Mortality Management on Livestock Operations

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MSU Extension & AgBioResearch State Council Meeting, October 3, 2013, Bavarian Inn & Hotel, Frankenmuth, MI

Today

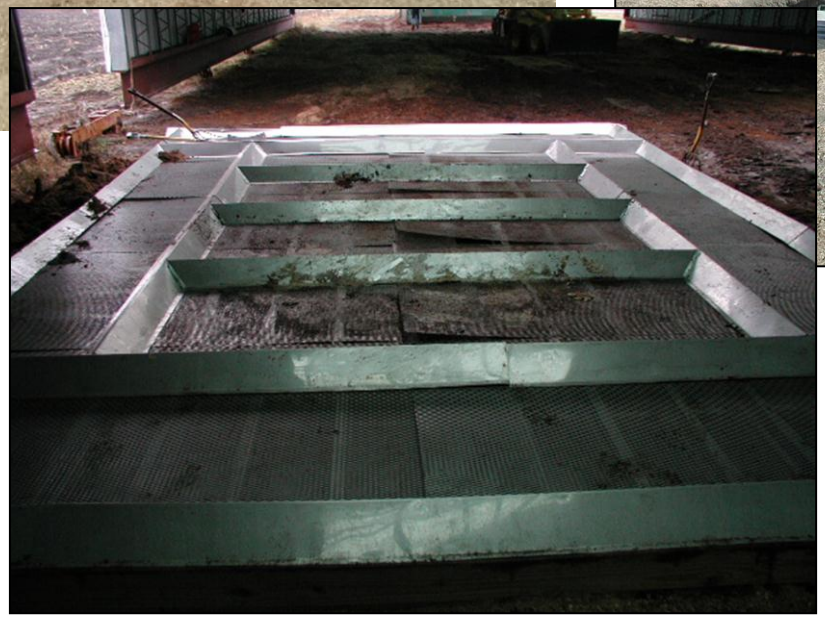
- Background
- Ag Expo Education
  - 2011-2013
- 4th International Symposium on Managing Animal Mortality, Products, By-products and Associated Health Risk
- Animal Tissue Composting Electronic Tools
- MI Commercial Animal Tissue Composting Task Force
- MI Mass Carcass Management Documentation

Mortality Management

- Routine or normal/natural
- Emergency or mass carcass management

Bodies of Dead Animals Act Amendments

- 1982 PA 239
  - burial, incineration, landfill, rendering
- 1993 PA 228
  - to include poultry bin composting
- 1998 PA 229
  - to include livestock bin composting
- 2005 PA 66
  - added open pile, windrow, in-vessel composting methods, more amendments, limits for mortality mass composted per year, delineation of producer and processor
- 2008 PA 311
  - to include anaerobic digestion



Mortality – Planning to Manage

- MI Right-to-Farm
- MAEAP
- NPDES
- NRCS
  - NI_190_304, CNMP Technical Criteria
    - Section 2 – Manure and Wastewater Handling and Storage
      - (v) 2.5 Normal Mortality Management
    - Section 3 – Farmstead Safety and Security
      - (iii) 3.3 Catastrophic Mortality Management

2011 MI Ag Expo


100
150
50
200
0
250
°F

Compost Amendment

- Blend
  - Dairy manure compost
  - Horse stall bedding
  - Finished swine mortality compost
  - Dry wood shavings

Item	
Moisture, %	48.3
Mineral matter, %	5.91
N, %	0.761
P, %	0.176
P_2O_5, %	0.402
K, %	0.512
K_2O, %	0.617
Ca, %	0.864
Mg, %	0.190
Na, %	0.129
S, %	0.146
C, %	24.113
B, ppm	7.4
Fe, ppm	1308.6
Mn, ppm	86.8
Cu, ppm	16.5
Zn, ppm	46.7
C:N	31.8
pH	8.72

Dutch In-vessel


Sharpie

2012 MI Ag Expo


JOHN DEERE
544

Extension Bulletin E3168 • New • April 2012

Carcass Composting – A Mortality Management Option for Michigan Equine Owners

Tom Guthrie – *MSU Extension Statewide Equine Educator*

Dale Rozeboom – *Professor and Extension Specialist, Department of Animal Science, Michigan State University*

Objectives of this bulletin:

1) Help horse owners in Michigan become aware of and understand how to utilize composting for animal carcass management.
2) Help horse owners develop or make improvements in mortality management procedures while achieving environmental compliance with state regulations (the Michigan Bodies of Dead Animals Act [BODA], Act 239 of 1982).

Unfortunately, if you own horses long enough, the time will come when you must make decisions about a deceased horse. For many horse owners, this becomes problematic because their land base resources do not allow for appropriate disposal procedures, so options for carcass disposal may be limited, and they may have no plan to manage equine mortality. Horse owners may not be aware that composting — more specifically, open-static pile composting — is an acceptable and viable way to dispose of a horse carcass.

Composting is the managed biological decomposition process that converts organic matter into stable, humus-like material. In the past three decades, science has proven that animal tissue can be effectively and safely composted. Before this, it was generally unacceptable to compost animal remains. Microorganisms flourish with the proper mixture of bulking agents (sometimes referred to as "feedstock" or "amendments"; see Table 1), animal tissue, water and air. The process consumes tissue, minimizes odors and produces quality finished compost.

Bacteria in a compost pile carry out the majority of the decomposition of the carcass and bulking agents. The activity of these organisms results in the production of heat as they consume sugars, starches, proteins, fat and some cellulose.

Site Selection

When selecting a composting site, especially if you are using the open-static pile composting method (Photo 1), it is critical to minimize environmental impacts. The location of the composting site should minimize the impact of odor and other air quality issues on neighboring residences, as well as minimizing the movement of nutrient-containing water or effluent into surface and groundwater resources.

Table 1. Bulking agents approved in Bodies of Dead Animal Act rules as amended June 2, 2011.

Sawdust	Fresh manure
Chopped straw	Manure, with or without bedding
Spelt hulls	Wasted feed (ground corn, silage, haylage)
Bean pods	Legumes (peas, beans, soybeans)
Grass clippings	Hay
Leaves	Shrub and tree trimmings
Shredded cardboard or newspaper	Cornhusks, cobs
Chopped cornstalks	Wood chips
Finished compost	

2013 MI Ag Expo


ALU

Extension Bulletin E3197 • New • June 2013

Carcass Composting – A Guide to Mortality Management on Michigan Cattle Farms

Dale Rozeboom – *Professor and Extension specialist, Department of Animal Science, Michigan State University*
Dean Ross – *Consultant, Agrosecurity Consulting*
Tom Guthrie – *Statewide pork and equine Extension educator*

Objectives of this bulletin:

1) Help cattle producers in Michigan become aware of and understand how to properly utilize composting for animal carcass management.
2) Help cattle producers develop or make improvements in mortality management procedures while achieving environmental compliance with state regulations (the Michigan Bodies of Dead Animals Act [BODA], Act 239 of 1982).

Cattle producers need to make decisions about mortality management on their farms and meet environmental compliance and societal expectations. For many, this can be problematic for a variety of reasons. Traditionally, on-farm burial or transfer of a carcass to a renderer have been the most common options. But the Michigan Bodies of Dead Animals Act allows several other mortality management options, and cattle owners need to be aware that composting — more specifically, open pile composting without a constructed facility — is an acceptable and viable way to dispose of livestock mortalities.

Composting is a managed biological decomposition process that converts organic matter into stable, humus-like material. In the case of mortality composting, the organic matter being converted includes the animal carcass. In the past three decades, research has proven that animal tissue can be effectively and safely composted. Before this, it was generally unacceptable to compost animal remains. Composting is a process in which microorganisms flourish with the proper mixture of bulking agents (sometimes referred to as "feedstock" or "amendments"; see Table 1), animal tissue, water and air. When done properly, the process consumes tissue, minimizes odors and produces quality finished compost.

Table 1. Bulking agents approved in Bodies of Dead Animal Act rules as amended June 2, 2011.

Sawdust	Fresh manure
Chopped straw	Manure, with or without plant fiber-based bedding
Spelt hulls	Wasted feed (ground corn, silage, haylage)
Bean pods	Legumes (peas, beans, soybeans)
Grass clippings	Hay
Leaves	Shrub and tree trimmings
Shredded cardboard or newspaper	Cornhusks, cobs
Chopped cornstalks	Wood chips
Finished compost	

4TH INTERNATIONAL SYMPOSIUM

Managing Animal Mortalities, Products, By- Products and Associated Health Risk: Connecting Research, Regulations & Response

May 21- 24, 2012
Dearborn, Michigan

Educational Focus

- Emergency Response and Policy
- Depopulation, Decontamination/Disinfection and Recovery
- Policy and Education
- By-products and Foods of Animal Origin
- Environmental Effects of Disposal
- 2010 FMD Outbreak in Korea-Government's Response to this Emergency and Important Lessons Learned
- Cross-Border FMD Response Disease Simulation Workshop

Attendance and Deliverables

- 147 participants
  - 8 countries (United States, Canada, Australia, New Zealand, South Korea, United Kingdom, Vietnam and Nigeria)
    - 27 states and the District of Columbia of U.S.
    - 5 provinces of Canada
- Documents submitted to Department of Homeland Security
  - *Evaluation Report Synopsis*
  - *Research, Policy, Response Capability, and Education Needs Identified by Participants of the 4th International Symposium on Managing Animal Mortality and Health Risk*

Costs

	In-Vessel (IV)	Open Static Pile (OSP)
System description		
Mortality per year, lb.	219,000	268,829
Composting system	IV unit, concrete pad, 24' x 26' open-sided pole building with mono-slope roof, concrete floor, 6' high concrete walls	6 bins, each is 12' x 22' x 6', concrete floor, no roof and 25' x 75' concrete apron
Capital investment	$62,000	$21,150
Machinery needed	Tractor loader	Tractor loader
Labor, hr per year	182.5	273
Bulking agent	121 yd^3 @ $10.50/$yd^3$	365 yd^3 @ $3.50/$yd^3$
Annual costs		
Fixed costs		
Composting system	$6,706.00	$2,488.50
Tractor loader	$1,152.05	$1,152.05
Operating costs		
Fuel and (or) electricity	$1,866.47	$2,598.96
Custom tractor and manure spreader	$1,032.78	$1,267.77
Labor	$2,874.00	$4,300.00
Other	$1,277.50	$1,277.50
Total annual cost	$14,908.81	$13,084.79
Cost/lb. mortality	$0.0681	$0.0487
Energy cost/lb. mortality	$0.0085	$0.0097

Costs

Item	Custom backhoe, individual graves	Custom backhoe and owned loader, common grave	Owned backhoe with loader, common grave
Backhoe time, hr (0.5 hr per carcass)	65	12	44.5
Custom backhoe cost,$84.50/hr[a]	$5,492.50	$1,014.00	-
Tractor loader time, hr (0.25 hr per carcass)	-	32.5	-
Tractor loader annual operating cost[b] (purchased used at $25,500)	-	$461.29	-
Own backhoe annual operating cost[b] (purchased used at $15,000)	-	-	$1,240.64
Labor, $15.75/hr	-	$511.88	$700.88
Total annual cost	$5,492.50	$1987.17	$1,941.52
Cost/lb. mortality	$0.2640	$0.0955	$0.0933

[a] Iowa State University Custom Rate Bulletin (2012)

[b] Includes 15-yr depreciation, interest (5% of value and 25% allocated to burial), insurance (premium - 0.01% of replacement value), repairs (0.01% of purchase price), taxes (avg. 23 mills), and fuel (2.8 gallon per hour at $3.40/gallon at the farm on April 25, 2012).

Estimating the Cost of Mortality Management

Research at Michigan State University estimated the costs of two animal composting systems and compared them to routine methods of managing mortalities.

Joe Vansickle

Jan. 15, 2013

The practice of composting to manage on-farm swine mortalities has increased from 10.5% in 1994 to nearly 36% in 2006, according to data supplied by USDA's Animal and Plant Health Inspection Service.

Traditionally, the most popular method of composting has been the open static pile (OSP) in bins, piles or windrows, managed by primary, secondary and curing stages.

More recently, in-vessel (IV) systems have become increasingly used. The most popular system is rotating drums.

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Work at Michigan State University estimated the costs of the OSP and IV animal composting systems and compared them to other routine methods of managing pig mortalities.

Data for the mortality systems was obtained from two Michigan farrow-to-wean operations of 3,300 and 2,500 sows.

The OSP system used on the first farm consisted of six, 12 x 22 x 6-ft., three-sided bins

Air Emissions from In-Vessel Rotating Drum and Open Static Pile Composting of Swine Carcasses, Whole and Ground

D.W. Rozeboom, A.C. Fogiel, Z. Liu,

and W.J. Powers

Michigan State University, East Lansing, MI

Appreciation expressed to National Pork Board for support of this research and Jolene Roth for photographs included in this presentation.

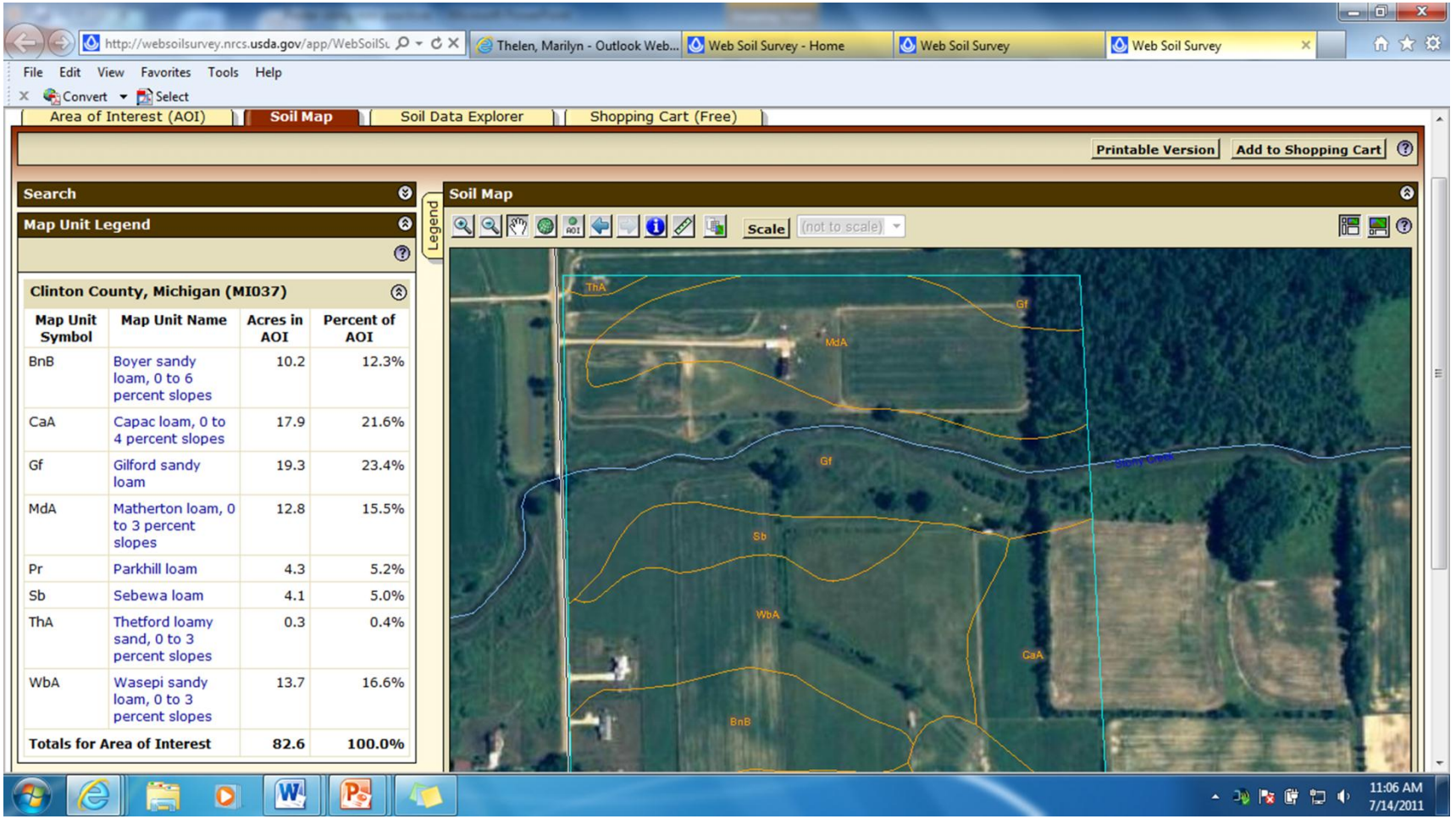
Working on Current Challenges

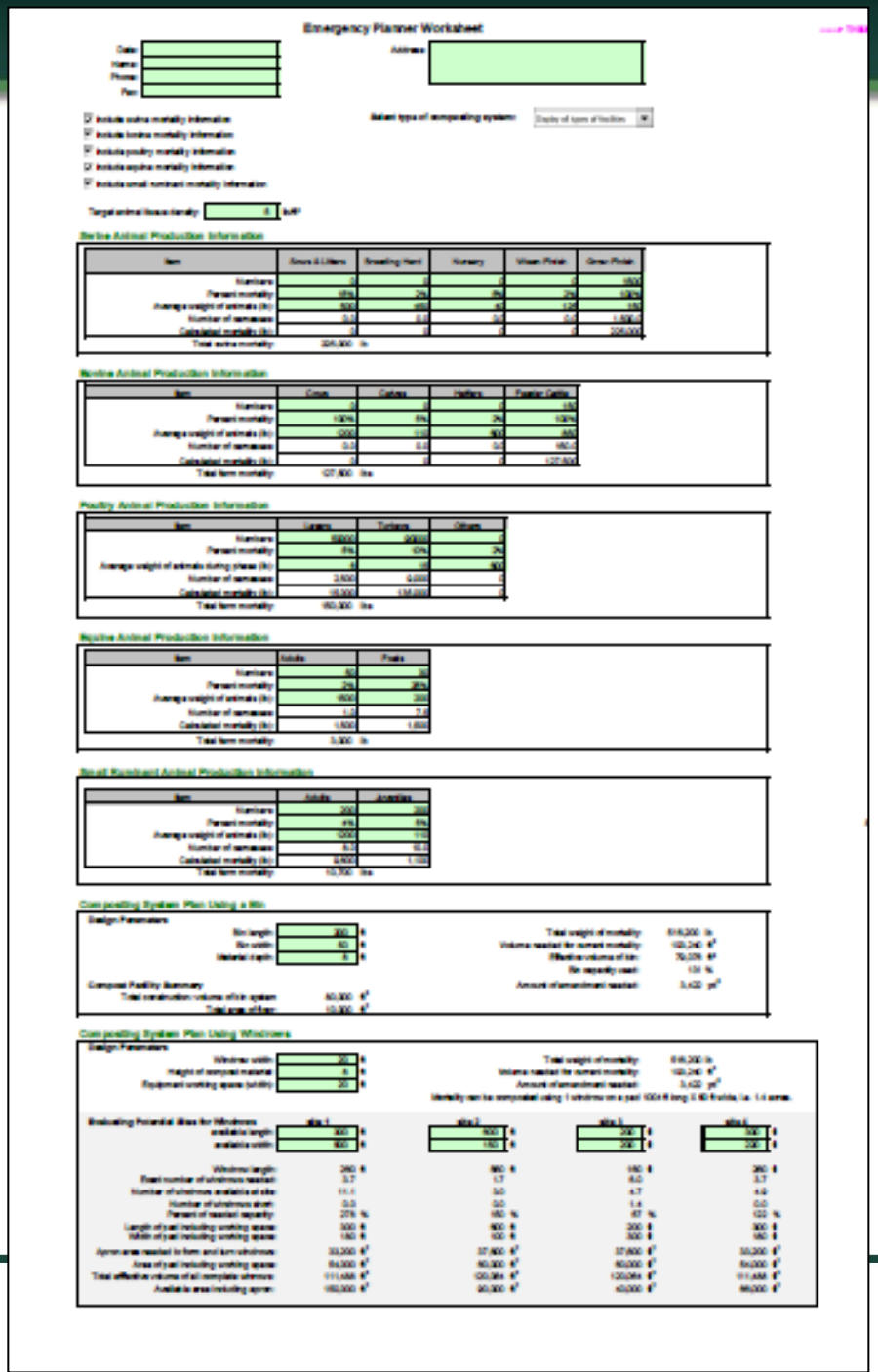
- Economic Viability
  - Commercial Animal Tissue Composting Task Force
    - MFB, MDARD, MDEQ, MSU, MI NRCS
    - Pilot Project Guidance Document drafted
- Improving Composting Management
  - *Spartan Animal Tissue Composting System Planner*
  - *Spartan Compost Recipe Optimizer*

Mass Carcass Management Committee

- *Michigan Mass Animal Carcass Event Management*
  - Anticipated release late 2013
- Standard Operating Procedures
  - Burial
  - Land-fill
  - Composting
  - Incineration
  - Rendering

Web Soil Survey – Burial & Composting





Emergency Planner Worksheet

Date:
Name:
Phone:
Fax:

Address:

☑ Include swine mortality information
☑ Include bovine mortality information
☑ Include poultry mortality information
☑ Include equine mortality information
☑ Include small ruminant mortality information

Select type of composting system: Display all types of facilities

Target animal mass density: 0 lb/ft²

Swine Animal Production Information

Item	Sows & Litters	Breeding Herd	Nursery	Wean-Finish	Grow-Finish
Numbers	0	0	0	0	450
Percent mortality	18%	2%	4%	2%	18%
Average weight of animals (lb)	500	400	40	120	180
Number of rotations	2.3	2.3	5.2	5.2	1,000
Calculated mortality (lb)	0	0	0	0	205,000
Total swine mortality:	224,000 lb				

Bovine Animal Production Information

Item	Cows	Calves	Heifers	Feeder Cattle
Numbers	0	0	0	110
Percent mortality	100%	5%	2%	100%
Average weight of animals (lb)	1200	110	800	800
Number of rotations	0.3	0.4	0.5	450
Calculated mortality (lb)	0	0	0	127,600
Total farm mortality:	127,600 lb			

Poultry Animal Production Information

Item	Layers	Turkeys	Others
Numbers	5000	2000	0
Percent mortality	4%	10%	2%
Average weight of animals during phase (lb):	4	15	800
Number of rotations	3.600	4.000	0
Calculated mortality (lb)	15,000	134,000	0
Total farm mortality:	149,000 lb		

Equine Animal Production Information

Item	Adults	Foals
Numbers	50	20
Percent mortality	2%	25%
Average weight of animals (lb)	1000	350
Number of rotations	1.0	7.0
Calculated mortality (lb)	1,000	1,650
Total farm mortality:	3,300 lb	

Small Ruminant Animal Production Information

Item	Adults	Juveniles
Numbers	200	200
Percent mortality	4%	5%
Average weight of animals (lb)	1200	110
Number of rotations	0.3	10.0
Calculated mortality (lb)	9,600	1,100
Total farm mortality:	10,700 lb	

Composting System Plan Using a Bin

Design Parameters

Bin length:	200 ft
Bin width:	50 ft
Material depth:	8 ft

Total weight of mortality: 616,200 lb
Volume needed for current mortality: 102,240 ft³
Effective volume of bin: 70,000 ft³
Bin capacity used: 134 %
Amount of amendment needed: 3,422 yd³

Compost Facility Summary

Total construction volume of bin system:	80,000 ft³
Total area of bin:	10,000 ft²

Composting System Plan Using Windrows

Design Parameters

Windrow width:	20 ft
Height of composted material:	6 ft
Equipment working space (width):	20 ft

Total weight of mortality: 616,200 lb
Volume needed for current mortality: 102,240 ft³
Amount of amendment needed: 3,422 yd³
Mortality can be composted using 1 windrow on a pad 100 ft long X 60 ft wide, i.e. 1.1 acres.

Evaluating Potential Sites for Windrows

	site 1	site 2	site 3	site 4
available length:	300 ft	500 ft	200 ft	300 ft
available width:	300 ft	150 ft	200 ft	200 ft
Windrow length:	260 ft	360 ft	160 ft	260 ft
Real number of windrows needed:	3.7	1.7	6.0	3.7
Number of windrows available at site:	11.1	3.0	4.7	4.6
Number of windrows short:	0.0	0.0	1.4	0.0
Percent of needed capacity:	278 %	160 %	67 %	122 %
Length of pad including working space:	300 ft	400 ft	200 ft	300 ft
Width of pad including working space:	160 ft	100 ft	300 ft	160 ft
Aprox area needed to form and turn windrows:	33,200 ft²	37,800 ft²	37,800 ft²	33,200 ft²
Area of pad including working space:	64,000 ft²	40,000 ft²	60,000 ft²	64,000 ft²
Total effective volume of all complete windrows:	111,466 ft³	120,064 ft³	120,064 ft³	111,466 ft³
Available area including aprox:	160,000 ft²	80,000 ft²	60,000 ft²	96,000 ft²

Developing Composting Practices

- 200 cow dairy
  - Total weight of mortality: 240,000 lb
  - Amount of amendment needed: 1,641 yd^3
  - Windrow 48,000 ft^3
  - Pad 488 ft long X 60 ft wide; 0.7 acres.
- May or may not aerate
  - Do not if disease agent involved
- 1 to 3 mo, decompose soft tissues and H_2O vaporized
  - Complete composting process elsewhere, landfill, combustion – gasification

Landfill

- Availability being determined by Mass Carcass Management Committee
- Completion of written declarations in advance of emergencies, to allow expedient delivery of large amount of mortality at time of emergencies


MICHIGAN STATE
UNIVERSITY

Prevalence of Mortality Management Method on Michigan Swine Farms

Method	Sow Farms (28)	Nursery Farms (35)	Wean-Finish Farms (27)
Burial on-farm	7.14%	5.71%	3.70%
Composting	78.6%	80%	85.29%
Incineration	0%	2.86%	0%
Land-fill	10.7%	8.6%	11.1%
Rendering	3.6%	2.9%	0%
Anaerobic digestion	0%	0%	0%
Gasification	0%	0%	0%
Alkaline hydrolysis	0%	0%	0%
Feeding to animals	0%	0%	0%