KANSAS DEPARTMENT OF HEALTH & ENVIRONMENT
BUREAU OF WASTE MANAGEMENT

Composting at Livestock Facilities

Introduction

Composting manure and livestock mortalities is a method of waste disposal that provides many benefits when compared to other waste disposal options such as land application, rendering, incineration, or burial. The number of poultry and livestock production operations that use composting has increased greatly in recent years. An advantage of composting is the ability of a producer to process wastes immediately. Manure can be incorporated into the composting process under adverse weather conditions that would make land application with incorporation of manure difficult. Livestock mortalities can be composted during periods when the ground is frozen and burial would be difficult. Also, since a waiting period for the rendering service is not necessary, the potential for disease transmission, air and water pollution, and the attraction of insects and scavenging animals is greatly reduced.

The economics of composting can also be very attractive. Composting can usually be accomplished with a minimum of new investment due to the equipment and management know-how that are already available at agricultural facilities.

Some advantages of composting are as follows:

- Relatively inexpensive
- Efficient recycling method for manure and livestock mortalities
- Greatly reduced volume and weight of waste material
- Reduced disease and odor problems
- Reduced risk of polluted precipitation runoff
- Final product may be reapplied to land or sold

Kansas Department of Health and Environment

Kansas Dept. of Health & Environment - Bureau of Waste Management
1000 SW Jackson, Suite 320
Topeka, KS 66612-1366
Phone: 785-296-1600 Fax: 785-296-8909
www.kdhe.state.ks.us/waste

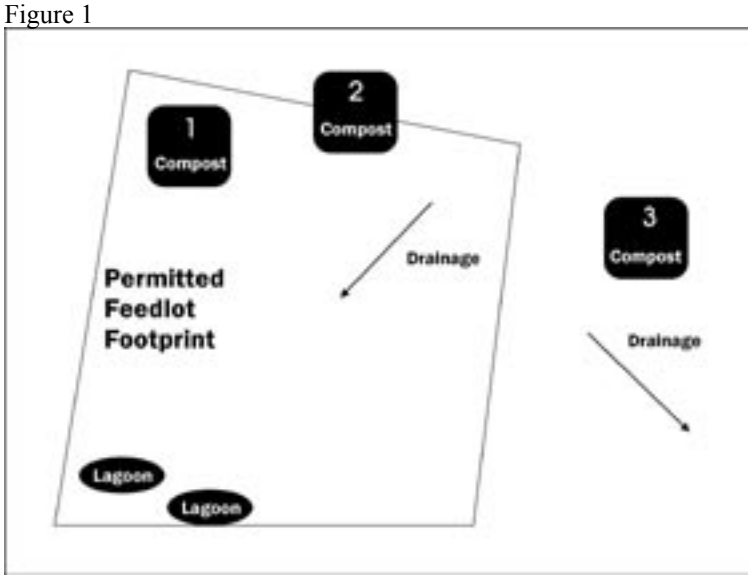
Composting at a Confined Feeding Facility

If you currently have a KDHE Livestock Waste Management Permit and wish to begin composting, you may be required to modify the permit. If the compost area is located within the permitted drainage area (as shown in areas 1 & 2), KDHE Livestock Waste Management District Staff should be contacted for assistance (see map below). If the compost area is located outside the drainage area (as shown in area 3) or you do not have a KDHE Livestock Waste Management Permit, KDHE Bureau of Waste Management District Staff should be contacted for assistance. Prior to initiating the composting operation, please contact the appropriate KDHE District Office Staff in your area.

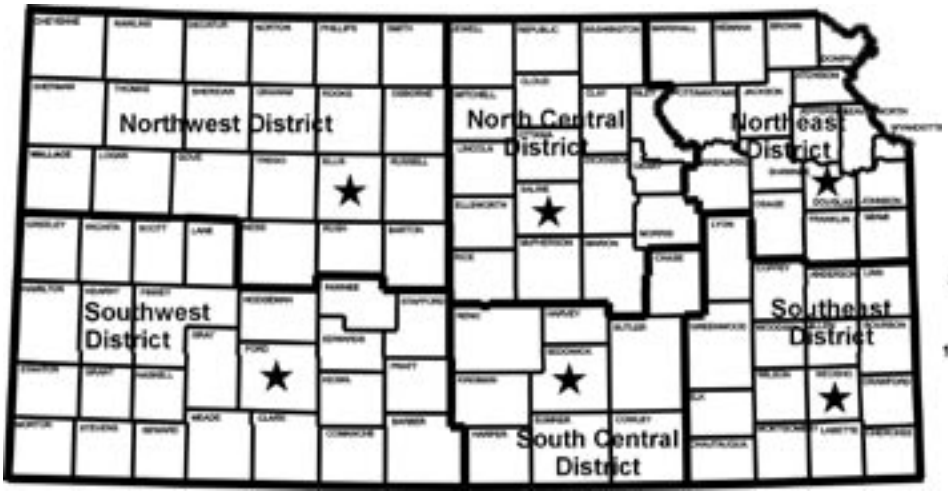
Manure and livestock composting operations are covered by K.A.R. 28-29-25c and K.A.R. 28-29d respectively. These regulations can be found on the KDHE Bureau of Waste Management web site at www.kdhe.state.ks.us/waste or a copy can be obtained by contacting the local KDHE district office.

Each regulation begins with the general requirements for design and construction, operations, and closure that apply to all facilities. The permit requirements are listed in paragraph (e) of both regulations. If the composting area, as defined by K.A.R. 28-29-3(h), is less than ½ acres, the site only needs to be registered. Larger composting facilities must be permitted.

Figure 1



KDHE District Office Information



Northwest Office
2301 E. 13th - Hays, KS 67601-2651
Phone: 785-625-5663 Fax 785-625-4005

North Central Office
2501 Market Place - Salina, KS 67401
Phone: 785-827-9639 Fax 785-827-1544

Northeast Office
800 W. 24th St. - Lawrence, KS 66046-4417
Phone: 785-842-4600 Fax 785-842-3537

Southwest Office
302 W. McArtor Road - Dodge City, KS 67801-6098
Phone: 620-225-0596 Fax 620-225-3731

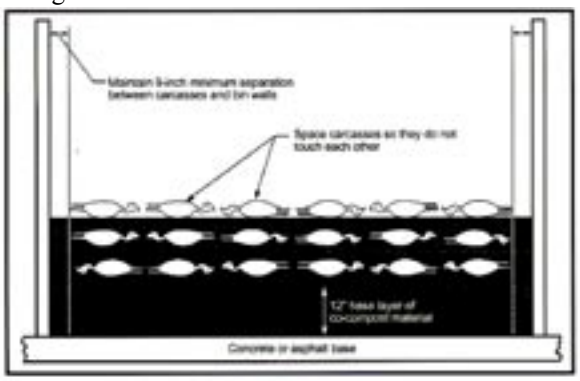
South Central Office
130 S. Market, Room 6050 - Wichita, KS 67202-3802
Phone: 316-337-6020 Fax 316-337-6023

Southeast Office
1500 W. 7th - Chanute, KS 66720-9701
Phone: 620-431-2390 Fax 620-431-1211

Livestock (Dead Animal) Composting

Dead animals from livestock facilities are becoming more difficult to properly dispose. Existing statutes and regulations require that the animals be disposed by burial, incineration, rendering, or composting. Burial in good weather is difficult, but when it is raining or the ground is frozen it can be more difficult. Incineration is becoming more heavily regulated and rendering is increasing in price and decreasing in availability. This leaves composting as a method of disposal which, when done correctly, is both environmentally sound and cost effective.

Figure 2



All species of livestock can be composted in Kansas. A floor or a roof designed to the specifications in the regulation is required for all dead animal composting facilities. The roof is important in helping control moisture and the floor helps to prevent groundwater contamination. Fencing the facility is also recommended to help prevent scavenging animals from having access to the pile. Poultry and swine are usually composted in bins (Figure 2) while beef and dairy cattle are composted in individual piles or windrows.

The Livestock Composting Process

Composting dead animals requires the same conditions that manure composting requires. A major difference is not turning the pile until the animals have almost completely finished composting. C:N ratio, moisture content and temperature are all still important. Livestock composting also requires co-composting materials, usually either sawdust, wood chips, litter or bedding. Co-composting materials should have moisture added to reach approximately 50% moisture content before being placed in the composting area since the materials will not be mixed further until the composting process is complete.

Site Selection & Design

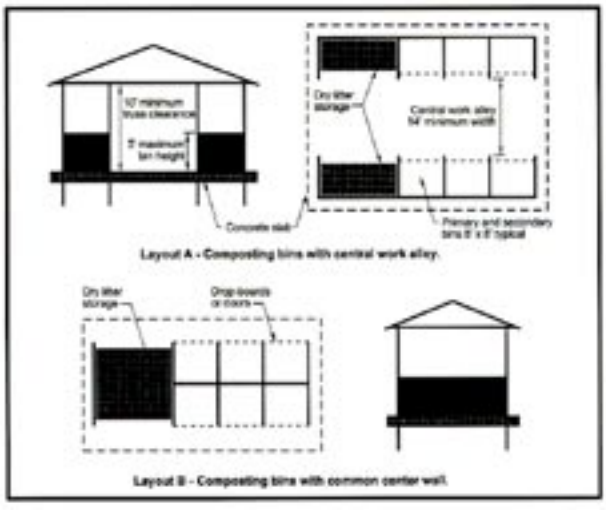
The site selected for a livestock composting facility should be out of view from the general public, have easy all weather access, have enough storage area for the co-composting material, and be located in an area which will be protective of ground and surface waters. Composting in bins is the recommended facility design for poultry and swine. Cattle composting is usually accomplished in either individual piles or windrows and is usually determined based on the volume of dead animals. A Missouri Extension Service publication titled “Composting Dead Swine” provides worksheets to help determine the size of the facility necessary based on the number of pounds of dead animals produced in a year. While this publication is specific to swine, the principles will work for the other species of livestock.

Site Operations

Unlike a manure operation where the piles are turned on a regular basis, livestock composting piles are usually only turned once. This turning should be done after all of the skin, flesh and other soft tissue of the animals are broken down. When the pile is turned, most of the bones will break into smaller pieces which will disappear in the second stage of the composting process. Most of the co-composting material will not be broken down and can either be reused in the next cycle or spread on a field.

The enclosed list of references provides the latest information available on the operation of a livestock composting facility.

Figure 3



Manure Composting

Composting of the manure produced at livestock facilities in Kansas is becoming more common. While some livestock facilities have practiced composting for years, others are just beginning to compost their manure. Many reasons exist for this change, but the one most producers emphasize is better management of the nutrients, especially the nitrogen and phosphorus, in the manure produced by the livestock. Since composting will reduce both the weight and volume of the manure, they can afford to haul the compost farther and spread the nutrients over more acres. Composting also uses a significant amount of water which can be supplied from facility lagoons. Accordingly, the process reduces the need for dewatering the lagoons on nearby fields.

The Composting Process

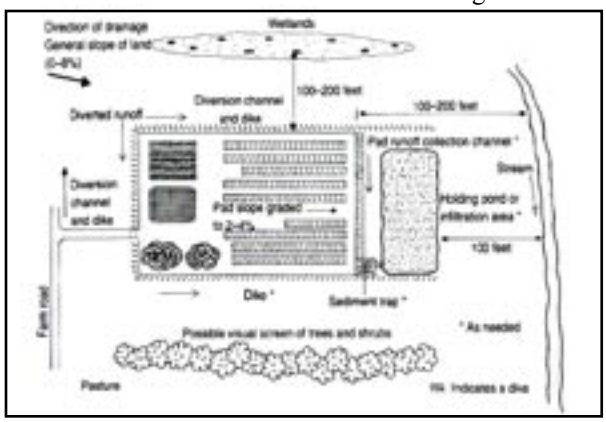
KDHE defines composting as "a controlled process of microbial degradation of organic material into a stable, nuisance-free, humus-like product". To achieve this humus-like product, the composting process must be actively managed. Manure that is in a pile will eventually break down, although the end product will not be as valuable as the compost from a well managed composting operation. Due to the large volumes of manure produced at livestock facilities, most manure composting is conducted using the windrow method. In this method, material is placed into long rows with a triangular cross-section. These rows are mechanically aerated by periodically turning and mixing using a front-end loader or a compost turner.

The three most important parameters to manage in a composting operation are the initial carbon to nitrogen ratio (C:N ratio), moisture content, and temperature of the pile. The optimum C:N ratio is 30:1 but the composting operation can work well between 25-40:1. Livestock manure C:N ratios range from 6:1 for some poultry manures to 41:1 for horse manure from race tracks. The amount of bedding mixed with the manure makes a considerable difference in the C:N ratio. Balancing the C:N ratio is the first step in producing a quality compost. Worksheets are available in the On Farm Composting Handbook to help determine the proper ratio to mix ingredients to achieve the 30:1 C:N ratio.

Managing the moisture is the second step. Because moisture is lost in the composting process, most compost windrows will require addition of large amounts of water at sometime during the process. This is especially true in the western two-thirds of Kansas. A moisture content of 50% is ideal but the composting process will proceed fairly well between 40 and 65% moisture. If the moisture content is too low the microbial activity will slow down or stop. If the moisture content is too high, the pile will become anaerobic because the water will take up the space where oxygen should be.

If the C:N ratio and moisture content are in the correct range, the rapidly multiplying microbes will produce heat. The composting process works fairly well between 110^{0}F and 150^{0}F with the ideal temperature range being 130^{0}F and 140^{0}F. A temperature of 131^{0}F is required to kill most human pathogens and a temperature of 145^{0}F will destroy most weed seeds. If the temperature raises to above 160^{0}F the beneficial microorganisms will die or become dormant, which makes it take longer to reheat after turning, and therefore the pile should be turned to cool the temperature down. As the composting process proceeds, the temperature will come down. When this happens, turning the pile will make new material available to the microorganisms, which will again cause the pile to heat up.

Figure 4



Site Selection

The composting site should be close to the livestock facility and a water source. It should have good drainage, limit environmental risks, provide for all weather operation, and provide an adequate area for all operations of the composting facility. Worksheets are available in the On Farm Composting Handbook to help determine the size of the site and the pad.

Pad design and development are important since this is where all of the work will be accomplished. The site should have a slope of between 1% and 5 % with a slope of 2% to 3% being ideal to provide for proper runoff and erosion control. Runoff controls (Figure 4) will need to be provided as contained in the regulations listed on page 2.

A good working surface is required to provide all-weather operation and protect groundwater from contamination. Most facilities in Kansas have enough clay soil available for compaction to provide an all-weather surface. If the pad is not built correctly, all site operations will be more difficult.

Site Operations

Many publications have been written which detail how to operate a manure compost site. Most of these are avaiable online or through the extension service of the state which published the information. Kansas State University, which is operating a site, can also be a valuable resource on the design and operation of manure composting sites.

Composting at Livestock Facilities References

BioCycle Magazine
The JG Press, Inc.
419 State Avenue
Emmaus PA, 18049
Phone: (610) 967-4135 ext.22
http://www.jgpress.com/

Composting News
McEntee Media Corp.
9815 Hazelwood Avenue
Strongsville, OH 44149
Phone: (440) 238-6603 Fax: (440) 238-6712
http://www.recycle.cc/cnpage.htm

US Composting Council
4250 Veterans Memorial Highway , Suite 275
Holbrook, NY 11741
Phone: (631) 737-4931 Fax: (631) 737-4939
http://www.compostingcouncil.org/index.cfm

United States Environmental Protection Agency (EPA)
http://oaspub.epa.gov/webi/meta_first_new2.try_these_first
http://www.epa.gov/epaoswer/non-hw/compost/index.htm

University of Missouri Extension Service
The following web site lists most of their publications which relate to manure and livestock composting.
http://muextension.missouri.edu/explore/envqual/index.htm

Cornell University
Cornell Composting
http://www.cfe.cornell.edu/compost/Composting_Homepage.html

Utah State University
Compost Page http://www.aste.usu.edu/compost/
Resource Link Page http://www.aste.usu.edu/compost/hotlinks.htm

Iowa State University
Publication List http://www.extension.iastate.edu/pubs/
Pigs Gone http://www.abe.iastate.edu/pigsgone/

Appropriate Technology Transfer for Rural Areas (ATTRA)
PO Box 3657
Fayetteville, AR 72702
Phone: 1-800-346-9140 Fax: (479) 442-9842
http://attra.ncat.org/attra-pub/farmcompost.html#suggested

On-Farm Composting Handbook
Rynk, Robert (Ed.), (NRAES-54). Ithaca, New York: Northeast Regional Agricultural Engineering Service. 1992

Composting For Municipalities
Dougherty, Mark (Ed.), (NRAES-94). Ithaca, New York: Natural Resource, Agriculture, and Engineering Service. 1998

Field Guide To On-Farm Composting
Dougherty, Mark (Ed.), (NRAES-114). Ithaca, New York: Natural Resource, Agriculture, and Engineering Service. 1999