

Composting Systems & Methods

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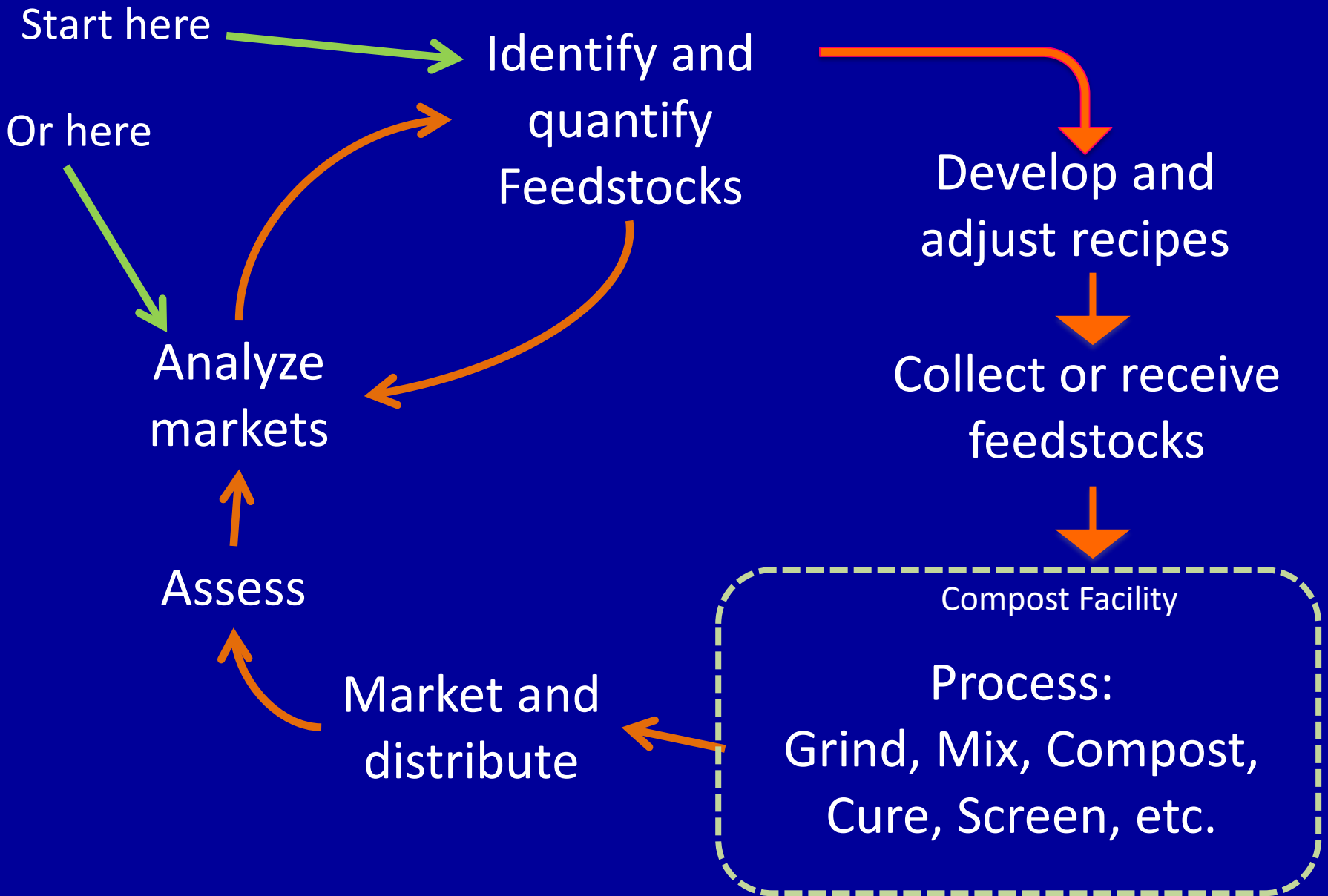
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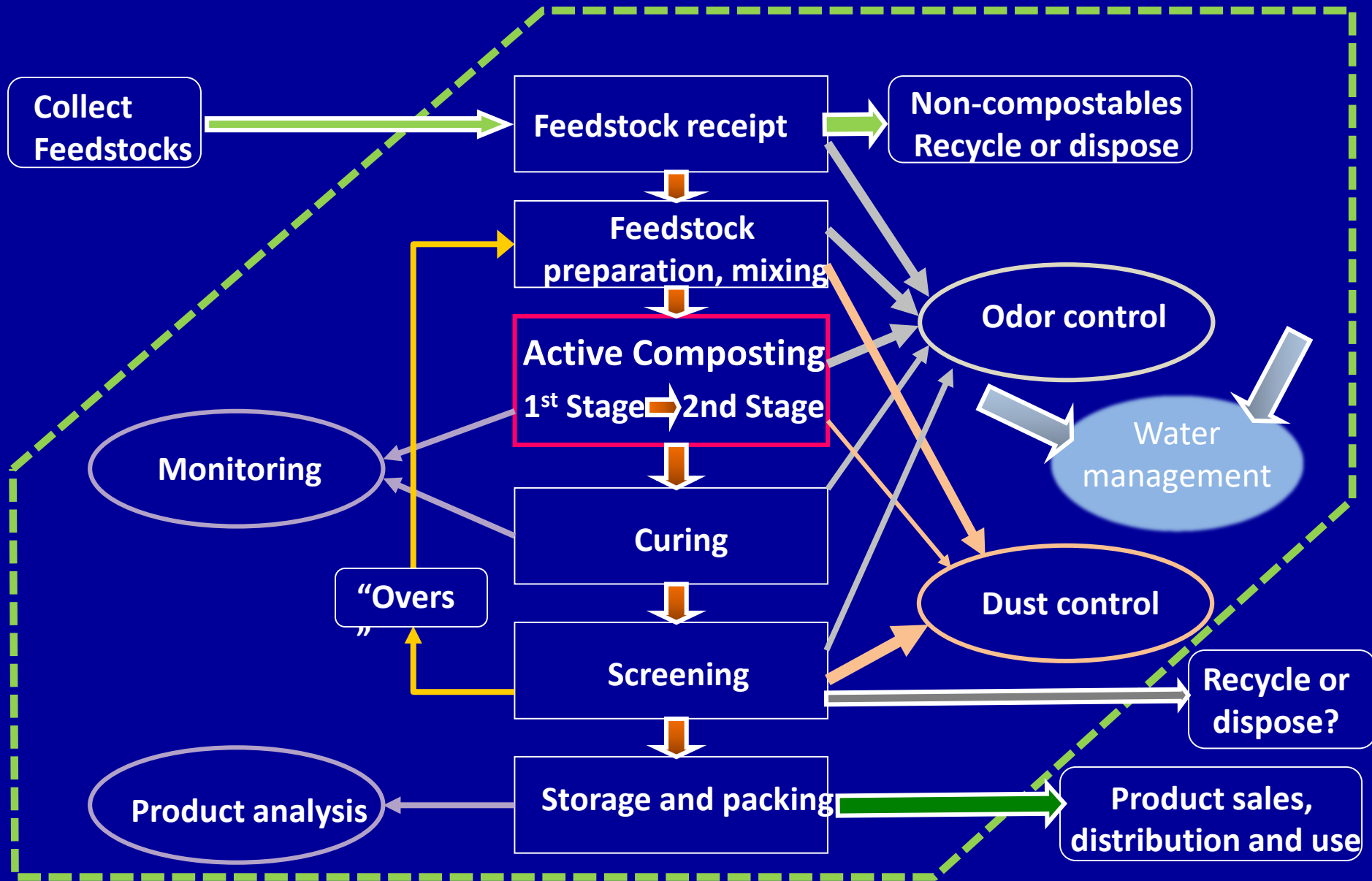
Acknowledgements

Content derived, in part, from U.S. Composting
Council Compost Operator Training Courses

Developing A Composting System



The composting facility system



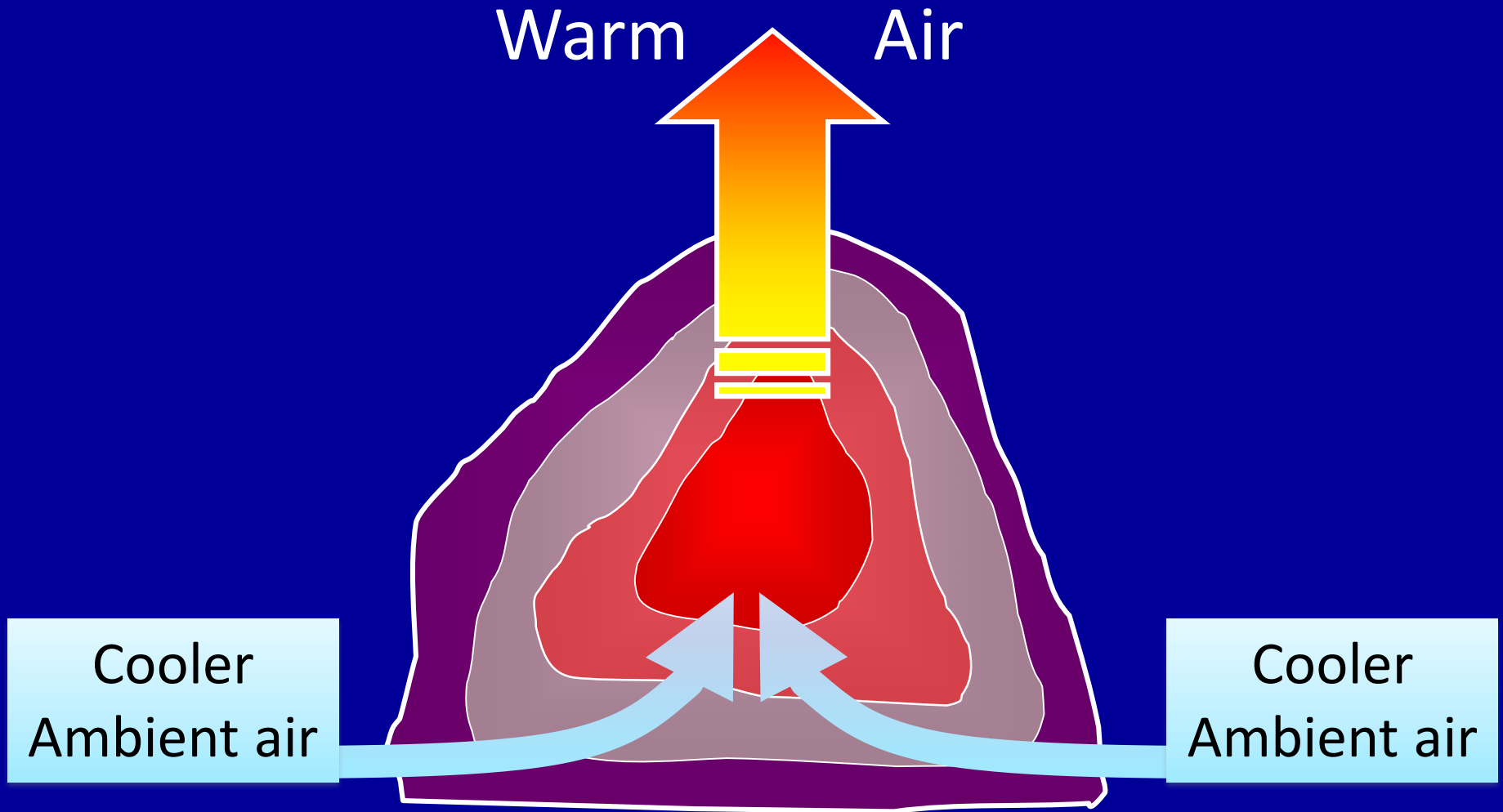
Active Composting Methods

- Piles or static windrows (Is time important?)
- Turned windrow
- Aerated static pile
- In Vessel
- Hybrids

Methods Descriptions

- **Open/freestanding** **vs.**
 - Covered
 - Bins
- **Passive aeration** **vs.**
- **Negative aeration** **vs.**
- **Static** **vs.**
- **Batch** **vs.**
- **Enclosed**
 - Contained
 - In-vessel
- **Forced aeration**
- **Positive aeration**
- **Agitated or turned**
- **Continuous**

Common to All



Static Piles or Windrows

- **Passive aeration**
- **Advantages**
 - Low labor
 - Footprint
 - Higher Organic Matter
 - Higher N
- **Disadvantages**
 - Little process control
 - Slow
 - Watch out for fires with large piles

Assisted Passive Aeration



Turned Windrow

- **Most common method**
- **Many options to accomplish “turning”**
- **Advantages**
 - **Effects of turning**
 - **Flexibility**
- **Disadvantages**
 - **Aeration and odors**

Turned Windrow



Dairy Farm Turned Windrows



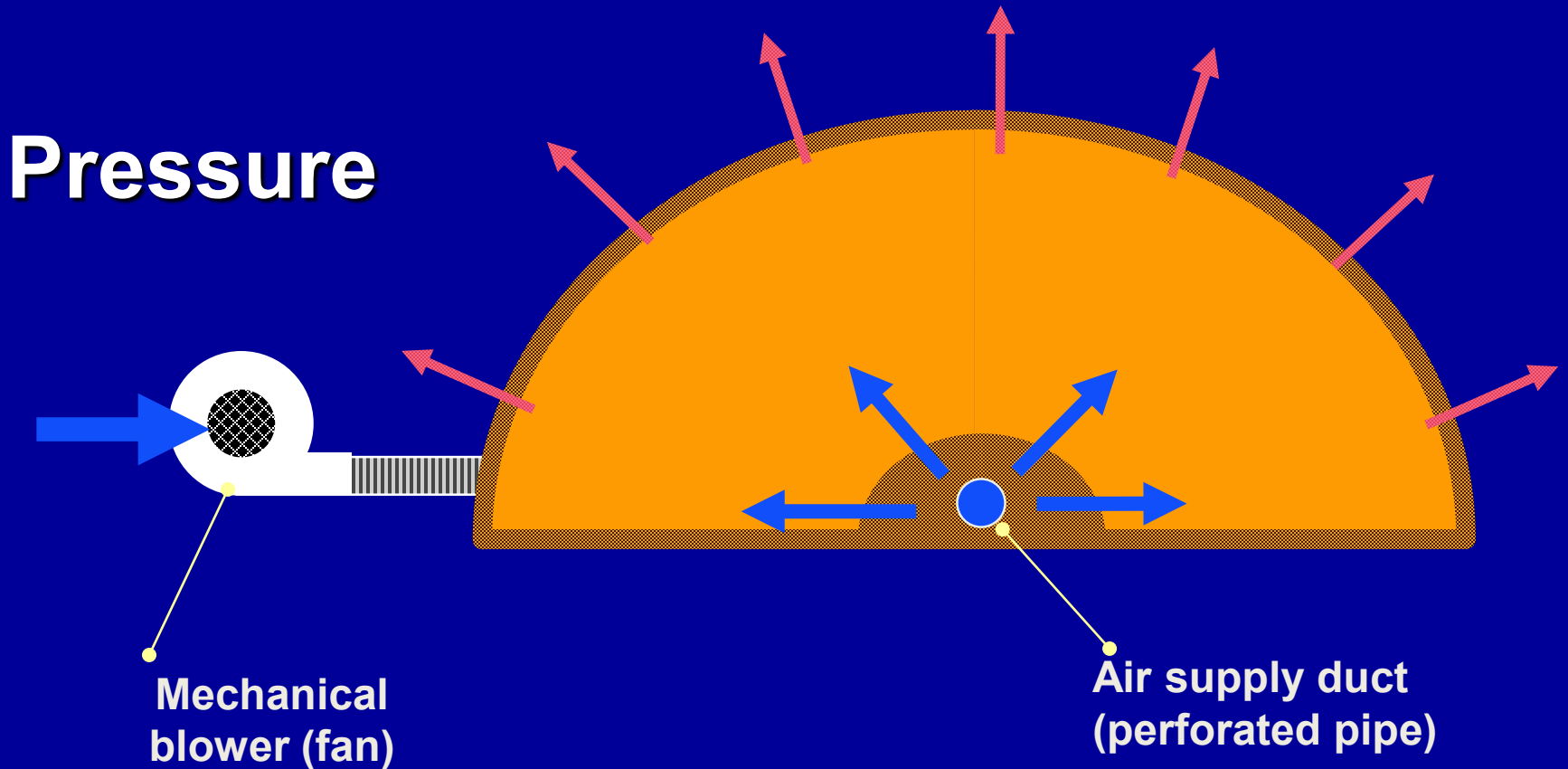
Aerated Static Pile



Forced Aeration

- **Active aeration**
- **Covered or uncovered**
- **Which direction should the air flow?**
 - **Positive (or Updraft)**
 - **Negative (or induced draft)**
 - **Reversing (or Bi-directional)**

Forced Aeration: Positive



POSITIVE Aeration

Advantages

- Simplest system
- 30% less energy consumption
- No condensate in piping or blower corrosion
- Good distribution of oxygen

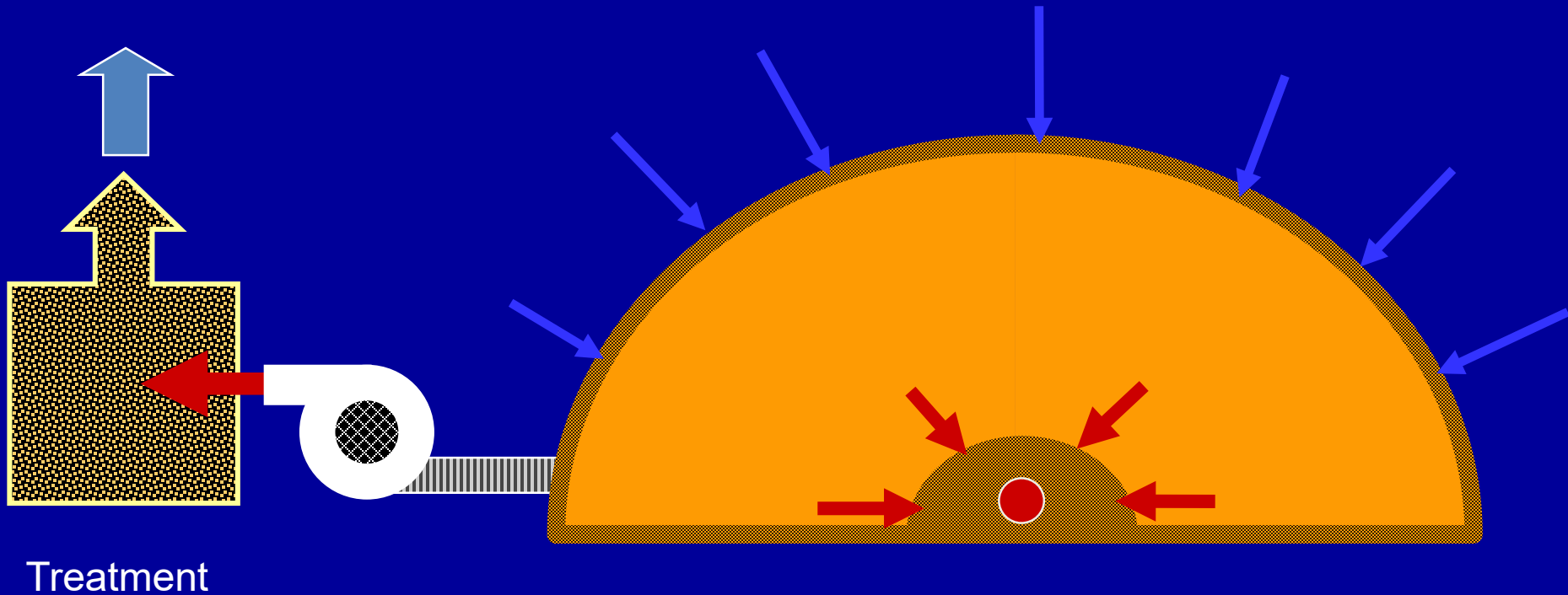
Disadvantages

- Large temperature gradients
- Limited options for odor control
- Dries base of pile, which is hard to re-wet

Odor Control with Positive Aeration

- **Bio-Covers/Compost Cap**
 - Shown to have 75-90% effective at odor removal
 - Can overheat or dry out
 - Time consuming procedure, especially with turning
- **Capture process air in a building**
 - High volumes of air for processing
 - Typically treated with biofilter
 - Fog and corrosion in building is challenging
- **Permeable Membrane Covers**
 - Effective odor control
 - Expensive and labor cost to deploy

Forced Aeration - Negative



NEGATIVE aeration

Advantages

- **Reduces surface odor emissions**
- **Smaller temperature gradients**
- **Retains more moisture in pile**
- **More options for Odor control**

Disadvantages

- **Corrosive condensate in ducts and blowers**
- **30% more power required for same air flow**
- **Requires biofilter or other odor control system**
- **Pulls solids and dust into aeration system**

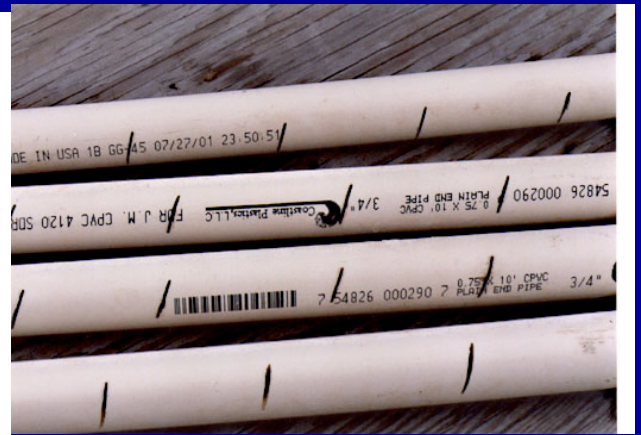
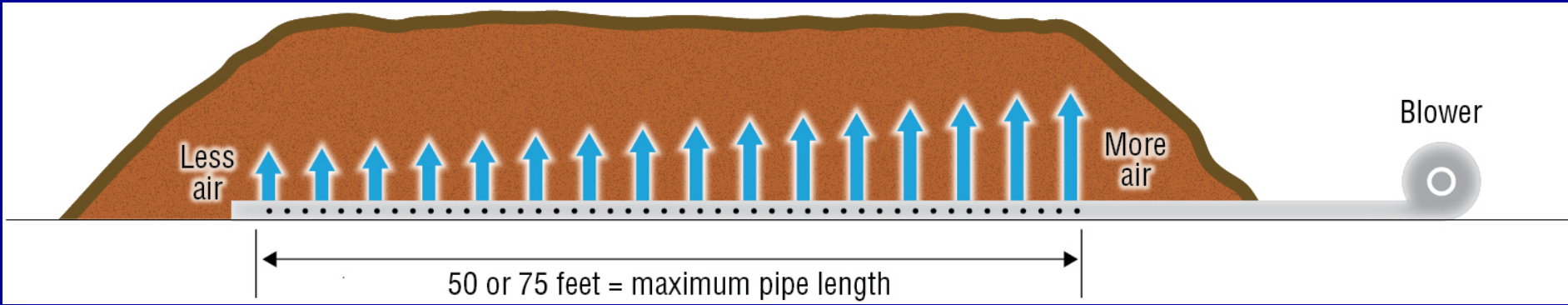
Aeration



Aerated Bins







Piping materials: HDPE, PVC

Addressing Pressure Loss



Aeration Floor Systems



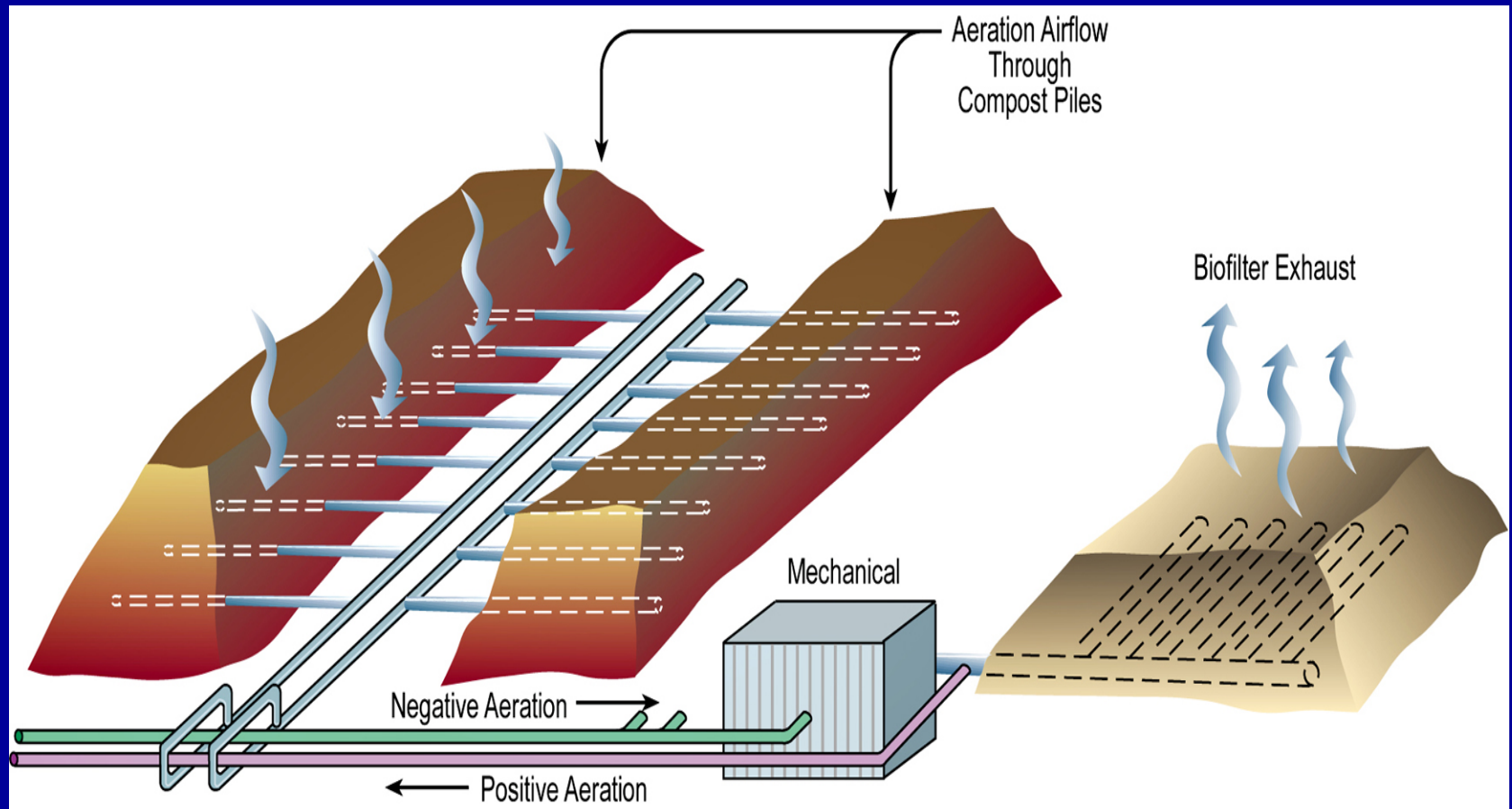
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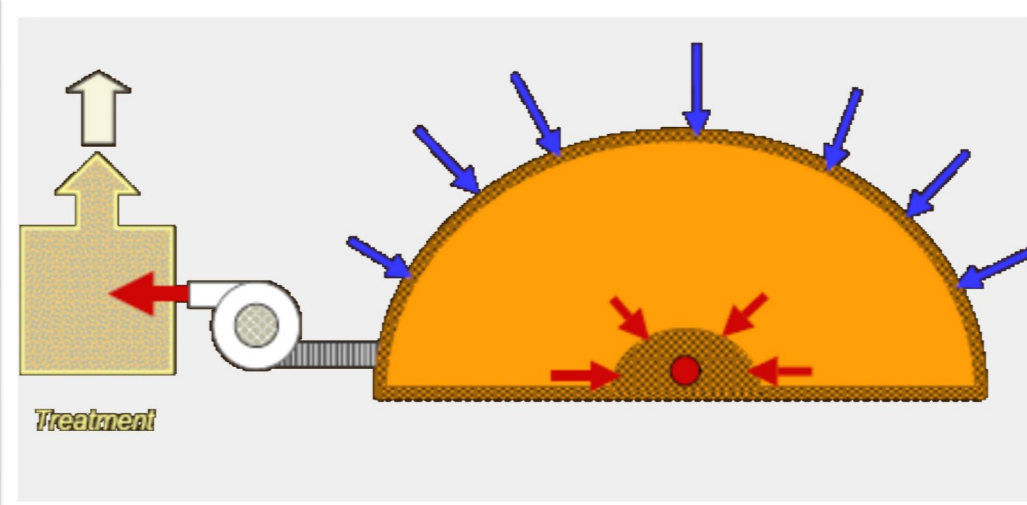
Aeration Channel Maintenance



Negative Aerated Static Pile



Forced Aeration: Negative



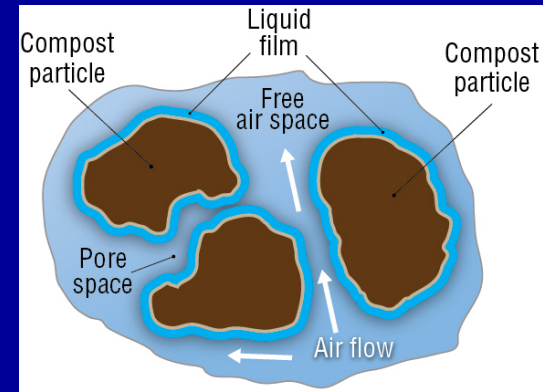
Howard County MD Neg ASP



Negatively aerated ASP
@ Washington State
University



Biofiltration



- Organic compounds are absorbed into an aqueous layer and adsorbed onto the media surface
- Use naturally occurring microbial populations to absorb and degrade odors
- Media to support microbes is usually mix of compost, bark mulch, woodchips, sand, soil, etc.
- Exhaust gases pass through biofilter media
 - Microbes digest, degrade and oxidize odorous compounds
 - CO_2 and H_2O are produced

Biofiltration of exhaust air

- Needed with negative aeration
- Condensate management needed
 - Low pH, corrosive
- Air should be cooled before entering biofilter

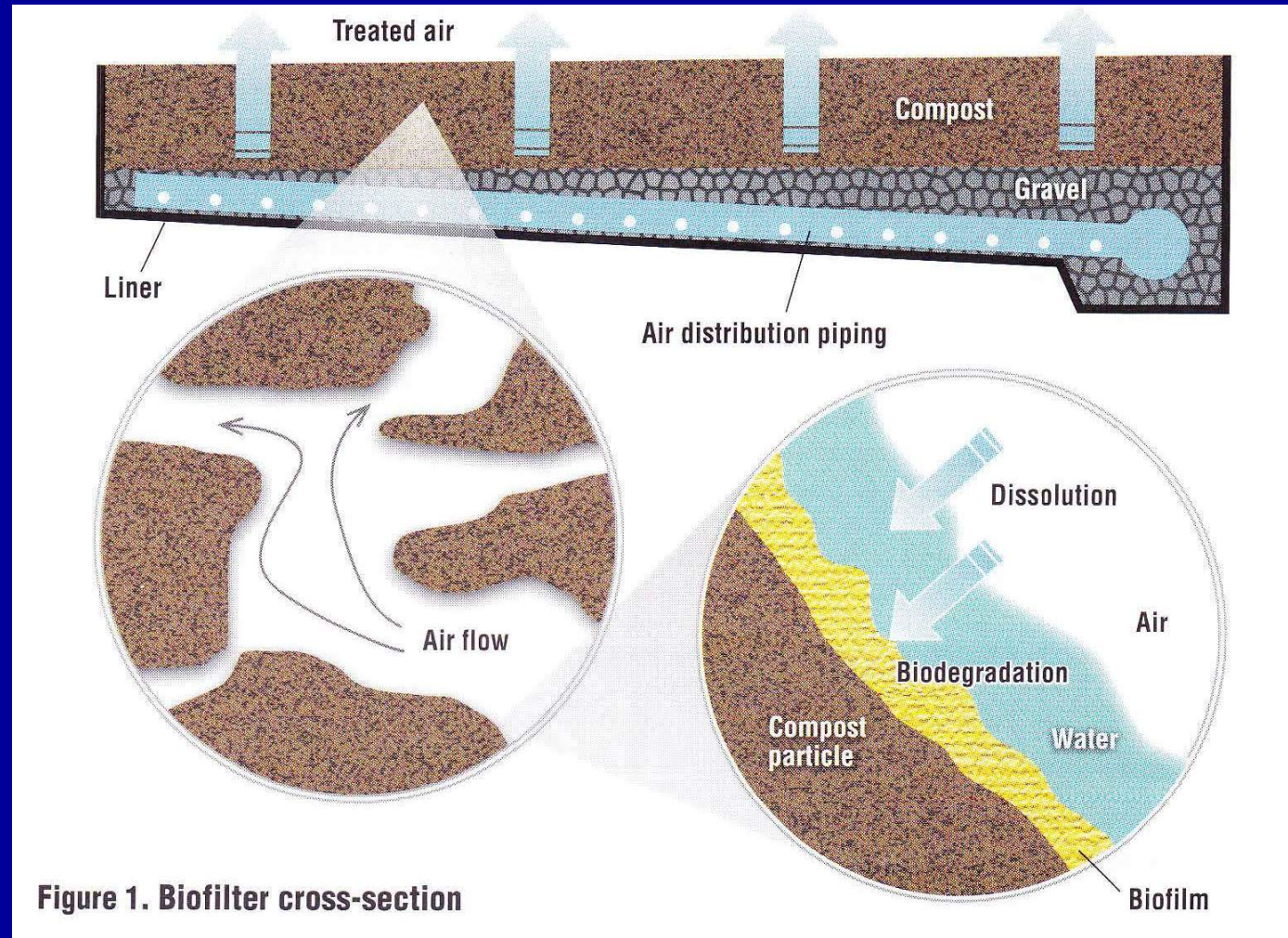
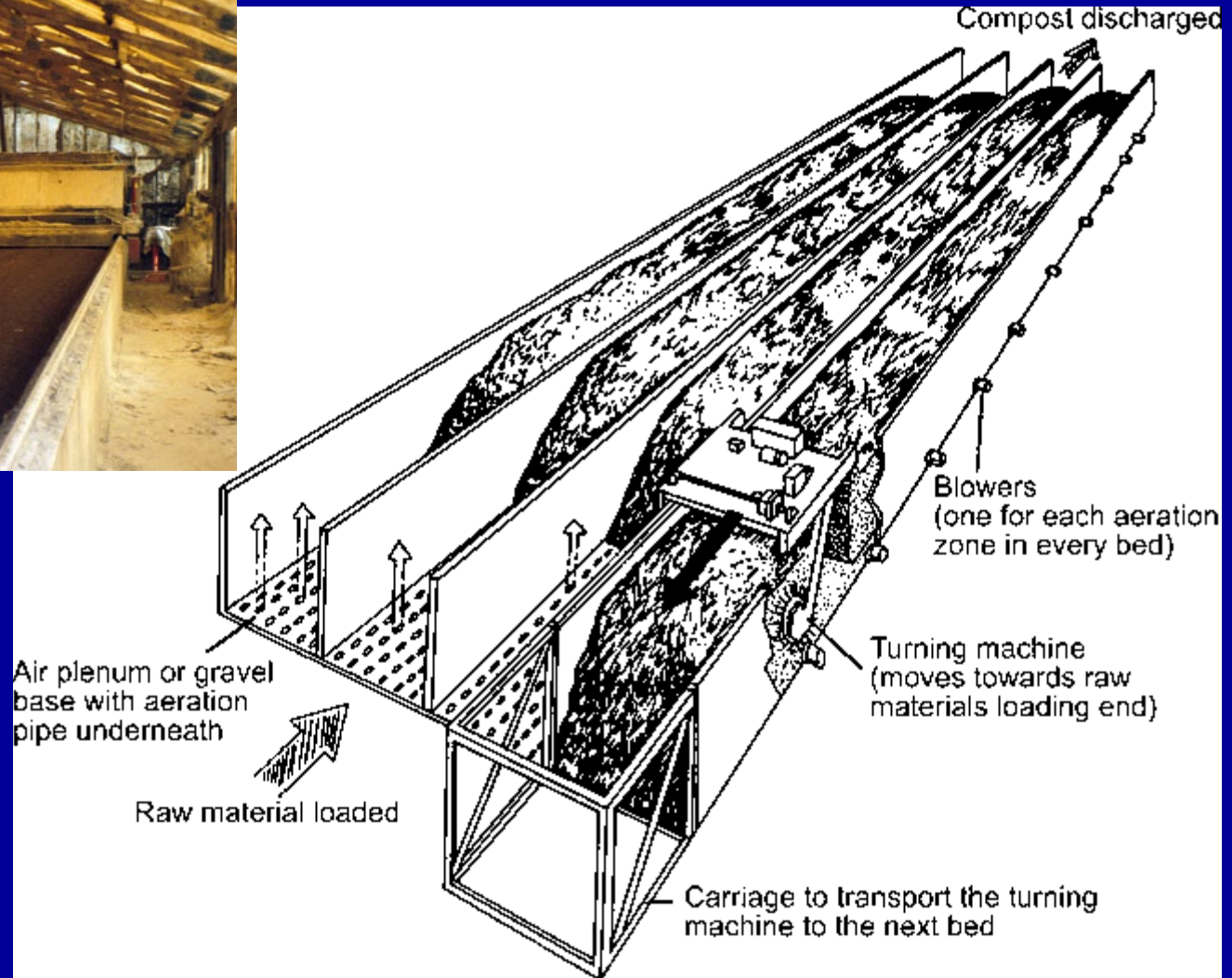


Figure 1. Biofilter cross-section

“In-Vessel”

- **Wide range of technologies**
- **Advantages**
 - **Increased control**
 - **Minimizes weather impacts**
- **Disadvantages**
 - **Cost**
 - **Management**

Agitated Bed Systems



Bins and Boxes

NatureTech



Hot Rot System



GMT Earth Tub





B&W

Rotating Drums





Cover



Power



Pad



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Questions?