Compost & Recycling
Occupational Hazards

By: Helen Mersereau, MHSc, CIH, ROH, CRSP
Cape Breton University
History

• Compost historically was conducted outside by individuals in their own yards
  – Now moving inside & mass produced
  – Large quantities handled

• Recycling was seldom done 10 years ago, now on the rise in many cities
  – handling has also moved inside
  – Large quantities handled
General Process - Composting

- Compostable materials brought in by truck
- Sorted
- Mixed
- Put in primary vessels
- Dozers/loaders used
- Put inside building for secondary composting
- Packaged and delivered
General Process – Recycling

• Blue bags brought in by truck
  – Sorted
    • Sent down chutes to large mesh bags
  – When full, large bags are pulled off chutes and tied up
    • Stacked against wall, waiting for pickup
  – Metal cans are crushed and compacted
What are the hazards?

- Noise
- Lacerations, bruising, slips, strains
- Carbon monoxide (from loaders/trucks running indoors and outdoors)
- Vehicles
- Fungi/bacteria/organic dust
- Chemical products from microbial action
  - VOCs (volatile organics)
  - Ammonia, methyl methacrylate, etc
Noise

– Noise over 85 dBA is present in some facilities
  • Dozers
  • Loaders
  • Conveyors
  • Mixers
  • Screening

– Need to wear hearing protection for some jobs
Physical Injuries

• Waste collection
  – Heavy lifting, pushing, pulling
  – 17% of waste collectors injured each year
    • Back, knee, hand, and foot most injured
  – Vehicle injuries

• Sorting/Receiving
  – Repetitive strain injuries
  – Lacerations (sharp objects, metals, etc)
Carbon monoxide

• Produced from vehicles
  – Sources
    • dozers, loaders coming into and out of facility throughout day
    • Large delivery or pick up vehicles idling outside
    • Fork lift trucks (moving bales)
    • Etc.
Fungal spores (toxigenic species)

- Aspergillus versicolor[2]
- Aspergillus fumigatus (present in compost)
- Stachybotrys species
- fusarium species
- ulocladium
- Eurotium species
- Wallemia species
Does Mould Cause Health Effect?

- Epidemiological studies of compost site indicate that the risk to healthy individuals is extremely small.
- where the person has a diminished immune system or where the receiver is exposed to very elevated concentrations of bioaerosols, illness may result.
  - skin infections
  - Nausea
  - Diarrhea
  - asthmatic and allergic reactions
  - hypersensitivity pneumonitis
  - allergic bronchopulmonary aspergillosis.
Organic Dust Syndrome

- cough, chest tightness, dyspnoea, chills, fever, muscle ache, joint pain, fatigue and headache [18].
Bacterial Exposure

- **Endotoxins**
  - Produced by bacteria
  - Can be measured
  - Standard is present

- **B(1-3) glucans**
  - May induce upper and lower airway inflammation.
Standards/guidelines

- Carbon Monoxide: 25 ppm
- Ammonia: 25 ppm
- total dust: 10 mg/m³
- noise: 85 dBA
- VOCs (as total): 5 mg/m³
- Endotoxin: 90 EU/m³
- Fungi: no standard cfu/m³
Methods – Methyl Methacrylate

- Pump attached to charcoal tube
- Worker wears pump for full day
Methods – dust

- Pump plus filter used to assess dust
- Pump worn on belt for full day
- Filter weighed before and after
Biologicals

- Use RCS Biotester
- Agar Strips
- 30 second period
- Incubate & count colonies
- Determine cfu/m$^3$
Endotoxin sampling

- Filter or impinger method
## Compost Facility - Results

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Average</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide</td>
<td>0-7 ppm</td>
<td>3 ppm</td>
<td>25 ppm</td>
</tr>
<tr>
<td>Methyl methacrylate</td>
<td>0.48 – 20 mg/m³</td>
<td>9.7 mg/m³</td>
<td>205 mg/m³</td>
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<tr>
<td>Tetrachloroethylene</td>
<td>0.19 – 0.4 ppm</td>
<td>0.25 ppm</td>
<td>10 ppm</td>
</tr>
<tr>
<td>Dust</td>
<td>0.06-1.0 mg/m³</td>
<td>0.49 mg/m³</td>
<td>10 mg/m³</td>
</tr>
<tr>
<td>TVOCs</td>
<td>0.5 – 15 mg/m³</td>
<td>3.8 mg/m³</td>
<td>30 mg/m³</td>
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<tr>
<td>Ammonia</td>
<td>0-0.8 ppm</td>
<td>0.2 ppm</td>
<td>25 ppm</td>
</tr>
<tr>
<td>Facility</td>
<td>Range</td>
<td>Average</td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------</td>
<td>---------</td>
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<tr>
<td>Composting and recycling</td>
<td>1476-8752</td>
<td>5983</td>
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<tr>
<td>Composting only</td>
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<td>3375</td>
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<td>12002</td>
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<tr>
<td>Composting</td>
<td>8300-98000</td>
<td>23147</td>
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</table>
## Results for Endotoxin EU/m³

<table>
<thead>
<tr>
<th>Study</th>
<th>Range</th>
<th>Ave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>8.5 - 100</td>
<td>55</td>
</tr>
<tr>
<td>US</td>
<td>0 - 10881</td>
<td>200</td>
</tr>
<tr>
<td>Denmark</td>
<td>4800 – 9900</td>
<td>6200</td>
</tr>
<tr>
<td>Norway</td>
<td>1.5 – 7.5</td>
<td>4.7</td>
</tr>
<tr>
<td>Germany</td>
<td>&lt;50</td>
<td>&lt;50</td>
</tr>
</tbody>
</table>
Recommendations

• Respirators
  A HEPA half face respirator or disposable HEPA respirator would be acceptable based on the concentrations of contaminants measured
  – Needs to be enforced
Recommendations

• Vaccination
  – vaccination schedule should be set up
    • (within 3 weeks of hiring is advisable).

• Medical monitoring
  – Pre screening prior to hiring
  – Mantoux test
  – Asthma
  – Allergies
  – Immune function
• Questions?
References

- TLVs and BEIs, 2010 American Conference of Governmental Industrial Hygienists
- Perez et al, Health Effects Associated With Organic Dust Exposure During the Handling of Municipal Solid Waste, Indoor and Built Environment, June 2006.