Cornell Waste Management Institute

Department of Crop & Soil Sciences Rice Hall • Ithaca, NY 14853 (607)255-1187
http://cwmi.css.cornell.edu E-Mail: cwmi@cornell.edu

Natural Rendering: Composting Livestock Mortality and Butcher Waste

On-Farm Mortality - Current Situation

Until recently rendering plants have offered prompt, reasonably priced pickup of dead livestock at the farm. However, recent declines in prices of hides, tallow, meat and bone meal and the other useful commodities produced from animal carcasses have curtailed many rendering operations. In 2002, remaining plants are charging up to $70 for cows, $60 for pigs and $200 per horse to pickup animal carcasses from farms in their area. As a result, many livestock farms no longer have affordable access to rendering service.

Many livestock producers are unsure of what they should or could be doing to properly dispose of the occasional animal carcass. Brief anonymous surveys conducted in western New York and northern Pennsylvania reveal a widespread practice of improper mortality disposal. Animal carcasses left to decay naturally above ground or buried in shallow pits pose risks to surface and groundwater and endanger the health of domestic livestock, wildlife and pets. Likewise, land spreading of farm hospital pen wastes and fetal membranes may have implications for the biosecurity of the herd.

Natural Rendering Fact Sheets:

- **Composting Livestock Mortality and Butcher Waste** *(2002) - Jean Bonhotal (CWMI), Lee Telega (PRO-DAIRY), Joan Petzen (CCE Allegany/Cattaraugus)*
- **Composting Road Kill** *(2007) - Jean Bonhotal, Ellen Harrison, Mary Schwarz (CWMI)*
- **Composting Poultry Mortality** *(2008) - Jean Bonhotal, Mary Schwarz (CWMI), Nellie Brown (Cornell ILR)*

In the year 2001, there were 670,000 milk cows and 80,000 beef cows in New York State (Source: NYS Agriculture Statistic Service, www.nass.usda.gov/ny). With a typical death loss in dairy herds of two percent each year and beef herds of one-half percent per year, and a disposal cost of $30-70 per head, the state's livestock producers could save over half a million dollars with an easily managed, low cost mortality disposal alternative.

Butcher Residuals - Current Situation

In many rural communities, the custom butcher business is important to the survival of small farm operations that raise livestock. These businesses provide a critical service by processing farm-raised animals into a salable retail product — table-ready meat. Most small livestock farms sell their products directly to consumers. It would be very costly for them to operate their own slaughter and butchering facilities.

Butchers, in 2002, are paying $20 per barrel for disposal of residuals. Since slaughtered cattle generally yield 40% in retail cut, the processing of a 1,200 pound steer would produce approximately 720 pounds of non-retail residuals. This equals 1.5-2 barrels or $30-$40 in disposal fees after the brains, spinal cord and paunch manure are removed. With 400 butchers in New York State each processing an average of 600 beef cattle per year, the average cost to each operation is $18,000 to $24,000 a year in disposal fees. Total cost to the custom butcher industry for beef slaughter residuals alone would be approximately $10 million

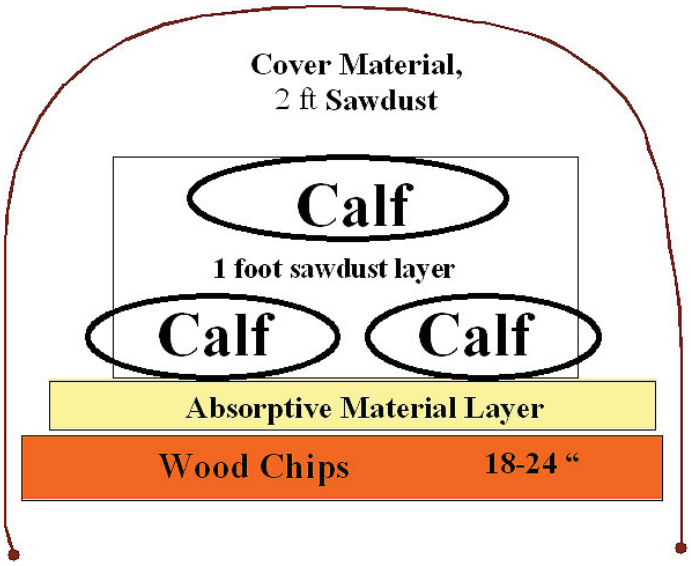
A 20-minute video (NRAES #163) complements this fact sheet and is available from NRAES.Contact: NRAES@cornell.edu or (607)255-7654.

Funded in part by: Empire State Development, American Association of Meat Processors and Cornell Cooperative Extension

for disposal of 58,000 tons of butcher waste. Many butchers also process other species, including ostrich, deer, goats, sheep and hogs. These residuals must also be disposed of and are not accepted for rendering. Blood is not generally collected from smaller operations even if they have rendering services available. Much of it is poured on the ground or buried. This practice can cause biosecurity problems, attract animals and potentially pollute ground and surface water.

The Need: Consider Composting

The livestock and custom butcher industries need a convenient, socially and environmentally acceptable, biosecure way of disposing carcasses and butchering residuals. Landfills generally will not accept residuals or carcasses. The livestock farmer and custom butcher find themselves, in many cases, without disposal services or facing high disposal fees. Most people don't realize that composting is a legal and acceptable way of disposing these materials. They fear that if regulators find out, they may be cited and fined. Regulators, on the other hand, fear that with the current disposal situation, farmers and butchers may cause serious problems with improper disposal. Composting can be accomplished in compliance with environmental regulations in many states, but check regulations before you start.



J. Craig Williams, Penn State Cooperative Extension
Lee Telega, PRO-DAIRY, Cornell University

Why Farms and Butchers Should Compost Mortality and Residuals

- Pathogen kill occurs in thermophilic composts
- Can be done any time of the year, even when the ground is frozen
- Can be done with equipment available on most farms
- Relatively odor free
- All sizes of animals can be composted
- Placental membranes and other tissue can be composted
- Paunch manure and other parts not accepted in rendering will compost
- Relatively low labor and management needed
- Low cost

Composting provides an inexpensive alternative for disposal of all dead animals, butcher wastes and other biological residuals. The temperatures achieved during composting will kill or greatly reduce most pathogens, reducing the chance to spread disease. Properly composted material is environmentally safe and a valuable soil amendment for growing certain crops.

Composting animal carcasses is not new. Chickens, pigs, calves and occasional larger animals are composted. Ohio, Utah and Maryland have written resources and Maryland has a video on chicken carcass composting. Little information, however, is available to guide farmers that want to compost adult cattle or butcher residuals.

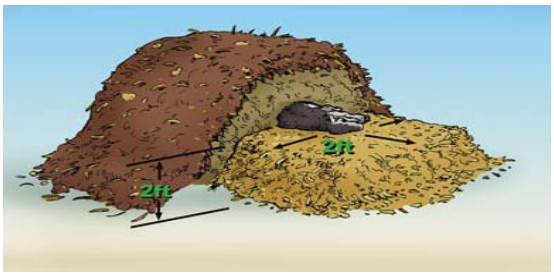
Composting

Static pile composting of dead, intact, fully-grown livestock and calves, aborted fetuses, placental membranes and butcher residuals is a practice that can fit into the management of livestock farms and butcher operations. The practice does require space on your land to construct the compost piles and takes from two to six months for the animal to decompose. Composting provides an inexpensive alternative for disposal of animal-based wastes.

Potential Environmental and Biosecurity Risk of Dead Animal Disposal

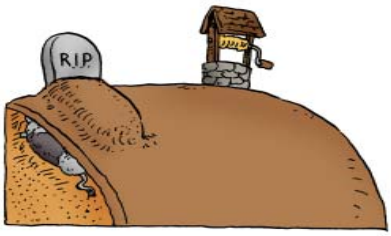
Lowest Risk

Picked up by rendering company within 48 hours after death or properly composted on the farm.



Buried 6-ft deep in appropriate soils and buried more than 200 feet from a water body, watercourse, well or spring**.**

Partially buried less than 6-ft deep or buried closer than 200 feet from a water body, watercourse, well or spring.



Highest Risk

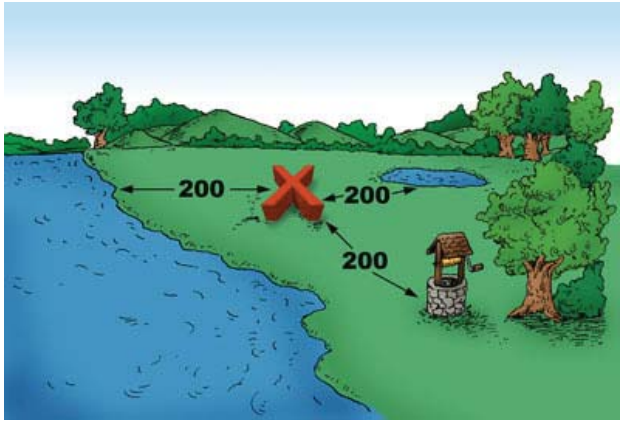
Carcass is left outside for scavengers or to decay. Because of the cost of disposal, it will be tempting to dispose of carcasses by leaving them exposed in a woodlot to be scavanged. This is very risky from an environmental standpoint and that of disease transmission on your farm.

From New York State Agriculture Environmental Management (AEM) Tier II Worksheet on Farm Waste Disposal, Revised September 2000.

Caution

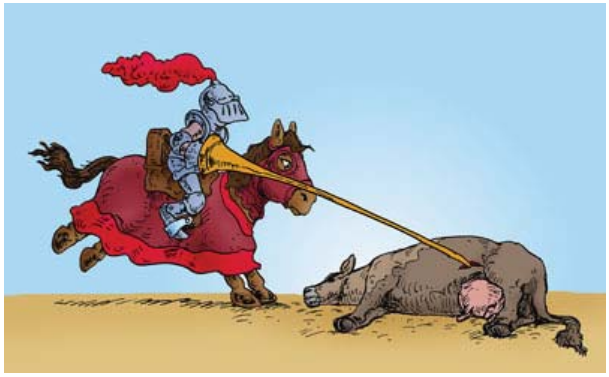
Animals showing signs of a neurological disease must be reported to authorities and disposed of in the manner they recommend. It is not clear whether prions, the agent that causes Bovine Spongiform Encephalitis (Mad Cow Disease), would be destroyed in the composting process. Animals that show signs of a neurological disease should not be composted. Animals under quarantine that die and those with anthrax should not be composted.

Key Points of Static Pile Carcass Composting



- Select site that is well drained, at least 200 feet from water courses, sinkholes, seasonal seeps or other landscape features that indicate the area is hydrologically sensitive.

- Lay 24-inch bed of bulky, absorbent organic material containing sizeable pieces 4-6 inches long. Utility and municipal wood chips work well. Ensure the base is large enough to allow for 2-foot clearance around the carcass.



- Lay animal in the center of the bed. Lance the rumen to avoid bloating and possible explosion. Explosive release of gases can result in odor problems and it will blow the cover material off the composting carcass.

- Cover carcass with dry, high-carbon material, old silage, sawdust or dry stall bedding (some semi-solid manure will expedite the process).

Covering a cow on a farm in Lewis County, NY.

- For young animals, layer mortalities with a minimum of 2 feet of carbon material between layers.

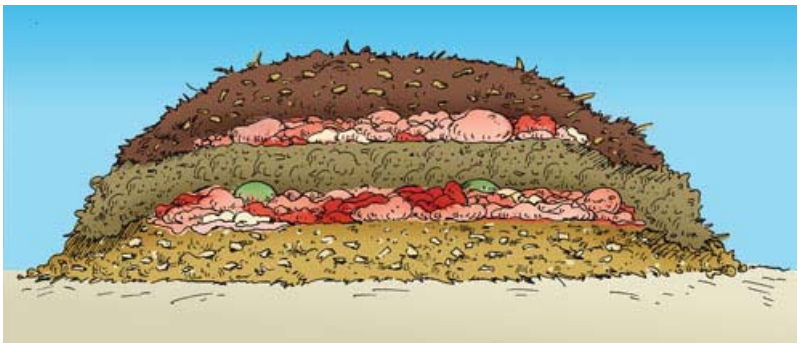
- Let sit for 4-6 months, then check to see if carcass is fully degraded.
- Reuse the composted material for another carcass compost pile, or remove large bones and land apply (see Use of Finished Product and Bones section, page 8). Site cleanliness is the most important aspect of composting, it deters scavengers, and helps control odors and keeps good neighbor relations.

Turning Note

Carcass and butcher residual piles should not be turned early in the process unless there are no neighbors that would be affected. Odor is a big issue most of the time. After 3 months, turning is an option and will speed the curing process.

Key Points of Static Pile Butcher Residual Composting

- Select site that is well drained, at least 200 feet from water courses, sinkholes, seasonal seeps or other landscape features that indicate the area is hydrologically sensitive.
- Lay a 24-inch deep bed of coarse wood chips 10-12-feet wide and as long as space permits to allow for 1-2 months of butcher residual.
- Spread a 12-15-inch layer of residuals then cover with a 12-18 inch layer of wood chips and add another layer of butcher residuals and cover with 2 feet of wood chips. The finished section should be 5-6 feet high.



Composting liquids at Intervale Compost, Burlington, VT.

- When incorporating large amounts of blood, make sure there is plenty of material to absorb the liquid. Make a depression so blood can be absorbed and then cover, if a blood spill occurs, scrape it up and put back in pile.

- Make sure all residuals are well covered to keep odors down, generate heat or keep vermin or other unwanted animals out of the windrow.

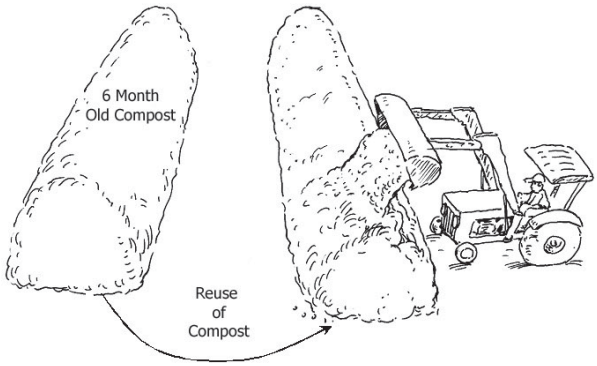
A composted Northern Right Whale at the Paleontological Research Institute, Ithaca, NY.

- Let sit for 4-6 months, then check to see if the offal is degraded.
- Remove large bones before land applying compost or use as part of the base for the next compost pile.
- Site cleanliness is the most important aspect of composting, it deters scavengers, helps control odors, and keeps good neighbor relations.

Monitoring Compost Piles or Windrows

A log of temperature, odor, vectors (any unwanted animals), leachate (liquid that comes out of the pile), spills and other unexpected events should be kept as a record of the process. This will allow the composter to see if sufficiently high temperatures were reached and adjust the process if there is any problem. Also, odor can be an issue and compost piles are an easy target for complaints. When there is an odor problem, a compost pile may be blamed and may not be the cause.

Monitoring of the pile is done mostly by checking temperatures. Internal compost pile temperatures affect the rate of decomposition as well as the destruction of pathogenic bacteria, fungi and some seeds. The most efficient temperature range for composting is between 104^0F and 140^0F (40^0C and 60^0C). Compost pile temperatures depend on how much of the heat produced by the microorganisms is lost through aeration or surface cooling. During periods of extremely cold weather, piles may need to be larger than usual to minimize surface cooling. As decomposition slows, temperatures will gradually drop and remain within a few degrees of ambient air temperature. Temperature monitoring is crucial for managing the compost process. Thermometers with a 3-4 foot probe are available (see Thermometer Sources, page 10).



Pathogen Control

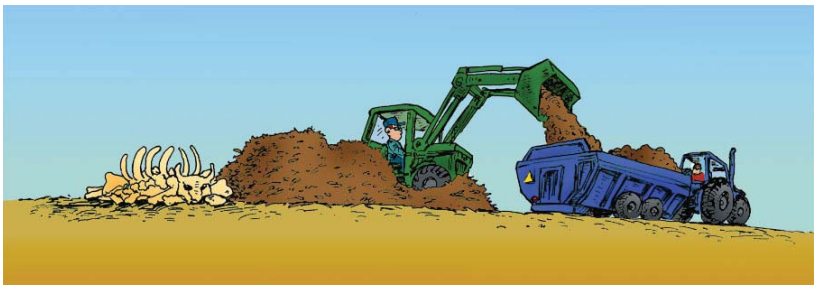
Pathogens are organisms that have the potential to cause disease. There is a wide array of pathogens found in our environment and pathogens may be elevated in compost operations. While there are currently no temperature regulations for mortality and butcher residual composting, following NYS DEC regulations currently applicable for biosolids is highly recommended to ensure adequate pathogen control and minimization in this type of composting.

If using an aerated static pile, the pile must be insulated (covered with a layer of bulking material or finished compost) and a temperature of not less than 131^0F (55^0C) must be maintained throughout the pile for at least 3 consecutive days, monitored 6-8 inches from the top of the pile.

Very little work has been done on documenting pathogen kill in composting of dead animals and butcher residual. Research at Ohio State University suggests that common bacterial and viral pathogens are killed in regularly turned compost piles

Windrows at Cornell University's composting site.

containing carcasses. Static-pile composting is being recommended as a more easily managed mortality composting technique. By properly constructing the compost pile to allow for adequate natural aeration, mortality composting can be completed on intact animals without physically turning and mechanically aerating the pile. Degree and duration of temperatures achieved in static-pile composting are adequate to significantly reduce pathogen survival. Compost amendment variables, temperature and pathogen kill in static compost piles are currently being investigated.



Use of Finished Product and Bones

It is recommended to reuse finished compost as the base for the next pile. The remaining bones add structure to the base material for improved aeration. The composted material can also be used on hay, corn, winter wheat, tree plantations and forestland. Applying this compost to "table-top" crops directly consumed by people is not recommended at this time. In the future, testing and quality assurance standards may enable expanded uses or sale of the finished compost product. Nutrients in carcass and butcher residue composts are higher in N, P and K than compost containing only plant material, giving it more fertilizer value on and off farms.

When animal carcasses or butcher waste is composted, the large bones do not completely break down. Bones from immature animals degrade very quickly, but bones from mature animals take several seasons to breakdown. After the material is composted, bones can be reused as part of the base for the next compost pile. The bones that did not completely break down will add structure to the pile. Bones can be buried or disposed of in bone piles. Animal in the wild eat bones to meet calcium requirements.

When spreading the composted material, the bones can be removed and put in a hedgerow or forested land. Because they contain phosphorus and calcium, rodents will eat them; the smaller bones can be land spread and will disappear quickly. Smaller bones can be land spread, but large bones may splinter and can puncture tires. Also, avoid leaving skulls in the fields. Neighbors and the passing public may not fully understand the sight of a skull in the fields!

Economics of Mortality Disposal Options

Pick-up

Where available, the fee for pickup of dead animals ranges from $25-70/cow, $60/pig, $200/horse. Some species are not accepted at all in rendering.

Burying

A Pennsylvania survey reports backhoe and loader rentals cost approximately $43.50 per hour. If we use one hour of labor at $10.00 per hour and about

A Butcher's Experience

When we started three years ago I was just doing deer bones. I didn't have enough wood chips and was mixing it on a 1:1 ratio. This was not enough to properly break down the bones. I also was dumping a barrel or two at a time and covering that with wood chips without mixing. This has created some pockets in my piles. Since the first year, I now dump my barrels in a line at the end of my working row. Then I dump wood chips on top of the bones. Then I push the mixture into the row and cap it with a good layer of chips (12 to18"). If I get any odor or uncovering from animals (vultures are a problem), then I will recap as needed. I let the rows stand for about six months then I turn them with our front-end loader. I usually have to recap for the first turn to keep the smell down and control flies. I also now mix in blood, hair, feathers and barn waste.

Source: Jeff Bringhurst, Bringhurst Meats, Inc., Berlin, NJ.

0.6 gallons of fuel at $1.50 per gallon, the total cost for burial of a large carcass would be $54.40. Though carcass burial is permitted in New York, some states have outlawed the practice citing potential groundwater contamination. Burial at the recommended depth is also impractical in areas of shallow bedrock and when soils are deeply frozen.

Composting

The amount of carbon material (i.e., wood chips, sawdust, etc.) required to compost a full-grown cow is 12 cubic yards. Many of these materials can be used more than one time. Example: incorporating the residual bones and chips into the next season's base material.

Presently, wood mulch is selling at about $550 per tractor trailer load, or $5.50 per cubic yard. The cost per carcass for the five cubic yard base would be $33. If we assume reuse of the composted material from other piles and a 30% loss of material during composting, the cost for the base would be $9.90 per carcass. The remainder would be used as cover on a new base of wood chips and mulch. Kiln-dried sawdust is selling for $550 per load, or $4.50 per cubic yard. If we used six cubic yards the cost would be $27. With a 30% loss of material during the process, the cost per carcass would be $8.10. The total cost of material per carcass would be $18.

If we estimate 30 minutes for preparation and covering, the cost for labor would be $5; fuel for a 100 hp tractor at 0.4 gallons or $0.60. Tractor and loader rental in the northeast as reported by Doanes is $28 per hour. The total cost for the material, equipment, fuel and labor would be $37.60 per large carcass.

As you can see, the cost of death is expensive in more ways than one.

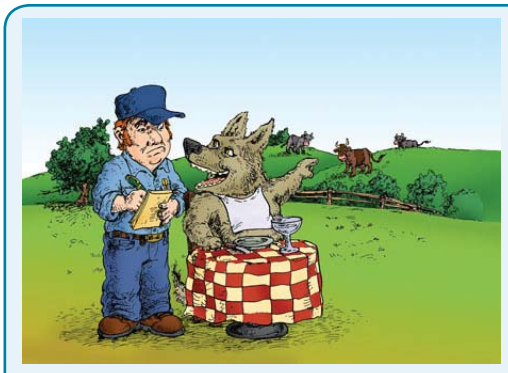
Economics of Butcher Residual Disposal Options

Composting

The amount of carbon material (i.e., wood chips, sawdust, etc.) required to compost one ton of butcher waste is 15 cubic yards. Many of these materials can be used more than one time. Example: incorporating the residual bones and chips into the next season's base material.

Presently, wood chips selling for about $550 per tractor-trailer load, or $5.50 per cubic yard. The cost per ton for the eight cubic yard base would be $44. Seven yards of cover material if purchased will be $38.50. With a 30% loss of material during the process, the cost per ton would be $24.75.

If we calculate 30 minutes for preparation and covering, the cost for labor would be $5; fuel for a 100 hp tractor at 0.4 gallons or $0.60. Tractor and loader rental in the northeast as reported by Doanes is $28 per hour. The total cost for the material, equipment, fuel and labor would be $44.35 per ton.



Waiter I'll Have Another**!**

I was explaining the benefits of large animal composting to a couple of area farmers and they informed me that they had no problem disposing of dead cows. "All we have to do is drag them up back and within three or four days the coyotes have them mostly cleaned up."

In conversations with other folks over the next few months, I found some avid coyote hunters who claimed to have killed the largest coyote they had ever seen. The pasture season was soon upon us and cows dotted the landscape, that's when the call came in. The dairyman was wondering how he could get compensation for the loss of a newborn calf killed, in the night, by (you guessed it) coyotes. This led me to question the process by which we feed the coyotes, to grow larger coyotes. We may be inviting coyotes to dine on more than just our mortality!

Source: Tom Parmeter, Cornell Cooperative Extension of Cattaraugus County.

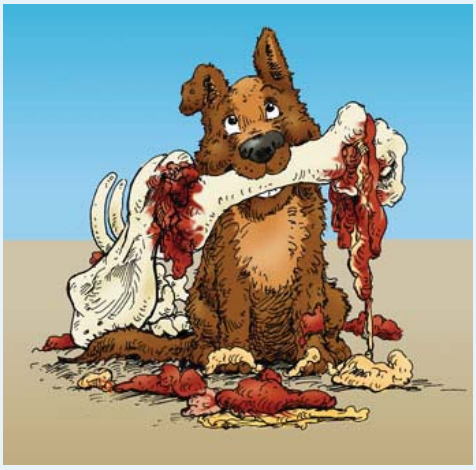
Troubleshooting Table

Symptoms	Problems	Recommendations
Pile fails to reach temperature.	Material is dense. Not enough air circulation.	Rebuild pile with more chunky carbon. *If it is in an odor sensitive area and can not move pile, let process run its course and turn in 4-6 months.
	Pile too small.	To heat, pile needs to be greater than 4'x4'x4'.
	In winter, too much ice in pile.	Keep ice out of pile. Add warm manure and cover.
Insect and animal attracted to pile.	Meat waste not covered well.	Cover carcass or residual well with carbon.
	Leachate puddling on pad surface.	Pad should have 1-2% slope and fill holes in to avoid standing water.
High pathogens.	Need to insure biosecurity at facility.	After 4-6 months of composting, turn pile for 2-3 weeks make sure temperatures are between 104°-140°F (40-60°C).
Carcass uncovered.	May not have lanced rumen or other large organs resulting in carbon being thrown off the pile.	Lance large organs before animal is put into pile.
Standing water/surface ponding.	Inadequate slope.	Establish 1-2% slope with proper grading.
	Improper windrow/pile alignment.	Improve drainage, add absorbent. Run windrows/piles down slope, not across.
	Depression in high traffic areas.	Fill and grade.

Doggie Story

The kitchen phone was ringing as I kicked my boots off in the mud porch. I had finished chores a bit early on a rather warm Indian-summer evening. On the phone was our neighbor, Patsy. She politely asked if I would be so kind to come over to her house and help clean up after her dogs. Earlier that afternoon, her two border collies had drug home a good portion of a dead heifer that I had hauled off to the back woods several days ago. To keep the dogs from continuing to chew on the carcass, she had locked them on her enclosed porch. Besides the decomposing and mangled carcass, the smell of the diarrhea caused by the dogs eating the rotting meat made cleaning up all the more memorable.

Source: A farming experience, Lee Telega.



Suppliers - Temperature Probes

Meriden Cooper Corporation, Meriden, CT 06450, 203-237-8448 • **Morgan Scientific,** Haverill, MA 01832, 508-521-4440 • **Omega Engineering, Inc.,** Stanford, CT 06907, 203-359-1660 • **Reotemp Instruments,** Strong, ME 04983, 800-648-7737 • **Spectrum Technologies,** Plainfield, IL 60544, 800-248-8873 • **Trend Instruments,** Westchester, PA 19380, 800-431-0002

Other University Resources (links last visited November 2008)

Cooperative Extension System -

http://www.extension.org/pages/Managing_Livestock_and_Poultry_Mortalities

Cornell University - http://cwmi.css.cornell.edu

http://cwmi.css.cornell.edu/Composting.htm

Iowa State University - http://www.ag.iastate.edu/

http://www3.abe.iastate.edu/cattlecomposting/

Michigan State University - http://www.msu.edu/%7erozeboom/catrn.html

Ohio State University - http://www.oardc.ohio-state.edu/fabe/composting.htm

http://ohioline.osu.edu/aex-fact/0711.html
http://ohioline.osu.edu/aex-fact/0712.html
http://ohioline.osu.edu/aex-fact/0713.html

Penn State - http://composting.cas.psu.edu/

Purdue University - http://www.ces.purdue.edu/pork/

Texas A&M University - http://tammi.tamu.edu/research.html

University of Maryland - http://www.agnr.umd.edu/MCE/

http://pubs.agnr.umd.edu/Category.cfm?ID=C#subCat18

University of Minnesota - http://www.ansci.umn.edu/poultry/resources/mortality.htm

University of Nebraska - http://water.unl.edu/manure

University of Wisconsin Extension - http://cdp.wisc.edu/Other.htm

Utah State Extension - http://extension.usu.edu/waterquality/files/uploads/PDF/ag507.pdf

Virginia Tech - http://www.ext.vt.edu/pubs/poultry/442-037/442-037.html

Washington State University - http://organic.tfrec.wsu.edu/compost/ImagesWeb/CompSys.html

A Whale of a Tale!

In 1999, a Northern Right Whale in the North Atlantic became severely entangled in fishing equipment. About six months later the whale was found dead off the coast of New Jersey. The US Coast Guard hauled the 30,000 pound whale to shore. Since there are only approximately 300 individuals left, a call went out to museums to see if there was interest to preserve the whale in some way. The Paleontological Research Institute (PRI) in Ithaca, NY said they would take it. They cut some of the flesh and blubber off the carcass and hauled it on a flat bed truck to Ithaca. Behind PRI, next to the Cayuga Medical Center, the whale was laid in a large bed of horse manure and completely covered and left to compost in a large pile. The pile was left for six months (October-April) and gently uncovered so the bones could be tagged and turned by hand. The bones, bits of flesh and skin were again covered and left until October. With many volunteers, the bones were cleaned and weighed and ready to be assembled. If you are ever in Ithaca, come to PRI and visit the whale skeleton that was composted on their site. (Note: in one year the bones actually showed signs of pitting and degradation, for preservation purposes it could have come out of the pile a bit sooner.)

Source: Jean Bonhotal, Cornell Waste Management Institute.

References

Andrew, Neil. 1999. On Farm Composting of Large Animal Carcasses. Unpublished fact sheet. William H. Miner Agricultural Research Institute, Chazy, NY.

Fulhage, Charles D. 2001. Management of Livestock Mortalities Through Composting. International Symposium Addressing Animal Production and Environmental Issues. National Center for Manure and Animal Waste Management. North Carolina State University, Raleigh, NC.

Gulliver, Jeff and Darcy. On-site Composting of Meat By-products. 2001. Prepared for New York State Department of Economic Development, Empire State Development Corporation, Environmental Management Investment Group, Environmental Investment Program: Contract # 999055.

Jerose, Brian, and Kelly Sevier. 2001. Composting Information Sheet: Meat Scraps, Slaughterhouse Waste and Animal Mortalities. Obtaining Your Feedstocks, Equipment Handling, Windrow Construction, Site Selection, Regulations, Making Your Compost Mix, End uses of Compost, Sampling, Monitoring and Testing. Environmental Fertilization Corp.

Keener, H.M., D.L. Elwell, M.J. Monnin. 2000. Procedures and Equations for Sizing of Structures and Windrows for Composting Animal Mortalities. Applied Engineering in Agriculture 16(6):681-692.

Natural Resources Conservation Service, U.S. Dept. of Agriculture. 1996. Agricultural Waste Management Field Handbook, Part 651: Agricultural Waste Management System Component Design. Chapter 10:10-59.

NYS Agricultural Environmental Management Program. 2000. Tier II Worksheet on Farm Waste Disposal, Revised September 2000.

NYS Consolidated Laws. Agriculture and Markets. “Disposal of Dead Animals,”Article 26 sec. 377.

Sherman-Huntoon, Rhonda. 2000. Composting Animal Mortalities in North Carolina. BioCycle 41(12):57-59.

Trinca, Lydia A., Bruce Miller and F. Richard Beard. 1999. Bovine Mortality Composting in Northern Utah. Presented at 1999 ASAE/CSAE-SCGR Annual International Meeting, Toronto. July 18-21, 1999.

Vidussi, Federica and Robert Rynk. 2001. Alternatives to Rendering: Meat By-products as Composting Feedstocks. BioCycle 42(3):71-74.

Special Thanks to Contributors and Supporters

Gary Tennant - Director of Cornell Farm Services, for his continued desire to experiment
Thomas Eddy - Cornell’s Animal Science Teaching and Research Center
William Van Loo - Senior Extension Educator, St. Lawrence County
Jim Ochterski - Senior Extension Resource Educator, Schuyler County
Steve Buckley - Extension Associate, Tompkins County
North Country Agricultural Development Project
Empire State Development, Environmental Services Unit, Environment Investment Program
American Association of Meat Processors
Cornell Cooperative Extension, Office of Director
Bill Davis - Artbear Pigmation Inc., for fabulous illustrations
Karen Holcomb - Department of Animal Science, Cornell University, for layout

Printed on recycled paper using vegetable-based inks. *© 2002 Cornell University.*
Updated 2003. Updated 2006. Updated 2008.