

Processes and Odor Control

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An experienced operator should be able to walk up to a compost pile, sniff, touch, and squeeze the compost and know what is going on in the pile at that particular moment



Managing the Compost Process

- Managing the composting process can make or break the operation

A good operator should:

- Have a good understanding of the composting process
- Know how to troubleshoot and remedy problems associated with composting



Managing the Compost Process

Good management

- Produces compost of desired quality
- Minimizes odors and other environmental impacts associated with composting
- Makes best use of materials, equipment, and labor available



Managing the Compost Process

Poor management

- Poor quality compost
- Odor problems and neighborhood complains
- Risk to environmental pollution
- Shutdown of operation



Managing the Compost Process

Factors affecting the composting process

- Nutrients (C:N ratio)
- Moisture
- Temperature
- Oxygen availability (Aeration)
- Time – sufficient to reach desired decomposition level

Temperature

The primary yardstick of the composting process

- Remember heat generated by microorganisms as they decompose organic material increases the compost temperature



Temperature

If pile gets too hot

- Can kill microbes
- Spontaneous combustion

Turning and/or watering
can bring the
temperature down



Temperature

Abnormally low temperatures signal reduced aerobic activity

- Process lacking oxygen
- Low moisture content
- Freezing conditions

Remedy for low temperatures – turn or aerate the compost pile

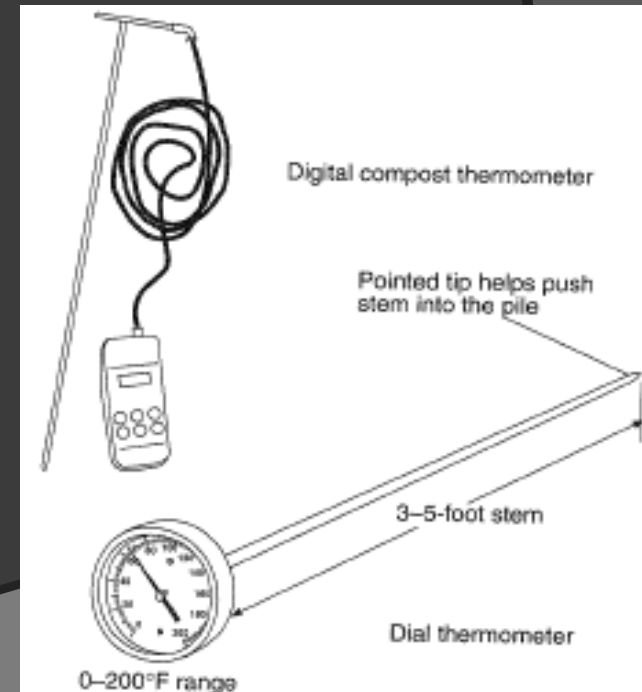
Temperature Monitoring



Instrument: Temperature sensor (Thermometer):

Recommended Thermometer

- Read out (dial or digital) with long enough stem to reach core of pile
- Temperature range 0 to 200°F
- A pointed stem tip – penetrates compost pile better



Temperature

Record compost pile temperatures daily

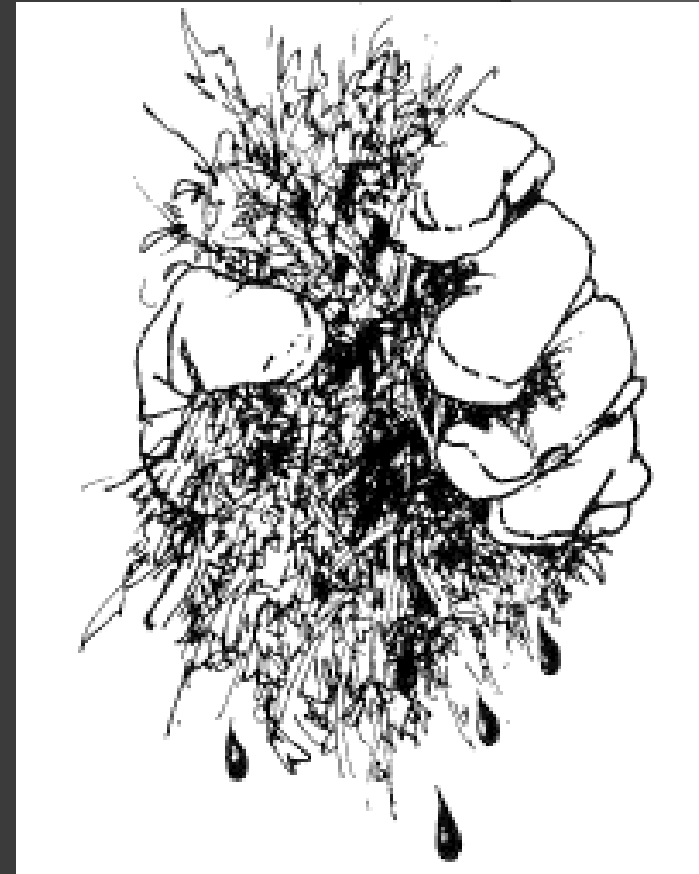
- ✓ Date
- ✓ Time of day
- ✓ Pile identity
- ✓ Odor (unusual)
- ✓ Location on the pile measured
- ✓ Name of person collecting information

Moisture

- 40-60% moisture content is adequate for microbial decomposition
- Too dry – limits microbial activity
- Too wet – limits air/oxygen supply and activity of aerobic microorganism; may lead to odor

Moisture Determination

- The Squeeze Method
 - ✓ A handful of material should feel damp not dripping wet
 - ✓ Material drips without being squeezed - Too wet
 - ✓ Material crumbles after squeezing - Too dry
- Moisture meters
- Gravimetric – use wet and dry weights



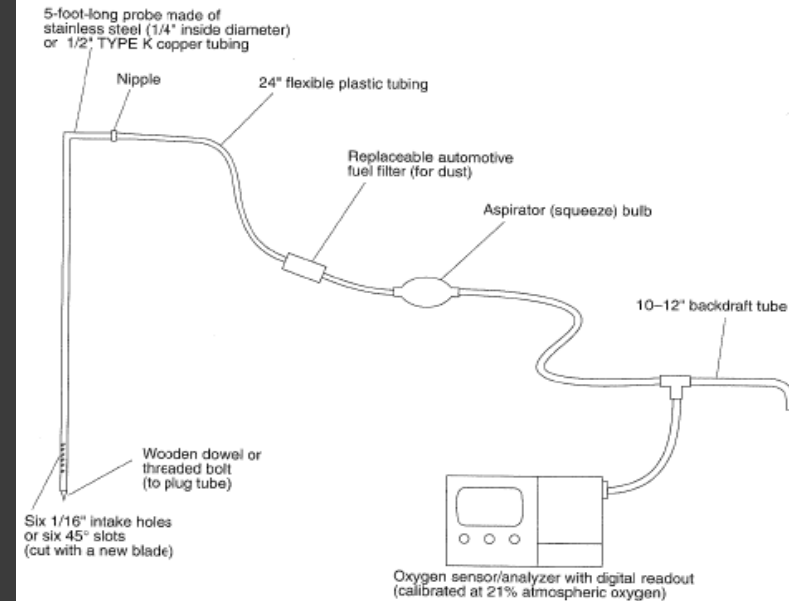
Moisture

Adding moisture – **not always necessary**

- During initial feedstock mixing
- On piles e.g. spraying

Aeration

- Microbes require oxygen for effective composting
- Use oxygen sensors to determine levels of oxygen in pile (5 to 16%)
- Enhance pile aeration by
 - ❖ Turning
 - ❖ Forced aeration
 - ❖ Using more coarse bulking materials in mix



pH

- pH fluctuation may limit activity of certain microorganisms
- pH monitoring is especially important with RAW materials with high N contents due to loss of N through NH_3 volatilization
- High (alkaline pH) – risk NH_3 volatilization
- Low (acidic pH) – risk release of sulfur smelling gases e.g. Hydrogen sulfide (H_2S)

pH

- Use pH meter on a composite sample steeped in distilled deionized water and thoroughly mixed into a paste
- Adjust pH during recipe formulation and blending stage (if you have to)

Odor and Odor Control

- There are odors associated with composting
- Nuisance odors are common in facilities where proper management and control are not practiced
- Odors can be sufficiently disturbing to force the facility to shut down



Not all odors are created equal; You can stop all of the odors some of the time, but you cannot stop all of the odor all of the time (Tim Haug, 2006)

Sources of Odor

- Raw materials – wet, high N containing feedstock e.g.
 - ❖ Fish processing residuals
 - ❖ Food residues
 - ❖ Manure, Biosolids
 - ❖ Grass clippings
- Ammonia and volatile organic compounds released from the compost pile
- Anaerobic conditions in the compost pile

Odor Control

- Proper management (consider a holistic approach which examines the entire system from feedstock preparation to utilization)
- Correct recipe mix (including right particle size)
- Start material composting as soon as possible

Odor Control

- Schedule activities which tend to release odors such as windrow turning, mixing, mixing and moving odorous raw materials to minimize odors - e.g.
 - ✓ Avoid turning windrows on hot still days, holidays, or weekends when neighbors are more likely to be affected
 - ✓ Monitor wind direction; postpone activities that release odors when wind is blowing towards the most sensitive neighbors

Odor Control

- As an operator be ready to
 - ✓ React quickly when complaints are raised
 - ✓ Work proactively to develop good neighbor relations at all times
- Remember not everyone smells through their noses – some people smell through their eyes

Nitrogen (N) Conservation

- Why?
 - ✓ To reduce N loss and NH_3 odor
- Most N loss through NH_3 volatilization

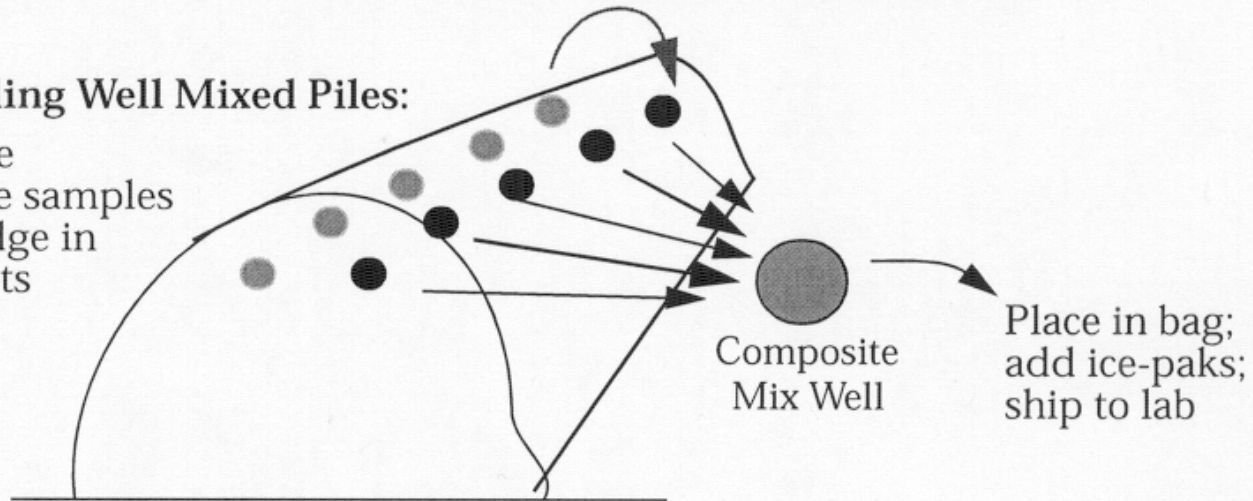
Nitrogen Conservation

- Conserve N:
 - ✓ By matching available N to requirements of microorganisms i.e. correct C:N ratio
 - ✓ Using additives that keep ammonia in the salt form (NH_4^+)
- Higher NH_3 volatilization risk at high pH values
- Higher NH_3 volatilization risk at high temperatures

Compost Sampling

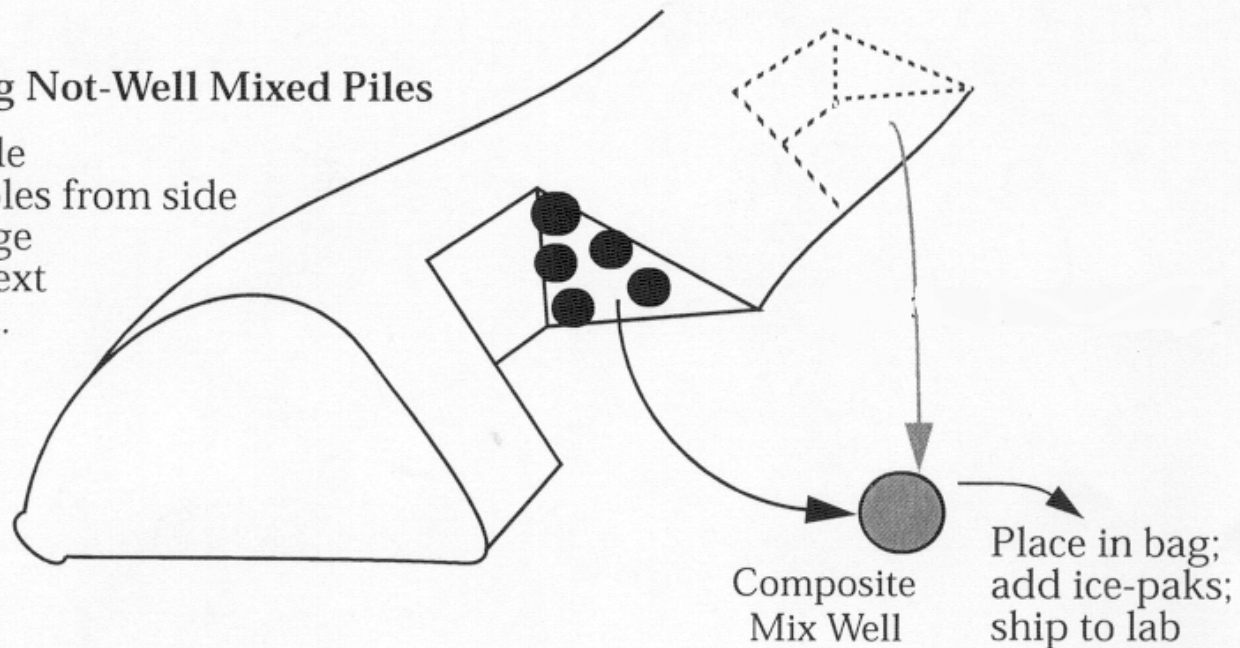
A. Sampling Well Mixed Piles:

- Mix pile
- Remove samples along edge in 5-10 spots



B. Sampling Not-Well Mixed Piles

- Cut into pile
- Take samples from side exposed edge
- Cut into next location, etc.



Troubleshooting & Management

1. The composting of a pile has been going on well for over two months and then suddenly, the temperature of the pile started to fall gradually. The pile does not reheat even after turning and the oxygen level is at 9%. What could be happening to the pile?

Troubleshooting & Management

2. You cannot squeeze water from the composting pile and the interior of the pile smells charred. The temperature of the pile is above optimal
 - What is happening to the pile?
 - How can you remedy the situation?

Troubleshooting & Management

3. You have prepared a recipe with the following characteristics

- ✓ C:N ratio 28:1
- ✓ Moisture Content – 55%
- ✓ Bulk density – 2,000 lbs per cubic yard
- ✓ pH – 8

On starting the composting process, you notice that the pile cannot heat

a. What is the problem with this pile?

b. What corrective measures should you take to get the composting started?

Troubleshooting & Management

For more details on Processes and Odor control refer to Chapter 6 of NRAES-54: On-Farm Composting handbook