

Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD
ANIMAL MORTALITY FACILITY

Code 316

(No.)

DEFINITION

An on-farm facility for the treatment or disposal of animal carcasses due to routine mortality.

PURPOSE

This practice may be applied to achieve one or more of the following purposes:

- reduce pollution impacts to surface water and groundwater resources
- reduce the impact of odors
- decrease the spread of pathogens

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to livestock and poultry operations where routine animal carcass storage, treatment, or disposal is needed. .

This standard does not apply to catastrophic animal mortality. In cases of catastrophic animal mortality, use NRCS Conservation Practice Standard (CPS) Code 368, Emergency Animal Mortality Management.

CRITERIA

General Criteria Applicable to All Purposes

Include the facility in the waste management system plan for the operation.

Meet the structural and foundational requirements of NRCS CPS Code 313, Waste Storage Facility, when designing slabs, walls, and support structures.

Use NRCS CPS Code 367, Roofs and Covers, for animal mortality storage facility covers and roofs.

Use NRCS CPS Code 342, Critical Area Planting, to revegetate all areas disturbed by construction.

Include provisions for closing and/or removing the facility where required.

Safety. Provide warning signs, fences, refrigeration unit locks, and other devices as appropriate, to ensure the safety of humans and livestock.

Address biosecurity concerns in all aspects of planning, installation, operation, and maintenance of an animal mortality facility.

Utilities and Permits. The landowner/contractor is responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State office](#) or visit the [Field Office Technical Guide](#).

NRCS, Georgia
October 2016

Location. Locate the facility so that prevailing winds and landscape elements minimize odors and protect visual resources.

Locate the animal mortality facility above the 100-year floodplain elevation unless site restrictions require location within the floodplain. If located in the floodplain, protect the facility from inundation or damage from a 25-year flood event.

Locate the facility down-gradient from springs or wells where possible or take steps necessary to prevent contamination of groundwater supply sources. Investigate hydrogeological conditions.

Direct surface runoff away from the animal mortality facility. Direct contaminated runoff from the animal mortality facility to an appropriate storage or treatment facility for further management.

Select a location for the animal mortality facility that is consistent with the overall site plan for the livestock or poultry operation. Locate the onsite mortality facility for acceptable ingress and egress and where it will not interfere with other travel patterns on the farm, such as livestock pathways and feed lanes.

Locate the facility as close to the source of mortality as practical, considering biosecurity issues and the need to keep the facility out of sight of the general public.

Seepage Control. Where seepage will create a potential water quality problem, provide a liner which meets the requirements of the National Engineering Handbook (NEH), Part 651, Agricultural Waste Management Field Handbook (AWMFH), Appendix 10D, for clay liner design criteria or other acceptable liner technology.

Temporary Storage. Where the mortality management system depends on periodic or cyclic operation (including, but not limited to, offsite disposal such as rendering), provide a facility with adequate capacity for temporary storage of carcasses until they can be processed or picked up. The temporary storage may be implemented as a pad or bin, a refrigeration unit, or other.

Additional Criteria Applicable to Composters.

Location. Locate on a base of low -permeability soils, concrete, or other liner material that will not allow contamination of groundwater. The floor of the composting facility shall be at least 2 feet above the seasonal high water table.

Locate so that water is available to the facility during dry periods to ensure proper moisture and acceptable curing times to meet the management goals.

Facility Type. Base the selection of the composting facility/method on availability of raw material, desired quality of final compost, equipment, labor, time, and land available.

Facility Size. Size the compost facility to accommodate the amount of raw material planned for active composting plus space required for curing. Base the size of the facility on normal mortality loss records for the operation. If this data is not available, use locally established mortality rates for the type of operation. Ensure that the final product of the composting process has no visible pieces of soft tissue remaining.

The facility shall have the capacity to maintain the compost temperature greater than 130° F for at least 5 days as an average throughout the compost mass followed by a compatible time for secondary composting. For a windrow system, the temperature of the compost shall be above 130° F for 15 days with a minimum of 5 turnings of the compost.

Size the animal mortality composting facility using one of the methods provided in the NEH, Part 637, Chapter 2, Composting; and NEH, Part 651, Chapter 10, Section 651.1007, Mortality Management; or comparable extension publication or State rules. Dimensions selected for elements of the compost facility shall accommodate equipment used for loading, unloading, and aeration.

Use of Finished Compost. Spread finished compost according to NRCS CPS Code 590, Nutrient Management, or provide for other acceptable means of disposal.

Additional Criteria Applicable to Incinerators and Gasifiers.

General. Use a Type 4 (human and animal remains) (as defined by the Incinerator Institute of America) incinerator that has been approved for use within the state. Gasification, which is a high temperature method of vaporizing the biomass with no direct flame with oxidation of the fumes in an after-burning chamber, gasifiers shall meet all applicable state air quality/emissions requirements.

Capacity. Size the incinerator/gasifier to handle the average maximum daily animal mortality during a growing cycle. Refrigeration units may be used in conjunction with the incinerator/gasifier to improve the loading cycle and fuel use efficiency of the incineration/gasification unit.

Ashes. Remove ashes daily or according to manufacturer recommendations. Spread ash according to NRCS conservation practice standard CPS Code 590, Nutrient Management, or provide for other acceptable means of disposal.

Location. Locate the incinerator/gasifier a minimum of 20 feet from any structure. Place the unit on a concrete pad with the fuel source as distant as practical. If the incinerator/gasifier is covered with a roof, provide a minimum air space between the chimney and any combustible roof part of at least 6 inches, or as recommended by the manufacturer, whichever is greater.

Additional Criteria Applicable to Refrigeration Units.

General. Refrigeration units used shall be compatible with the emptying mechanism. Protect the refrigeration unit from precipitation and direct sun as deemed appropriate.

Unit design, construction, power source, and installation shall be in accordance with manufacturer's recommendations and all applicable building and electrical codes. Refrigeration units shall be constructed of durable material, be leak proof, and have a life expectancy compatible with other aspects of the waste management system.

Place the refrigeration units on a pad of suitable strength to withstand loads imposed by vehicular traffic used to load or remove the box or tray.

Temperature. The refrigeration units will be self-contained units designed to freeze animal carcasses before decomposition occurs. Carcasses to be rendered should be maintained between 22° and 26° F. Carcasses that will be composted, incinerated, or gasified should be stored a few degrees above freezing in order to facilitate burning and to reduce the composting time or amount of fuel needed to incinerate or gasify the carcasses.

Capacity. Size the refrigeration units to accommodate the normal maximum volume of mortality to be expected in the interval between emptying. When calculating the volume required, include the expected daily mortality rate of the animal, the period of time between emptying, the average weight of the animal, and a conversion factor for weight to volume. Use a weight to volume conversion of 45 pounds per cubic foot unless a local volume conversion factor has been documented.

Power Source. Provide an alternative source of power, where available, to maintain the integrity of the freezing process during power outages. Where an alternative power source is not available, identify the contingencies for disposal of the animal carcasses in the Operation and Maintenance plan.

CONSIDERATIONS

Major considerations in planning animal mortality management are:

- The management capabilities of the operator,
- Available equipment and land application area at the operation,
- The economics of the available alternatives,
- The degree of pollution control required by state and local agencies,
- Effect on wildlife and domestic animals,

Take measures to maintain appropriate visual resources, reduce odor, and provide dust control. Vegetative screens and topography can be used to shield the animal mortality facility from public view, to reduce odors, and to minimize visual impact.

For facilities that are organic producers or that sell compost to organic producers, ensure that the treated lumber used in the facility meets the requirements for organic production. It may be best to have the producer consult with the organic certifier as to the use and acceptability of treated lumber.

Additional Considerations for Composting.

Initial planning of site suitability should include referring to the web Soil Survey's soil interpretations for "composting facility" <http://websoilsurvey.nrcs.usda.gov/>.

Composting of any mortality will be hindered if the carcasses are allowed to freeze. Dead animals or birds should be placed in the compost mix as quickly as practical or kept in a dry, nonfreezing environment until added to the compost mix. Composting frozen carcasses will lengthen the amount of time needed for composting to occur and will likely require added management to ensure that proper composting temperatures are reached.

Poultry operations often experience higher rates of mortality as the birds reach maturity.

To reduce offensive odors increase the carbon nitrogen ratio. A carbon nitrogen ratio of 30:1 in the initial mix should have minimal odors.

Minimize odors and nitrogen loss by selecting carbonaceous material that, when blended with the nitrogenous material, provides a balance of nutrients and porous texture for aeration.

A chemical neutralizing or other additive agent should be used if structural components do not provide adequate odor reduction.

Maximize solar warming by aligning piles north to south configured with moderate side slopes.

Orient windrows to prevent ponding of surface runoff.

Protect compost facilities from the wind in cold or dry climates. Wind protection may help prevent excess drying of the compost.

Minimize blown-in rain by providing roof overhang.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for animal mortality facilities that describe the requirements for applying the practice according to this standard. As a minimum the plans and specifications shall include:

- A plan view showing the location and extent of the practice.
- Description of facility.
- Size, type and number of animals that will be the feedstock.
- Pertinent elevations of the facility, if applicable.
- Soil and foundation findings, interpretations, and reports.
- Location of electrical lines, gas lines, water supply and other utilities
- Requirements for burial
- Quality of materials.
- Drainage/grading plan, if needed.
- Structural details of all components.
- Temporary erosion control measures during construction.
- Vegetative requirements.
- Safety requirements for the facility.

OPERATION AND MAINTENANCE

The Operation and Maintenance (O&M) Plan developed for the animal mortality facility will become part of the overall CNMP. The plan should document needed actions to ensure that the practice performs adequately throughout the expected life.

As a minimum, include the following information in the O&M plan:

- Method and procedures of mortality disposal for normal losses
- Odor management or minimization requirements
- Biosecurity protocols
- Safety measures and procedures
- Periodic inspections
- Need for prompt repair or replacement of damaged components
- Site references and/or manufacturer or installer for trouble shooting

Additional O&M for Composters

Compost Recipe. Include a recipe of ingredients which gives the ingredient quantities and layering/mixing sequence.

Refer to [Georgia Composting Recipes](#) in Section I of the Field Office Technical Guide for specific composting recipes used in Georgia.

Carbon-Nitrogen Ratio. The initial compost mix shall result in a carbon-to-nitrogen (C:N) ratio between 25:1 and 40:1. Compost with a lesser C:N ratio can be used if nitrogen mobilization is not a concern.

Carbon Source. Store a dependable source of carbonaceous material with a high C: N ratio to mix with nitrogen-rich waste materials.

Bulking Materials. Add bulking materials to the mix as necessary to enhance aeration. The bulking material may be the carbonaceous material used in the mix or a nonbiodegradable material that is salvaged at the end of the compost period. Make provision for the salvage of any nonbiodegradable material used in the composting process.

Compost Mix. Develop a compost mix that encourages aerobic microbial decomposition and avoids nuisance odors.

Moisture Level. Maintain adequate moisture in the compost mix throughout the compost period within the range of 40 to 65 percent (wet basis). Prevent excess moisture from accumulating in the compost in high precipitation climatic regions. This may require the facility to be covered.

Temperature of Compost Mix. Closely monitor temperatures above 165°F. Take action immediately to cool piles that have reached temperatures above 185°F. If the pile is too hot, turn it to aerate the pile and release heat build-up.

Turning/Aeration. The frequency of turning/aeration shall be appropriate for the composting method used, and to attain the desired amount of moisture removal and temperature control while maintaining aerobic degradation.

Monitoring. The operation and maintenance plan shall state that composting is a biological process that needs monitoring and management throughout the composting period to insure proper composting processes. The operation may need to undergo some trial and error in the start-up of a new mortality composting facility. Manage the compost piles for temperature, odors, moisture, and oxygen, as appropriate. Test the finished compost as appropriate to assure that the required decomposition has been reached. Include the method, procedure, and record -keeping requirements for proper utilization of compost.

Additional O&M for Incinerators and Gasifiers

Use the incinerator and gasifier only for the disposal of animal carcasses.

Operate the unit properly to maximize equipment life and minimize emission problems.

Load the unit according to the manufacturer's recommendations.

Remove ashes frequently to maximize combustion and prevent damage to equipment. Include methods for collecting and disposing of the ash material remaining after incineration.

Inspect the unit periodically to ensure that all components are operating as planned and in accordance with the manufacturer's recommendations.

Additional O&M for Refrigeration Units

Operate the refrigeration unit properly to maximize equipment life and minimize potential problems.

Load the refrigeration unit according to manufacturer's recommendations and do not exceed the design capacity.

Use the refrigeration unit only for the dead animals associated with the planned operation.

Inspect the refrigeration unit periodically for leaks, structural integrity, and temperature.

REFERENCES

Nutsch, A., J. McClaskey, and J. Kastner, Eds., 2004. Carcass disposal: a comprehensive review, National Agricultural Biosecurity Center, Kansas State University, Manhattan, Kansas.

USDA, NRCS. National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook. Washington, D.C.

USDA, NRCS. National Engineering Handbook, Part 637, Chapter 2, Composting. Washington, D.C.

Georgia Composting Recipes, Georgia eFOTG Section I

NATURAL RESOURCES CONSERVATION SERVICE

GEORGIA

OPERATION AND MAINTENANCE REQUIREMENTS

ANIMAL MORTALITY FACILITY

CODE 316

Land Owner/Operator_____

County_____ SWCD_____ Farm/Tract No. _____

Prepared By_____ Date_____

OPERATION AND MAINTENANCE ITEMS

A properly operated and maintained animal mortality facility is an asset to the farm. This system was designed and installed for temporary storage, composting, and treatment of animal mortality. The estimated life span of this installation is at least _____ years. The life of the practice can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require periodic maintenance and may also require operational items to maintain satisfactory performance. Your operation and maintenance program requirements include:

COMPOSTER OPERATION

- The composter shall be loaded according to the recipe included in your design package. If this recipe was not included, contact your NRCS office to obtain a copy. Careful attention must be paid to the recipe in order for the composter to work properly. Contact NRCS to assist with troubleshooting during the composting process.
- Failure to manage the system will result in an odorous operation that may attract flies, buzzards, and other vermin. Mosquitoes may reproduce where standing water is present. To minimize vector problems:
 - Adhere to the composting recipe.
 - Eliminate standing water.
 - Employ good housekeeping to keep the area clean.
- The compost shall be land applied at the rates outlined in the Nutrient Management Plan and in accordance with state law.
- This composter was designed to handle normal mortality rates from this operation. The facility is not designed for catastrophic losses resulting from excessive heat, collapse of buildings, loss from disease, etc. Such losses shall be disposed of in a manner consistent with state law.

COMPOSTER MAINTENANCE

- The compost structure should be inspected at least twice each year when the facility is empty. Replace any wooden parts or hardware as needed. Roofed structures should be examined for structural integrity.
- Maintain all electrical and mechanical equipment by following the manufacturer's recommendations. Maintain grounding rods and wiring for all electrical equipment.
- All fences, railings, and/or warning signs shall be maintained to provide warning and/or prevent unauthorized human or livestock entry.
- Check backfill areas around structure for excessive settlement. Make necessary repairs.
- Check walls and floor often for cracks and/or separations. Make any necessary repairs.
- To prevent erosion, a good vegetative cover should be established and maintained around facilities. Clipping twice a year should suppress noxious weeds and ensure a vigorous stand. Traffic accesses shall be maintained and/or replaced as necessary.
- Do not let dead poultry compost come into contact with litter stored in a litter storage shed.
- Do not compact the material by driving over it or packing it with equipment. Do not allow the operation of any equipment that exceeds the design limit on or within ten feet of the structure.
- Immediately repair any vandalism, vehicular or livestock damage to the structure, earthen areas surrounding the structure, or any appurtenances.
- Positive drainage shall be maintained around the structure.

FREEZER OPERATION and MAINTENANCE

- The freezer shall be protected from precipitation and direct sunlight.
- Maintain the power source to the freezer. Consider alternative power sources in case of power outages. Contingencies for disposal of mortality during prolonged power outages, freezer failure, or adversely impacted removal schedule are outlined below.
- Observe the freezer for leaks. Repair or replace damaged components as necessary.
- Maintain the temperature of the freezer between 22 and 26 degrees Fahrenheit.
- Freezer pads shall be maintained. Damaged pads shall be repaired or replaced as necessary.

INCINERATOR OPERATION and MAINTENANCE

- Incinerator pads shall be maintained. Damaged pads shall be repaired or replaced as necessary.
- Maintain at least six inches between the incinerator chimney and any combustible roof parts.

Quality Assurance Plan (QAP)

Landowner/Project: _____ **Engineering Job Class^{1/}:** _____
Service Center: _____ **County:** _____
Conservation Practice(s) & Engineering Job Class Included in this Job: Animal Mortality Facility, Code 316
QAP Prepared By: _____ **Job Approved By:** _____
Est. Construction Start Date: _____ **Est. # Site Visits:** _____ **Est. # QA Hours:** _____

^{1/}The engineering job class for a given job will is based on the most restrictive element or conservation practice included in the job.

Certification Statements

I certify that the items, intensity, and inspection requirements listed in Table 1 is adequate quality assurance (QA) for this project.

Approver of Engineering Plans (Signature)

Date

I certify that _____ has the experience necessary to perform the construction inspection for the items shown in Table 1 and has the qualifications as shown in Table 2 for this project. I support this individual as the construction inspector and will allow the individual adequate staff time to perform the QA inspection for this project.

Line Supervisor (Signature)

Date

I certify that I have reviewed the engineering plans and specifications and fully understand the QA requirements of the subject project. I will contact the Project Approver if I have any questions or concerns regarding the QA activities and will notify and obtain approval from the Project Approver if there is need to make any changes to the plans and/or specification during construction.

QA Inspector (Signature)

Date

Quality Assurance Plan (QAP)

Table 1 - Items to be Inspected and Verified

Items ^{2/}	Intensity ^{3/}	Inspection Requirements ^{4/}
Preconstruction Meeting	NA	Meet with landowner and contractor, discuss project, sign and date documents; provide all applicable documents including drawings and specifications.
Permits	NA	Verify that the landowner has obtained all required permits prior to construction.
Utility Notification	NA	Verify that landowner has contacted utility companies prior to construction for underground utility location.
Pollution Control	P/F	Inspect to verify that pollution control measures are install as per the plans and specification and/or as required by the permits.
Clearing and Grubbing	P/F	Limited inspection will be required on clearing and grubbing. The limits for clearing and grubbing will be staked and inspections will be required to verify that the item was completed in accordance with the plans and specifications.
Excavation	P/F	Verify that the subgrade is properly excavated to the neat lines and grades as specified in the engineering plans and specifications.
Earthfill	C	Verify that foundation and all earthfill is of the quality and moisture content specified and compacted to the degree as specified and placed to the neat lines and grades as shown on the plans and specifications.
Concrete	P/F	Verify that the concrete is of the Class as specified and placed to the neat lines and grades as shown on the plans. Check reinforcing steel prior to pouring the concrete to ensure it is on the type, size and spacing as shown on the drawings. Verify that the concrete is cured properly in accordance with the specifications.
Structural Components	P	Verify that the concrete slabs, walls support structures roofs & covers are of the quality specified and constructed to the neat lines and grades as specified in the construction plans and specifications. Obtain certification of truss from a Georgia registered professional engineer prior to installation.
Spoil Disposal		Verify that all spoil material is disposed of at the location and manner shown on the plans or stated in the specifications.
Incinerators and Gasifiers	P/F	Verify that the incinerators and gasifiers were constructed in accordance with the plans and specifications.
Refrigeration Units	P/F	Verify that the refrigeration unit design, construction, power source, and unit installation are in accordance with the manufacturer's recommendations.
Vegetative Measures	P/F	Verify that disturbed areas are stabilized and vegetated during and after construction. Verify the type, quality, and quantity of seed mixture.
Quantity Computation	P/F	Perform quantity computations for payment purposes as per the payment schedule and specifications. Quantity computations shall be recorded on standard NRCS forms or NRCS-ENG-523A and <u>checked</u> and <u>initialed</u> by a second person.
Photographs	P	Take photographs of the site, before, during and after construction.
As-built Drawings	P	Keep drawings current during construction and prepare as-built drawings within 14 days of final construction.
Survey Notes	P	All construction checks taken including periodic elevation checks shall be recorded on loose leaf survey notes (form ENG 28, 29) or in a bound survey field book.

^{2/} Include items that require quality assurance.

^{3/} Intensity of inspection: NA – Not Applicable, C – Continuous, P – Periodic, F– Final. The inspector shall immediately notify the approver of the job if continuous inspection is required and cannot be performed with available staff.

^{4/} Inspection requirements shall be to the degree necessary to certify that the project is installed in accordance with the plans and specifications.

Quality Assurance Plan (QAP)**Table 2 – Required QA Qualifications for Construction Inspector**

QA Qualifications
1. Appropriate EJAA for the engineering job class for construction of the conservation practices to be installed.
2. Knowledgeable of the following references: a) National Engineering Manual (NEM) Part 512 – Construction b) National Engineering Handbook, Part 645, Construction Inspection

STATEMENT OF WORK
Animal Mortality Facility (316)
Georgia

These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

Licensure

Georgia Code Title 43, Professions and Businesses, Chapter 15, Professional Engineers and Land Surveyors, regulates the practice of engineering in Georgia and provides the definition of engineering in Chapter 15 §2(11). Technical assistance for this engineering conservation practice may be considered the practice of engineering and subject to licensure requirements of Georgia Code Chapter 15. It is the responsibility of the individual providing technical assistance to determine and verify whether this practice is subject to Georgia Code Chapter 15.

DESIGN

Deliverables:

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
 - a. Practice purpose(s) as identified in the conservation plan
 - b. List of required permits to be obtained by the client
 - c. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities)
 - d. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
 - i. Geology and Soil Mechanics (NEM Part 531 – Geology, Subpart A)
 - ii. Capacity
 - iii. Structural, Mechanical and Appurtenance design
 - iv. Environmental Considerations (e.g. air quality, bio-security)
 - v. Safety Considerations (NEM Part 503-Safety, Subpart A)
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits...
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certification that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Part 505, Subpart A, 505.3 (B)).
6. Design modifications during installation as required.

INSTALLATION

Deliverables

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
 - a. Actual materials used (Part 512, Subchapter D Quality Assurance Activities, 512.33)
 - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements (NEM Part 505, Subpart A, 505.3 (C)).

CHECK OUT

Deliverables

1. As-Built documentation.
 - a. Extent of practice units applied
 - b. Drawings
 - c. Final quantities

STATEMENT OF WORK
Animal Mortality Facility (316)
Georgia

2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03 (c) (1)).
3. Progress reporting.

REFERENCES

- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Animal Mortality Facility, 316
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook
- National Engineering Handbook (NEH), Part 651, Agricultural Waste Management Field Handbook (AWMFH)
- National Engineering Handbook Part 637, Chapter 2 – Composting