



# Research Supports Need, Effectiveness, and Improvements for Engineering Controls

*Dust exposure reduced while tuckpointing*

## The Challenge

Grinding or cutting out mortar between bricks or blocks during tuckpointing operations generates clouds of dust. The amount of silica in this dust may be hundreds of times higher than legal or recommended limits. Construction workers who breathe dust containing silica are at risk for serious diseases such as silicosis, lung cancer, chronic obstructive pulmonary disease (COPD), and other diseases associated with silica exposure. Portable local exhaust ventilation (LEV) that draws the hazardous dust away from the worker's breathing zone and does not interfere with the work can significantly reduce the health risk.



Grinding without LEV

## The Response

A research team, led by CPWR's Exposure Assessment Program Director, Pam Susi, evaluated the effectiveness of several commercially available LEV systems and identified ways to promote use of these systems to reduce silica exposure during tuckpointing operations. The team, which consisted of industrial hygienists and a social science researcher, engaged workers, contractors, manufacturers, OSHA, and NIOSH in selecting the equipment to test, carrying out the evaluation, analyzing the results, and developing strategies to increase the use of LEV. The following four LEV systems were evaluated using a standardized protocol of repeat, randomized trials with and without LEV:

- Metabo grinder (model WE14-125 Plus), Dustcontrol 2900C vacuum, and Dust Director shroud;
- Bosch grinder (model 1775E), Dustcontrol 2900C vacuum, and Dust Director shroud;
- Bosch grinders (models 1775E and AG40-85), Ermator S26 vacuum, and two Dust Director shrouds (note: this LEV system allowed two workers to use one vacuum simultaneously); and
- Hilti grinder (model DAG-500), Hilti VC 40-U vacuum, and Hilti DC-EX shroud (note: this was the only system evaluated with all components from a single manufacturer).

## The Results

The researchers found that just four hours of continuous grinding can produce roughly 100 pounds of dust. Uncontrolled, this dust is in the air breathed by the worker performing the task, those working nearby, and other bystanders (including the public).

Grinding out mortar joints without LEV to control the dust resulted in exposures on average between 127 and 220 times the NIOSH Recommended Exposure Limit (REL) of 50 µg/m<sup>3</sup>. When two grinders were used in close proximity, the exposures averaged 690 times the REL.

When the LEV systems were used, the researchers found that silica exposures were reduced by more than 95% in each case and exposures were reduced significantly to between 1.8 and 7.5 times the REL on average. When two grinders were used simultaneously, attached to the same LEV system, the exposures were reduced to an average of 16.5 times the REL. (Note: All results were based on the time sampled and not on 8-hour time weighted averages.)

The evaluation performed with the Ermator S26 vacuum prompted the manufacturer to design, patent, and manufacture a new Dust Hood (shroud) for use with their S26 (two operators) or S13 (one operator) vacuums.

**“Construction is a competitive industry, but if there’s a floor or a standard that says you have to protect workers in this way, it’s still competitive and workers are protected.”**

— Barry Scott, CIH, Deputy Director of Finance  
Risk Manager, City of Philadelphia

# The CPWR IMPACT

Collaboration among project researchers, stakeholders, equipment manufacturers, and other CPWR researchers was key to documenting exposure levels during tuckpointing operations with and without use of engineering controls, and raising awareness of the importance of using LEV to reduce workers' risk for exposure to silica dust. The research findings led to the development of a new equipment option for controlling silica exposures during this high-exposure activity, and were used to encourage new policies to promote LEV use in construction.

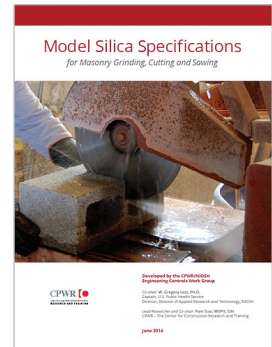
**DESIGN:** A major dust control manufacturer developed and patented a new dust hood for use with angle grinders.

**SPECIFICATIONS:** In February 2014, the Philadelphia School District adopted model silica specifications developed by CPWR and NIOSH for masonry grinding, cutting, and sawing. Contracts for capital improvement projects for schools city-wide now require use of engineering and/or work-practice or administrative controls.

**MUNICIPAL GUIDELINES:** Information provided by CPWR researchers and Bricklayers & Allied Craftworkers Local 1 PA/DE prompted the city of Philadelphia to publish dust control guidance for construction, renovation, and demolition work.

The model specifications, an example of how the Philadelphia School District has used the language, and the dust control guidance document can be found on the Work Safely with Silica website ([www.silica-safe.org](http://www.silica-safe.org) – click on Regulations & Requirements – Other).

The results of the exposure monitoring were included in brief technical summaries and detailed reports shared with the Masonry r2p Partnership and the CPWR-NIOSH Engineering Controls Work Group, and posted on [www.cpwr.com](http://www.cpwr.com).



## What made it a success?

The research team's inclusion of workers, contractors, manufacturers, and government agencies raised awareness of the challenge and importance of using engineering controls to reduce exposures during this high-risk operation.

Steps that led to success included:

- Involvement of stakeholders in the selection of LEV systems to test.
- Direct communication between manufacturers, LEV users, and researchers, which led to the exchange of information on how controls impact work and exposure levels.
- Industrial hygiene evaluations, which delivered measurable performance data that end-users could use to select, and manufacturers could use to improve, available technologies.
- Documentation of the exposure levels with and without controls that provided policy makers with the evidence needed to encourage the use of engineering controls, implement new requirements, and rewrite local policies.

**“The dialogue between the Local, contractors, equipment manufacturers, and researchers was an important part of this project. We gave our opinion on what would work best stemming from our hands-on experience in the field....”**

— Don Anderson, Vice Chairman –  
Business Agent – Pointers, Cleaners,  
Caulkers Bricklayers & Allied Craftworkers  
Local 1 PA/DE

