Midwest Research Institute
Applied Engineering Division

Control of Abrasive Blasting Emissions through Improved Materials

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Overview

• Background
  – Emission studies
  – Newer materials

• Scoping Study
  – Methodology
  – Results

• Future Activities
Background

- AP-42 emission factors based on 1993 tests with silica sand

- Very limited data available for
  - Other traditional media (e.g., coal slag)
  - Improved materials
Foam-based abrasive media

Polyurethane foam

Impregnated with abrasive material
Conventional Abrasive Blasting Media

1. Single-component, conventional abrasives are propelled to the surface using an air-driven system.

2. Upon impact conventional abrasives...
   - Absorb the high-speed collision by fracturing and ricocheting into the air.
   - Transfer heat to the substrate.
   - Strip the complete coating system.

3. Conventional abrasives release all fractured abrasives, contaminants, and coating layers as airborne dust.
Conventional Abrasive Bonded Into Sponge Media

1. Dual-component, Sponge Media abrasives are propelled to the surface using an air-driven system.

2. Upon impact Sponge Media abrasives:
   - Absorb collision energy
   - Flatten and suppress the release of loosened surface contaminants
   - Expose its abrasives with little abrasive fracturing and remove contaminants
   - Selectively or completely strip the coating system and profile the substrate

3. Sponge Media abrasives entrap most of what would normally have become airborne dust.
Scoping Study

Objectives

- Develop comparative data between traditional and foam-based abrasives
- Develop guidelines for future testing
Methodology

Mimic essential features of 1993 EPA tests

- Low-speed wind tunnel
- Same test substrate (auto hoods)
- Same grade of silica sand for comparison
Low-Speed Wind Tunnel
Cyclone Preseparator

Collects both PM-10 and total particulate samples
Test Substrates

Before

After
Total Particulate Emission Factors

Arithmetic Scale  Logarithmic Scale
PM-10 Emission Factors

Arithmetic Scale

Logarithmic Scale
### Comparison with 1993 Results (Silica Sand)

<table>
<thead>
<tr>
<th></th>
<th>TP Emission Factor (kg/kg media)</th>
<th>PM-10 Emission Factor (kg/kg media)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1993 EPA Tests</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Painted hood surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average of 5, 10 and 15 mph tests</td>
<td>0.063</td>
<td>0.022</td>
</tr>
<tr>
<td>Average of 5 and 10 mph tests</td>
<td>0.049</td>
<td>0.029</td>
</tr>
<tr>
<td><strong>Present Study</strong></td>
<td></td>
<td></td>
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<tr>
<td>(7 mph)</td>
<td>0.14</td>
<td>0.030</td>
</tr>
<tr>
<td>Condition</td>
<td>Based on Coal Slag</td>
<td>Percent Reduction in Emissions</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Virgin</td>
<td>TP 94 PM-10 97</td>
<td></td>
</tr>
<tr>
<td>10th Use/Mix</td>
<td>TP 91 PM-10 93</td>
<td></td>
</tr>
</tbody>
</table>
Future Testing

Objectives – For a full-scale, field operation

- Develop size-specific particulate emission factors
- Characterize metal emissions due to
  - abrasive media itself
  - test substrate
- Develop supporting data for permit applications
Meeting with USEPA in February 2006

- Presented results from scoping study
- Discussed “working group” approach for future tests
  - State regulators
  - Trade groups
  - End users
Conclusions

- Foam-based provides up to 2 orders of magnitude of control than traditional abrasives
- Future tests to better characterize particle size distribution and metal emissions
- Currently assembling working group to oversee future testing efforts