OSHA Respirable Crystalline Silica Exposure Update

3B Investigate Silica Exposure Control Options and Develop Silica Exposure Control Plan
Objectives

• To satisfy the OSHA requirement to develop exposure control improvement plans for every job situation where worker exposures exceed the revised OSHA Permissible Exposure Limit (PEL) for respirable crystalline silica.

• To describe three important aspects of the planning process and identify resources for addressing each aspect.
Challenges to Planning for Compliance with the Revised OSHA Silica PEL

• Challenge to expand the scope of the silica exposure control effort in the areas of process materials, equipment and methods.

• Challenge to get more foundry staff and functions involved.

• Challenge to place more emphasis on establishing the feasibility of silica exposure control options prior to implementation.

• Challenge to organize the monitoring, troubleshooting and maintenance of engineering exposure control methods.
Action Items to be Addressed in a Silica Exposure Control Plan

A. Assessing the Causes of Silica Exposure

B. Establishing Silica Exposure Control Baselines

C. Evaluating Silica Exposure Control Options

D. Implementing Silica Exposure Controls (see Section 3-C)
Action Item A: Assessing the Causes of Silica Exposure

Objectives

1. To determine which silica sources contribute most to a worker’s 8-hour time-weighted-average (TWA) silica exposure.
2. To provide needed direction for identifying exposure control improvement options.
3. To facilitate the process of determining the feasibility of exposure control methods.
## Action Item A. Assessing the Causes of Silica Exposure: Evaluation Methods and Resources

<table>
<thead>
<tr>
<th>Evaluation Method</th>
<th>Reference</th>
<th>Resources Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Visual Surveillance of workers throughout their work shifts and time study of their activities and locations</td>
<td></td>
<td></td>
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<tr>
<td>2. Notes made during time-weighted-average (TWA) exposure sampling (compliance sampling) with regard to worker tasks and conditions</td>
<td>1, Section 2.5</td>
<td>Interpreting sampling results</td>
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<tr>
<td>3. Worker feedback concerning worker tasks and conditions</td>
<td>3, Section 3</td>
<td>Planning of exposure sampling; Reasons for exposure variability</td>
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<td>4. Segmental personal silica sampling of task performance</td>
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<td>Consult an industrial hygienist</td>
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</table>
### Action Item A. Assessing the Causes of Silica Exposure: Evaluation Methods and Resources continued

<table>
<thead>
<tr>
<th>Evaluation Method</th>
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</thead>
<tbody>
<tr>
<td>5. Evaluation of silica content of process materials; use of Safety Data Sheets (SDS)</td>
<td>1, Section 2.2</td>
<td>Silica content of process materials</td>
</tr>
<tr>
<td>6. Use of contour mapping (grid sampling) of foundry-wide concentrations of respirable particulate matter (contour mapping of RPM)</td>
<td>2, Section 8.5</td>
<td>Silica dust dispersion profiling; Workplace RPM mapping</td>
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<tr>
<td></td>
<td>1, Section 3.2</td>
<td>Workplace RPM mapping</td>
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<tr>
<td>7. Use of real-time personal RPM sampling to isolate tasks and conditions causing elevated exposure</td>
<td>1, Section 3.1</td>
<td>Real-time dust exposure monitoring</td>
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<td></td>
<td>5</td>
<td>Description of measurement method with examples</td>
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</table>
### Action Item A. Assessing the Causes of Silica Exposure: Evaluation Methods and Resources continued

<table>
<thead>
<tr>
<th>Evaluation Method</th>
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<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Assessment of foundry silica sources</td>
<td>1, Table 2-2 and 2-3;</td>
<td>Listing of potential process, material handling and housekeeping variables</td>
</tr>
<tr>
<td></td>
<td>Sections 3.3 and 3.4</td>
<td></td>
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<tr>
<td>9. Ventilation assessment</td>
<td>2, Sections 8.3 and 8.4</td>
<td>Air mass balance and ventilation pattern assessment;</td>
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<td></td>
<td>2, Subsection 8.5.1 through 8.5.3</td>
<td>Assessment of ventilation defects;</td>
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<tr>
<td></td>
<td>1, Section 3.5</td>
<td>Ventilation of silica sources</td>
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</tbody>
</table>
Action Item B. Establishing Silica Exposure Control Baselines

Objectives

1. To optimize the capability of the current foundry program of process control, work practices, ventilation and housekeeping to protect workers from silica exposure.

2. To demonstrate how well the current foundry program, if operating as intended, can control worker exposures to silica.

3. To create a cost-efficient situation where additional exposure controls are not implemented until the performance of the current silica control measures in the foundry are optimized.
Action Item B. Establishing Silica Exposure Control Baselines

Procedure

1. After potential sources of silica exposure have been identified in Action Item A, attention can then be turned to the foundry conditions most responsible for those sources. These conditions may include:
   - How foundry processes and material handling are conducted and maintained
   - How work practices are involved
   - How ventilation is applied and monitored
   - How foundry residuals are managed
   - How housekeeping is managed
Action Item B.
Establishing Silica Exposure Control Baselines

Procedure continued:
2. An inventory should be conducted of the ways that current foundry practice limits silica emissions.
3. The emphasis then turns to optimizing that emission limiting capability by setting standards of performance for it.
4. The impact of this performance enhancing technique can ultimately be demonstrated and quantified by gathering exposure samples of affected workers with the performance standards in place (termed “baseline exposure control sampling”).
## Action Item B. Establishing Silica Exposure Control Baselines: Resources

<table>
<thead>
<tr>
<th>Evaluation Method</th>
<th>Reference</th>
<th>Resources Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assessing exposure control performance</td>
<td>3, Section 5</td>
<td>Establish objectives and standards of performance for exposure control methods,</td>
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<tr>
<td></td>
<td></td>
<td>with examples; strategy for assessing the performance of exposure control methods</td>
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<tr>
<td></td>
<td>1, Section 3.6</td>
<td>Silica exposure control program strategy</td>
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<tr>
<td></td>
<td>followed by</td>
<td></td>
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<tr>
<td></td>
<td>case histories</td>
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<td></td>
<td>2, Section 9</td>
<td>Monitoring parameters and failure mode analysis</td>
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Action Item C. 
Evaluating Silica Exposure Control Options

Objectives

1. To develop silica exposure control options to address the root causes of exposure (Action Item A).

2. To utilize to the extent possible the control measures whose baseline performance has been confirmed.

3. To evaluate control measures on the basis of demonstrated effectiveness and feasibility.
Performance Factors Checklist for Measures to Control Worker Exposures to Air Contaminants in Foundries

- Effectively addresses potential exposure sources.
- Can feasibly be installed in this operation.
- Does not create new hazards to safety and health.
- Does not disrupt the capability to produce a quality product.
- Is acceptable to workers.
- Standards of performance are defined and performance monitoring methods are established.
- Can readily perform reliably with periodic maintenance and worker training.
- Reduces/eliminates the sources of air contaminants.
- Reduces/eliminates the need for respiratory protection.
Feasibility Considerations

Make certain that a control measure will reduce exposures before it is adopted into normal production methods. Assure the capability to produce quality product in a timely manner.

- Demonstrations under controlled conditions
- Previous successful methods at this or other foundries
Characteristics of a Feasible Exposure Control Method

• Achievable
• Sustainable
• Representing best practices for the particular foundry

What feasible is not:
“Feasible” is not the same as “possible”. Anything is possible!
Three Pillars of Feasibility

The feasibility of an exposure control method must be sufficiently examined to assure that:

1) the method does not create new hazards to safety and health in the process of controlling air contaminant hazards;

2) the method does not detract from the ability to perform process tasks and produce a quality product;

3) the method is acceptable to the workers who are expected to use it.
## Action Item C. Evaluating Silica Exposure Control

### Methods and Resources

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<thead>
<tr>
<th>Evaluation Method</th>
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<th>Resources Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Evaluation of silica exposure control options</td>
<td>4</td>
<td>Performance-based approach to selecting exposure control methods</td>
</tr>
<tr>
<td></td>
<td>4, Table 3 with case histories</td>
<td>Capabilities and limitations of exposure control categories</td>
</tr>
</tbody>
</table>
Resources

1. AFS 10-Q Health and Safety Committee, Control of Silica Exposure in Foundries, American Foundry Society, Schaumburg, IL (November, 2007) – available at no cost
   • https://hub.afsinc.org/NC__Product?id=a2Z1a000000NDfCEAW

   • https://hub.afsinc.org/NC__Product?id=a2Z1a000000ACrFEAW

   • https://hub.afsinc.org/NC__Product?id=a2Z1a000000NDe4EAG

To obtain References 4 and 5, contact Industry Information Specialist Mary Crompton, mcrompton@afsinc.org. In 2018, the AFS library policy will be to provide these copies only as an AFS membership service.
