Lesson 4: Site Selection, Facility Design and Equipment Selection

Learning Objectives:

- Know the characteristics of appropriate sites for food waste (FW) and yard trash (YT) composting
- Learn the key components of a well-designed composting facility
- Understand the pros and cons of various composting methods
- Be familiar with the range of equipment used for food waste and yard trash composting

Siting Requirements

- DEP requirements (62-709.300(7)):
  - Stable geology
  - Not in water, wetland, or unlined dewatered pit
  - At least 200 ft from water body; at least 50 ft if yard trash only
  - At least 500 ft from well; at least 100 ft if yard trash only
  - Not on public highway, road or alley
  - At least 10,000 ft from jet airport runway, and at least 5,000 ft from prop airport runway
- Other recommended siting parameters:
  - >500 ft to sensitive receptors
  - >3 ft. depth to groundwater

“Ideal” Composting Location

- Meets all siting requirements
- Zoned correctly (commercial, industrial, agricultural, etc.)
- Close to sources of organic materials
- In same area as compost markets
- Readily accessible for large vehicles
- Year-round accessibility
- Large enough with room to expand

“Ideal” Composting Site

- Level terrain
- Firm and stable surface to support heavy equipment under varying weather conditions
- Native soil with moderate permeability (not excessively or poorly drained)
- Visual buffer from neighbors
- Large volume source of water

Common Siting Options

- Stand-alone site
- Co-located with related facility:
  - Landfill
  - Transfer station/MRF
  - Wastewater treatment plant
  - Agricultural operation (on-farm composting)
  - On-site at source of feedstock

Adapted from:

Benefits of Co-Locating

- Share existing infrastructure
- Better use of available processing space and/or equipment
- Use existing traffic patterns and impacts
- Potential to take advantage of existing permits
- Potential use of some existing equipment
- Avoid creating impacts at a second site

Adapted from:

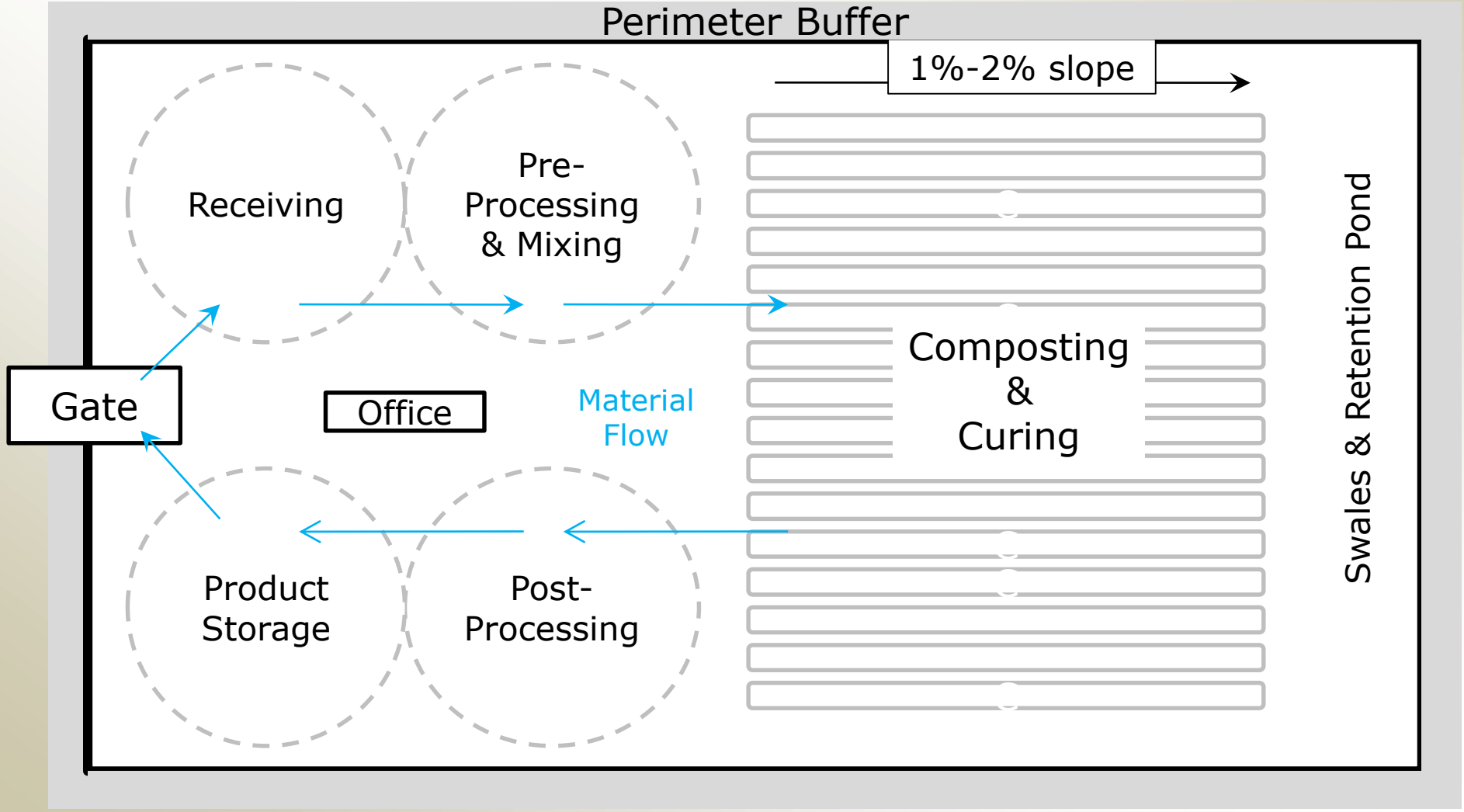
Components of Compost Facility Design

- Receiving and mixing area
- Pre-processing area for size-reducing YT
- Area to stockpile bulking agent
- Active composting and curing areas
- Surface water control and drainage structures
- Post-processing area for screening compost
- Area to store compost

Other Site Features

- Gate and perimeter fence (or other barrier) to control access to site
- Signage to control incoming traffic and public access
- Buffers to control off-site visual, noise, odor and dust impacts
- Weather monitoring equipment
- Truck scale
- Equipment garage
- Office/employee facilities
- Analytical lab

Generic Compost Facility Design



Site Design to Minimize Trouble

- Storm water management structure, i.e. drainage swales and retention pond(s)
- Adequate space for equipment movement, storage, safety and growth
- Logical process flow
- Structures
- Access and traffic management
- Use of visual barriers

Adapted from:

Annual Site Maintenance

- Inspect and repair working surfaces and drainage structures
- Regrade to eliminate ruts and depressions and maintain proper slope; bring in fill material as needed
- Regrade, line and/or clear drainage swales, channels and retention ponds

Composting and Curing Pad Design

- Constructed of durable material that supports heavy equipment in all weather conditions, e.g. compacted sand & gravel
- Evenly graded with a 1% - 2% slope to prevent ponding and convey runoff water to storm water system
- An impermeable surface (paved) is not required for registered facilities

Drainage System Design

- Site graded to divert water from running onto site
- On-site leachate & runoff conveyed by gentle slope to drainage structures
- Drainage structures:
  - Swales & diversion channels (grass-, gravel-, or geotextile-lined)
  - Sediment removal
  - Retention pond
- Design for 25 year storm

Composting Technology Options

- Passively Aerated Windrow
- Turned Windrow
- Aerated Static Pile
- In-vessel
- Hybrid

Passively Aerated Windrow

Photo source: organic.tfree.wsu.edu

Passively Aerated Windrow

(continued)

- Advantages
  - Reduces labor/equipment inputs
  - Reduces moisture loss and water need
  - Relatively low potential for odor
- Disadvantages
  - Requires longer time and relatively large area
  - Increases time to build windrow
  - Limits ability to adjust mixture
  - Does not physically break & mix material
  - Not a regulatory process for disinfection
- Low capital & operating cost
- Requires 6 – 10 months to produce finished compost

Turned Windrow

Photo source: FORCE – Reedy Creek, FL

Photo source: FORCE – Reedy Creek, FL

Turned Windrow

(continued)

- Advantages
  - Can be operated with range of basic to specialized equipment
  - Is flexible enough to handle wide range of materials
  - Assists decomposition by re-mixing materials
  - Allows adjustment of mixture during composting
  - Regulatory process for disinfection
- Disadvantages
  - Requires relatively large area
  - Can require significant amounts of water
  - Can generate significant odor when turning
- Low capital & moderate operating cost
- Requires 3 – 6 months to produce finished compost

Aerated Static Pile

Photo source: 02compost.com

Photo source: 02compost.com

Aerated Static Pile

(continued)

- Advantages
  - Reduces labor/equipment inputs
  - Reduces moisture loss and water need
  - Able to treat air for odor control
  - Regulatory process for disinfection
- Disadvantages
  - Requires relatively large area
  - Increases time to build windrow
  - Limits ability to handle wide range of materials
  - Limits ability to adjust mixture
  - Does not physically break & mix material
  - Requires site with utilities
- Moderate capital & moderate operating cost
- Requires 3 – 6 months to produce finished compost

In-vessel

Photo source: FORCE - Sumter County, FL

In-vessel

(continued)

- Advantages
  - Reduces moisture loss and water need
  - Able to treat air for odor control
  - Requires smallest area
  - Regulatory process for disinfection
- Disadvantages
  - Requires relatively high degree of expertise & training
  - Limits ability to handle wide range of materials
  - Requires site with utilities
- High capital & high operating cost
- Requires 2 – 4 months to produce finished compost

Hybrids

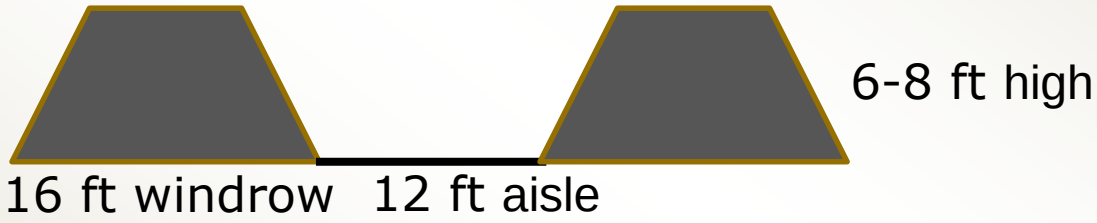
- Modified Static Pile
  - Passively aerated static windrow during initial phase followed by turned windrow during later phase of active composting
- Combines the advantages of both technologies

Turned Windrow Most Common for Registration Operations

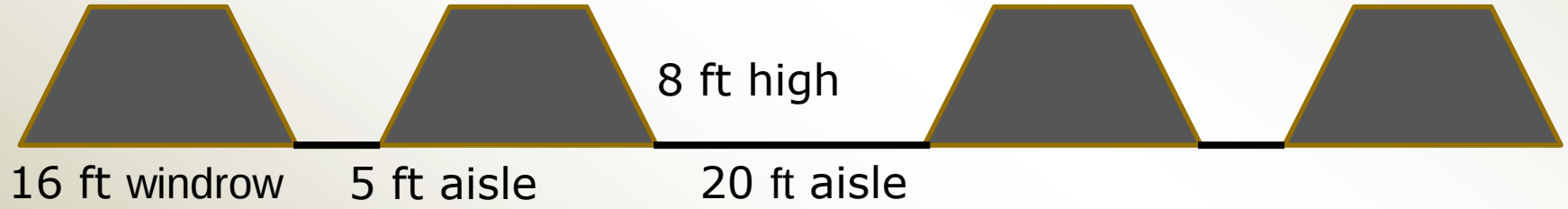
- Provides good balance of flexibility, process control, and economics for most registration composting facilities
- Use of higher technology (aerated static pile and in-vessel) is typically driven by:
  - Proximity of sensitive receptors
  - Limited site size
  - Cost of disposal

Generic Windrow Dimensions and Spacing

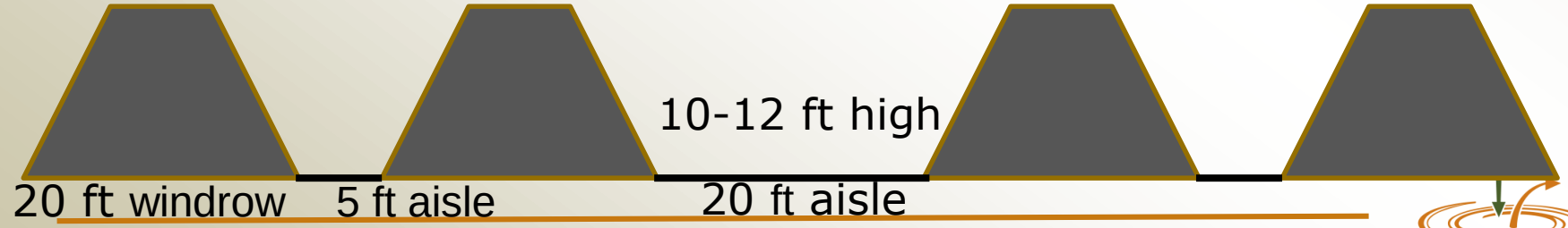
For Windrow Turning Machine:



For Front Loader:



For Curing:



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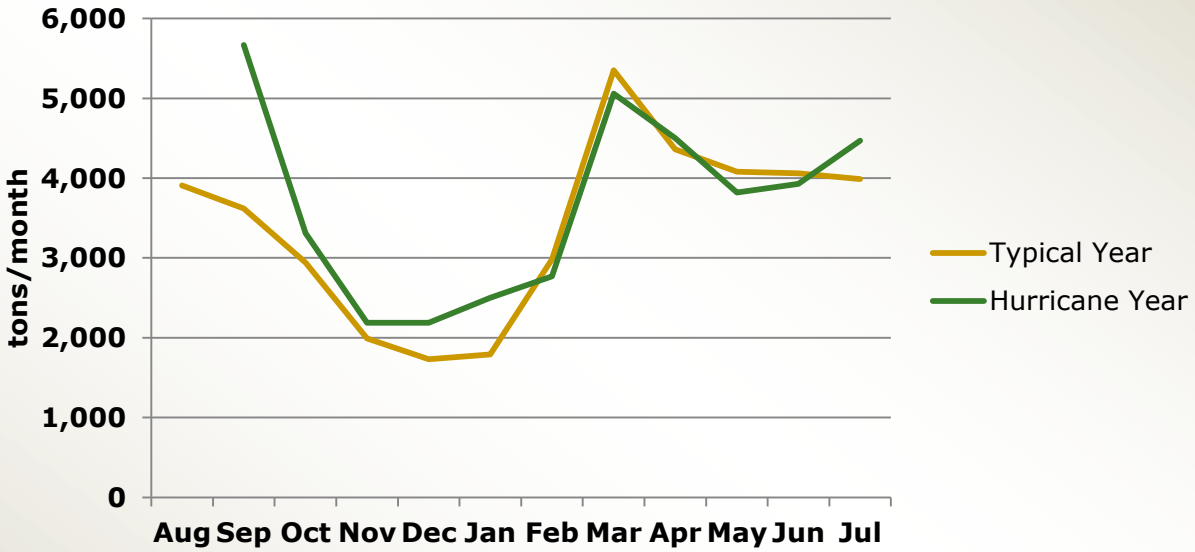
Composting and Curing Pad Capacity

- Turned windrow composting accommodates 4,000 to 6,000 cubic yards per acre in active composting, depending on:
  - Turning machine used: windrow height & width, width of aisles
  - Site configuration
- If a separate curing area is used, it can accommodate 6,000 – 7,000 cy/acre

Determine Area Requirements

- Design for peak month of incoming material, typically March & April for YT … unless there is a hurricane



- Windrows typically reduce 60% in volume during active composting, which requires combining two into one and freeing up space

Materials Handling Equipment

- Front end loaders are the essential piece of equipment
- Large bucket size is essential for efficient materials handling
- Excavators with grapple are commonly used to load YT into grinding equipment

Materials Handling Equipment

Front End Loader

Photo source: Kessler Consulting, Inc – Charleston County, SC

Grapple

Photo source: Kessler Consulting, Inc, – Charleston County, SC

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Pre-Processing Equipment

- A tubgrinder or horizontal grinder is essential for pre-processing YT
- Both are highly versatile to handle materials ranging from brush to stumps
- Shredders are less frequently used; not compatible with variability of YT

Pre-Processing Equipment

Grinder

Photo source: Kessler Consulting, Inc. – Charleston County, SC

Shredder

Photo source: www.cbi-inc.com

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Comparison of Grinders

- Tubgrinders:
  - Perform better with large diameter material (stumps & root balls) and brushy material
  - Long materials may require pre-cutting
  - Have high feed height
  - Can eject large pieces
- Horizontal Grinders:
  - Perform better with long material (trees & limbs) due to long feed table
  - Have lower feed height
  - Tends to have heavier rotors better suited for contamination
- Some large-scale yard trash processors operate both

Composting Equipment

- Turning machines are recommended for larger operations where their higher capital & operating cost is offset by their higher throughput than front end loaders
- Wide variety of options:
  - Straddle, offset, or side discharge
  - Flail drum, auger drum, elevating face
- Water trucks are effective for moving water around a site and applying to windrows; also useful for dust control & fire protection

Composting Equipment
(continued)

Windrow Turner

Photo source: Kessler Consulting, Inc. – Charleston County, SC

Water Truck

Photo source: Kessler Consulting, Inc. – Charleston County, SC

Post-Processing Equipment

- A trommel screen is the most effective equipment for separating fine-textured compost “unders” from larger pieces “overs”
- A multi-screen with air classification can be effective for separating plastic bags as well as compost and “overs”

Post-Processing Equipment

Trommel Screen

Photo source: Kessler Consulting, Inc. – Okaloosa County, FL

Multi-Screen Air Classification Unit – Plastic Removal

Photo source: Kessler Consulting, Inc. – Seminole, County, FL

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Monitoring Equipment

- A long-stem thermometer is essential - combined with an experienced nose and hand, it's all that's needed to ensure optimal conditions
- Moisture meters and oxygen probes are helpful for obtaining additional diagnostic information

Monitoring Equipment

Compost thermometer

Photo source: FORCE

Oxygen and Moisture Meters

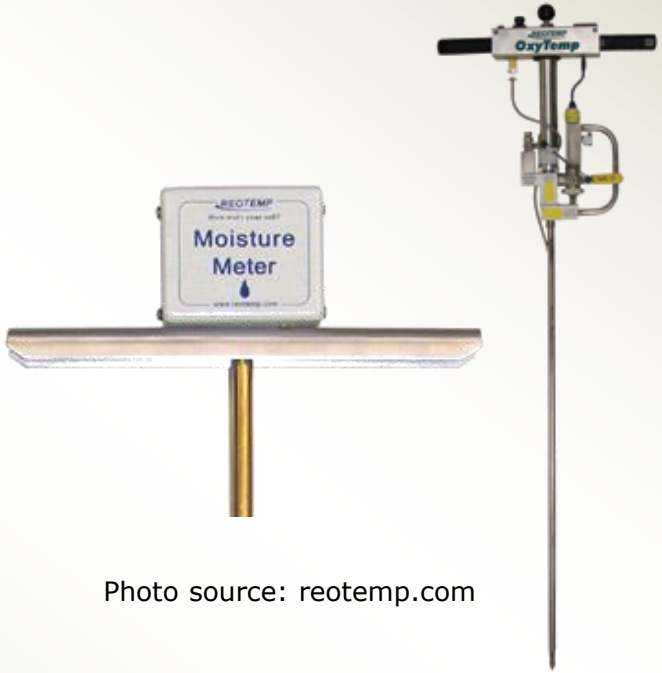

Photo source: reotemp.com

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Safety Equipment

Photo source: nene.co.uk

- Hard hat & steel-toe boots
- Safety vest
- Eye and hearing protection
- Proper training and enforcement