Aerated Window Composting, (Un-) Covered

John Paul and Dieter Geesing,

Transform Compost Systems Ltd.

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The Composting Process

- Material Receiving and Preparation for Composting
  - Debagging
  - Grinding
  - Blending
- Active Composting
  - Pathogen kill
  - Product stabilization
  - Pollution control (air and water)
- Curing and Storage
  - Larger piles for further product stabilization
- Post Processing
  - screening
  - removal of contaminants (plastics etc)

The aerated cover system is one option for <u>active composting</u>

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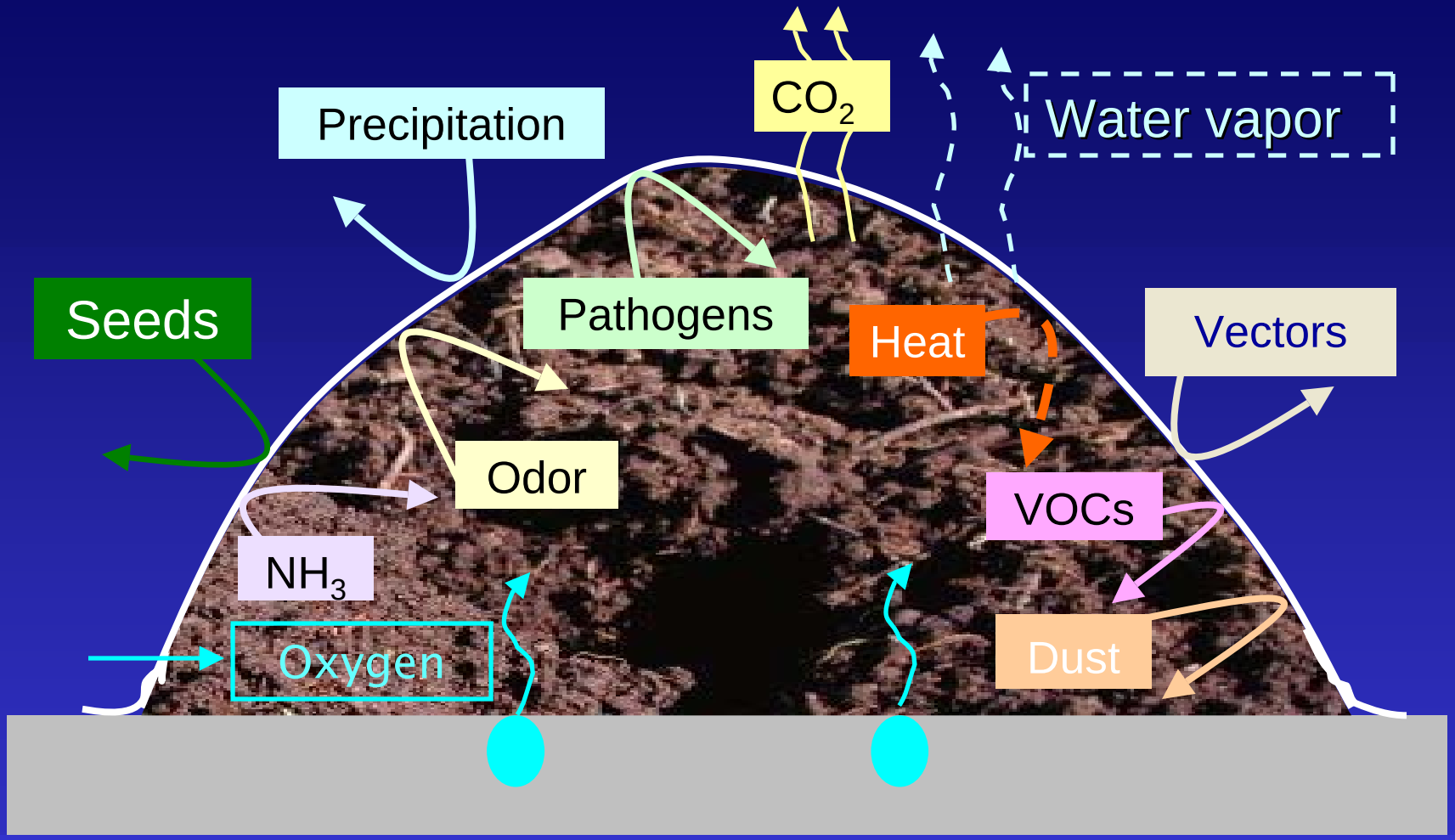
Purpose of Aerated Windrow Composting



A cost effective active composting process that provides a quality compost and ensures environmental protection.

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Components of an Aerated Windrow System

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Aerated Windrow Cover Materials

e-PTFE expanded (Polytetrafluoroethylene) (and Polyester)

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Aerated Windrow Cover Materials

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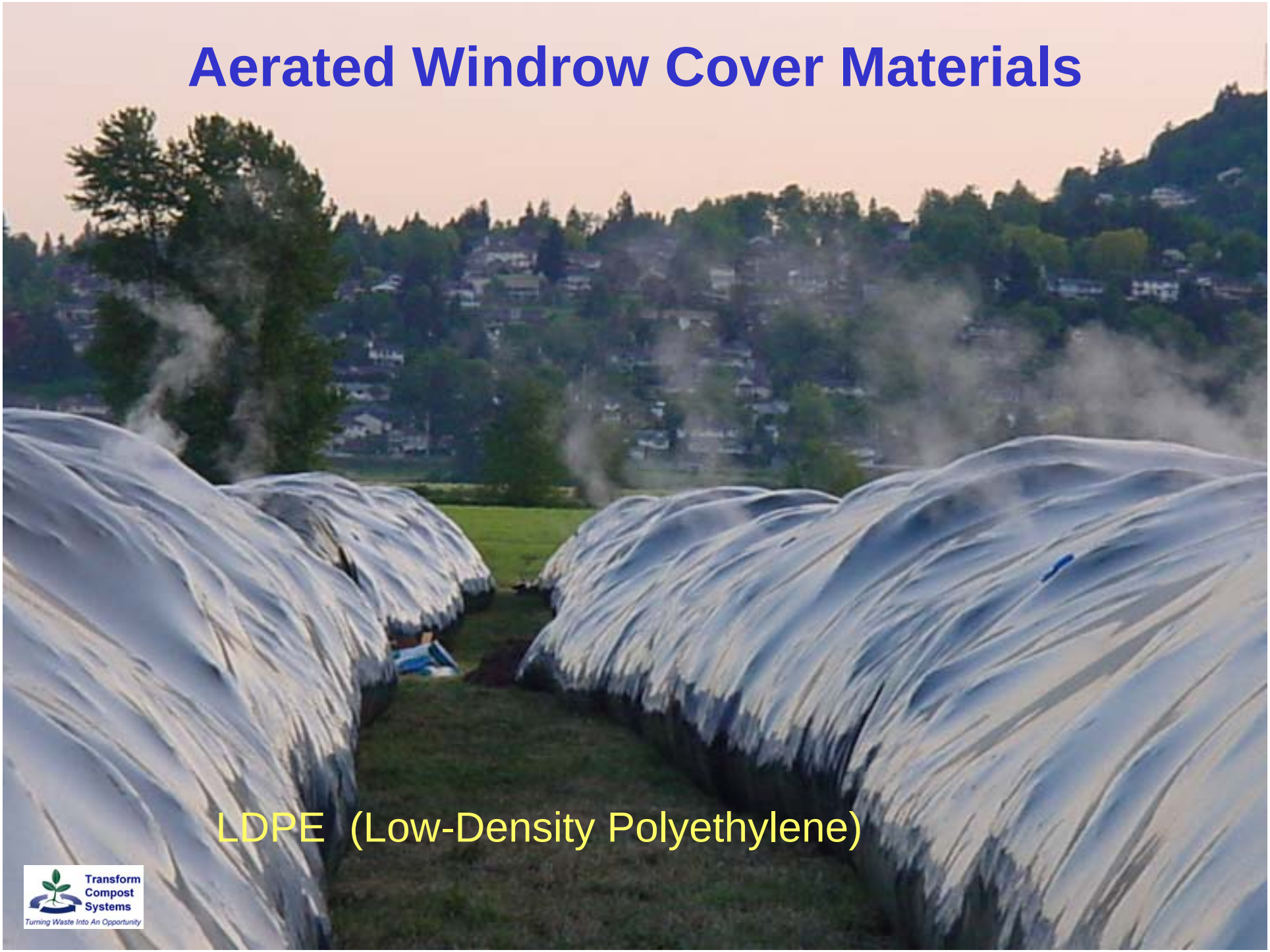
Aerated Windrow Cover Materials



LDPE (Low-Density Polyethylene)

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Aerated Windrow Cover Materials

Biofilter-cover: Porous organic material

Example: finished compost, wood chips

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Covers

Membrane cover

- VOC and odor control, some ammonia control
- Protection against precipitation
- Moisture control
- Leachate management requirements

Biofilter layer only (> 15 cm)

- VOC, odor and ammonia control.
- Provides Insulation
- Low capital cost
- Increased dust potential
- Leachate management requirements
- Little protection from precipitation

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Emission Control

- **Odor**
  - All covers reduce odor, sometimes > 90%
  - Odor reduction dependent on
    - Feedstock
    - Feedstock mix
    - Composting phase
    - Operation (turning)
- **Ammonia**
  - All covers reduce ammonia emission
  - Less concern with green waste composting
  - Trials indicate best ammonia reduction achieved with biofilter
- **VOCs**
  - Reduced by all covers
  - Increasing C:N decreases VOC emissions

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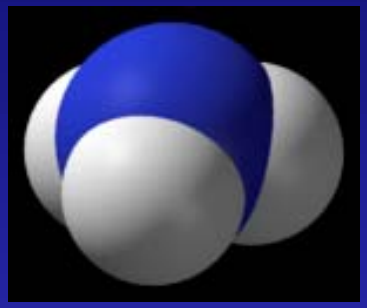
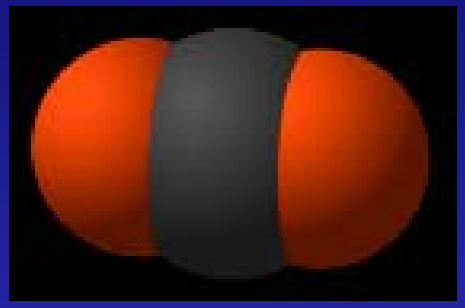
How do synthetic membranes trap molecules?





NH_3 CO_2 VOC (Ex:Dimethyl Disulfide)

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Membrane Pore Size

Membrane pores: e-PTFE covers 0.1 – 3 μm;
other covers ? μm ……> 100 μm

Water: Drop ~ 100 – 3000 μm; vapor ~ < 0.3 μm

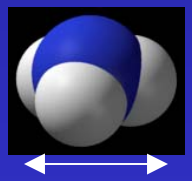
Bacteria, and bacterial spore: 0.5 – 10 μm

Fungal spore: 1 – 30 μm

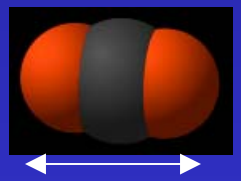
Virus: 0.02 – 0.26 μm

Particulate matter: PM_{10} < 10 μm

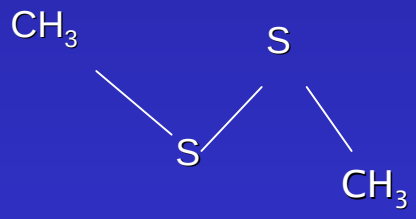
Chemical molecules:



2 x 101.7 pm



2 x116 pm



NH_3 < CO_2 << Ex: Dimethyl Disulfide

A Micron-Size Particle on a Pin Head

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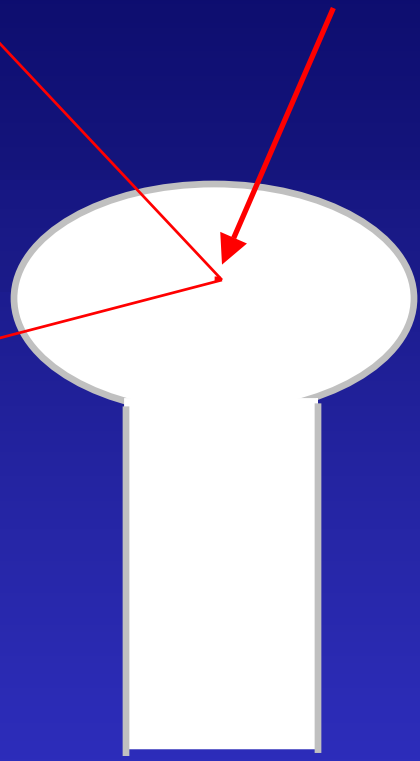
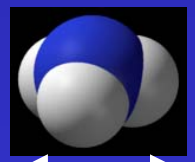
Molecule Sizes

a CO_2 or NH_3 molecule
in a 1-μm membrane pore



A Micron-Size Particle on a Pin Head

Chemical molecules:



2 x 101.7 pm

NH_3

2 x116 pm

CO_2

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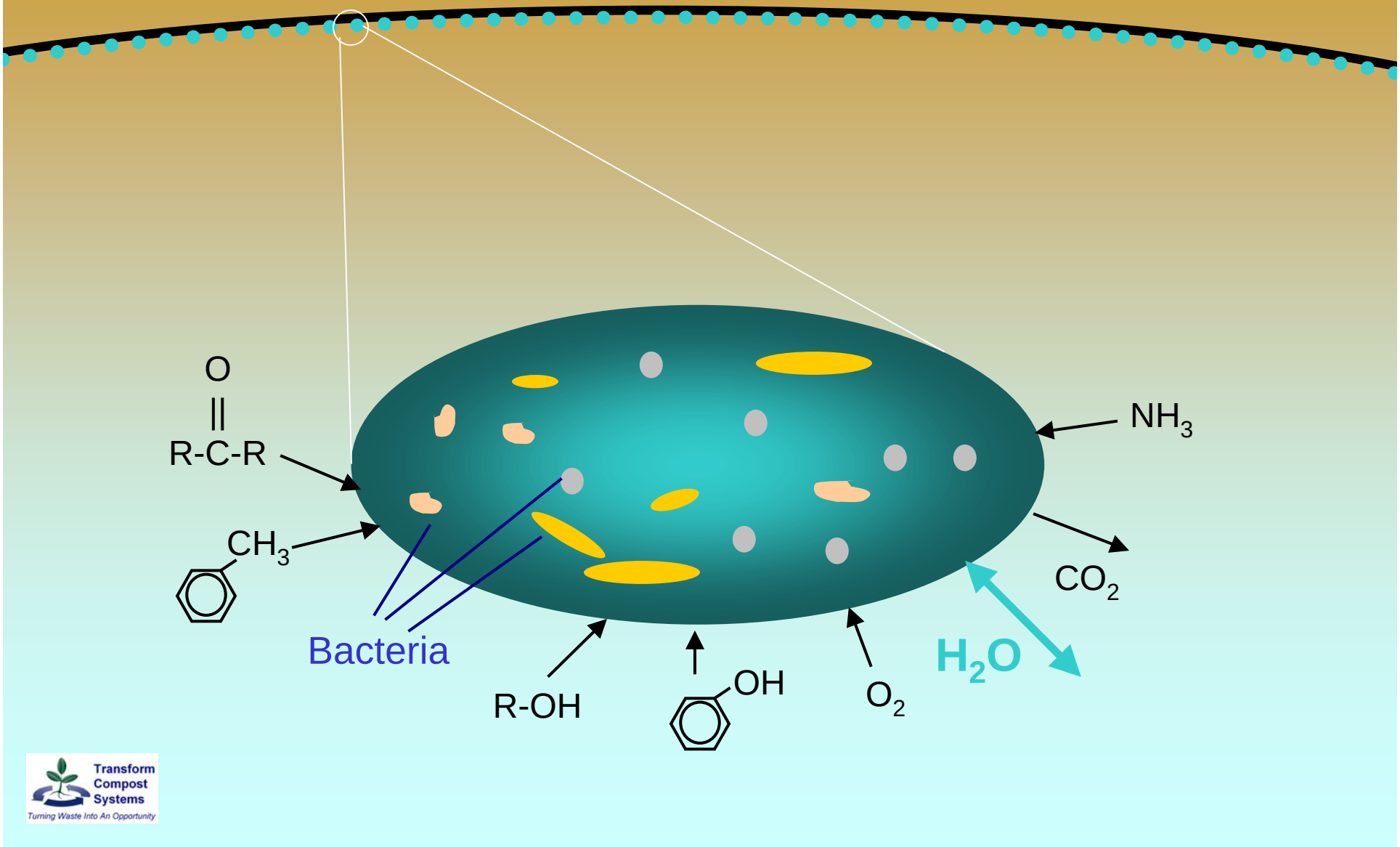
How do membranes trap emissions?



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Aerated Covers – Small Pore Sizes

Very small pore sizes in compost covers may result in air bypass between the floor and the cover – may not aerate as well as one hopes – also becomes important for odor and emissions testing protocols

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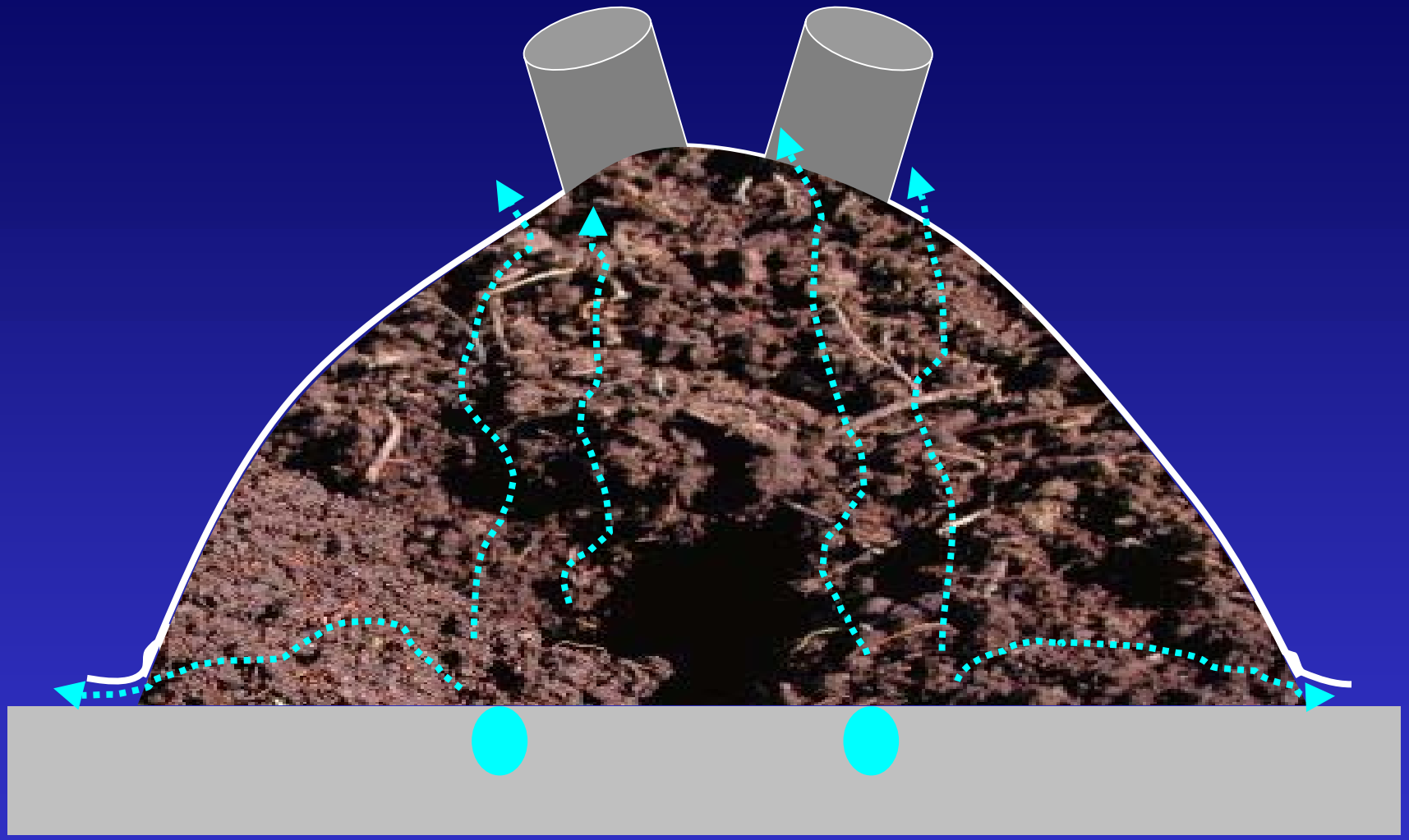
Emission Testing Protocol



Blower ON

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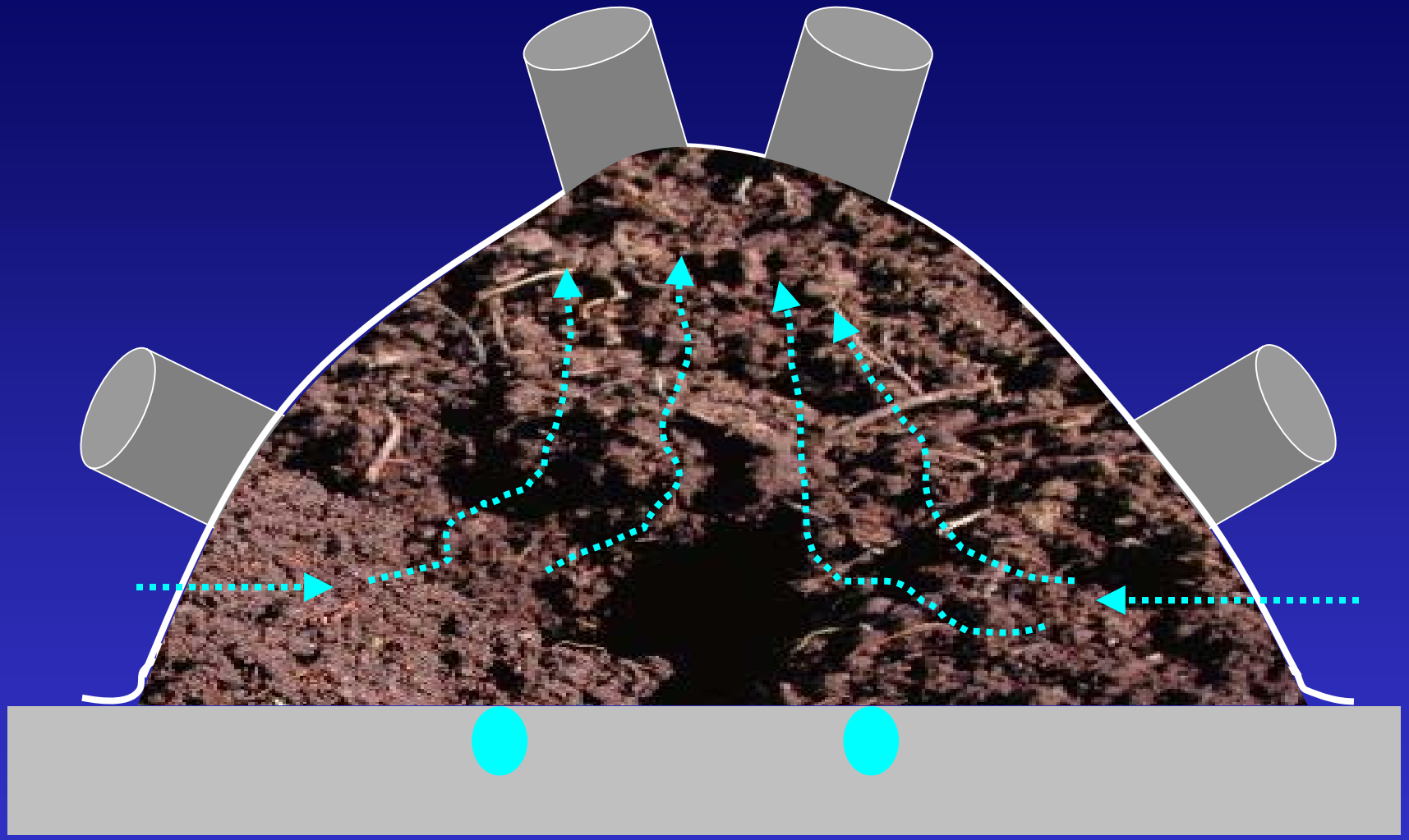
Emission Testing Protocol



Blower OFF

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Questions to Ask About Covers

- What is the porosity on the material – does it allow air to exchange but not water?
- What sizes are available – relates to pile size and shape
- What is the cost?
  - Cover (from $ 1.50 m^2 – $ 75 m^2)
  - Life span (often 5 years warranted on e-PTFE)
- What is the UV-resistance?
- What is the tear-strength?
- Is the material recyclable?

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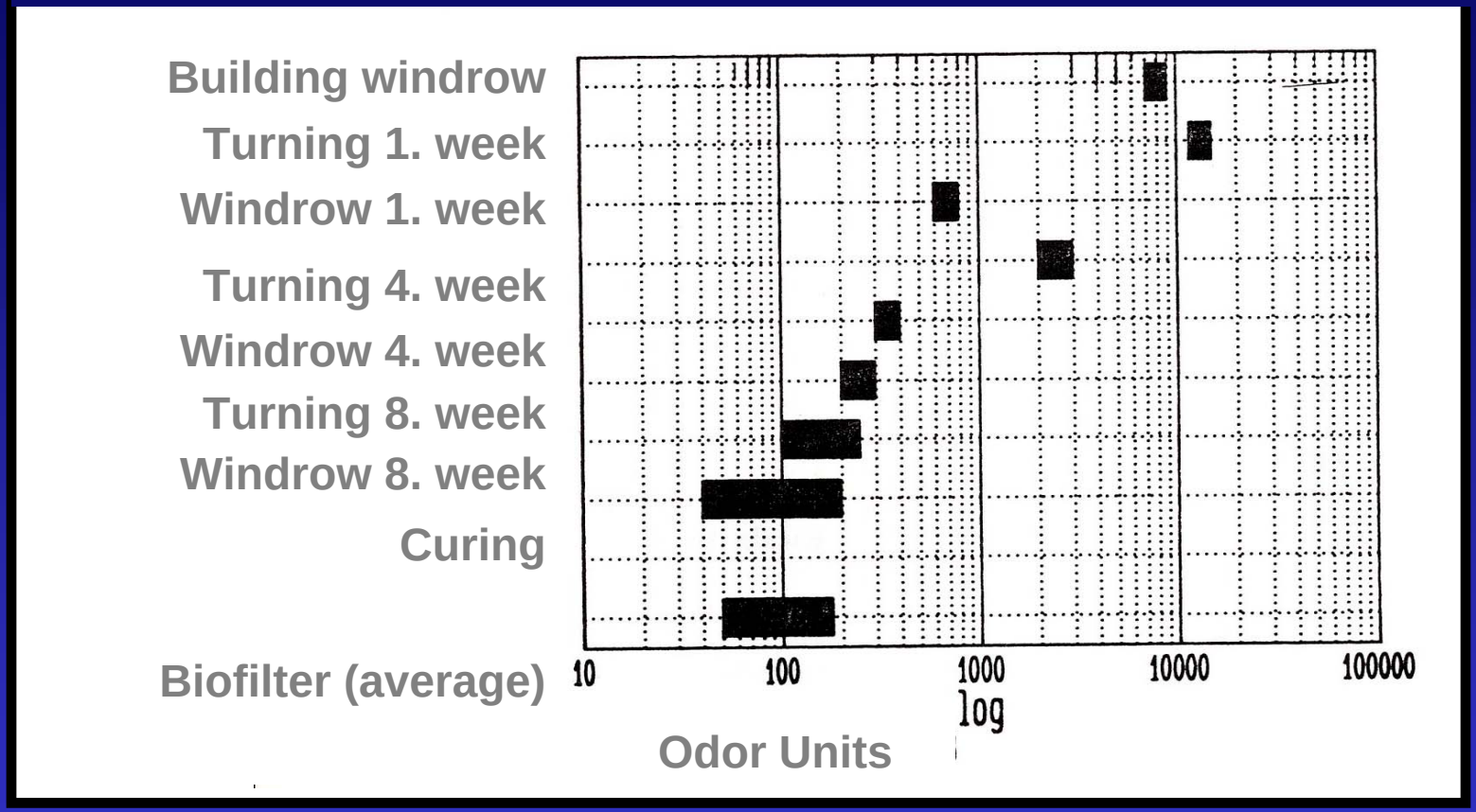
ODOR POTENTIAL

Example: Turned Windrow



Cover required

- the first 2 – 4 weeks for odor control
- after 2 – 4 weeks for protection

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Additional Considerations

- Needs proper design at base
  - Moisture wicks through material to bottom edge
  - Water ponding at bottom can become insect breeding ground

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Other Relevant Questions on Aerated Windrow Systems

- Is the cover sold separately or only as part of a package?
- What kind of aeration system do we need?
- What size of footprint do I need for this?
- What are the operating costs of this type of system?
- How am I going to achieve pathogen kill with this technology?

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What kind of aeration system do we need?

- Negative or positive
  - Positive: Better temperature control, better pressure control, less stress on material, less energy requirement
  - Negative: Better odor control
- Below grade (in slab) or above grade
  - Below grade: much simpler operating
  - Above grade: less capital cost
- Aeration control
  - Timer controlled
  - Temperature controlled
  - Oxygen controlled
  - Combination

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Footprint Requirements for Aerated Windrow Systems

Depends on the size of the windrow, the space required between windrows,
and the duration of the composting process

Calculation of windrow vs. aerated bin

Example: 1500 tonnes of material

Assumption: Same height (2.5 m), same width (8 m), same length (60 m) same active composting time

$\Rightarrow$ Two Aerated bins: area 975 m^2

$\Rightarrow$ Three Windrows: area 1,870 m^2

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How am I going to achieve Pathogen Kill with Aerated Windrow Systems?

- In-vessel systems – 3 days at 55°C
- Windrow systems – 15 days at 55°C and 5 turns
- Many aerated covered systems are considered as in-vessel – why?
- We need to consider the floor and edges, where the temperature does not reach 55°C
  ⇒ at least one mix is required during the process

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Operating Costs for Aerated Windrow Systems

- If there is no conveyor system, there is high operations cost associated with loaders

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Summary … message to take home

- Covered ASP can efficiently process organic waste relative to turned windrows
- Covered ASP are not always the most cost efficient solutions
- Compost operation often more important than system to reduce environmental impact
- Many ASP systems can be used with comparable efficiency and emission control
  ⇒ Most expensive solutions are not necessarily the best solutions

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Thank You For Your Attention