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.

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.

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References:

Respirable Silica During Concrete Drilling with a Pneumatic Rock Drill

<table>
<thead>
<tr>
<th>Drilling Method</th>
<th>Mean, mg/m³ (range)</th>
<th>Standard Deviation</th>
<th>Percent Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling with jig and vacuum</td>
<td>0.04 (&lt;0.02 - 0.05)</td>
<td>0.01</td>
<td>94.3</td>
</tr>
<tr>
<td>Drilling with jig and without vacuum</td>
<td>0.30 (0.09 – 0.64)</td>
<td>0.24</td>
<td>55.3</td>
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<tr>
<td>Manual drilling</td>
<td>0.68 (0.42 – 0.84)</td>
<td>0.19</td>
<td>NA</td>
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A compared to manual drilling, without the jig and vacuum