Waste Powder Paint User Group
Project Overview

Dr. David Meade
Brian Wummel – Research Coordinator
Dr. Andre Venter - Chemistry
Dr. John Miller - Chemistry
Dr. Upul Attanayake – Civil Eng.
Dr. Valery Bliznyuk – Polymer Science

American Seating
Haworth
Herman Miller
Light Corp.

Michigan Manufacturing Technology Center
• Opportunity
• Group Formation
• Current Progress
• Future Plans
Opportunity

• Lean Manufacturing has led to:
  – Frequent color changes
  – Frequent material changes

• Resulting in:
  – Difficulties in re-claim
  – Recycling challenges
  – High volume of waste exceeding capacity of outlets
## Opportunity: Survey Results

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>User's Group Total Surveys Submitted</td>
<td>6</td>
</tr>
<tr>
<td>Total number of facilities that use powder paint</td>
<td>11</td>
</tr>
<tr>
<td>Total lbs purchased per year</td>
<td>3,927,957 (estimated)</td>
</tr>
<tr>
<td>Average cost per lb</td>
<td>$3.47 (missing data)</td>
</tr>
<tr>
<td>Total disposal cost</td>
<td>$12,701</td>
</tr>
<tr>
<td>Average disposal cost</td>
<td>$2,117</td>
</tr>
<tr>
<td>Total waste in lbs per year</td>
<td>1,454,173</td>
</tr>
<tr>
<td>Average facility transfer efficiency</td>
<td>63%</td>
</tr>
<tr>
<td>Average waste powder recycled</td>
<td>18%</td>
</tr>
<tr>
<td>Average waste going to landfill</td>
<td>68.4%</td>
</tr>
<tr>
<td>Average amount being reclaimed</td>
<td>11.2%</td>
</tr>
</tbody>
</table>

- **Annual Purchase Cost**: $5,045,980.31
- **Range**: 50-70%
- **Range for Waste Powder Recycling**: 0-50%
- **Range for Waste Going to Landfill**: 0-100%
- **Range for Amount Being Reclaimed**: 0-30%
Group Formation

• April 19, 2011
  – Discussion of problem and sharing of experiences
  – Understand total volume of waste powder paint involved
• June 29, 2011
  – Discuss challenges with recycling powder paint
  – Bring in MMTC to facilitate future meetings
• September 26, 2011
  – Official members: Haworth, Herman Miller, Light Corp, American Seating
  – Bi-monthly meetings with MMTC
• Exploring alternatives for waste
• Research to improve transfer efficiency and/or standardize material formulas and colors
Group Formation - WMU

• Dr. David Meade – GMIC
• Brian Wummel – Research Coordinator
• Chemistry
  – Dr. Andre Venter
  – Dr. John Miller
• Engineering
  – Dr. Upul Attanayake (Civil)
  – Dr. Valery Bliznyuk (Polymer Science)
Spring 2012

- Site visits
  - Herman Miller, Haworth, IVC
- Sample collection
  - Powder paint before and after use from multiple sources
- Literature review
- Initial testing
Testing Phase

- Combustion energy
- Volatile organic compounds and hazardous air pollutants
- Solubility tests
- FTIR spectroscopy
- Particle size

To understand the differences between used and un-used powder
- 300 seconds test shows degradation
- Interesting particles

2.74 µm

6.15 µm

Virgin Mean 7.4 µm

Mean - 33 µm by number

Mean - 18 µm by number
Particle Sizes

- Powder Supplier
- 60 seconds
- Dry powder
- Expected results

Virgin 54 µm

Used 37 µm
## Solubility Test

- Sample 3

<table>
<thead>
<tr>
<th>#</th>
<th>Solvent</th>
<th>Chem. Formula</th>
<th>$\delta$ (cal/cm³)½</th>
<th>$\mu$(D)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>ethanol</td>
<td>C₂H₅OH</td>
<td>12.92</td>
<td>1.7</td>
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<tr>
<td>2</td>
<td>isopropanol</td>
<td>C₃H₈O</td>
<td>11.9</td>
<td>1.6</td>
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<tr>
<td>3</td>
<td>acetone</td>
<td>C₃H₆O</td>
<td>9.9</td>
<td>2.9</td>
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<tr>
<td>4</td>
<td>toluene</td>
<td>C₇H₈</td>
<td>8.9</td>
<td>0.4</td>
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<tr>
<td>5</td>
<td>chloroform</td>
<td>CHCl₃</td>
<td>9.21</td>
<td>1.0</td>
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<tr>
<td>6</td>
<td>N-methyl-2-pyrrolidone (NMP)</td>
<td>C₅H₉NO</td>
<td>11.1</td>
<td>3.8</td>
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<tr>
<td>7</td>
<td>dimethylformamide (DMF)</td>
<td>C₃H₇NO</td>
<td>12.14</td>
<td>3.8</td>
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<tr>
<td>8</td>
<td>hexane</td>
<td>C₆H₁₄</td>
<td>7.3</td>
<td>0.0</td>
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</tbody>
</table>
• Analyze data from all tests
• Pursue specific research project
  – Concrete applications
  – Transfer efficiency improvement
    • Novel transfer method
    • Altering particles
  – Fuel conversion
• Assist WPUG members with industrial testing
  – Concrete products