




# **On-Farm Composting of Livestock Mortalities**

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# **TABLE OF CONTENTS**

Foreword.....	1
Use of the Terms “Compost” & “Composting”.....	2
Requirements of SSB 5602.....	2
Table 1 - Agricultural Composting Requirements in Washington State.....	3
How Does SSB 5602 Affect On-Farm Composting? .....	4
Elements of Mortality Composting.....	5
Site Selection.....	5
Windrows vs. Static Piles.....	6
Co-composting Material.....	6
Table 2 - C:N Ratio and Percent Moisture Values of Common Carbon Sources .....	8
Moisture Content.....	8
Aeration.....	9
Temperature .....	9
pH Levels .....	9
Recommended Equipment Needs .....	9
Managing Mortalities in Compost Piles.....	10
Finished Product.....	11
Testing Requirements .....	11
Taking Samples .....	13
Sanitation/Sterilization .....	14
Frequently Asked Questions .....	15
Will a pile containing dead animals produce odors and attract rodents? .....	15
What happens to the pile during the winter?.....	15
Should the pile be constructed on an engineered pad?.....	15
Will there be any problems with flies?.....	15
Can composted material be applied to grow “Certified Organic Produce”?.....	15
Appendix A - Substitute Senate Bill 5602, Section 6.....	16
Appendix B - Animal Disease Reporting Requirements .....	18
WAC SECTIONS .....	18
WAC 16-70-005 - Definitions.....	18
WAC 16-70-010 - Reporting Diseases - Requirements .....	18
Table B1 - Foreign or eradicated diseases to be reported immediately .....	19
Table B2 - Suspected/confirmed diseases to be reported the next working day .....	21
Table B3 - Diseases reportable monthly .....	22

Table B4 - Diseases to be reported upon notification by state veterinarian's office ...	23
WAC 16-70-020 - Reporting diseases - Not Required, Requested Only .....	24
Appendix C- Solid Waste Regulatory Citations .....	25
WAC 173-350-040 - Performance Standards .....	25
WAC 173-350-220 - Composting Facilities .....	25
Table A- Metals .....	31
Table B- Other Testing Parameters.....	31
Table C- Frequency of Testing Based on Feedstocks Received.....	31
Appendix D-Additional Resources .....	35
Basics of Composting.....	35
Livestock Composting.....	35
Cattle Composting.....	35

# Foreword

Section 6 of Substitute Senate Bill 5602 (SSB 5602), passed during the 2005 Washington Legislative session, includes a requirement that the Department of Ecology (Ecology), in conjunction with the Department of Health (Health) and Department of Agriculture (Agriculture), develop guidelines for on-farm composting of routine mortalities of bovine and equine animals at livestock animal feeding operations (AFOs). It also broadened existing agricultural exemptions in state solid waste regulations for composting bovine and equine mortalities by eliminating testing for metals and solid waste permit requirements. The bill placed restrictions on use of the compost and mandates that recipients of the material be notified of the nutrient value, pathogen levels, stability, use restrictions and origins of the compost. (Section 6 of SSB 5602 is included in Appendix A)

These guidelines have been developed to provide Washington bovine and equine producers, and those that provide technical assistance to the producers, with an understanding of how to comply with regulatory and the recently revised statutory requirements. It also provides the basics of composting large livestock as one possible animal mortality management tool. Proper composting of other types of livestock is allowed in Washington but is not covered in this guidance document. The focus is on managing what is considered routine, day-to-day livestock mortalities, and may not be suitable for managing mortality due to reportable diseases as listed in WAC 16-70-010 (See Appendix B). Operators who suspect the presence of any of the listed diseases should contact the State Veterinarians office and their local Health Department.

This publication will also be of specific interest to bovine and equine producers seeking alternative disposal options to burial, incineration and rendering as part of development of mortality management plans required in 40 CFR Part 122 for Concentrated Animal Feeding Operations (CAFOs). A companion guidance document is being developed by Agriculture that provides general information on a variety of disposal options for all types of livestock, including composting. Numerous published reports and methods for large and small scale composting techniques for a variety of other livestock are available on-line. It should be understood that animal composting may require some trial and error to achieve acceptable results. You are encouraged to work with your conservation district staff or other professionals to identify the best approach to mortality management at your facility. In the event of an animal emergency, as declared by the Director of the Department of Agriculture, the State Veterinarian's office and the local health department will determine appropriate disposal options.

As Ecology, Agriculture, Health, and the livestock producers gain more knowledge through hands-on experience, this publication may be updated. Most of the information presented in these guidelines is assembled from a variety of sources in the United States and Canada that have researched carcass composting methods and shared their findings with colleagues in the academic, agricultural, and environmental communities. These guidelines are available on-line at <http://www.ecy.wa.gov/biblio/0507034.html> and it is suggested that you visit this site to ensure you have the most current version available. Also, Agriculture and Health are in the process of reviewing current rules applicable to dead animal disposal requirements. These efforts are intended to eliminate conflicts that create confusion regarding legal animal carcass disposal and associated requirements.

# Use of the Terms “Compost” & “Composting”

Before getting started, it is important to understand that the terms “compost” and “composting” as used in this document do not meet the regulatory definitions found in state solid waste regulations. The composting methods described are adaptations of conventional large scale composting but the methods are not entirely consistent with all the steps described in regulation to meet the regulatory definition of composting which is “*the biological degradation of organic solid waste under controlled conditions designed to promote aerobic decomposition. Natural decay of organic solid waste under uncontrolled conditions is not composting*”. As used in this document, “compost” and “composting” might be better thought of as “*above ground burial*”.

These guidelines describe a practical alternative to traditional mortality disposal methods such as burial, rendering and incineration. They provide detailed steps necessary to achieve safe volume reduction of large animal carcasses and produce a material that may be suitable as a soil amendment when testing indicates the compost meets standards. While the steps do not include the intensive management found in typical large scale composting operations, they do require specific management activities for success.

Understanding the distinction between use of the terms “compost” and “composting” in this document versus solid waste regulation is important. There are fundamental differences in pile management when comparing conventional composting with piles used to decompose horses and cows. For example, typical windrow composting requires, by rule, frequent turnings to promote aerobic conditions, but the process of degrading large animal carcasses in windrows requires, by practicality, that they remain undisturbed for a number of months to allow complete degradation of hair, protein, fats, and smaller bones and other calcium structures in the carcass. While SSB 5602 allows bulk distribution of the compost when statutory conditions are met, operators are encouraged to make on-site use a priority whenever possible as a soil amendment, supplemental co-composting material in future compost piles, or as a biofilter over a pile to help absorb odors. ***On-site use offers substantial advantages over off-site distribution such as reduction of testing and transportation costs, and greater overall biosecurity.***

## Requirements of SSB 5602

While the techniques for composting described in this document may prove useful to anyone managing large animal mortalities, SSB 5602 is specifically applicable to bovine and equine livestock producers that wish to compost and distribute materials off-site *and* when the operator anticipates that more than 1000 cubic yards of co-compost material, partially composted material, and unused finished compost in piles will be on-site at any one time. Smaller operations may find that exemptions are already in place that provide regulatory relief for on-farm composting. ***Table 1*** (following page) should prove useful in identifying existing options for managing large carcasses through agricultural composting.

**Table 1 - Agricultural Composting Requirements in Washington State<sup>1</sup>**

<b>Composting Scenario</b>	<b>Permits Required</b>	<b>Volume Limit</b>	<b>ECY/JHD Notification Required</b>	<b>Meet Performance Standards<sup>2</sup></b>	<b>Testing Required</b>	<b>Annual Reporting</b>	<b>Allow Inspections</b>	<b>Recipient Notification</b>
All agricultural feedstock is generated on-site and all product is used on-site	No	No	No	Yes	No	No	Yes	N/A
Agricultural feedstock is generated both on-site and off-site but all compost is used on site and the cumulative amount of feedstock, partially composted material, and unused finished compost does not exceed 1000 cy	No	Yes	No	Yes	No	No	Yes	N/A
Agricultural composting at Registered Dairies when composting is included as part of a certified Dairy Nutrient Management Plan in accordance with RCW 90.64, <i>Dairy Nutrient Management Act</i>	No	No	Yes	Yes	Yes	Yes	Yes	No
Agricultural composting when material is distributed off-site and more than 40 cy but less than 1000 cy of agricultural feedstock, partially composted material, and unused finished compost is on-site and composting activities are managed in accordance with a farm management plan that conforms to the standards in the Washington Field Office Technical Guide written by the NRCS <sup>3</sup>	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Agricultural composting when material is distributed off-site and more than 1000 cy of agricultural feedstock, partially composted material, and unused finished compost is on-site and composting occurs in compliance with these guidelines developed as a result of SSB 5602	No	No	Yes	Yes	Yes <sup>4</sup>	Yes	Yes	Yes

**1-** This table references state solid waste regulations only. Efforts are currently under way to clarify requirements for mortality management in Department of Agriculture and Department of Health regulations. These are being amended to clearly to allow composting of dead animals. Check local regulations to determine if there are any additional requirements.

**2-** See Appendix C

**3-** Natural Resources Conservation Service

**4-** SSB 5602 exempts producers from the metals testing requirements of WAC 173-350-220

# How Does SSB 5602 Affect On-Farm Composting?

SSB 5602 exempts bovine and equine livestock producers from the solid waste permitting and metals testing requirements when compost is distributed off-site in bulk provided that these guidelines and applicable requirements in WAC 173-350-220 are followed at operations expected to accumulate co-composting material, partially composted material, and unused finished compost on-site at any one time **in combined excess of 1000 cubic yards**. To maintain the exemption, the following terms and conditions must be met:

- The composter must follow these guidelines.
- Carcasses must not be known or suspected to be infected with prion-related diseases, spore-forming disease (e.g. anthrax) or other diseases of concern identified by the state veterinarian.
- The operator must compost animals from his/her own animal feeding operation (AFO) and not accept animals from other sources.
- The operator must notify the end user that the compost includes animal mortalities, its nutrient content, pathogen levels, stability rating, and restrictions on uses discussed below.
- Compost may only be applied to agricultural lands that will not be used for root crop production within 3 years after application.
- Compost is applied in a manner that prevents direct contact with any parts of the crops that are harvested for human consumption.
- The composter reports annually to Ecology the number of bovine and equine animals composted and an estimate of the total tonnage or yardage of all co-compost materials used for composting. Ecology will provide annual report forms to producers that have notified the department of the intent to operate under the terms of SSB 5602 required as described below. Annual reports detailing activities for the preceding calendar year are due by April 1.

SSB 5602 provides relief from the permitting requirements and some testing parameters but did not affect other terms and conditions in the state solid waste regulations that apply to AFOs when the 1000 cubic yard threshold is exceeded and when the operator intends to distribute bulk finished material offsite.

To maintain an exempt status, applicable operations must also comply with the following:

- Notify both the local jurisdictional health department and Ecology of the intent to operate under one of the exemptions listed in rule. A list of jurisdictional health departments is available at <http://www.doh.wa.gov/LHJMap/LHJMap.htm>. Notification forms are available at <http://www.ecy.wa.gov/biblio/ecy040154.html>
- Allow inspections by Ecology and the local jurisdictional health department at reasonable times
- Meet the performance standards in WAC 173-350-040 (See Appendix C)
- Operate in such a manner that flies and other vectors are not attracted.
- Control odors
- Ensure protection of ground and surface waters



# Elements of Mortality Composting

Proper management of farm mortalities is an important aspect of sustainable livestock production. Traditional disposal methods have included rendering, burial, incineration and natural decomposition on rangeland. These options are becoming either less acceptable or less available due to disease, biosecurity concerns, environmental matters, and economic considerations. The compost process described in these guidelines involves enveloping the animal in a high carbon source such as saw dust, silage, animal bedding, or similar material in a manner that promotes generation of temperatures high enough to kill human and animal pathogens and promotes microbial activity that will accelerate decomposition of tissue and all but the largest bones in the carcass. It is a process that borrows conventional composting principles that if done properly, can result in a material that meets regulatory standards necessary for bulk distribution when on-farm use is not possible.

The benefits associated with on-farm mortality composting include:

- Prevention of nuisances associated with flies, scavengers, vermin and odors
- Lower operational costs
- Reduced risk to ground and surface water
- Recycling of nutrients from mortalities
- Increased on-farm biosecurity
- Potential to handle large volumes of mortality material

The major factors affecting successful mortality composting include:

- Site Selection
- Pile Type (Windrow vs. Static Pile)
- Co-Composting Materials and carbon to nitrogen ratios (C:N)
- Moisture Content
- Aeration
- Temperature
- pH

## *Site Selection*

When selecting a location to conduct animal composting, the following are minimum considerations:

- Distance to surface water and drinking water wells. Compost activity should be set back at least 300' from these resources.
- Groundwater depth. Composting activities may not adversely impact groundwater resources and should not occur in areas with seasonally high groundwater unless conducted on an impervious surface with leachate collection and means to prevent stormwater run-on.

- Distance to property lines, residences, schools and other public areas. Local regulations should be checked for specific constraints.
- Public acceptance of composting mortalities which necessitates off-site impacts such as odors and negative aesthetics be prevented.
- Available infrastructure such as paved pads, year round access, ability to properly manage leachate and prevent stormwater run-on and run-off
- Wind direction
- Potential Future expansion

### ***Windrows vs. Static Piles***

Windrows and static piles are similar in design. Piles might be more suitable when expecting infrequent mortalities. Windrows may be more suitable for large operations where the need to manage mortalities is ongoing. Walls and roofs are not required in these designs, making it easier to load, unload and mix pile materials. Piles and windrows should be constructed on all weather surfaces such as concrete or asphalt pads or on soils with low permeability. Consult the NRCS or local conservation district office for advice on methods to alter native soils to reduce permeability. Techniques described in NRCS Technical Field Guides addressing pond construction and other soil treatment methods may be useful in conditioning soils to achieve low soil permeability.

With a windrow design, the length of the windrow is extended as mortalities occur. They are typically 4 to 12 feet high and 12 to 20 feet wide and grow in length as mortalities are added to the pile. Piles and windrows should be protected from water running into them. Runoff must be controlled so that it does not pollute surface or groundwater. Static piles are generally more useful for composting single animals. A cow or horse is placed on a minimum 2' deep layer of absorbent co-composting material, taking into account settling and compaction. The base must be large enough so that no part of the animal is any closer than 2 feet from the edge.

Once placed, the animal is covered with at least two feet of co-compost cover and no part of the animal may be left exposed. Both static piles and windrows are turned when pile materials have been left undisturbed long enough for tissue to decompose leaving only large bones. This usually takes between 9-12 months for large carcasses. Because new sections are continually added to the length of windrows over time, certain sections are turned before others as they complete decomposition. Stakes or markers should be inserted along the length of the windrow to help distinguish newly constructed sections from older sections. A log book should be used to keep records of such matters as pile construction dates, temperatures, turning schedules, etc.

### ***Co-composting Material***

Mortality management requires the addition of a carbon amendment, or co-composting material, which serves several key functions:

- Surrounds the carcasses making them less accessible and attractive to pests and scavengers
- Absorbs excess liquids released by decomposing carcasses
- Provides structure and porosity that promotes air movement throughout the piles

- Provides an energy source for microbial activity

Co-composting material refers to any material added to the compost pile to aid in the decomposition process and is also sometimes referred to as **bulking material**. Typically, these materials need to have a high C:N ratio and be relatively fresh from harvesting or not have undergone significant decomposition. Since mortalities are high in nitrogen, co-composting materials high in carbon such as sawdust, corn silage, screened or dried manure solids, or small woodchips should be used when composting dead animals. Other materials may be available regionally that are also suitable as a carbon source.

Particle size should be taken into consideration. The bulking material should be large enough to allow air flow into the pile, but small enough to help prevent rapid cooling and drying of the pile. Particle size ranging from 0.25-1 inches should be targeted but considerations such as how the material compacts and holds water need to be factored in as well. For example, wood chips and straw will work, but research has shown they do not work as well as sawdust due to their larger particle sizes and tough surfaces. With these materials, longer decomposition times may be required, leaching of liquids from piles is more likely, and opportunities for flies and other vectors to become a problem increase.

Larger particle size will create increased porosity and can speed the rate of moisture loss in the pile and result in longer decomposition time and more pile management. Sawdust, with its smaller particle size, has been found to be more absorbent and reduce potential release of leachate, maintain more consistent temperatures, and require less maintenance. If particle size is too small however, anaerobic conditions are likely and carcasses will fail to compost properly.

The carbon material should have moisture content between 50% and 60%. A dry amendment (<20%) will not decompose properly and may require the addition of water to re-establish the proper moisture balance. An excessively wet material may require the addition of a dry amendment before building the pile or after turning to correct the moisture balance. Proportions of co-compost material to carcass weight will vary and require some experimentation dependent on weather, moisture, co-compost material, etc., but as a rule of thumb, it takes approximately 5 lbs. of sawdust or similar material for every pound of carcass that is decomposed.

Experience elsewhere in the United States and Canada has indicated it is possible to use finished compost stockpiles to replace up to 50% of the bulking material. An added benefit of using finished compost, especially as a “blanket” over the pile, is its ability to help capture most odors and insulate the pile in cold weather. Note that substituting more than 50% of the carbon source with finished compost may negatively limit carbon availability and decrease the rate of carcass decomposition.

**Table 2** (following page) details the C:N ratio and typical moisture content of some commonly available bulking materials frequently used in composting. Characteristics of many other potential co-composting materials are available in Appendix A of the “On-Farm Composting Handbook”. This is an excellent resource for agricultural composting and is available by contacting the Natural Resource, Agricultural, and Engineering Service at [www.nraes.org](http://www.nraes.org).

**Table 2 - C:N Ratio and Percent Moisture Values of Common Carbon Sources**

<b>Materials</b>	<b>C:N (weight to weight)</b>	<b>% Moisture (wet weight)</b>
Corn stalks	60-73:1	12
Corn silage	38-43:1	65-68
Hay	15-32:1	8-10
Cow Manure solids	11-30:1	67-87
Horse Manure Solids	22-50:1	59-79
Straw	48-150:1	4-27
Sawdust	200-750:1	19-65
Wood chips	451-819:1	–
Leaves	40-80:1	–

Source: On-Farm Composting Handbook, 1992, R. Rynk.

### ***Moisture Content***

Ensuring that the material used to build the pile has sufficient moisture is one of the most important aspects of successful mortality composting. Also, it is important to make certain that moisture stays within reasonable levels throughout the process. When monitoring pile moisture content, examine materials at least 6” below the surface of the pile. A moisture content of 50% to 60% is optimal. If the moisture content is too low, the carcasses will decompose at a very slow rate.

**In general, a handful of material that does not feel moist to the touch and readily crumbles after squeezing is too dry.** Low moisture conditions are typically corrected through the addition of water to obtain a damp feel. Water may be added to smaller piles with a hose, while larger piles may require larger equipment, such as liquid manure handling equipment or tank trucks. Once the pile is established and temperatures high enough to kill pathogens are reached, water from manure lagoons or leachate collection devices may not be suitable sources of moisture if the presence of human or animal pathogens of concern is suspected. In most cases, the carcasses will contribute adequate moisture content within the recommended range and piles will not require moisture adjustments.

A pile that is not protected from heavy precipitation may also become excessively wet. **As a rule of thumb, the pile is too wet if water can be squeezed from the material.** Once the carcasses have decomposed, excess moisture may be reduced by turning the pile and adding additional dry bulking material. Constructing the pile under a roof or covering with a tarp can be effective in protecting the pile from becoming too wet. Any leachate that is generated should be collected and managed in a manner that prevents introduction to ground or surface waters. Saturation resulting from stormwater run-on can be prevented by locating the pile on higher ground or installing measures such as berms or other means to prevent storm water run-on.

## ***Aeration***

Composting is most efficient when maintained as an aerobic process. Microorganisms require oxygen to decompose co-compost materials. Oxygen levels should be maintained above 5%. The target range is about 5-15%.

Passive aeration is controlled by variables such as the porosity of the co-composting materials, moisture content in the pile, pile size, and density of the pile. Meters are available to measure oxygen levels within the pile but they can be expensive, particularly if the operator anticipates limited amounts of composting. Conservation district staff or others providing technical assistance may have access to meters however.

If a meter is not available, other indicators of low oxygen include strong ammonia odors, very low pH, or saturated conditions. There are many ways to provide aeration “artificially” but these should be attempted only after consulting conservation staff or qualified compost experts that have experience with mortality composting. Problems with flies, excessive drying, or exposure of animal parts can be experienced with many traditional aeration methods.

## ***Temperature***

The warmer the pile, the faster the microorganisms work, *up to a point*. Temperatures between 110-150°F (43-65°C) are acceptable, but anything above 158°F (70°C) may be too hot for the compost microorganisms to thrive. High temperatures may also reduce the pile moisture to unacceptable levels. Water can be added to bring temperatures down and correct moisture deficiency. The preferred temperature range is 130-140°F (54-60°C). The operator must ensure the process includes reaching temperatures above 131°F (55°C) at points all around the carcass at a two foot depth from the outer surface for at least 3 consecutive days to kill pathogens.

## ***pH Levels***

Composting is effective at pH levels between 5 and 10, with 7 being optimum.

## ***Recommended Equipment Needs***

- ***Front end loader or similar machine:*** composting requires a front-end or skid-steer loader to move carcasses and bulking material, cover the carcasses, turn and mix the compost, and move the finished compost.
- ***3' Temperature Probe:*** temperature is a key indicator in determining the success of a compost pile since microbial activity is directly related to heat. Temperatures should be monitored at least weekly with a temperature probe 3 ft (1 m) in length, except that temperatures should be monitored daily once they reach or exceed 131°F (55°C) to ensure that temperature is maintained for at least 3 consecutive days to kill pathogens. There are both manual and digital temperature probes available at hardware stores, farming supply stores, and on-line.
- ***Rebar or other Lancing Tool:*** it is recommended that the rumen be lanced 3-4 times prior to covering the carcasses to prevent bloating. Lancing also exposes the stomach

cavity and can speed the onset of decomposition. **Basically, animal composting begins from the inside out.**

- **Log Book or Forms:** It is important to keep a record of your activities to help troubleshoot in the event of failure of the composting process. Information to be recorded should include the weights of carcasses, type and amount of co-compost material, temperature measurements, weather conditions and any notable observations. If something goes wrong with your composting pile you can look back to see what error or mistakes may have occurred along the way, find a solution, and avoid future failures. Record keeping is required if finished compost is distributed off-site under the conditions of these guidelines. Log books will make annual reporting easier.
- **Miscellaneous:** It may be useful to have a shovel or pitchfork on hand to maintain your compost pile. It is also a good idea to have access to a water source. In areas where there is not much rain, water may need to be added to the compost pile.

### ***Managing Mortalities in Compost Piles***

The following is a step-by-step procedure for composting livestock mortalities on-farm:

- Start the pile by creating a base. The base should consist of at least 24” of co-composting material. Be sure to account for compaction and settling that will result after placement of the carcass.
- Place the carcass on the base, centered so that no part of the animal is any less than 24” from the edges. Carcasses should not be placed directly on the ground or pad as they will not decompose properly. Do not stack large animal carcasses in the pile.
- Lance the rumen 3-4 times with a sharp object such as a piece of rebar to prevent bloating and encourage quicker onset of decomposition.
- Carcasses must be added to piles within 24 hours after death. If uncertain about the cause of death of the animal and the appropriateness of composting as a means of carcass disposal, consult a qualified veterinarian.
- Cover carcasses with at least 24” of co-compost material.
- Once the carcasses are covered with 24” of co-compost material, consider capping the pile with 12-24” of finished compost to provide insulation, retain heat and moisture, prevent the release of odors, and avoid attraction of vectors such as flies and scavengers to the pile;
- Ensure that piles constructed in the open are mounded to promote shedding of rainfall off the pile.
- Check the pile regularly to ensure that the carcass remains adequately covered. Settling of the pile as decomposition occurs and windy conditions can move the bulking material and expose the carcass. This can cause heat loss and impact the moisture balance in the pile and result in attraction of flies and scavengers that may further disturb the pile. The decomposition process may be slowed and the exposed carcass may create odor and aesthetic nuisances.
- Monitor the temperature at least once a week, using the 3’ thermometer. Note that piles constructed during extremely cold weather may not begin to warm and promote

decomposition immediately. Placement of a compost “blanket” utilizing finished material should help insulate the pile and promote heating, even in severe weather. Monitor temperature daily when it reaches 131° F (55° C) to ensure three consecutive days at these temperatures for pathogen reduction.

- After 9 to 12 months, the pile should be turned for the first time to re-introduce oxygen and create a more homogeneous mixture. At this stage, the protein, fats, hair, and other soft tissue should be fully decomposed and only fragments from larger bones should remain recognizable but these will be brittle. Timelines may vary and should be adjusted by the operator as experience and understanding of site specific composting variables is gained.
- Turn the pile at least twice a month after the initial turning and monitor temperatures with the 3' thermometer. When significant heating no longer occurs after turning, the material should be finished.
- If the pile does not produce heat after initial turning, additional nitrogen may need to be added. Manure is generally available and can be used as a nitrogen source but should not be mixed into a pile at a rate exceeding ½ the overall volume.
- The material can be stockpiled, ideally for use in future compost piles, directly land applied to your own property at appropriate agronomic rates, or otherwise used on your own property. Off-site distribution is allowed provided these guidelines are followed, the characteristics of the finished materials meet applicable regulatory standards, and the recipient is provided required documentation.
- If material is to be distributed off-site, it must be tested at this stage for pathogens, pH, stability, and nutrient levels as described below.

### ***Finished Product***

Little or no trace of the carcass should be detectable in the finished product. Some bones (skull parts, femurs, teeth) may be visible in the material, but they should be brittle and easily crumbled in most equipment used to spread the compost. Larger bones can be removed and placed back into a new pile for further decomposition if preferred.

If the recommendations provided in this manual are followed, the finished product should have the following characteristics:

- Crumbly texture that allows air to penetrate yet holds moisture, while allowing excess moisture to drain away
- Raw materials are not detectable except for larger bones
- Brown to dark brown in color
- Earthy odor

## **Testing Requirements**

***Note: It is not necessary under solid waste rules to test finished compost if all materials are to be used on your own property, regardless of volume. However, if you are a dairy or permitted Concentrated Animal Feeding Operation, you are required to conduct nutrient testing on material used on your property to ensure proper applications and***

***nutrient balance under your Nutrient Management Plan. All facilities are encouraged to work with your Conservation District or similar professional to ensure compost is applied at agronomic rates if land applied. Determining appropriate agronomic applications will necessitate that basic nutrient testing be conducted on the finished material prior to use.***

In order to bulk distribute compost produced from bovine or equine mortalities, an operator must test the compost to ensure it meets standards for pathogens, pH, and stability and provide the user with information on nutrient content, limits on the use of the materials, and details of the feedstock (i.e. bovine or equine mortalities).

Allow sufficient lead time for results to be provided by the laboratory. An accredited lab is not required but be certain the laboratory selected is qualified to conduct the necessary tests to ensure compost quality complies with regulatory standards. A list of labs accredited by Ecology can be found at [http://www.ecy.wa.gov/programs/eap/labs/labs\\_main.html](http://www.ecy.wa.gov/programs/eap/labs/labs_main.html)

A list of labs that follow “Test Methods for the Examination of Composting and Compost” (TMECC) protocols established by the U.S. Composting Council is available at <http://tmecc.org/sta/>

***Compost must, at a minimum, be tested for:***

- ***Nutrients:*** For purposes of these guidelines the nutrient of concern is nitrogen. An agronomist needs this information to properly calculate application rates. Most labs already uses by the agricultural community are familiar with nutrient testing. Results should be reported on a “dry weight” basis.
- ***Pathogen Levels (Fecal Coliform or Salmonella):*** Levels for fecal coliform must be below 1000 “most probable number” (MPN) per gram of solids. Levels of salmonella must be below 3MPN per 4 grams of solids. Results must be reported on a “dry weight” basis. Many labs are familiar with pathogen tests, but be certain the lab selected understands methods for testing for pathogens in soils or compost.
- ***pH-*** Compost pH must be between 5 and 10. Tests are available for on-site testing and most labs capable of conducting the tests for nutrients and pathogens will also be able to test pH.
- ***Stability-*** Compost stability refers to the biological activity in a compost sample. The biological activity of composting material starts high and goes down as microorganisms consume the raw *feedstocks*. Measuring stability of the compost tells when the composting process is complete enough to use the end product. Regulations require that this determination be made as outlined in TMECC test standards, Chapter 5.08, “Respirometry”. Six methods are offered. Four require lab services. The other two, the Solvita<sup>®</sup> test and the Dewar Self-Heating test can be conducted on-site. The Dewar method measures the rise in temperature of a compost sample in a Dewar flask over several days. The Solvita<sup>®</sup> test measures carbon dioxide and ammonia evolution in a compost. Much more information is available for both methods on-line.



## ***Taking Samples***

Please consult TMECC, Method 02.01-B online at <http://tmecc.org/tmecc/> for more information related to the method of taking samples described below. This web site offers far greater detail on a variety of matters related to good compost sampling practices.

***Composite sampling*** is the most common approach to preparing compost for analysis and testing. A composite sample is a single sample composed of multiple, well-blended grab samples that represent the traits of interest for an entire pile or windrow.

When sampling, it is critical to ensure instructions for sample preparation and handling provided by the lab conducting the analysis are closely followed. A laboratory will provide advice about the appropriate storage and shipping containers as well as instructions on sample preparation, chain-of-custody, storage temperatures, handling requirements and other specifications. Some will also provide containers and shipping materials.

Before beginning the process of collecting samples, be sure all equipment has been assembled and properly sanitized. (See “*Sanitation/Sterilization*” on following page.)

Following the instructions below should result in preparing a representative sample of compost for analysis:

1. Cut into the pile or wind row in at least 5 locations. The 5 cuts must be randomly assigned and may be selected from either side of the windrow or pile. Cut into the entire vertical depth of the pile and at least into half of the width of the pile. The cut should expose the middle of the pile from its natural base to its natural peak.
2. Collect 15 1-cup grab samples from various depths and levels from one side of the cut area. Combine and thoroughly mix the 15 grab samples in a sterilized stainless bowl or plastic collection bucket. Place the mixed sample in a sterile 5-gallon mixing pail. Repeat this process for each cut area. Avoid collection of samples from pile or windrow surfaces that are excessively wet, i.e., greater than about 60% moisture, or from the exterior of the pile.
3. Once the composite samples from each of the five cuts have been placed in the sterile 5-gal mixing pail, thoroughly mix to make one composite sample.
4. Repeatedly divide the sample in half until you have a 2-gal sample. Gently transfer the 2-gal sample into 2 1-gal sterile plastic resealable storage containers or other sterile containers as directed by the laboratory. Do not compact the compost samples.
5. After transferring samples into the 1-gal containers, chill them to about 39°F (4°C) and follow the laboratory’s directions for shipping. Samples should be chilled as soon as possible after collection to ensure they remain representative of the compost being tested.
6. It is recommended that the selected laboratory be contacted prior to sampling to determine if its protocols differ from the directions above.

## ***Sanitation/Sterilization***

Sanitized equipment is critical when samples are being prepared for pathogen testing. If the lab has supplied the containers, they will usually already be sterilized.

Be certain hands are washed before sanitizing equipment. Utensils such as scoops and mixing containers (stainless steel, plastic, or glass) should be clean and sanitized by first washing with soap and water and rinsing, then sterilized with a 5% bleach solution as is typically found in household bleach.

Containers and utensils should then be triple rinsed with clean distilled water. If preparing equipment ahead of time, wrap containers and utensils in sanitized aluminum foil to avoid re-contaminating sterilized equipment during transport into the field.

Equipment can be sanitized in the field by placing bleach in a squeeze bottle and taking along distilled water in gallon jugs. **Always use caution and appropriate eye and skin protection when using bleach.**

# Frequently Asked Questions

## ***Will a pile containing dead animals produce odors and attract rodents?***

As long as the carcasses are properly covered with at least 24" of cover, odors, scavengers, and rodents should not be a problem. Using finished compost as a blanket will further reduce the likelihood of odors.

## ***What happens to the pile during the winter?***

Carcasses typically decompose more rapidly when the ambient temperature is warm. Pile temperatures of 122° F or higher may be attained when ambient temperatures are as low as 5° F. Frozen carcasses placed in frozen bulking material will not decompose during cold weather but they should begin to breakdown once ambient temperatures increase in the spring. Adding more bulking material or finished compost material will also help retain heat in the winter. Avoid turning piles during extremely cold weather.

## ***Should the pile be constructed on an engineered pad?***

A concrete or asphalt pad will reduce the risk of water contamination, improve the ability to control leachate and storm water, and make turning the pile easier. Many farms already have paved areas suitable for composting as described in these guidelines. Techniques to reduce soil permeability may be available through the NRCS or similar organization.

If an engineered pad is not feasible, at a minimum the pile should be located on sloped land that drains into a collection area and a deeper base of co-compost material should be established under the carcasses to increase the ability to absorb any liquids generated in the pile. Any uphill surface water should be diverted away from the compost pile and drainage off the pile should be managed to prevent surface or groundwater contamination.

## ***Will there be any problems with flies?***

If carcasses are composted as described above, flies should not be a problem. Research has shown that efforts to improve aeration by placing perforated pipes under the pile have resulted in breeding habitat for flies because the pipes collect leachate and the open ends will draw flies in. Perforated pipes should not be necessary for mortality composting.

## ***Can composted material be applied to grow “Certified Organic Produce”?***

It is possible for finished compost to be used in organic food production as long as only natural untreated feedstocks are used.

Questions about the Washington Department of Agriculture’s “Organic Food Program” should be directed to (360) 902-1805.

Online information is available at <http://www.agr.wa.gov/FoodAnimal/Organic/default.htm>

## Appendix A - Substitute Senate Bill 5602, Section 6

NEW SECTION. **Sec. 1)** A new section is added to chapter 70.95 RCW, to be codified after RCW 70.95.305, to read as follows:

- (1) By July 1, 2005, the department of ecology and the department of agriculture, in consultation with the department of health, shall make available to livestock producers clearly written guidelines for the composting of bovine and equine carcasses for routine animal disposal.
- (2) Composters of bovine and equine carcasses are exempt from the metals testing and permit requirements under the solid waste handling rules for compost that is distributed off-site if the following conditions are met:
  - (a) The carcasses to be composted are not known or suspected to be affected with a prion-protein disease such as bovine spongiform encephalopathy, a spore-forming disease such as anthrax or other diseases designated by the state veterinarian;
  - (b) The composter follows the written guidelines provided for in subsection (1) of this section;
  - (c) The composter does not accept for composting animal mortalities from other sources not directly affiliated with the composter's operation;
  - (d) The composter provides information to the end-user that includes the source of the material; the quality of the compost as to its nutrient content, pathogens, and stability; and the restrictions on use of the compost as stated in (f) of this subsection;
  - (e) The composter reports annually to the department the number of bovines and equines and the amounts of other material composted, including the composter's best estimate of the tonnage or yardage involved; and
  - (f) The end-user applies the compost only to agricultural lands that are not used for the production of root crops except as prescribed in the guidelines and ensures no compost comes into contact with the crops harvested from the lands where the compost is applied.
- (3) If a compost production facility does not operate in compliance with the terms and conditions established for an exemption in this section, the facility shall be subject to the permitting requirements for solid waste handling under this chapter.

**Sec. 2)** RCW 70.95.315 and 1998 c 156 s 7 are each amended to read as follows:

The department may assess a civil penalty in an amount not to exceed one thousand dollars per day per violation to any person exempt from solid waste permitting in accordance with RCW 70.95.300, 70.95.305, or section 6 of this act who fails to comply with the terms and conditions of the exemption. Each such violation shall be a separate and distinct offense, and in the case of a continuing violation, each day's continuance shall be a separate and distinct violation.

# Appendix B - Animal Disease Reporting Requirements

## Chapter 16-70 WAC

Last Update: 3/1/2000

### WAC SECTIONS

**16-70-005**     **Definitions**

**16-70-010**     **Reporting diseases -- Requirements**

**16-70-020**     **Reporting diseases -- Not required, requested only**

### *Dispositions of sections formerly codified in this chapter:*

**16-70-001** Promulgation. [Order 1005, Promulgation, filed 7/22/66, effective 8/22/66; Order 655, Promulgation, effective 5/19/53.] Repealed by 00-06-064, filed 3/1/00, effective 4/1/00. Statutory Authority: RCW 16.36.010(1), [16.36.]040 and [16.36.]080 (4).

**16-70-030** Reporting diseases -- Lists may be modified. [Order 1005, Regulation 5, filed 7/22/66, effective 8/22/66.] Repealed by 00-06-064, filed 3/1/00, effective 4/1/00. Statutory Authority: RCW 16.36.010(1), [16.36.]040 and [16.36.]080(4).

### **WAC 16-70-005 Definitions**

For the purpose of this chapter:

- (1) "Animal" means any animal species except fish and insects including all those so classified as wild, captive wild, exotic wild, alternative livestock, semidomesticated, domestic or farm.
- (2) "Domestic animal" means any farm animal raised for the production of food and fiber or companion animal or both.
- (3) "Farm animal" means any species which have normally and historically been kept and raised on farms in Washington, the United States, or elsewhere and used or intended for use as food, fiber, breeding, or draft and which may be legally kept for such use in Washington and are not those animals classified as wildlife or deleterious exotic wildlife under Title 77 RCW.
- (4) "Alternative livestock" means any species which can be kept or raised on farms and used or intended for use as food, fiber, breeding, or draft and which may be legally kept for use in Washington and are not those animals classified as wildlife or deleterious exotic wildlife under Title 77 RCW.

- (5) "Wild animal" means those species of the class Mammalia whose members exist in Washington in a wild state.
- (6) "Exotic wild animal" means those species of animals whose members do not exist in the state of Washington but exist elsewhere in the world in the wild state.
- (7) "OIE" means Office International des Epizooties.
- (8) "Veterinary laboratory" means a place equipped for performing diagnostic or investigative procedures on submitted specimens from animals and fish or their environment where the tests are conducted by personnel whose primary duties are to conduct such procedures.

[Statutory Authority: RCW 16.36.010(1), [16.36.]040 and [16.36.]080 (4). 00-06-064, § 16-70-005, filed 3/1/00, effective 4/1/00. Statutory Authority: RCW 16.36.096 and 16.36.040. 93-19-127 (Order 5011), § 16-70-005, filed 9/21/93, effective 10/22/93.]

## **WAC 16-70-010 Reporting diseases - Requirements**

- (1) Any person licensed to practice veterinary medicine in the state of Washington, veterinary laboratories, and others designated by statute shall report to the director the discovery of the existence or suspected existence among any animals within the state any of the reportable diseases as published by the director of agriculture. Case definitions shall conform to OIE standards under the OIE International Animal Health Code where a case means an individual animal affected by one of the infectious or parasitic diseases recognized by OIE, the criterion by which "affected" is defined and made clear in each instance (for example: Clinical signs, serological evidence, etc.). The OIE International Animal Health Code can be found on the internet under OIE-International Standards. The International Animal Health Code is available in web format or a hard copy version may be ordered from OIE. Exceptions to the above standards are as noted in subsection (3) of this section.
- (2) The following listed emergency diseases, suspected or confirmed, shall be reported immediately (by telephone or fax on day discovered) to the office of the state veterinarian whenever encountered among animals within the state:

**Table B1 - Foreign or eradicated diseases to be reported immediately**

<b>All suspected foreign or eradicated diseases including all of the following diseases:</b>
African Horse Sickness
African Swine Fever
Bovine Spongiform Encephalopathy (BSE)
Caprine and Ovine Brucellosis (excluding <i>Brucella ovis</i> )
Classical Swine Fever (Hog Cholera)
Contagious Bovine Pleuropneumonia

Contagious Equine Metritis
Contagious Agalactia
Contagious Caprine Pleuropneumonia
Dourine
Enterovirus Encephalomyelitis (exotic strains)
Epizootic Lymphangitis
Equine Piroplasmosis
Exotic (velogenic and mesogenic strains) Newcastle Disease
Foot and Mouth Disease (all types)
Glanders
Heartwater
Horse Pox
Japanese Encephalitis
Lumpy Skin Disease
Malignant Catarrhal Fever (foreign strain)
Nairobi Sheep Disease
Ovine Pulmonary Adenomatosis
Peste des Petits Ruminants
Rift Valley Fever
Rinderpest
Salmonellosis (Salmonella abortus ovis)
Screwworm
Sheep Pox and Goat Pox
Surra (Trypanosoma evansi)
Theileriosis (Theileria parva, T. annulata and other foreign species)
Trypanosomiasis (Trypanosoma congolense, T. vivax, T. brucei brucei)
Venezuelan Equine Encephalomyelitis
<b>In addition the following foreign fish diseases are reportable to the director through the director of the Washington department of fish and wildlife:</b>
Epizootic Hematopoietic Necrosis
Herpesvirosis of Salmonids (Onchorynchus Masou Virus Disease)
Spring Viremia of Carp
Viral Hemorrhagic Septicemia (European strain)



<b>The following domestic diseases are also reportable immediately:</b>
Anthrax
Fowl Plague (Highly Pathogenic Avian Influenza)
Rabies
Swine Vesicular Disease
Sylvatic plague
Vesicular stomatitis

- (3) The following listed diseases suspected or confirmed shall be reported the next working day, by telephone or fax to the office of the state veterinarian whenever encountered among animals within the state. Case definitions are as indicated for each disease.

**Table B2 - Suspected/confirmed diseases to be reported the next working day**

Brucellosis (positive serology, abortion, or bacterial culture)
Contagious Ecthyma (sheep, goats, llama, alpaca) (clinical signs or virus isolation)
Chronic Wasting Disease (Cervids) (clinical signs, histopathology, or chemical histopathology)
Equine Encephalitis EEE, WEE (horses) (clinical signs, histopathology, or positive serology with increasing titer)
Fowl Typhoid ( <i>Salmonella gallinarum</i> ) (bacterial culture and positive serology)
Infectious Coryza (poultry) (clinical signs, bacterial culture and positive serology)
Laryngotracheitis (poultry) (clinical signs, viral culture or positive serology)
Lyme Disease (any species) (clinical signs and positive serology)
Ornithosis or Psittacosis (all birds) (bacterial culture, positive serology, or other positive laboratory diagnostic tests)
Pullorum Disease ( <i>Salmonella pullorum</i> or typhoid) (bacterial culture and positive serology)
Potomac Horse Fever (horses) (clinical signs and positive serology)
Pseudorabies (swine) (positive serology)
Scrapie (sheep, goats) (clinical signs, histopathology, or chemical histopathology)
Tuberculosis (clinical signs, history of exposure, responder to tuberculin, granulomas submitted as possible tuberculosis lesions, acid fast organisms not identified as <i>Johne's</i> or benign types, bacterial culture positive for <i>M. tuberculosis</i> , <i>M. bovis</i> or <i>M. avium</i> in a mammal, or other laboratory tests diagnostic for <i>M. tuberculosis</i> , <i>M. bovis</i> or <i>M. avium</i> in a mammal)
Tularemia (sheep, dogs, cats, rabbits, wildlife) (clinical signs, serology or bacterial culture)

- (4) The following listed diseases are reportable monthly by the fifth working day of the month to the office of the state veterinarian when diagnosed in the previous month by any veterinary laboratory performing testing or diagnostic procedures on any animal

resident in the state of Washington. Only the first case of each individual disease diagnosed each month needs to be reported.

The diseases listed below with others listed in subsections (1) and (2) of this section will be reported on a qualitative basis each month to the National Animal Health Reporting System (NAHRS) by the state veterinarian.

**Table B3 - Diseases Reportable Monthly**

Anaplasmosis
Atrophic Rhinitis
Babesiosis
Bovine Genital Campylobacteriosis
Avian Infectious Bronchitis
Avian Tuberculosis
Caprine Arthritis/Encephalitis (CAE)
Cysticercosis
Dermatophilosis ( <i>Dermatophilus congolensis</i> ) cattle only
Duck Viral Enteritis
Duck Viral Hepatitis
Bluetongue
Echinococcosis/Hydatidosis
Enzootic Abortion of Ewes (Ovine Psittacosis, <i>Chlamydia psittaci</i> )
Enzootic Bovine Leukosis (BLV)
Equine Influenza (Virus Type A)
Equine Rhinopneumonitis (1 and 4)
Equine Viral Arteritis (EVA)
Fowl Cholera ( <i>Pasteurella multocida</i> )
Fowl Pox
Hemorrhagic Septicemia ( <i>Pasteurella multocida</i> )
Horse mange
Infectious Bursal Disease (Gumboro Disease)
Infectious Bovine Rhinotracheitis/Infectious Pustular Vulvovaginitis (IBR/IPV)
Infectious Hematopoietic Necrosis (to be reported by fish laboratories)
Leptospirosis
Maedi-Visna/Ovine Progressive Pneumonia

Marek's Disease
Mycoplasmosis ( <i>Mycoplasma gallisepticum</i> )
Ovine Epididymitis ( <i>Brucella ovis</i> )
Paratuberculosis (Johne's Disease)
Porcine Reproductive and Respiratory Syndrome (PRRS)
Transmissible Gastroenteritis (TGE)
Trichomoniasis
Q Fever ( <i>Coxiella burnetti</i> )

- (5) The following list of diseases suspected or confirmed by veterinarians or veterinary laboratories shall be reported if notified to do so by letter from the state veterinarian's office whenever encountered in any animals during the reporting month. These diseases are to be reported by the 10th day of the next month. The case definition will be supplied with notification of required reporting.

**Table B4 - Diseases to be reported upon notification by state veterinarian's office**

Anaplasmosis
Aleutian disease (mink)
Atrophic rhinitis
Blackleg
Bovine viral diarrhea
Botulism (horses, swine, mink)
Campylobacteriosis
Coccidiosis (clinical cases only)
Distemper (dogs, mink)
Edema disease of swine
Equine protozoal myeloencephalitis
Equine viral arteritis (abortion or respiratory)
Equine viral rhinopneumonia (abortion)
Erysipelas (swine)
Feline panleukopenia
Heartworm
Histoplasmosis
Influenza (swine) (horses)
Leptospirosis

Leukosis (cattle)
Leukemia (cats)
Listeriosis
Malignant edema (horses, cattle)
Malignant catarrhal fever (sheep)
Mycotic stomatitis
Infectious mastitis (cattle) (goats)
Newcastle disease (lentogenic or low pathogenic strain)
Paratuberculosis (Johne's disease, confirmed only)
Parvo and related viruses (dogs)
Salmonellosis (including paratyphoid and enteritidis in poultry typhimurium (DT 104), S. dublin and S. newport in cattle and any salmonella outbreaks in horses)
Scabies (swine and small animals) (nonotodectic)
Strangles (confirmed Strep. equi)
Tetanus (clostridium tetani) (horses) (sheep)
Transmissible mink encephalopathy
Toxoplasmosis
Transmissible gastroenteritis (TGE of swine)
Tuberculosis (dogs, cats)
Trichomoniasis

[Statutory Authority: RCW 16.36.010(1), [16.36.]040 and [16.36.]080 (4). 00-06-064, § 16-70-010, filed 3/1/00, effective 4/1/00. Statutory Authority: RCW 16.36.096 and 16.36.040. 93-19-127 (Order 5011), § 16-70-010, filed 9/21/93, effective 10/22/93; Order 1005, Regulations 1-3, filed 7/22/66, effective 8/22/66; Order 655, Regulation 1, effective 5/19/53.]

## **WAC 16-70-020 Reporting diseases - Not required, requested only**

The state veterinarian may request reports on any other diseases that concern the director from a statistical or survey standpoint associated with overall disease control measures. Any veterinarian may also voluntarily report any other diseases of this nature on the monthly disease report forms as he/she determines they are pertinent to the purposes of the department and advantageous to disease control in the state.

[Statutory Authority: RCW 16.36.096 and 16.36.040. 93-19-127 (Order 5011), § 16-70-020, filed 9/21/93, effective 10/22/93; Order 1005, Regulation 4, filed 7/22/66, effective 8/22/66.]

# Appendix C - Solid Waste Regulatory Citations

## WAC 173-350-040 Performance standards

The owner or operator of all solid waste facilities subject to this chapter shall:

- (1) Design, construct, operate, and close all facilities in a manner that does not pose a threat to human health or the environment;
- (2) Comply with chapter [90.48](#) RCW, Water pollution control and implementing regulations, including chapter [173-200](#) WAC, Water quality standards for ground waters of the state of Washington;
- (3) Conform to the approved local comprehensive solid waste management plan prepared in accordance with chapter [70.95](#) RCW, Solid waste management -- Reduction and recycling, and/or the local hazardous waste management plan prepared in accordance with chapter [70.105](#) RCW, Hazardous waste management;
- (4) Not cause any violation of emission standards or ambient air quality standards at the property boundary of any facility and comply with chapter [70.94](#) RCW, Washington Clean Air Act; and
- (5) Comply with all other applicable local, state, and federal laws and regulations.

[Statutory Authority: Chapter [70.95](#) RCW 03-03-043 (Order 99-24), § 173-350-040, filed 1/10/03, effective 2/10/03.]

## WAC 173-350-220 Composting facilities

### (1) *Composting facilities - Applicability.*

- (a) This section is applicable to all facilities or sites that treat solid waste by composting. This section is not applicable to:
  - (i) Composting used as a treatment for dangerous wastes regulated under chapter 173-303 WAC, Dangerous waste regulation;
  - (ii) Composting used as a treatment for petroleum contaminated soils regulated under WAC 173-350-320;
  - (iii) Treatment of liquid sewage sludge or biosolids in digesters at wastewater treatment facilities regulated under chapter 90.48 RCW, Water pollution control and chapter 70.95J RCW, Municipal sewage sludge -- Biosolids;
  - (iv) Treatment of other liquid solid wastes in digesters regulated under WAC 173-350-330; and
  - (v) Composting biosolids when permitted under chapter 173-308 WAC, Biosolids management.
- (b) In accordance with RCW 70.95.305, the operation of the following activities in this subsection are subject solely to the requirements of (c) of this subsection and are exempt from solid waste handling permitting. An owner or operator that does

not comply with the terms and conditions of (c) of this subsection is required to obtain a permit from the jurisdictional health department and shall comply with all other applicable requirements of this chapter. In addition, violations of the terms and conditions of (c) of this subsection may be subject to the penalty provisions of RCW 70.95.315.

- (i) Production of substrate used solely on-site to grow mushrooms;
  - (ii) Vermicomposting, when used to process Type 1, Type 2, or Type 3 feedstocks generated on-site;
  - (iii) Composting of Type 1 or Type 2 feedstocks with a volume limit of forty cubic yards of material on-site at any time. Material on-site includes feedstocks, partially composted feedstocks, and finished compost;
  - (iv) Composting of food waste generated on-site and composted in containers designed to prohibit vector attraction and prevent nuisance odor generation. Total volume of the containers shall be limited to ten cubic yards or less;
  - (v) Agricultural composting when all the agricultural wastes are generated on-site and all finished compost is used on-site;
  - (vi) Agricultural composting when any agricultural wastes are generated off-site, and all finished compost is used on-site, and total volume of material is limited to one thousand cubic yards on-site at any time. Material on-site includes feedstocks, partially composted feedstocks, and finished compost; and
  - (vii) Agricultural composting at registered dairies when the composting is a component of a fully certified dairy nutrient management plan as required by chapter 90.64 RCW, Dairy Nutrient Management Act.
  - (viii) Composting of Type 1 or Type 2 feedstocks when more than forty cubic yards and less than two hundred fifty cubic yards of material is on-site at any one time.
  - (ix) Agricultural composting, when any of the finished compost is distributed off-site and when it meets the following requirements:
    - (A) More than forty cubic yards, but less than one thousand cubic yards of agricultural waste is on-site at any time; and
    - (B) Agricultural composting is managed according to a farm management plan written in conjunction with a conservation district, a qualified engineer, or other agricultural professional able to certify that the plan meets applicable conservation practice standards in the *Washington Field Office Technical Guide* produced by the Natural Resources Conservation Service.
  - (x) Vermicomposting when used to process Type 1 or Type 2 feedstocks generated off-site. Total volume of materials is limited to one thousand cubic yards on-site at any one time.
- (c) Composting operations identified in subsection (b) shall be managed according to the following terms and conditions to maintain their exempt status:

- (i) Comply with the performance standards of WAC 173-350-040;
  - (ii) Protect surface water and ground water through the use of best management practices and all known available and reasonable methods of prevention, control, and treatment as appropriate. This includes, but is not limited to, setbacks from wells, surface waters, property lines, roads, public access areas, and site-specific setbacks when appropriate;
  - (iii) Control nuisance odors to prevent migration beyond property boundaries;
  - (iv) Manage the operation to prevent attraction of flies, rodents, and other vectors;
  - (v) Conduct an annual analysis, prepared in accordance with the requirements of subsection (4)(a)(viii) of this section, for composted material that is distributed off-site from categorically exempt facilities described in subsection (1)(b)(vii) through (ix) of this section.
  - (vi) Prepare and submit an annual report to the department and the jurisdictional health department by April 1st for categorically exempt facilities described in subsection (1)(b)(vii) through (ix) of this section. Annual reports are not required for facilities operating under the permit exemption provided in (b)(vii) of this subsection if the composted material is not distributed off-site. The annual report shall be on forms supplied by the department and shall detail facility activities during the previous calendar year and shall include the following information:
    - (A) Name and address of the facility;
    - (B) Calendar year covered by the report;
    - (C) Annual quantity and type of feedstocks received and compost produced, in tons;
    - (D) Annual quantity of composted material sold or distributed, in tons;
    - (E) Results of the annual analysis of composted material required by subsection (1)(c)(v) of this section; and
    - (F) Any additional information required by written notification of the department.
  - (vii) Allow the department or the jurisdictional health department to inspect the site at reasonable times;
  - (viii) For activities under (b)(viii) through (x) of this subsection, and registered dairies where compost is distributed off-site, the department and jurisdictional health department shall be notified in writing thirty days prior to beginning any composting activity. Notification shall include name of owner or operator, location of composting operation and identification of feedstocks.
- (2) *Composting facilities - Location standards.* There are no specific location standards for composting facilities subject to this chapter; however, composting facilities must meet the requirements provided under WAC 173-350-040(5).

- (3) *Composting facilities - Design standards.* The owner or operator of a composting facility shall prepare engineering reports/plans and specifications, including a construction quality assurance plan, to address the design standards of this subsection. Scale drawings of the facility including the location and size of feedstock and finished product storage areas, compost processing areas, fixed equipment, buildings, leachate collection devices, access roads and other appurtenant facilities; and design specifications for compost pads, storm water run-on prevention system, and leachate collection and conveyance systems shall be provided. All composting facilities shall be designed and constructed to meet the following requirements:
- (a) When necessary to provide public access, all-weather roads shall be provided from the public highway or roads to and within the compost facility and shall be designed and maintained to prevent traffic congestion, traffic hazards, dust and noise pollution;
  - (b) Composting facilities shall separate storm water from leachate by designing storm water run-on prevention systems, which may include covered areas (roofs), diversion swales, ditches or other designs to divert storm water from areas of feedstock preparation, active composting and curing;
  - (c) Composting facilities shall collect any leachate generated from areas of feedstock preparation, active composting and curing. The leachate shall be conveyed to a leachate holding pond, tank or other containment structure. The leachate holding structure shall be of adequate capacity to collect the amount of leachate generated, and the volume calculations shall be based on the facility design, monthly water balance, and precipitation data. Leachate holding ponds and tanks shall be designed according to the following:
    - (i) For leachate ponds at registered dairies, the design and installation shall meet Natural Resources Conservation Service standards for a waste storage facility in the *Washington Field Office Technical Guide*.
    - (ii) For leachate ponds at composting facilities other than registered dairies, the pond shall be designed to meet the following requirements:
      - (A) Have a liner consisting of a minimum 30-mil thickness geomembrane overlying a structurally stable foundation to support the liners and the contents of the impoundment. High density polyethylene geomembranes used as primary liners or leak detection liners shall be at least 60-mil thick to allow for proper welding. The jurisdictional health department may approve the use of alternative designs if the owner or operator can demonstrate during the permitting process that the proposed design will prevent migration of solid waste constituents or leachate into the ground or surface waters at least as effectively as the liners described in this subsection;
      - (B) Have dikes and slopes designed to maintain their structural integrity under conditions of a leaking liner and capable of withstanding erosion from wave action, overfilling, or precipitation;
      - (C) Have freeboard equal to or greater than eighteen inches to avoid overtopping from wave action, overfilling, or precipitation. The



jurisdictional health department may reduce the freeboard requirement provided that other engineering controls are in place which prevent overtopping. These engineering controls shall be specified during the permitting process;

- (D) Leachate ponds that have the potential to impound more than ten-acre feet (three million two hundred fifty-nine thousand gallons) of liquid measured from the top of the dike and which would be released by a failure of the containment dike shall be reviewed and approved by the dam safety section of the department.
- (iii) Tanks used to store leachate shall meet design standards in WAC 173-350-330 (3)(b).
- (d) Composting facilities shall be designed with process parameters and management procedures that promote an aerobic composting process. This requirement is not intended to mandate forced aeration or any other specific composting technology. This requirement is meant to ensure that compost facility designers take into account porosity, nutrient balance, pile oxygen, pile moisture, pile temperature, and retention time of composting when designing a facility.
- (e) Incoming feedstocks, active composting, and curing materials shall be placed on compost pads that meet the following requirements:
  - (i) All compost pads shall be curbed or graded in a manner to prevent ponding, run-on and runoff, and direct all leachate to collection devices. Design calculations shall be based upon the volume of water resulting from a twenty-five-year storm event as defined in WAC 173-350-100;
  - (ii) All compost pads shall be constructed over soils that are competent to support the weight of the pad and the proposed composting materials;
  - (iii) The entire surface area of the compost pad shall maintain its integrity under any machinery used for composting activities at the facility; and
  - (iv) The compost pad shall be constructed of materials such as concrete (with sealed joints), asphaltic concrete, or soil cement to prevent subsurface soil and ground water contamination;
  - (v) The jurisdictional health department may approve other materials for compost pad construction if the permit applicant is able to demonstrate that the compost pad will meet the requirements of this subsection.
- (4) *Composting facilities - Operating standards.* The owner or operator of a composting facility shall:
  - (a) Operate the facility to:
    - (i) Control dust, nuisance odors, and other contaminants to prevent migration of air contaminants beyond property boundaries;
    - (ii) Prevent the attraction of vectors;
    - (iii) Ensure that only feedstocks identified in the approved plan of operation are accepted at the facility;

- (iv) Ensure the facility operates under the supervision and control of a properly trained individual during all hours of operation, and access to the facility is restricted when the facility is closed;
- (v) Ensure facility employees are trained in appropriate facility operations, maintenance procedures, and safety and emergency procedures according to individual job duties and according to an approved plan of operation;
- (vi) Implement and document pathogen reduction activities when Type 2, 3 or 4 feedstocks are composted. Documentation shall include compost pile temperature and notation of turning as appropriate, based on the composting method used. Pathogen reduction activities shall at a minimum include the following:
  - (A) In vessel composting - the temperature of the active compost pile shall be maintained at fifty-five degrees Celsius (one hundred thirty-one degrees Fahrenheit) or higher for three days; or
  - (B) Aerated static pile - the temperature of the active compost pile shall be maintained at fifty-five degrees Celsius (one hundred thirty-one degrees Fahrenheit) or higher for three days; or
  - (C) Windrow composting - the temperature of the active compost pile shall be maintained at fifty-five degrees Celsius (one hundred thirty-one degrees Fahrenheit) or higher for fifteen days or longer. During the period when the compost is maintained at fifty-five degrees Celsius (one hundred thirty-one degrees Fahrenheit) or higher, there shall be a minimum of five turnings of the windrow; or
  - (D) An alternative method that can be demonstrated by the owner or operator to achieve an equivalent reduction of human pathogens;
- (vii) Monitor the composting process according to the plan of operation submitted during the permitting process. Monitoring shall include inspection of incoming loads of feedstocks and pathogen reduction requirements of (a)(vi) of this subsection; and
- (viii) Analyze composted material for:
  - (A) Metals in Table A at the minimum frequency listed in Table C. Compost facilities composting only Type 1 and Type 2 feedstocks are not required to test for molybdenum and selenium. Testing frequency is based on the feedstock type and the volume of feedstocks processed per year;
  - (B) Parameters in Table B at the minimum frequency listed in Table C. Testing frequency is based on the feedstock type and the volume of feedstocks processed per year;
  - (C) Nitrogen content at the minimum frequency listed in Table C; and
  - (D) Biological stability as outlined in United States Composting Council Test Methods for the Examination of Composting and Compost at the minimum frequency listed in Table C;

- (E) The jurisdictional health department may require testing of additional metal or contaminants, and/or modify the frequency of testing based on historical data for a particular facility, to appropriately evaluate the composted material.

**Table A - Metals**

<b>Metal</b>	<b>Limit (mg/kg dry weight)</b>
Arsenic	< = 20 ppm
Cadmium	< = 10 ppm
Copper	< = 750 ppm
Lead	< = 150 ppm
Mercury	< = 8 ppm
Molybdenum <sup>1</sup>	< = 9 ppm
Nickel	< = 210 ppm
Selenium <sup>1</sup>	< = 18 ppm
Zinc	< = 1400 ppm

<sup>1</sup>Not required for composted material made from Type 1, Type 2 or a mixture of Type 1 and Type 2 feedstocks.

**Table B - Other Testing Parameters**

<b>Parameter</b>	<b>Limit</b>
Manufactured Inerts	< 1 percent
Sharps	0
pH	5 - 10 (range)
Fecal Coliform	< 1,000 Most Probable Number per gram of total solids (dry weight)
Salmonella	< 3 Most Probable Number per 4 grams of total solids (dry weight)

**Table C - Frequency of Testing Based on Feedstocks Received**

<b>Feedstock Type</b>	<b>&lt; 5,000 cubic yards</b>	<b>= or &gt; 5,000 cubic yards</b>
Type 1 or Type 2	Once per year	Every 10,000 cubic yards or every six months whichever is more frequent
Type 3	Once per quarter (four times per year)	Every 5,000 cubic yards or every other month whichever is more frequent
Type 4	Every 1,000 cubic yards	Every 1,000 cubic yards or once per month whichever is more frequent

- (b) Inspect the facility to prevent malfunctions and deterioration, operator errors and discharges, which may cause or lead to the release of waste to the environment or a threat to human health. Inspections shall be conducted at least weekly, unless an alternate schedule is approved by the jurisdictional health department as part of the permitting process. For compost facilities with leachate holding ponds, conduct regular liner inspections at least once every five years, unless an alternate schedule is approved by the jurisdictional health department as part of the permitting process. The frequency of inspections shall be specified in the operations plan and shall be based on the type of liner, expected service life of the material, and the site-specific service conditions. The jurisdictional health department shall be given sufficient notice and have the opportunity to be present during liner inspections. An inspection log or summary shall be kept at the facility or other convenient location if permanent office facilities are not on-site, for at least five years from the date of inspection. Inspection records shall be available to the jurisdictional health department upon request.
- (c) Maintain daily operating records of the following:
  - (i) Temperatures and compost pile turnings for Type 2, Type 3, and Type 4 feedstocks;
  - (ii) Additional process monitoring data as prescribed in the plan of operation; and
  - (iii) Results of laboratory analyses for composted materials as required in (a)(viii) of this subsection. Facility inspection reports shall be maintained in the operating record. Significant deviations from the plan of operation shall be noted in the operating record. Records shall be kept for a minimum of five years and shall be available upon request by the jurisdictional health department.
- (d) Prepare and submit a copy of an annual report to the jurisdictional health department and the department by April 1st on forms supplied by the department. The annual report shall detail the facility's activities during the previous calendar year and shall include the following information:
  - (i) Name and address of the facility;
  - (ii) Calendar year covered by the report;
  - (iii) Annual quantity and type of feedstocks received and compost produced, in tons;
  - (iv) Annual quantity of composted material sold or distributed, in tons;
  - (v) Annual summary of laboratory analyses of composted material; and
  - (vi) Any additional information required by the jurisdictional health department as a condition of the permit.
- (e) Develop, keep and abide by a plan of operation approved as part of the permitting process. The plan of operation shall convey to site personnel the concept of operation intended by the designer. The plan of operation shall be available for inspection at the request of the jurisdictional health department. If necessary, the

plan shall be modified with the approval, or at the direction of the jurisdictional health department. Each plan of operation shall include the following:

- (i) List of feedstocks to be composted, including a general description of the source of feedstocks;
  - (ii) A description of how wastes are to be handled on-site during the facility's active life including:
    - (A) Acceptance criteria that will be applied to the feedstocks;
    - (B) Procedures for ensuring that only the waste described will be accepted;
    - (C) Procedures for handling unacceptable wastes;
    - (D) Mass balance calculations for feedstocks and amendments to determine an acceptable mix of materials for efficient decomposition;
    - (E) Material flow plan describing general procedures to manage all materials on-site from incoming feedstock to finished product;
    - (F) A description of equipment, including equipment to add water to compost as necessary;
    - (G) Process monitoring plan, including temperature, moisture, and porosity;
    - (H) Pathogen reduction plan for facilities that accept Type 2, Type 3, and Type 4 feedstocks;
    - (I) Sampling and analysis plan for the final product;
    - (J) Nuisance odor management plan (air quality control plan);
    - (K) Leachate management plan, including monthly water balance; and
    - (L) Storm water management plan;
  - (iii) A description of how equipment, structures and other systems are to be inspected and maintained, including the frequency of inspections and inspection logs;
  - (iv) A neighbor relations plan describing how the owner or operator will manage complaints;
  - (v) Safety, fire and emergency plans;
  - (vi) Forms for recordkeeping of daily weights or volumes of incoming feedstocks by type and finished compost product, and process monitoring results; and
  - (xvii) Other such details to demonstrate that the facility will be operated in accordance with this subsection and as required by the jurisdictional health department.
- (5) *Composting facilities - Ground water monitoring requirements.* There are no specific ground water monitoring requirements for composting facilities subject to this chapter; however, composting facilities must meet the requirements provided under WAC 173-350-040(5).

- (6) *Composting facilities - Closure requirements.* The owner or operator of a composting facility shall:
- (a) Notify the jurisdictional health department sixty days in advance of closure. At closure, all solid waste, including but not limited to, raw or partially composted feedstocks, and leachate from the facility shall be removed to another facility that conforms with the applicable regulations for handling the waste.
  - (b) Develop, keep and abide by a closure plan approved by the jurisdictional health department as part of the permitting process. At a minimum, the closure plan shall include methods of removing solid waste materials from the facility.
- (7) *Composting facilities - Financial assurance requirements.* There are no specific financial assurance requirements for composting facilities subject to this chapter; however, composting facilities must meet the requirements provided under WAC 173-350-040(5).
- (8) *Composting facilities - Permit application contents.* The owner or operator of a composting facility shall obtain a solid waste permit from the jurisdictional health department. All applications for permits shall be submitted in accordance with the procedures established in WAC. In addition to the requirements of WAC 173-350-710 and 173-350-715, each application for a permit shall contain:
- (a) Engineering reports/plans and specifications that address the design standards of subsection (3) of this section;
  - (b) A plan of operation meeting the requirements of subsection (4) of this section; and
  - (c) A closure plan meeting the requirements of subsection (6) of this section.
- (9) *Composting facilities - Construction records.* The owner or operator of a composting facility shall provide copies of the construction record drawings for engineered facilities at the site and a report documenting facility construction, including the results of observations and testing carried out as part of the construction quality assurance plan, to the jurisdictional health department and the department. Facilities shall not commence operation until the jurisdictional health department has determined that the construction was completed in accordance with the approved engineering report/plans and specifications and has approved the construction documentation in writing.
- (10) *Composting facilities - Designation of composted materials.* Composted materials meeting the limits for metals in Table A and the parameters of Table B of this section, and having a stability rating of very stable, stable, or moderately unstable as determined by the analysis required in subsection (4)(a)(viii)(D) of this section, shall no longer be considered a solid waste and shall no longer be subject to this chapter. Composted materials that do not meet these limits are still considered solid waste and are subject to management under chapter 70.95 RCW, Solid waste management -- Reduction and recycling.

[Statutory Authority: Chapter 70.95 RCW. 03-03-043 (Order 99-24), § 173-350-220, filed 1/10/03, effective 2/10/03.]

# Appendix D - Additional Resources

## *Basics of Composting*

Action On Waste: The Composting Process- Fundamental Principles (PDF)

[http://www.compost.org/pdf/sheet\\_1.PDF](http://www.compost.org/pdf/sheet_1.PDF)

NRAES Publications and Resources

<http://www.nraes.org/publications/composting.html>

## *Livestock Composting*

Minnesota Department of Agriculture - Composting Animal Mortalities (PDF)

<http://www.mda.state.mn.us/composting/compostguide.pdf>

University of Maryland - Composting Animal Mortalities on the Farm

<http://www.agnr.umd.edu/ces/pubs/pdf/FS717.pdf>

Clemson University Extension

[http://www.clemson.edu/camm/Camm\\_d/contents.htm](http://www.clemson.edu/camm/Camm_d/contents.htm)

Penn State - Composting Research and Cooperative Extension

<http://composting.cas.psu.edu/NatRendering.htm>

Cornell Waste Management Institute - Cornell Composting - The Science and Engineering of Composting

<http://compost.css.cornell.edu/science.html>

Ontario (Canada) Agriculture and Food - On-Farm Composting of Livestock and Poultry

<http://www.gov.on.ca/OMAFRA/english/livestock/deadstock/facts/03-083.htm>

Iowa State University - Composting Dead Livestock: A new solution to an old problem

<http://www.leopold.iastate.edu/pubs/other/files/SA8.pdf>

Saskatchewan Agriculture, Food, and Rural Revitalization - Composting Animal Mortalities

[http://www.agr.gov.sk.ca/docs/livestock/beef/production\\_information/CompostingAnimalMortalities.pdf](http://www.agr.gov.sk.ca/docs/livestock/beef/production_information/CompostingAnimalMortalities.pdf)

US Department of Agriculture - NRCS Practice Standards for Animal Mortality Facility, # 316

<http://efotg.nrcs.usda.gov/references/public/AL/tg316.pdf>

US Department of Agriculture – NRCS - Part 637, Environmental Engineering, National Engineering Handbook, Chapter 2-Composting

<http://www.info.usda.gov/CED/ftp/CED/neh637-ch02.pdf>

Colorado State University, Dairy Cow Necropsy Manual

<http://www.cvmb.colostate.edu/ilm/necropsy/notes/composting.htm>

Alberta (Canada) Department of Agriculture, Food, and Rural Development, On-Farm Composting: Animal Mortality Composting

[http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/sag2147](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag2147)

Iowa State University - Department of Agricultural and Biosystems Engineering

<http://www.abe.iastate.edu/cattlecomposting/overview.asp>

## *Cattle Composting*

Iowa State University - Department of Agricultural and Biosystems Engineering - Draft Guidelines for Emergency Composting of Cattle Mortalities

[http://www.abe.iastate.edu/cattlecomposting/guidelines/Guidelines%20for%20Emergency%20Cattle%20Composting3\\_2.pdf](http://www.abe.iastate.edu/cattlecomposting/guidelines/Guidelines%20for%20Emergency%20Cattle%20Composting3_2.pdf)

On-Farm Disposal of Large Dead Stock in Manitoba (Canada) (PDF)

<http://www.gov.mb.ca/conservation/regoperations/livestock/pdf/large-carcass-composting-fs.pdf>