Food Scrap Management

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Northeast Recycling Council

www.NERC.org

Centralized Composting Operation BMPs

Successful centralized composting requires

- A solid plan of action
- Available land
- Appropriate equipment
- Proper training and management
- Community support

Funding Options

- **Tip Fees**
  - Residents
  - Landscapers & other small commercial generators
  - Keep fees lower than solid waste tip fees
- **Sales of compost product**
  - Mulch – grind brush, wood, pallets
  - Compost – quality product can be sold to offset costs

Cost Control

- Sharing equipment & labor
- Using available public land
- Used equipment
- Calculating avoided disposal costs
- Reduced soil & fertilizer purchase costs through use of compost

Planning a Compost Operation

- Estimating the volume expected
- Conducting a needs assessment to determine available space, staffing, & equipment
  - And, additional land/operating space, staffing, & equipment required
- Capital & operating requirements necessary for start-up, as well as ongoing expenses

Planning, cont.

- Know your regulations/permit requirements
  - Consult state agencies
- Feasibility of the operation
- Public involvement

Siting Specifics

- Schematic layout
  - Site
  - Materials flow
  - Leachate & storm water management
  - Equipment & personnel list
    - Qualifications and/or training

Siting Specifics, cont.

- Composting method
- Safety & fire emergency plan
- Monitoring techniques & record keeping
- Provisions for controlling odors
- Contingency plan

Financing

- Capital & operating requirements will vary widely
- Needs for smaller scale operations will be minimal, if existing land & equipment are available for use
  - Site preparation & drainage requirements can potentially be conducted in house, depending on the requirements
  - If equipment is needed & more extensive site preparation required, financing professionals should be consulted
- Regional facilities will need to extensively plan capital investment requirements & determine effective financing options

Composting Technology

- Processing technologies
  - Minimum-level
  - Low-level
  - Intermediate-level
  - High-level
- Site requirements, labor & equipment, & costs vary
- Processing time—*function of*:
  - Feedstocks
  - Technology applied
  - Labor: mixing, turning, & monitoring the process

Composting

- Controlled, aerobic (requiring oxygen) biological process
- Results in the decomposition of organic materials
- Occurs naturally in nature
- Microorganisms (bacteria, fungi, other organisms)
  - Digest organic residues for food and energy
  - Speeds up the decomposition process
- Primary end-products—carbon dioxide, water, & compost

Compost Process

- Combining organic materials in proper ratios
- Containers/vessels, piles, or rows
- Turn or aerate to provide adequate air flow
- Sufficient moisture to accelerate decomposition
- Cure “finished” material maturity

Five Primary Components

Feedstock and nutrient balance (Carbon:Nitrogen Ratio)

- "Green" materials (Nitrogen)—grass clippings, food scraps, manure
- "Brown" materials (Carbon)—paper, dry leaves, wood shavings, brush

Particle size

- Smaller particles
  - More surface area upon which the microorganisms can feed
- Helps to speed up the decomposition process
- Improves porosity (air flow)
- A more homogeneous compost mixture
- Mowing, grinding, chipping, or shredding

Five Primary Components, cont.

Oxygen flow

- "Aerobic"—requiring air to be active
  - Turning or placing materials on aeration system
  - "Bulking agents"—wood chips, shredded newspaper

Temperature

- Mesophilic—active at lower temperatures
- Thermophilic—above 120°F (131°F)
  - Necessary for more rapid composting
  - Ensure that pathogens & weed seeds are destroyed

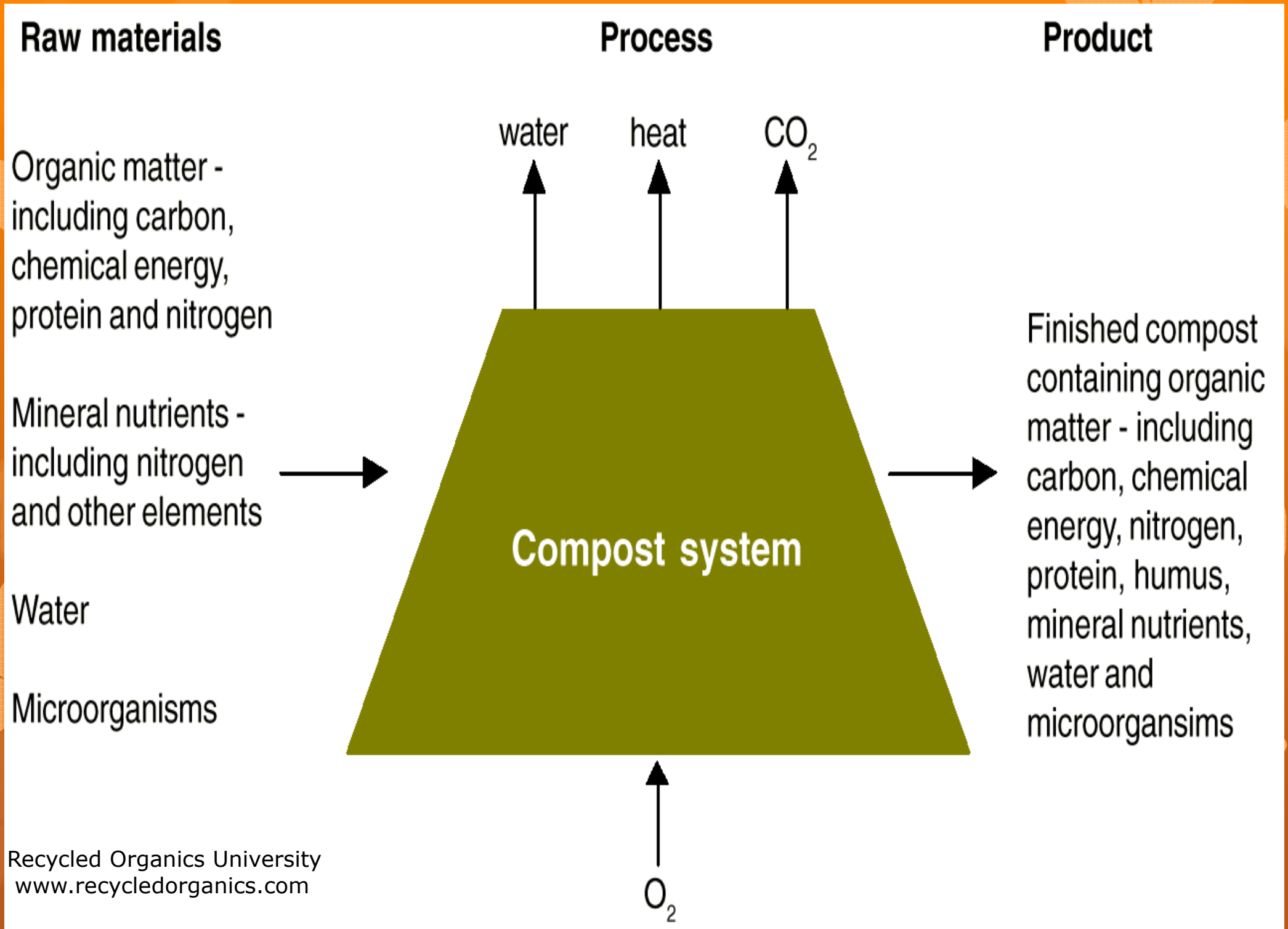
Five Primary Components, cont.

Moisture content

- Required to keep the microorganisms in compost alive & active
- Helps to transport substances within the compost pile
- Makes nutrients accessible to the microbes
- Should feel like a damp sponge…moist, but not dripping when squeezed

Best Management Practices (BMPs)

- Produce compost in shortest time possible with:
  - Minimum odors
  - Minimum environmental impacts
  - Minimum process-related problems
- Efficient Materials Movement
  - Nothing should move more than twice in its same physical condition
  - Move in as linear a fashion as site constraints allow
  - Timing production



Elements of Composting

- Aeration – Oxygen concentrations - 10-14+%.
- Carbon to Nitrogen (C:N) Ratio – 20:1-60:1
  - Preferred 30:1-50:1
- Moisture—40 to 65 percent
  - Preferred 50 – 60%
  - Like a damp sponge

Elements of Composting, cont.

- Optimum pH range - 5.5 to 8
  - Preferred 6.5 – 8.0
- Temperature – 120° - 160°F.
  - *Process to Further Reduce Pathogens (PFRP)*
  - 131°F for 3-15 days (*f* of system)

Elements of Composting, cont.

- Bulk density < 1000 lbs. per cubic yard
- Particle size (diameter in mm) – 3-13
- Porosity, structure, texture - particle size, shape & consistency influence aeration
  - Adjust with bulking agents – raw materials
  - Compost recipe
  - Grinding or mixing

The Recipe

- What feedstock(s) do you have available?
- Characteristics?
  - Nutrient content
  - C:N ratio
  - Moisture content
  - Bulk density – how easy it is to mix/handle materials
  - pH
  - Potential for odors – grass clippings, food scraps

The Recipe, cont.

- Carbon – Essential for mixing with food scraps
  - Leaves, ground brush
- Bulking agents – wood shavings, chips
  - Provide porosity
  - Pile stabilization
  - Aid air flow

The Recipe, cont.

- Adding food scraps
  - No more than 20%
  - Balance C:N ratio, moisture, bulk density, etc.
- Observation, feel of compost, temperature, trial & error
- Calculations

Sample Carbon and Nitrogen Ratios of Various Organics

Carbon Sources	Carbon: Nitrogen Ratio
Yard wastes	50 - 90:1
Straw/hay	50 - 80:1
Wood chips/sawdust	250 - 500:1
Nitrogen Sources	
Vegetable scraps	10 – 30:1
Fruit scraps	10 – 30:1
Grass & garden gleanings	10 – 20:1
Chicken manure	10 – 25:1
Cow manure	20 – 30:1
Horse manure	25 – 30:1

Adapted from Robert Rynk, "*On-Farm Composting Handbook*," Natural Resource, Agriculture, and Engineering Service, 1992.

Getting the Right Mix

- Compost Mix Calculator: Solves for the total carbon to nitrogen ratio of up 4 materials (or less) in a mix
  - http://www.klickitatcounty.org/solidwaste/fileshtml/organics/compostCalcAbout.htm
- Green Mountain Technologies
  - http://compostingtechnology.com/resources/compost-calculator/
  - Highfields Recipe & Pad Size Calculation Worksheets
  - www.highfieldscomposting.org

Healthy biological activity is essential to successful composting—setting up the right environment and conditions is fundamental to the process.

Process Management

- Know the compost process
- Essential equipment: loader, screen, thermometer
- Cover

Windrows

- Front loader, backhoe, or manure spreader
  - Mix materials, form & turn windrows
- Land for the operation
- Minimum staffing

Windrows

- Access to water
- Monitor temperatures
  - PFRP
- Cover – tarp, GORE™, chips

Windrows

- Typically 10’ – 16’ wide by 3’ – 8’ high
- Keep windrow piles as straight and uniform as possible
- Blend materials without compacting them
- Check & adjust moisture level
  - Add water or dry bulking agent
- Move materials from surface to center of windrow and vice versa
  - When turning with a frontend loader, lift material, let it cascade down to maximize aeration & porosity
  - Re-shape the windrow for consistent dimensions & smooth sides
- If building more than one windrow, leave sufficient space between them for drainage & to allow for turning

Windrows, cont.

- Monitor temperatures daily during the active compost phases & after turning
  - Take measurements at various depths (e.g., at one foot and three feet into the pile) & at least every 75 feet along the windrow
  - Always turn and aerate a pile or windrow if temperatures reach above 160°F.
- Once the active composting phase for pathogen reduction is met, materials can be turned weekly or as needed until ready for curing
- Curing time can range from 30 to 60 days

Windrows, cont.

- Moisture management is important
  - If is too dry, add water when turning & rebuilding the windrow
  - Start by watering the outside of the pile before mixing materials into the center
  - Shape the windrow to increase rain infiltration
- If the windrow is too wet
  - Turn it to release excess water vapor or mix more dry carbon material into the pile
  - Windrows typically reduce 60% in volume during active composting
- Two windrows can then be combined into one to free up space
- Track when windrows were formed

Windrow Composting
Low-to-Intermediate Technology, Costs, & Labor

Town of Skowhegan Leaf, Yard, Food Scraps

Mark King, ME DEP

Screening Compost

Front Loader or Windrow Turner

County Operation

Aerated Static Pile

- Blower system & piping
  - Build compost pile on top of a “forced air” system
- Perforated pipe (10-inch diameter) connected to a blower system
  - System may be a positive (pressure) aeration or negative (suction) aeration
- Materials must be well mixed before piling to create a homogeneous mixture with good porosity
- Cover with a layer of peat, wood chips, or finished compost (insulation & odor control)

ASP, cont.

- Speeds up the composting process by ensuring proper air flow
- Initial moderate capital costs & operating costs
  - Purchase & installation of pipes and blowers
  - Utilities & ongoing maintenance
  - Less daily labor
  - Using portable aeration equipment, an ASP System can be installed for $15,000 or less for a 10,000 ton per year compost facility.

ASP, cont.

- After two-ten weeks of composting material can be turned into another aerated system or windrowed to finish the compost process
  - Up to 6 months to produce compost ready for curing
- Excellent, scalable process for managing food scraps

ASP, cont.

- Homogenous “haystack” type pile 4’ – 6’ high
  - No more than 6’ high and 12’ wide to ensure sufficient air movement
- Start with a higher initial moisture content
- Include a bulking agent or carbon source with higher percent of larger particles to promote greater aeration

ASP, cont.

- Use a porous, well-aged capping layer
  - Wood chips or finished compost
- Sufficient space should be available for additional piles, depending on the volume of organics collected
- Place a layer of woodchips over aeration pipes to help protect the pipes and assist in air flow through the pile

Aerated Static Windrow Moderate Technology, Costs & Labor

Aerated Bins or Sheds

O2Compost

Onondaga County Resource Recovery Agency (OCRRA) Aerated Static Pile Operation

Process to Further Pathogen Reduction

- **Turned Windrow**: 15 consecutive days with temperatures ≥131°F (55°C) with 5 turnings
- **Aerated Static Pile**: 3 days with temperatures ≥131°F (insulated pile)
- **In-vessel**: 3 days with temperatures ≥131°F

Siting Parameters

- Check with state and local regulatory agencies prior to siting
- "Set-backs" or distances from waterways and structures may vary depending on the materials and volume to be composted
- The following provides general guidance for siting compost piles or windrows:
  - From 100' – 500' from wells and potable water sources
  - Adequate distance from wetlands, surface water bodies (streams, ponds), and flood plains; recommended at 200'
  - Minimally 200' away from residences and 50' from property lines
  - A low water table to reduce flooding risk on the site
  - A high soil percolation rate, but not excessively permeable soils in order to avoid standing water.
  - Gently sloped surface (1-3% grade)

The amount of land required for the composting site depends on the volume and type of material accepted, the composting system, and the amount of time required for the process to complete.

- Typically 2 - 20 acres is adequate for most small communities.

Site Plan

- Material receiving area
- Mixing area
- Active composting area
- Curing area

Mixing Area

- Mixing & chipping/shredding can be done in or near the material receiving area
- Storage of carbon & bulking materials nearby
- Cover &mix food scraps immediately upon dumping
  - Lay down a bed of bulking materials, such as ground yard trimmings, to absorb liquid associated with food residuals

Mixing Area

BioCycle

COMPOST RECEIVING AREA

Bob Spenser,
WCSWMD

Site

- Year-round accessibility
- Depending on operation, the site will need to be accessible for large vehicles
  - Space for future expansion
- Access to a water source is necessary

Site, cont.

- Gate & a perimeter fence (or other barrier) is recommended to control access to the site and prevent illegal dumping
- Signage to control incoming traffic & public access to areas where equipment will be operating
- Area to store finished compost
  - Accessible to the public if materials are to be sold or given away

Site, cont.

- Plan site so that customers see the end product…not the feedstock unloading & mixing area
- Set up the site so that the oldest finished product can be moved first
- Material movement is in as linear a fashion as site constraints allow
  - Nothing should move more than twice in its same physical condition

Site, cont.

- A neat site appearance is important
  - Don’t let weeds grow on finished product
  - Deal effectively with leachate/ponding
  - Consider the view from the road
- A “buffer zone” will alleviate any nuisance issues, including noise, blowing material, dust, potential traffic concerns, & odor
  - Use shrubbery or fencing to block view

Drainage/Buffer

- A grassy or vegetated filter/buffer serves as a relatively low cost drainage field
  - Crushed glass or other filtration material, covered with grass or vegetation provides a cost effective system
- Rain gardens & marsh areas work for smaller sites
- Check with state and local agencies to determine if this drainage system is adequate—a more extensive drainage system may be required

Drainage/Buffer, cont.

- Site grading to divert surface runoff from the up-slope side of piles will reduce leachate issues and help to control soil erosion around the site
- Trenching can be used to capture or divert leachate
- Install piping around larger piles or windrows or where seepage becomes an issue
  - Capture wastewater and divert it to the filer area, drainage pond, or holding tank
- Reusing the water to spray back onto composting may be a cost effective

Compost Pad

- Firm &stable surface to support heavy equipment under varying weather conditions
  - Compacted soil is adequate
  - Native soil with moderate permeability (not excessively or poorly drained) is best
- Six inches of compacted and graded sand or gravel should be installed if soil conditions are not sufficient for drainage
  - Small diameter dark gravel is recommended
  - Gravel can become mixed in with the composting materials
- Hard packed or cement mixing area is recommended
  - Limit mud problems
  - Good foundation for equipment

Controlling Odors

BioCycle

Biofiltration

Bruce Fulford

Staffing

- For most small community operations one or two employees will be sufficient
  - If operation is co-located with a transfer station or other facility, staff at smaller compost operations can be shared
  - One person should have the role of compost operator or manager
  - All employees should understand & know all aspects of the operation and how to deal effectively with issues that arise
- Duties:
  - Monitoring materials as they come into the operation
  - Ensuring BMPs
  - Monitoring & maintaining records

Employee Training

- Basic understanding of the compost process
- Know how to monitor & record temperatures & assess moisture levels
- Be familiar with general troubleshooting guidelines to manage issues as they arise
- Equipment operators of front loaders or other heavy equipment used in the composting process must be trained and properly certified

Equipment

- Pre-processing equipment: tub grinder or horizontal grinder
- A frontend loader
  - 500 cubic yards/year or less
- Windrow turner
- Post-processing equipment: trammel screen

Monitoring Equipment

- Long-stem, non-mercury compost thermometer at least 2’ -3’ long
- Moisture meters and oxygen probes are helpful for obtaining additional diagnostic information
- A windsock is a simple tool that can be used to monitor wind direction.
- Safety equipment for workers includes: hard hats and steel-toe boots; safety vests; dust masks; and eye and hearing protection.

Observing, monitoring, and record keeping should be the foundation for decisions and activities at the compost operation, whether it's turning the materials and adding water because temperatures are below 120°F and moisture content is low or adding carbon or bulking agents because the materials are too wet.

Monitoring the Process

- *Observation*—Daily observation of the composting materials will help to ensure that the process is occurring, odors are not an issue, and that there are no other concerns.
  - Are the windrows or piles steaming?
  - Are materials looking different – is decomposition occurring, materials starting to slowing look like soil? Is the pile uniformly composting?
  - Are strong odors present? Are there persistent puddles of leachate or water?
- *Compost feel*—Does the squeeze test indicate that there is moisture in the material—does it feel like a damp sponge so that when a handful is squeezed, the material sticks together and your hand is moist (about 50% moisture content)

Monitoring the Process

- *Temperature*—Is the temperature rising appropriately for rapid compost? Does the temperature rise to at least 131°F in windrows, maintain this temperature for 15 days through 5 turnings (or 3 days for aerated static piles)?
  - Daily recording of temperature is essential
  - Note turning & watering dates
- *Oxygen*—Smell is the best measure of properly aerated composting for small-to-medium sized operations
  - If there is an unpleasant odor, chances are there are anaerobic conditions in the pile
  - This is an indication that the pile needs to be turned

- Once the temperature goes below 120°F materials should be turned until temperatures no longer rise.
- Materials should also be turned if temperatures rise above 140°F.
- Depending on the materials and compost management, the active composting phase will last 6 – 10 weeks.

Ready for Curing

- Once the organic ingredients in the pile or windrow are digested & bacterial activity declines
- Compost pile heats up very little, even after turning or aerating the pile
- Finished compost will have a uniform, crumbly appearance, earthy smell

Curing

- Necessary part of the compost process
- Ensures that the compost is completely done & ready for use
- Cured compost is stable
  - Remaining ammonia nitrogen to convert to nitrate nitrogen
  - Remaining large woody particles will also continue to break down
- Compost ingredients should not be recognizable
  - Wood chips may not entirely decompose & will require screening
- Compost should be cured for a minimum of 45 days

Screening

Compost Test

- At a minimum—analyze the basic nutrient content—nitrogen, phosphorous, & potassium (N:P:K:)
- Bioassay testing

County Operation

Opportunities and Action

- Organics management program focusing on the "hierarchy" of reduction, recovery, & composting
  - Reduce the amount of organics to be managed
  - Help to control costs
  - Food scraps can later be phased-in for additional diversion
- Upfront education for residents & businesses will pay off in cleaner feedstocks & a more efficient operation
  - Involve the community in the initial planning
  - Feedback mechanism—create two-way communication

Compost Markets

- Erosion Control/Reclamation
- Agricultural applications
- Topsoil
- Nurseries/Silviculture
- Sod production
- Turf grass
- Public Works
- Construction sites
- Landfill cover
- Marginal soils
- Biofiltering
- Direct marketing
- Retail sales
- Landscapers and Lawn Care Companies
- Golf Courses
- Greenhouses
- Rainwater filters
- Roof top gardens
- Compost socks

Major Factors Affecting Compost Demand and Sales

- Compost quality
- Product consistency
- Product availability (meeting demand)
- Economics of transportation & distance to markets
- Economics & challenges associated with compost application
- Industry standards & specifications

Who's Doing it?

St. George, Maine

- Transfer Station accepts yard waste, grass clippings, leaves, manure, specified food scraps (no meat or dairy), & wet & waxed cardboard from residents
- Town website promotes the compost operation & backyard composting as a way to reduce the town's overall disposal costs

Who's Doing it?

Skowhegan, Maine

- Yard trimmings, brush, leaves, farm manure, food scraps are composted at the town transfer station
- Two certified compost operators manage the facility
- 800 yards of compost are generated each year

Who's Doing it?

Ulster County Resource Recovery Agency

- Aerated static pile to manage yard waste, food scraps, & other organics
- Tip fee $50/ton for separated organics (vs. $100/ton LF)
- Currently accepting food waste from supermarkets, grocers, and restaurants

“It’s Yucky…”
“It Smells…”
“It will attract mice, bears…”

Goals of Outreach/Education

Ensure participants:

- Learn about the program
- Know what's required
- Have concerns & questions addressed
- Learn what's in it for them

General strategies are applicable to virtually all education campaigns…

The message will be specific to the program

Getting Started

- Requested “behavior changes”
  - *What do you want participants to do*
- Address concerns

What’s in a word?

- Food scraps
- Materials management

What's the Program Requirements?

Put requirements in terms of practices they are already doing.

"Participation is simple—just scrape your plate into the compost bucket!"


Cola
Recycle More.
It's Easy To Do.


COMPOST
SF Environment
Recology


FEED ME!
Tea Bags
Vegetable Scraps
Fruit Scraps
FOOD SCRAPS
Egg Shells
Bread
Coffee Grounds & Filters
No Plastics or Meats


COMPOST ONLY
Fruit and vegetable scraps
Paper towels
Tea bags
Coffee grounds and filters
COMPOSTS!
Do not include:
Meat, dairy, grains
Paper cups or paper plates
Plastic or metal
If in doubt, throw it out
Questions? Contact the Multnomah County Sustainability Program
recyclinginfo@co.multnomah.or.us
or http://MRT.info/recycle


WE ARE NOT TRASH!

Universal Signs & Symbols

Consistent Images

Consistent Colors

Overcoming "Yuck Factor"

- Broad-based education to begin changing the culture, the language
- Continuously
- Be Consistent
- Seek Feedback
- Biobags/paper bags in kitchen bucket
- Collect soiled paper, pizza boxes

Overcoming "Yuck Factor," cont.

- Simple, concisely worded fliers
  - Distributed to residents at least at the start of the collection program
- Signage at the point of collection
- Website & social media

Tips to Provide Residents

- Line the kitchen collection container with newspaper or wrap food scraps in newspaper or paper towels
- Sprinkle baking soda in the kitchen container & the outside collection cart
- Wash the collection container thoroughly after dumping it
  - Rub vinegar around the rim of the bucket

Tips to Provide Residents, cont.

- Use a vacuum cleaner to remove fruit flies
- Put melon scraps directly into the outside collection cart (not in the kitchen container)
- After dumping the food scraps in the collection cart, cover with yard trimmings, shredded paper, or damp newspaper, a little soil

Give Back

RECYCLE YOUR FOOD SCRAPS

Ulster County throws away 40,000,000 lbs of food scraps each year

Composting is now available at the Ulster County Resouce Recovery Agency

Find us on Facebook

www.ucrra.org


Recycling & Composting
Saves Tax Dollars
Thank you
For Doing Your Share

NERC Can Help

We're experts in

- Waste reduction & recycling
- Recycling program design & implementation
- Organics management
- Green procurement
- C&D reuse & recycling
- Electronics recycling
- School reuse, recycling & composting
- Textile recycling programs
- Multi-stakeholder dialogues & negotiations
- & More!

Fee for service program makes NERC's sustainable materials management

expertise available at a reasonable price with outstanding results

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