WORK SAFELY WITH SILICA:
The Latest Research by CPWR

Eileen Betit, Director, Research to Practice

AUGUST 7, 2019
1:15 – 2:15
BCSP FOUNDATION
INAUGURAL RESEARCH AND INNOVATION SUMMIT
INDIANAPOLIS, IN.
Who We Are

- Non-profit dedicated to reducing injuries, illnesses, and fatalities in the construction industry.
- Focus areas: training, service, and research,
- Serve as NIOSH’s National Construction Center
- Research to Practice (r2p)

- Take the Research
- Repackage it
- Into Materials to
- • Identify Hazards
- • Prevent Injuries & Illnesses
- On Jobsites
Situation when we started....

➢ What we thought:
  ✓ r2p Gap

➢ What we learned:
  ✓ Difficult to find information
  ✓ Available information is too general or complicated
  ✓ Need specific, practical information -- “Make it easy”
  ✓ Generate a take-away – “The last thing you should do before you leave the site is hit PRINT”

➢ What we proposed:
  ✓ A “one-stop” website

Focus Group slide used for discussion
Work Safely with Silica

www.silica-safe.org

1. About
2. Regulations & Requirements
3. What’s New
4. Know the Hazard
5. Training & Other Resources
6. What’s Working
7. Ask a Question
8. Control the Dust – Create-A-Plan
Know the Hazard

**Workers** may be exposed to dangerous levels of silica dust when cutting, drilling, grinding, or otherwise disturbing materials that contain silica. These materials and tasks are common on construction jobs. Breathing that dust can lead to serious, often fatal illnesses. This section contains information that workers – and contractors – need to know to recognize the hazard, understand the risk factors, and work safely with silica.

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**Why is Silica Hazardous?**

**What's the Risk?**

**Who's At Risk?**

**What are the Health Effects?**

**Take Action**
Regulations & Requirements

OSHA Construction Standard

OSHA General Industry Standard (including Oil & Gas)

Voluntary

Other

Status of Regulatory Efforts

SEP 13, 2013
OSHA Rulemaking - Final Rule Issued

AUG 03, 2012
History

AUG 02, 2012
Timeline
Training and Other Resources

Everyone involved in tasks that produce silica dust, including project managers, foremen, superintendents, and workers should receive training before being assigned work. Training should address:

- Identifying the materials and tasks that create silica hazards;
- The dust-generating operations that will be undertaken and how the employer plans to control the dust (the silica control plan);
- The health risks;
- Working safely with silica, including proper use of equipment, protective clothing, and appropriate hygiene practices;
- The identity of the competent person designated by the employer to implement the silica control plan and inspect the job site, materials and equipment; and
- The purpose and description of the medical surveillance program.

Supervisors and others responsible for safety should also receive training on how to implement the employer’s silica control plan.

The following is a selection of training materials and other resources for contractors, instructors, and workers.

PLEASE NOTE: The Silica Control Plan you create using the Create-A-Plan tool on this website is specific for your worksite. Your Plan can be used as the subject of a toolbox talk — review the elements of the Plan with your supervisory personnel and workers.

Manuals & Guides
Presentations
Toolbox Talks
Handouts
Videos
Oil & Gas Resources
Other Resources
Historical Resources
OSHA’s Special Emphasis Program on Silicosis was established in 1996. The Program raised worker and employer awareness of the hazards associated with exposure to crystalline silica and prompted stakeholders to identify or develop methods and tools to control the dust and eliminate the hazard.

The following is a selection of videos – some recent and some dating back to the early days of the Special Emphasis Program (Workers are the Experts) – demonstrating steps taken to reduce exposures and protect workers.

If you have information or a video to share that shows what you’re doing to reduce dust exposures, or if you have a dusty-job challenge let us know by clicking on "Share Your Success and Challenges" or by emailing us at silica@cpwr.com. We want to hear from you.

Controlling Silica Dust - Learning from Each Other

Share Your Success and Challenges
Know the Hazard

Workers may be exposed to dangerous levels of silica dust when cutting, drilling, grinding, or otherwise disturbing materials that contain silica. These materials and tasks are common on construction jobs. Breathing that dust can lead to serious, often fatal illnesses. This section contains information that workers – and contractors – need to know to recognize the hazard, understand the risk factors, and work safely with silica.

Control the Dust

There are ways contractors can reduce the dust and reduce the hazard. This easy to use planning tool takes you step-by-step through conducting a job hazard analysis for silica, selecting appropriate controls, and creating a job-specific plan to eliminate or reduce silica hazards. You can save as a pdf, print and/or email your plan.

CREATE-A-PLAN

Training & Other Resources

Find silica-related handouts, fact sheets, videos, toolbox talks and other resources for workers and contractors.

What’s Working

Contractors, workers, manufacturers, and researchers are on the lookout for the best ways to control silica dust. Learn what is happening in the field and share what you are doing.

Ask a Question

Get answers to commonly asked questions about silica and ask one of your own.
Referenced in:

✓ Industry testimony and evidence in support of the silica standard

✓ The preamble to the final standard

✓ OSHA’s Small Entity Compliance Guide: “The Center for Construction Research and Training (CPWR) has a tool to help employers develop written exposure control plans that is available at www.silica-safe.org.” OSHA Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction (page 45)
Written Exposure Control Plan

✓ The plan must describe:
  ▪ **Tasks** involving exposure to respirable crystalline silica
  ▪ Engineering **controls**, work practices, and respiratory protection for each task
  ▪ **Housekeeping** measures used to limit exposure
  ▪ Procedures used to **restrict access**, when necessary to limit exposures

✓ Reviewed and the effectiveness evaluated at least annually and updated as necessary

✓ Implemented by a **competent person**

*OSHA Standard - §1926.1153 Respirable crystalline silica, section (g)*
Step 1. Will you generate dust containing silica on the job?

The materials listed below contain silica. Select all of the materials you plan to use. As you select a material a list of dust generating tasks will appear. Please select the task(s) that you will perform with the material.

- Asphalt
- Brick
- Cement
- Concrete
- Concrete Block
- Drywall
- Fiber Cement products
- Grout
- Gunite/Shotcrete
- Mortar
- Paints containing silica
- Plaster
- Refractory Mortar/Castables
- Refractory Units
- Rock
- Roof Tile (concrete)
- Sand
- Sand - Frac Sand
- Soil (fill dirt, top soil, soil mixture, topsoil, compost, sod)
- Stone (including: granite, sandstone, shale, slate, coal, diatomite)
- Stucco/EIFS
- Terrazzo
- Tile (clay and ceramic)
- Material Other

If you will not be using one of the materials listed above or another silica-containing material, You Don’t Need a Silica Control Plan.

If you are not sure if a material contains silica, there are several ways you can find out... Learn more.

To find out if a material contains silica:

Option 1 - Check the label: OSHA’s silica standard requires employers to include silica in their program to comply with the hazard communication standard. OSHA’s Hazard Communication Standard requires materials containing silica to be labeled. Learn more

Option 2 - Check the Safety Data Sheet Learn more

Option 3 - Review the published data Learn more

Option 4 - Analyze a sample of the material Learn more
Step 1. Will you generate dust containing silica on the job?

The materials listed below contain silica. Select all of the materials you plan to use. As you select a material a list of dust generating tasks will appear. Please select the task(s) that you will perform with the material.

- Asphalt
- Brick
- Cement
- **Concrete**
  - Abrasive blasting
  - Bushhammering
  - Cutting/sawing
  - Demolishing/disturbing
  - Drilling/coring
  - Earthmoving
  - Frac sand cleanup
  - Frac sand mixing
  - Frac sand offloading
  - Frac sand onloading
  - Frac sand transferring
  - Grinding
  - Jackhammering
- **Rock**
  - Milling
  - Mixing/pouring
  - Polishing
  - Sacking/patching
  - Sanding
  - Scabbling
  - Scarifying
  - Scraping
  - Sweeping/cleaning up
  - Well mixing/pumping
- Refractory Units
- Roof Tile (concrete)
- Sand
- Sand - Frac Sand
- Soil (fill dirt, top soil, soil w/ fly ash added)
- Stone (including: granite, limestone, quartzite, sandstone, shale, slate, cultured, etc.)
- Stucco/EIFS
- Terrazzo
- Tile (clay and ceramic)
- Material Other

If you will not be using one of the materials listed above or another silica-containing material, **You Don’t Need a Silica Control Plan.**

If you are not sure if a material contains silica, there are several ways you can find out... learn more.

CONTINUE
Step 2. How do you plan to control the dust?

Select the type of equipment and dust control you plan to use for each material and task you selected in Step 1.

Not Sure - Perform Air Monitoring.
To find the exposure control methods in OSHA’s silica standard, learn about air monitoring, or to find studies and data on the use of controls click here. To give users the greatest flexibility, any material-task combination may be selected. For uncommon combinations or those not typically performed, the default control is respiratory protection.

1. Concrete – Drilling/coring

Select the Equipment/Control:
- Click here for examples of commercially available equipment and controls.
- Anchor System
- Core Drill with Dust Extraction
- Core Drill with Water (Table 1 Entry)
- Dowel Drilling with Dust Collection (Table 1 Entry)
- Drill Press with Hand-Held Drill and Vacuum (Table 1 Entry)
- Hand-Held Drill with Dust Extraction (Table 1 Entry)
- Hand-Held Drill with Hollow Drill Bit Extraction
- Hand-Held Drill with Vacuum (Table 1 Entry)
- Other

2. Concrete – Jackhammering

Select the Equipment/Control:
- Click here for examples of commercially available equipment and controls.
- Hand-Held Breaker with Dust Extraction (Table 1 Entry)
- Jackhammer with Vacuum (Table 1 Entry)
- Jackhammer with Water (Table 1 Entry)
- Mounted Chipping Tool with Water
- Other

3. Rock – Jackhammering

Select the Equipment/Control:
- Click here for examples of commercially available equipment and controls.
- Jackhammer with Vacuum (Table 1 Entry)
- Jackhammer with Water (Table 1 Entry)
- Other

More information to help you decide how to control the dust:

Option 1 - OSHA Exposure Control Methods:

The exposure control methods and respiratory requirements specified in the OSHA silica standard for construction. Learn More

Option 2 - Perform Air Monitoring:

Information on how to find an industrial hygienist to conduct air monitoring, questions to ask, and what’s involved. Learn More

Option 3 - Studies and Data on the Use of Dust Controls:

RETURN TO YOUR SILICA CONTROL PLAN
Engineering controls, work practices, and respiratory protection for each task.
Step 3. Complete your Silica Control Plan

Company:

Person Completing the Plan/Title:

Jobsite/Project:
(name, location, lat/long (if applicable), etc.)

Description of Work:

Description of work

Please fill in the name and title of the competent person for silica on a construction project or responsible person on an oil and gas project.

Competent Person (g)(4) & Responsible Person 1910.1053 (f)

Exposure Assessment and Controls

1. Concrete
   - Task: Drilling/coring
   - Equipment and Control(s):
     - 1) Core Drill with Dust Extraction
     - 2) Drill Press with Hand Tool Control

2. Concrete
   - Task: Jackhammering
   - Equipment and Control(s):
     - Hand-Held Breaker with Dust Extraction (Table 1 Entry)

3. Rock
   - Task: Jackhammering
   - Equipment and Control(s):
     - Jackhammer with Water (Table 1 Entry)

Please describe the procedures to restrict access to work areas in construction as required by 29 CFR 1926.1153 (g)(1)(iv).

Restricting access to work areas and regulated areas, when necessary, minimizes the number of employees exposed to respirable crystalline silica and their level of exposure, including exposures generated by other employees or sole proprietors.

For the oil and gas industry, please describe the procedures to establish, demarcate, and limit access to regulated areas as required by 29 CFR 1910.1053(e).

Medical Surveillance

Please use the space below to describe the medical surveillance that will be provided.

Housekeeping

Please use the space below to describe the housekeeping measures that will be used on the project to limit employee exposure to respirable crystalline silica as required by 29 CFR 1926.1153 (h). In construction or 29 CFR 1910.1053(b) in oil and gas.

Other Considerations

Other things that need to be taken into consideration when controlling dust on this project.

Training

Click here for a description of the competent person's role on construction projects and what is required under 29 CFR 1926.1153 (g)(4). Click here for an explanation of the responsible person's role on oil and gas projects and what is required to implement a general industry plan under 29 CFR 1910.1053(e).

Restricting Access (g)(1)(iv) & Regulated Area-1910.1053 (e)
## Your Silica Control Plan

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<thead>
<tr>
<th>Material</th>
<th>Task</th>
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**Equipment and Control(s):**
1. Core Drill with Dust Extraction, 2. Drill Press with Hand-Held Drill and Vacuum (Table 1 Entry)

**Task/Control Description:**
- Note: This space is for specific information on the task and equipment, such as where it will be used, and other information that may be useful for the competent person and others who use this plan.

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**Equipment and Control(s):**
- Hand-Held Breaker with Dust Extraction (Table 1 Entry)

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**Equipment and Control(s):**
- Jackhammer with Water (Table 1 Entry)

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**Safety of Others:**
- Space to describe steps that will be taken to ensure other workers are not exposed to hazardous levels of silica dust.

**Worker Training:**
- Space to describe how the hazard will be communicated to employees and the training provided.

**Housekeeping:**
- Space to describe how the housekeeping requirements will be met.

**Medical Surveillance:**
- Space to describe how the medical surveillance requirements will be met.

**Other Considerations:**
- Additional space for other information that an employer may want to convey to those responsible for implementing the silica control plan.

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**Having Trouble Downloading?**
- If you get a “Network Error” or have another issue when downloading in Chrome, try the following:
  1. Click on Print;
  2. Click on the “Change” button under “Destination”;
  3. Select “Save as PDF”;
  4. Click “Save”.

This will save a PDF version of your plan to your computer. Alternatively, you can use another browser (such as Firefox).
Table 1 – Equipment Names and Best Practice Tips – Update September 2018

- Includes equipment terms commonly used by different trades and in different geographic areas
- ‘Best practice’ tips are intended to help employers and their employees operate the equipment-control options effectively and are based on 1) OSHA’s Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction; 2) OSHA’s Frequently Asked Questions (“FAQs”) for the Construction Industry; 3) silica standard’s Table 1; 4) manufacturer specifications; and 5) craft worker/contractor input based on experience in the field.

<table>
<thead>
<tr>
<th>Equipment/Control</th>
<th>Photo &amp; Video</th>
<th>Engineering, Work Practice Control Methods &amp; Required Respiratory Protection</th>
<th>Best Practice Tips</th>
</tr>
</thead>
</table>
| (l) Stationary masonry saws | ![Photo courtesy of the International Masonry Institute & OSHA](https://www.silica-safe.org) | **CONTROL:** water  
- Use saw equipped with integrated water delivery system that continuously feeds water to the blade.  
- Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust emissions.  
- **Required Respiratory Protection:**  
  - ≤4 hours/shift: NONE  
  - >4 hours/shift: NONE | OSHA requires the employer to ensure that:  
- The saw is equipped with an integrated water delivery system (commercially developed specifically for the type of tool in use)  
- An adequate supply of water for dust suppression is used  
- The spray nozzle is working properly to apply water at the point of dust generation  
- The spray nozzle is not clogged or damaged  
- All hoses and connections are intact  
- Water is applied at least at the flow rate specified by the manufacturer  
- Additional exhaust is provided as needed to minimize the accumulation of visible airborne dust when operating indoors or in an enclosed space (area where airborne dust can build up)  
- Additional means of exhaust could include: portable fans (e.g. box fans, floor fans, axial fans, oscillating fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust.  
- “Indoors or in enclosed areas” refer to any areas where, without the assistance of forced ventilation, the dispersal of airborne dust can be impeded and concentrations can build up. Parking garages, pits, trenches, empty swimming pools, open-top structures with 3 walls, or other structures with limited air movement could be considered enclosed.  

Tips for this tool continued on next page.
Work Safely with Silica
A ONE-STOP SOURCE OF INFORMATION ON HOW TO PREVENT A SILICA HAZARD AND PROTECT WORKERS

Training and Other Resources

Everyone involved in tasks that produce silica dust, including project managers, foremen, superintendents, and workers should receive training before being assigned work. Training should address:

- Identifying the materials and tasks that create silica hazards;
- The dust-generating operations that will be undertaken and how the employer plans to control the dust (the silica control plan);
- The health risks;
- Working safely with silica, including proper use of equipment, protective clothing, and appropriate hygiene practices;
- The identity of the competent person designated by the employer to implement the silica control plan and inspect the job site, materials and equipment; and
- The purpose and description of the medical surveillance program.

Supervisors and others responsible for safety should also receive training on how to implement the employer's silica control plan.

The following is a selection of training materials and other resources for contractors, instructors, and workers.

PLEASE NOTE: The Silica Control Plan you create using the Silica Control Plan Software is specific for your worksite. Your Plan can be used as the subject of a tool box talk or presented to your supervisors, personal protective equipment, and others, involved in your project.

Manuals & Guides
Presentation
Toolbox Talks
Handouts
Videos
Other Resources
Historical Resources

How can we stay safe today?
When will we start removing the dust?
What respirator and equipment do we need to use?
What are the important personal protective equipment?
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Industry Specific Resources: www.silica-safe.org

What You Can Do to Reduce Silica Dust Exposure

Recognize the hazard. Milling, cutting, or otherwise disturbing asphalt pavement can create airborne dust containing silica. Pay attention to winds and any visible dust emissions.

Use ventilation and water-spray controls on asphalt pavement milling machines. Water-spray plus ventilation controls are collectively considered to be the best practice approach to asphalt pavement milling dust control. Ventilation controls used in combination with water-spray controls can consistently reduce exposures below the NIOSH REL. Typical ventilation controls designed to reduce silica exposures on asphalt pavement milling machines include a collection hood, fan, and ductwork as shown in Figure 1. Milling machines should also be designed to allow the operator to temporarily turn the ventilation control off when milling into the wind. If the ventilation control can be shut off, however, then a filter should be in place to automatically turn the ventilation control back on when it has been off for longer than 60 minutes. Water-spray controls should always remain ON regardless of wind direction.

Always use water-spray controls on asphalt pavement milling machines that do not have ventilation controls. When ventilation controls are unavailable, water-spray systems should be used.

Maintain your dust control systems and follow these tips:

- Locate the machine operator's manual that contains a maintenance schedule for the water-spray or ventilation controls. Each operator's manual should include detailed sketches, performance criteria, and troubleshooting instructions for equipment owners to use in their periodic inspection of the controls.
- Inspect and maintain the systems according to the manufacturer's recommendations and record the dates of periodic inspections in the operator's manual.
- Check the air-flow indicator to verify that the ventilation control is operating within the designed operating range. The manufacturer should attach a plate to the milling machine

Example Daily Dust Control Checklist

Table provided by Payne & Dolan, Inc.
Questions addressed:

• Which employees are covered by the medical surveillance requirement?
• When and how often should employees have a medical exam?
• How do you set up a medical monitoring program?
  - Step 1 – Find a health professional to work with
  - Step 2 – Interview the health professional to ensure they are able to meet your needs
  - Step 3 – Finalize the contract and begin to make appointments for your employees
• Links to other resources

Location: Training and Other Resources: Manuals & Guides (www.silica-safe.org)
Coming Soon...

Prevent Exposure: Silica Dust in Enclosed Cabs

Silica is in many materials common at construction sites, such as sand, concrete, and rock. When heavy construction equipment disturbs these materials, the dust containing harmful silica can be generated. Exposure to silica dust can lead to lung diseases such as silicosis, which is a chronic, progressive, and irreversible lung disease. It can also lead to other serious health effects, including an increased risk of developing lung cancer, chronic obstructive pulmonary disease (COPD), and kidney disease.

Grace's Story
Grace's work involves mixing silica-containing materials at a large construction site. Although she typically works in an enclosed cab, dust gets into the cab through cracks and doors, and she sometimes works with other workers who expose her to dust. Grace has developed signs of silicosis, which include a cough, fatigue, and shortness of breath. These symptoms are often caused by prolonged exposure to silica dust and can be made worse by smoking.

How can we stay safe today?
1. What will we do at the worksite to control and prevent exposure to silica dust?
2. How will we monitor the silica dust levels?

ODA Regulations: 1926.1153 Respirable crystalline silica. MSHA Act. 20

CPWR TOOLBOX TALK

Remember This

- Make sure the cab is equipped with a proper air filtration system.
- Inspect the air filter and replace it as needed.
- Monitor the air pressure in the cab to maintain a positive pressure.
- Clean the cab daily to remove any dust that may build up.
- Know the symptoms of silicosis and report them to your supervisor.

HAZARD ALERT

PROTECT WORKERS FROM SILICA DUST...

Working in an Enclosed Cab

CPWR

THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING
Recent Research: Concrete Drilling Pneumatic vs Electric Rotary Drill: Vibration, Dust, Noise, Productivity

Drilled holes 10-20 mm in diameter for structural upgrades to buildings, highways, bridges and airport tarmacs
<table>
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<tr>
<th></th>
<th>Electric</th>
<th>Pneumatic</th>
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<tbody>
<tr>
<td>Weighted total vibration $a_{hw}$ (m/s²)</td>
<td>7.15 (0.11) [4 h]</td>
<td>39.14 (2.53) [8 min]</td>
</tr>
<tr>
<td>Noise $L_{eq}$ (dBA)</td>
<td>102.0 (0.1) [~9 min]</td>
<td>116.2 (0.4) [~5 min]</td>
</tr>
<tr>
<td>Respirable silica (mg/m³)</td>
<td>0.55 (0.05) [11.0]</td>
<td>22.23 (1.79) [444.6]</td>
</tr>
<tr>
<td>Productivity (mm/s)</td>
<td>9.09 (0.09)</td>
<td>8.69 (0.37)</td>
</tr>
</tbody>
</table>
Recent Research: Tuckpointing

- Engineering controls don’t reduce dust below the PEL
- Respirators required
  - \( \leq 4 \text{ hours/shift}: \text{APF 10} \)
  - \( >4 \text{ hours/shift}: \text{APF 25} \)
- NIOSH Researchers tested Tools with the help of the Masonry r2p Partnership
- Reports on findings under review
- Training materials for a 1) plugging chisel with a rotary hammer and 2) brick and mortar saw in development.
Objective Data Collection Form
(Exposure Assessment (d) (2))

• Sampling environment
  • Indoor/outdoor
  • Wind and weather
• Work conditions
  • Task and material
• Equipment specifics
  • Tool and controls used
• Sample data
  • Personal breathing zone
  • Duration
  • Flow rate
• Lab report with concentration

Send data to Sara Brooks – sbrooks@cpwr.com
and where we are...

Raising awareness:
➢ Articles, presentations, internal and external webinars – examples:
   ✓ CPWR’s webinar participants & Views on Demand = 5,300+
   ✓ Submitted - Patty's IH and Toxicology

Site Usage:
➢ Sessions overall 800,000+
  ✓ Planning tool alone – 130,000+
  ✓ Registered Users – 8,600+
    o Plans Created – 18,000+

Use of Controls Increasing
➢ BAC example

“Always” Use

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<th>Year</th>
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<th>19%</th>
<th>26%</th>
<th>61%</th>
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<td>2017</td>
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Silica Controls
WORK SAFELY WITH SILICA:
The Latest Research by CPWR

Eileen Betit, Director, Research to Practice
ebetit@cpwr.com

WWW.SILICA-SAFE.ORG