’t)

• If vacuum does not have a liner, select a heavy-duty plastic trash bag large enough to completely cover the vacuum collection tank opening
  – Place the bag on the collection tank opening. Tape the bag to the tank to hold in place if necessary
  – Invert the tank and empty into the bag, allow time for dust to settle
  – Remove the disposable filter (if necessary) and place into the bag
  – Gently expel excess air from bag and tie-wrap or tape closed
  – Discard bag in regular trash
• Reassemble the vacuum with a new liner and filter
  – Wipe the outer surfaces with a damp paper towel to remove dust
  – Discard paper towels in regular trash

Wear a respirator when emptying vacuums and handling equipment contaminated with silica
How to dispose of water-borne silica?

• If large volumes of water-borne sediment will be generated, discuss the disposal plan with John Sawyer before starting work.

• Collect slurry in buckets,
  – Allow sediment to settle for 24 hours.
  – Pour off clear liquid from buckets after settling, and dispose in drain designated by Sawyer.
  – Place lid on bucket(s) containing remaining sediment and dispose in regular trash.

Never sweep or used compressed air on dried slurry; if slurry dries, immediately wet it down and clean it up with the wet vacuum.
LLE has equipment available for silica dust control

Click [this link](#) to see available equipment
Summary

• *All* LLE tasks with the potential to generate silica dust must follow a Silica Exposure Control Plan that has been approved by a designated competent person.

• Silica dust is hazardous when very small (respirable) particles are inhaled.

• OSHA has new standards to control employee exposure to silica, including a new PEL = 50 µg/m³.

• The UR Exposure Control Plan summarizes tasks and controls, including water delivery systems and dust collectors. Be sure to check Table 1 or the ECP to determine respirator requirement.
For more information

- OSHA **Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction** (includes sample exposure control plans)

- OSHA Standards for Silica
  - [29 CFR 1910.1153](#) (Construction)
  - [29 CFR 1910.1053](#) (General Industry)

- Speak with one of LLE’s Competent Persons (see slide 3)

- EH&S (275-3241)