Reducing Silica Exposure During Lateral Drilling of Concrete

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Problem:

- Silica is found in numerous building materials including concrete and is a pervasive exposure risk in construction.
- Exposures associated with use of rock drills for lateral drilling in concrete structures have not been characterized or controlled.

Resolution:

- The University of California at San Francisco is developing a jig to support a rock drill and reduce the upper body strain to workers when drilling.
- A dust control system was used with the jig to evaluate its impact on silica exposure using a randomized study design.
- The study included trials of the following drilling conditions:
  1. drilling with jig and vacuum (n=4);
  2. drilling with jig and without vacuum (n=4); and
  3. manual drilling, without jig and without vacuum (n=4)
- The dust collection system consisted of a vacuum (114 cfm air flow rate), a drill bit shroud and a 2-inch diameter hose.

Manual Drilling

14 times the NIOSH REL

Drilling with the jig, no vacuum

6 times the NIOSH REL

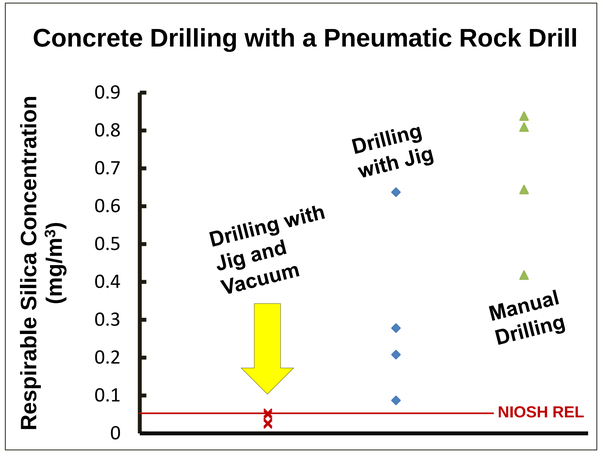
Drill bit shroud and vacuum hose

Drilling with the jig and vacuum

80% of the NIOSH REL

Results:

- Drilling without the jig and dust control resulted in mean exposure to respirable silica 14 times the NIOSH REL.
- Drilling with the jig reduced silica exposure 55% compared to drilling without the jig.
- Drilling while using the jig and the vacuum reduced exposures by 94% compared to manual drilling and brought the mean exposure to 80% of the REL.



Lessons learned:

- Lateral concrete drilling is likely to generate hazardous airborne silica concentrations.
- Use of the jig without the vacuum system reduced respirable silica exposure by approximately half, but exposures still exceeded the REL.
- Use of the tested vacuum dust collection system reduced the operator's exposure to 80% of the NIOSH REL for respirable silica based on task TWAs.
- **Combined use of the jig and vacuum system is recommended to reduce both musculoskeletal strain and silica exposure.**

Respirable Silica During Concrete Drilling with a Pneumatic Rock Drill

	Mean, mg/m³ (range)	Standard Deviation	Percent Reduction[A]
Drilling with jig and vacuum	0.04 (<0.02 - 0.05)	0.01	94.3
Drilling with jig and without vacuum	0.30 (0.09 – 0.64)	0.24	55.3
Manual drilling	0.68 (0.42 – 0.84)	0.19	NA

[A] compared to manual drilling, without the jig and vacuum

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