The Feasibility of Ruminant Composting

October 2010

About the Feasibility Study Developers

Joe Parcell, PhD, an Iowa native, is an Associate Professor in the Department of Agricultural Economics at the University of Missouri. He was raised on a family-owned hog farm, and he and his wife owned and operated a row-crop farm from 2001 through 2008. He received his BA in mathematics from the University of Northern Iowa and MS and PhD from Kansas State University. He is the author of over 50 journal articles and extension publications related to various areas of agriculture. He is the co-author of the sixth edition of "The Agricultural Marketing System," by Rhodes, Dauve, and Parcell. He is founder and president of Value Ag., LLC. Value Ag, LLC is an economic consultancy group committed to "Analyzing Innovative Ideas for Tomorrow's Agriculture." Clientele include MFA Livestock, Missouri Food and Fiber, Missouri Farms Dairy, Osage Catfisheries, USDA, law firms, and various other producers and agricultural focused clientele.

Joe Horner, MS, is an extension economist with the Commercial Agriculture Program at the University of Missouri. He works extensively with cattle (beef and dairy) producers, focusing on production economics and expansion strategies. He has twenty years of experience with extension, serving as a regional extension dairy specialist and as a state extension economist. He has contributed to numerous feasibility studies for several small scale dairy processing startups. In addition, he has worked extensively with modeling new forms of sustainable dairy production systems utilizing intensive rotational grazing on larger dairy farms. He is a graduate of the Graduate Institute of Cooperative Learning. He has also worked internationally as a volunteer with VOCA and with various University of Missouri connected training projects.

Ryan Milhollin, MBA, is a project manager / extension associate with the Commercial Agriculture Program at the University of Missouri. He has eight years of experience in extension, working on various educational programs and feasibility reports related to the dairy, beef and biofuel industries. He has substantial experience working in dairy and beef production in the areas of business planning and management, finance, risk management, and environmental regulations. He received BSs in Agricultural Economics and Business Administration from the University of Missouri in May 2002 and completed a MBA from Columbia College in December 2006.

Jason Franken, PhD, is a Missouri native who is a Post-Doctoral Fellow at the University of Missouri. His research addresses the organization of supply channels for managing risk and adding value. Jason received his BS and MS from the University of Missouri and his PhD from the University of Illinois. Jason remains involved in his family's diversified beef and crop farm in Central Missouri.

Chandra Jackson, BS, began working for Value Ag, LLC in 2008, serving as a Business and Financial Analyst. Chandra attended the University of Missouri, receiving a BS in Agribusiness Management. Her responsibilities include actively investigating various aspects of national and international markets, collecting project specific data, and creating financial projections based on current fiscal and economic information. Chandra is also working to complete her MS in Agriculture Economics at the University of Missouri.

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Exhibits

1. Executive Summary

The University of Missouri, on behalf of the Southwest Missouri Cattlemen's Association, requested a Rural Business Enterprise Grant of $56 thousand for development of a feasibility study of a farmer-owned large animal (ruminant) composting facility to be located in the rural region of southwest Missouri. The need for this feasibility study was brought about due to the closure of the area's last rendering operation, Halfway Pack.

While Halfway Pack's rendering business has resumed operation again, farmers believe there to be a definitive business opportunity and environmental need to understand what alternatives exist, how to implement them and the costs associated with developing a farmer-owned composting facility. A well designed composting facility using sawdust, woodchips and other carbon sources could significantly increase efficiency and enable good throughput for dead animal mortalities.

The state of Missouri requires that all dead animal mortalities be properly disposed with 24 hours and there are five acceptable options available for farmers. These options are rendering, composting, land filling, incineration and burial (in order of preference), according the Missouri Department of Natural Resources. Renderers, commercial incinerators and landfills that allow dead animal disposal are very limited in the state of Missouri. Burial of dead animals is challenging due to equipment needs, burial limitations, geographic restrictions and other conditions. Composting can be very environmentally compatible and less capital intensive than the other options for dead animal disposal.

An estimation of the potential dead animal supply for various livestock industries and deer population in Missouri was completed. Various assumptions on death losses and average animal sizes were made to calculate an average mortality pounds per county that could be expected each year. Missouri has a total of 584 million pounds of yearly mortalities from the beef, dairy, hog, horse and deer populations. Within the Southwest Missouri target region, approximately 57 million pounds of yearly mortalities could potentially be sourced for a composting facility.

The two main products of the composting process are hides and the compost itself. There is some uncertainty regarding revenue stream from hide (due to the state of the economy), but hide prices have recently rebounded. Typically, hides run between $40 and $55 per hide with some regional variation. High value markets for compost, such as horticultural uses, typically require mixtures that deliver nutrients that are conducive for growth of these plants. Notably, the process does not yield high levels of key nutrients such as nitrogen and phosphorus and mostly contributes dry matter. Due to low fertilizer value and potential zoonotic disease liability associated with animal-based compost, use in high end horticultural markets is not advisable. However, nutrient composition is sufficient for nearby farmers to utilize the compost as a soil amendment if they can pick it up from the composting site. Thus, the compost would not be a revenue source but also would not pose a cost as farmers would provide free removal.

Four dead animal composting systems were examined in detail for their technical feasibility, flexibility, and financial viability. These systems were identified as strong alternatives that could be potentially developed into a value-added farmer owned entity.

Two Mechanical Composting Systems

- Dutch Composter – Vertical Mechanical Composter
- BIOvator™ – Horizontal Mechanical Composter

The mechanical systems have been very popular in Canada where stricter rendering and disposal regulations are already in place. The mechanical systems have also been very popular in large livestock complexes where the arrival of dead animal pickup vehicles have spurred bio-security concerns that have outweighed the high capital costs of the mechanical systems.

Two Static Pile Passive Compost Systems

- Static Compost Piles (Unroofed)
- Static Compost Piles (Under Roof)

Composting dead animals in a static pile unroofed is a simple system with minimal investment required. Composting dead animals in a static pile under roof is similar to the unroofed static piles except all the composting takes places under a roof and on top of an impervious layer of packed clay, asphalt, or concrete. This roofed system is preferred from an environmental standpoint because runoff from the piles after rainfall is eliminated. In addition, the moisture levels of the compost are easier to control, allowing more ideal composting conditions.

All four systems were assumed to be built into a facility capable of handling 1,500 mortality pounds per day. This was the minimum starting point thought to be practical. Fees assessed for each 1,500 lbs. to be composted would be $75. Complete financial analysis was completed for all four systems, which demonstrated the variations between each system.

Exhibit 1.1 Financial Comparison of Composting Systems

Financial Parameter	Dutch Composter	BIOvator™	Static Compost Piles (Unroofed)	Static Compost Piles (Under Roof)
Initial Capital Investments	$345,700	$255,600	$94,600	$244,600
Operating Expenses (Year 5)	$30,696	$21,686	$5,586	$20,585
Net Income (Year 5)	($37,923)	($4,376)	$12,399	($2,601)
Net Cash Flow (Year 5)	($8,353)	$16,183	$16,858	$16,858

The recommended compost system for a regional animal mortality facility was static piles under roof. This system was chosen for the following reasons:

- Offers a minimal environmental risk and minimal handling of dead animals
- Roofed barns should not present public acceptance problems
- This system offers the most flexibility of scale and throughput volume of dead animals
- This system can operate without regard to rain, snow or other bad weather
- Most robust model in its ability to be implemented correctly with minimal management.
- Capital investment and operating costs are lower than the two mechanical options
- Roofed buildings may be built with public assistance and then potentially operated for decades with minimal additional repairs or investments.

2. Industry Assessment

2.1 Need for a Centralized Mortality Compost Facility

The issue of efficient and environmentally sound, large animal carcass disposal reached a pinnacle in 2009 with the closure of Halfway Pack, a rendering business that served the southwest region of Missouri. The loss of this business was due to economic and regulatory factors. The primary cause of the shutdown was due to changes in the U.S. Food and Drug Administration (FDA) regulations issued on April 27, 2009. These regulations required rendering operations to remove brains and spinal cords of all cattle older than 30 months if the carcass is processed for animal feed. While Halfway Pack has recently reopened under new management, Missouri livestock producers still need to seek additional options for disposing of ruminant carcasses.

An alternative for these producers is the development of a farmer owned carcass composting facility to dispose of dead animals. A well designed mortality composting facility using sawdust, woodchips or other carbon sources can be efficient and have reduced labor requirements when compared to other mortality disposal options.

The area of study for this project is the southwest Missouri counties of Barry, Cedar, Dade, Hickory, Lawrence, Polk, and St. Clair. This area was chosen for the mortality composting investigation because of the high density of cattle, proximity to environmentally sensitive areas and the need for increased economic activity. The geographic area of this study is limited; however, the results of this mortality compost facility feasibility study could be implemented in other areas of Missouri.

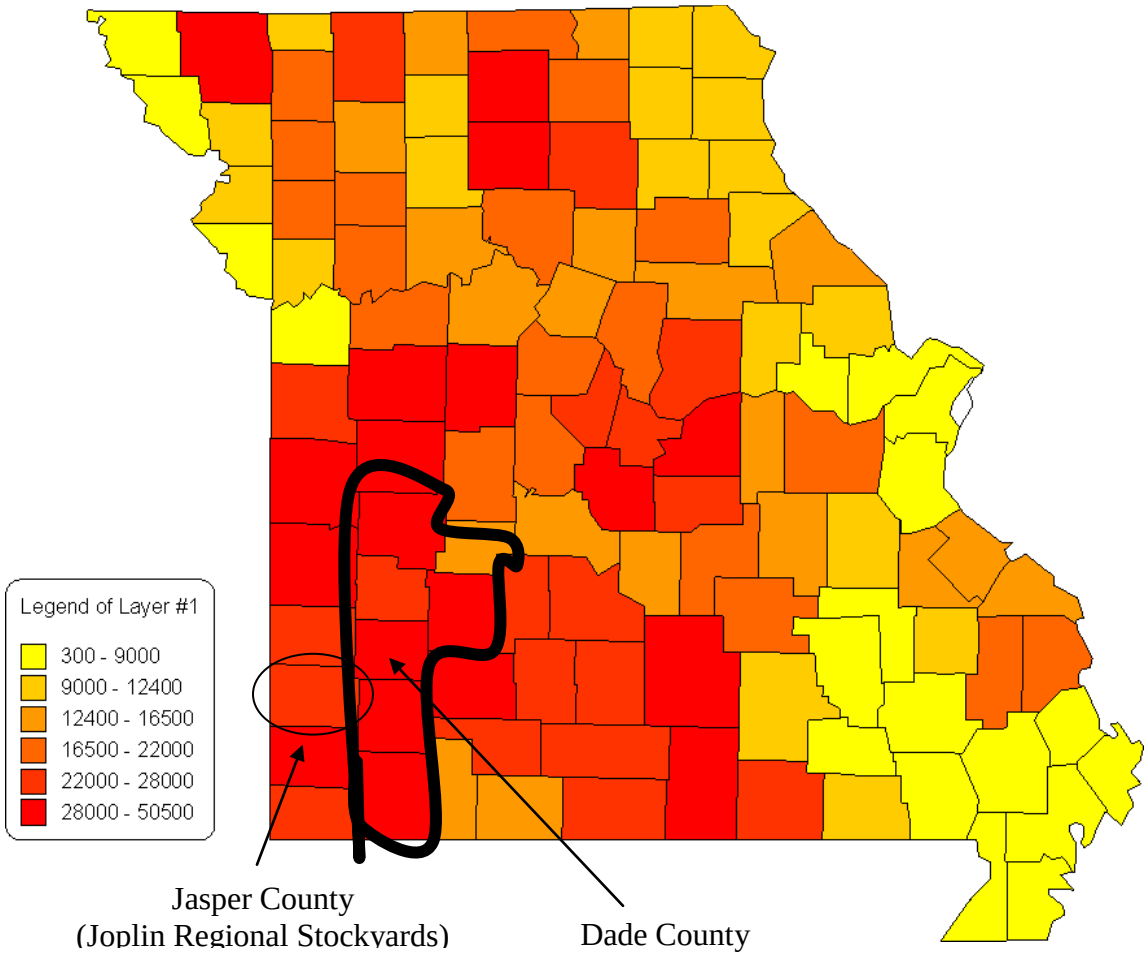
Cattle numbers and producers in the geographic study area are shown using Exhibit 2.1.1. Ideally the mortality composting business operation would be located in Dade County. Dade County provides a central geographic location, is logistical convenient to two major highways and sparsely populated. Exhibit 2.1.2 shows locations of counties in the study with cattle inventories shaded.

Exhibit 2.1.1 Farmographic Factors for Target Region Counties and Missouri

County	# of Beef Operations	# of Dairy Operations	# of Beef Cows	# of Dairy Cows
Barry	922	38	44,000	2,700
Cedar	515	10	26,100	800
Dade	550	7	33,500	800
Hickory	307	10	15,500	1,100
Lawrence	1,113	77	51,000	5,100
Polk	1,058	59	48,000	4,200
St. Clair	438	11	27,800	100
Area Total	4,903	212	245,900	14,800
Missouri	44,336	1,705	2,070,000	110,000

Source: USDA – National Agricultural Statistics Service

Exhibit 2.1.2 Number of Cattle per County and Relevant Market Area
(darker area indicates more cattle)



Source: USDA – National Agricultural Statistics Service

The market region analysis indicates a compost market potential of 800 to 1,000 animals per year from on-farm sources. The below scenarios indicate the throughput potential for the state of Missouri and for the immediate market region of this mortality composting feasibility study. Livestock auction mortalities and offal from small-scale meat processors would also add to the compost market potential. This estimate is factored by using cattle inventories, applying conservative death loss percentages and estimating producers that would render their animals.

Missouri

2.1 million head of beef and dairy cows (2% death loss)
= 42,000 head of mature animal mortalities annually

20% opt for rendering removal instead of other approved methods of disposal
= 8,000 head of mature animal mortalities annually to be composted

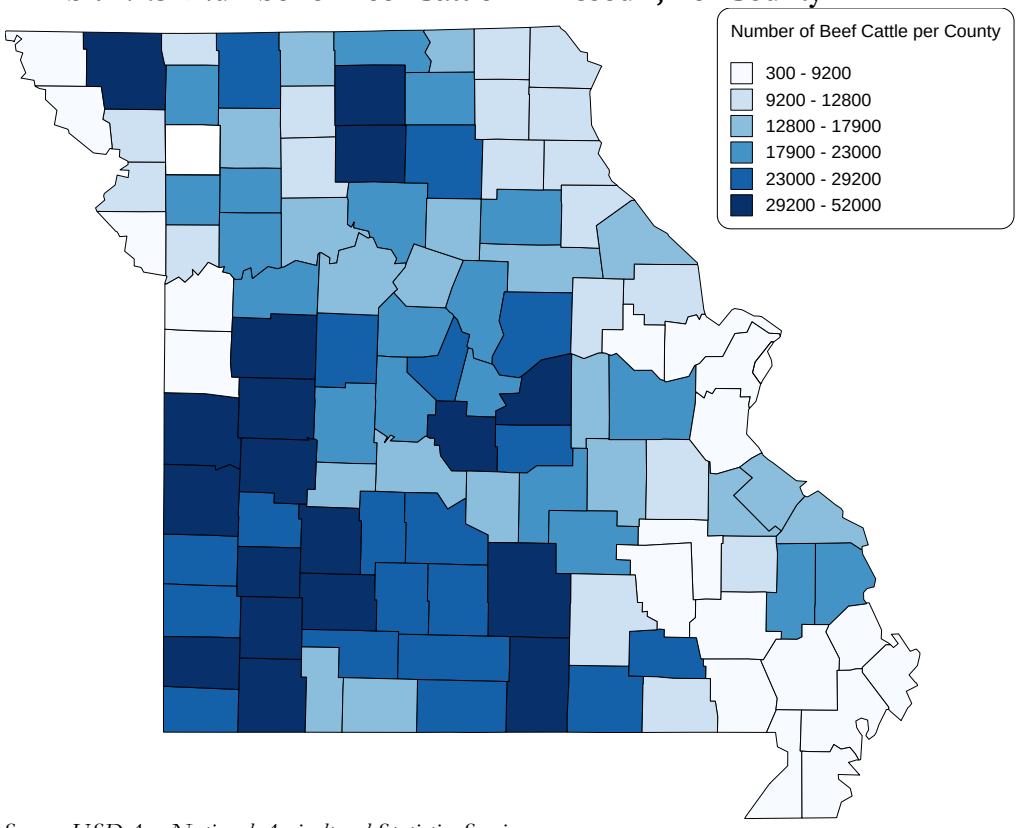
Southwest Missouri Region of Interest

245,900 head of beef and dairy cows (2% death loss)
= 4,918 head of mature animal mortalities annually

20% opt for rendering removal instead of other approved methods of disposal
= 800 to 1,000 head of mature animal mortalities annually to be composted

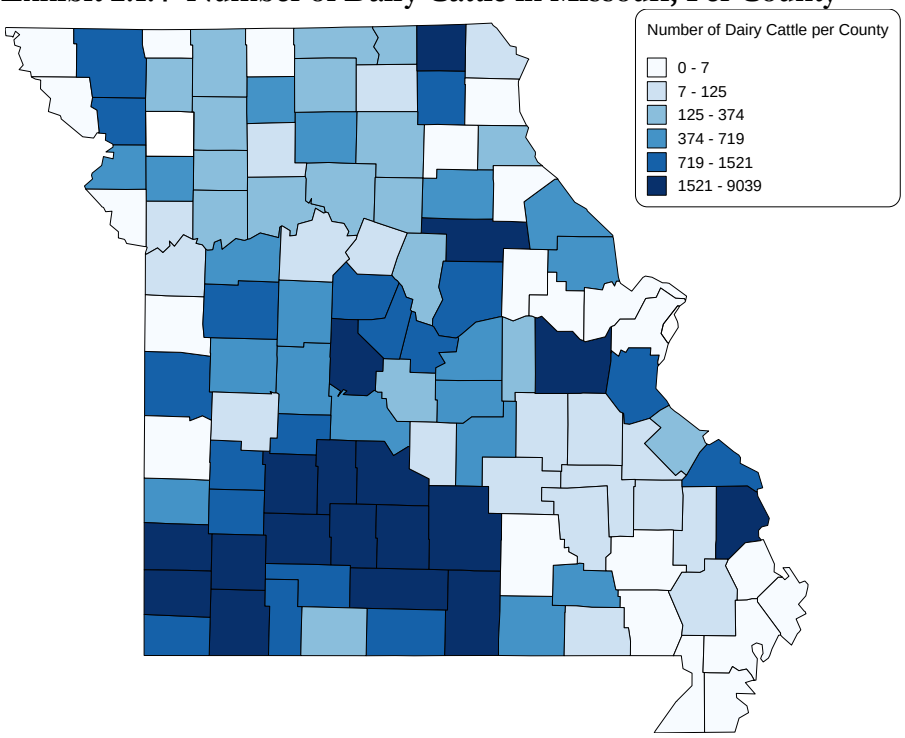
The following exhibits illustrate the animal densities in the target market area and across the state of Missouri. In addition to beef and dairy cattle, other animal mortalities of interest could include hogs, deer, sheep, goats and horses.

Exhibit 2.1.3 Number of Beef Cattle in Missouri, Per County



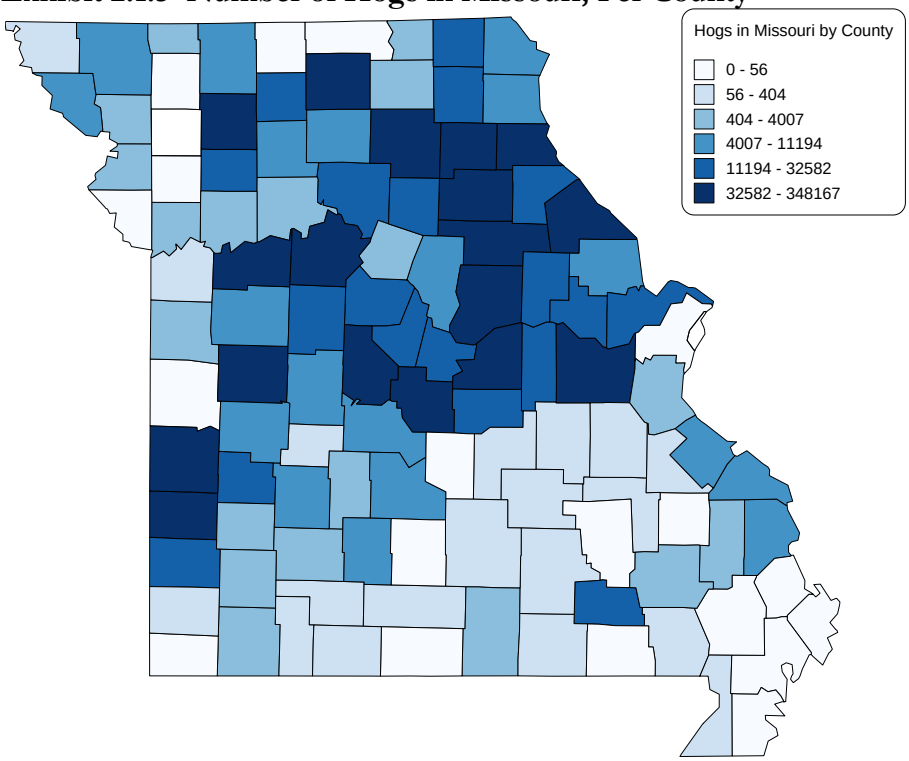
Source: USDA – National Agricultural Statistics Service

Exhibit 2.1.4 Number of Dairy Cattle in Missouri, Per County



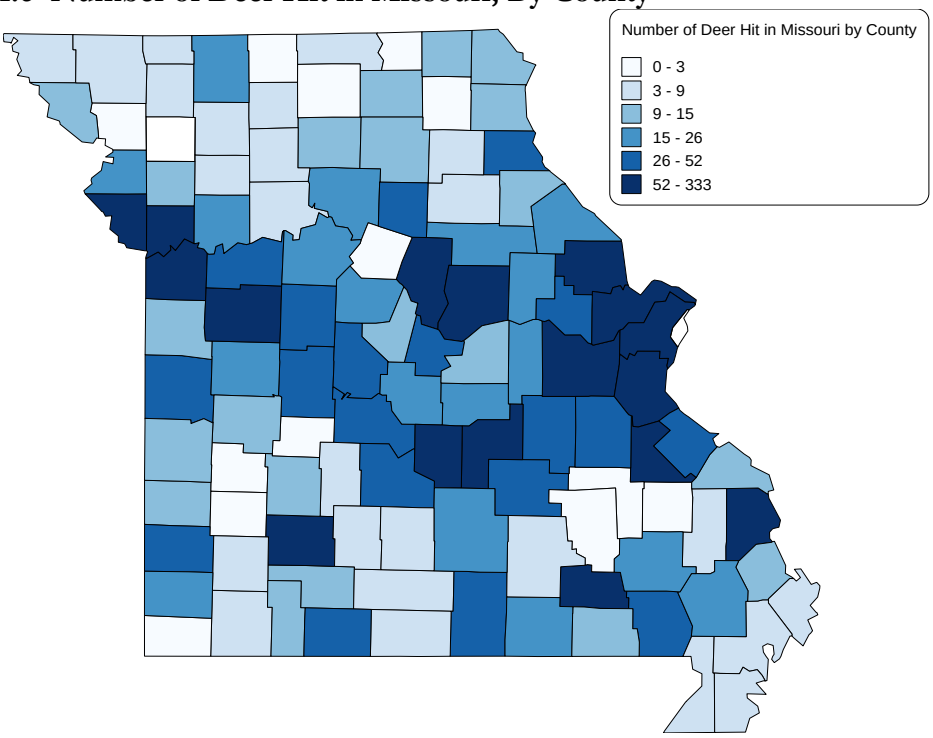
Source: USDA – National Agricultural Statistics Service

Exhibit 2.1.5 Number of Hogs in Missouri, Per County



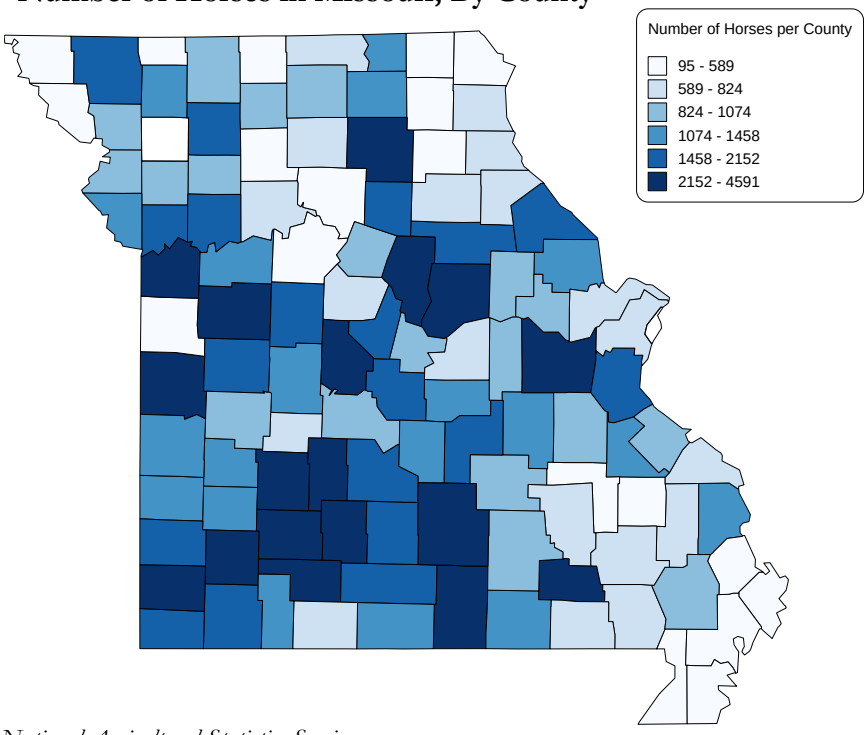
Source: USDA – National Agricultural Statistics Service

Exhibit 2.1.6 Number of Deer Hit in Missouri, By County



Source: Analysis of Deer Involvement in Missouri Traffic Crashes, Missouri State Highway Patrol, 2007

Exhibit 2.1.7 Number of Horses in Missouri, By County



Source: USDA – National Agricultural Statistics Service

2.2 Current Animal Disposal Practices

The state of Missouri requires that all dead animal carcasses be properly disposed with 24 hours. There are five acceptable options available for farmers according the Missouri Department of Natural Resources (MDNR). The five acceptable options are rendering, composting, disposal in approved landfills, incineration and burial (in order of preference).

Disposal of dead animals in a state licensed and approved rendering facility is a challenge because of the limited number of rendering plants available to pickup animals. Halfway Pack has recently resumed operations in the Southwest Missouri region and Millstadt Rendering (based out of Millstadt, Illinois) picks up mortalities in the eastern and southeastern regions of Missouri where animal densities are high enough to warrant having routes.

A survey in March 2010 provided the following data:

- Halfway Pack charged $0 to $45 per mortality pickup. Pickup charge depended on the county and mileage from their facility. Swine and horse mortalities were $50 and $75 per pickup, respectively since Halfway Pack does not process these animals.
- Millstadt Rendering typically charges $25 to $30 per animal for pickup. Pickup is in areas that a route truck has a density of animals for pickup (typically around 50 to 75 miles from their plant). Route trucks typically drive 350 miles per day and bring in 10,000 pounds of carcass when they return.

Discussions with both carcass disposal service companies indicate that the future viability of their businesses depends upon a changing regulatory environment and a changing economic environment. U.S. regulatory actions to safeguard against bovine spongiform encephalopathy (BSE) has significantly changed rendering company business practices, the value of their products, and the costs they must charge animal producers.

Composting is an effective alternative that recycles dead animals into soil amendments. Composting requires a carbon source (wood chips, sawdust, hay, etc.) be placed around the carcasses to ensure a proper carbon/nitrogen ratio to compost the carcasses. Carcasses should be placed on a layer of carbon at least one foot thick, covered with at least one foot of carbon on all sides. Abdominal cavities of large animals must be punctured prior to placing carcasses in the carbon layer. The amount of carbon needed vary by carbon source (carbon/nitrogen ratio), but a good rule of thumb for sawdust is to use a minimum of 200 cubic feet of sawdust per 1,000 lbs of carcass to be composted.

Exhibit 2.2.1 On-Farm Composting Example

Landfills approved for mortality disposal are another option for farmers; however, many landfill facilities will not allow for dead animal disposal. Exhibit 2.2.2 below is a list of landfills present in the Southwest Missouri region. These landfills were contacted by telephone concerning acceptance of large animal mortalities specifically cattle, hogs, deer and/or horses, for disposal in the landfill.

Exhibit 2.2.2 Large Animal Composting in Southwest Missouri Landfills

Company	Town (Missouri)	Allow Animal Disposal
Black Oak Recycling and Disposal Facility	Springfield	no
Eagle Ridge Sanitary Landfill	Springfield	no
Lemons Sanitary Landfill	Dexter	no
Prairie View Regional Waste Facility	Lamar	yes
City of Springfield	Springfield	yes
WCA Waste Corporation (transfer station)	Joplin	no

Source: University of Missouri Survey, 2010

Black Oak Recycling and Disposal Facility, Eagle Ridge Sanitary Landfill, and Lemons Sanitary Landfill do not accept large animals for disposal in the landfill. Prairie View Regional Waste Facility and the City of Springfield both accept animals at their facilities and dispose of the carcasses with the garbage in the landfills. WCA Waste Corporation is a waste transfer station located in Joplin, MO. This facility does not allow large animal disposal as the waste is dumped on a concrete slab for a limited amount of time and then loaded on trucks and transferred out of state to a landfill.

Incineration is an energy intensive process and has the potential for polluting the environment if the incinerator is not designed, operated and maintained properly. Open burning of dead animals or burning in an open container is not allowed. All incineration of dead animals must be done in an incinerator that is designed, constructed and operated in accordance with Missouri laws and regulations.

Burial of dead animals is the least preferred disposal method by MDNR. There are various laws and rules restricting on-site burial of dead animals. The following burial limitations, geographic restrictions and other conditions were obtained from Missouri's Dead Animal Law (RSMO 269.020). .

(1) For areas defined by the department of natural resources, division of geology and land survey, as having major groundwater contamination potential, the maximum loading rate shall be limited to:

(a) One bovine, six swine, seven sheep, and beginning July 1, 1995, seventy turkey carcasses or three hundred poultry carcasses on any given acre per year; or

(b) All other species and immature cattle, swine, and sheep, and beginning July 1, 1995, turkeys or poultry shall be limited to one thousand pounds of animals on any given acre per year;

(2) A maximum loading for areas excluded from subdivision (1) of this subsection shall be limited to:

(a) Seven cattle, forty-four swine, forty-seven sheep, and beginning July 1, 1995, four hundred turkey carcasses, or two thousand poultry carcasses on any given acre per year; or

(b) All other species and immature cattle, swine, sheep, and beginning July 1, 1995, turkeys or poultry shall be limited to seven thousand pounds of animals on any given acre per year;

(3) The maximum amount of land that shall be used for on-site burial of animals on any person's property during a given year shall be limited to ten percent of the total land owned by that person or one acre, whichever is greater; and

(4) Burial sites shall not be located in low-lying areas subject to flooding; and

(5) The lowest elevation of the burial pits shall be six feet or less below the surface of the ground; and

(6) The dead animals shall be immediately covered with a minimum of six inches of soil and a final cover of a minimum of thirty inches of soil; and

(7) Carcasses shall not be placed on the ground, in a ditch, at the base of a hill, or in a cavern and covered with soil; and

(8) The abdominal cavity of carcasses over one hundred fifty pounds shall be punctured to allow escape of putrefactive gasses; and

(9) The location of dead animal burial sites must be in accordance with the following separation distances:

(a) At least three hundred feet from any wells, surface water intake structures, public water supply lakes, springs or sinkholes; and

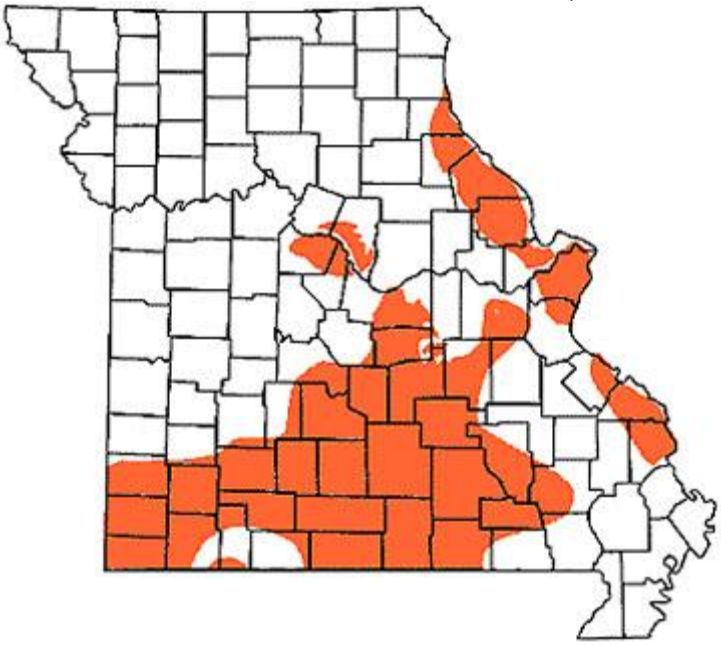
(b) At least fifty feet from adjacent property line; and

(c) At least three hundred feet from any existing neighboring residence; and

(d) More than one hundred feet from any body of surface water such as a stream, lake, pond, or intermittent stream.

Exhibit 2.2.3 outlines the areas of Missouri considered to have major groundwater contamination potential. Specific location information can be obtained by contacting MDNR, Division of Geology and Land Survey, at Rolla, Missouri for an evaluation of the groundwater pollution potential.

Exhibit 2.2.3 Major Groundwater Contamination Potential (Shaded Area)



Source: University of Missouri Extension Guide Sheet WQ216

While Missouri has these five approved methods for animal disposal, it is still a common practice for certain producers to operate outside of law. The "coyote disposal" method is disposal of animal carcasses in remote locations not easily accessible by neighbors or the general public. Animals are left in these areas to naturally decompose or be consumed by predatory animals. "Coyote disposal" is practiced for economic reasons, simplicity of disposal, and because it is has been the traditional method in many operations. This traditional disposal method is not environmentally compatible and is not in compliance with state regulations. "Coyote disposal" is becoming more difficult to hide due to the increasing rural populations in some areas.

Livestock auctions are another source of dead animals in Missouri. A survey was conducted to identify the mortality disposal method used by livestock auctions in Southwest Missouri. Exhibit 2.2.4 lists the auctions surveyed and the mortality disposal method used as well as the average monthly mortalities at each respected market. The calculation of average monthly mortality is dependent on weather conditions and fluctuates with those weather conditions. For example, average monthly mortalities will be elevated during both extreme hot and cold weather conditions.

Exhibit 2.2.4 Survey of Southwest Missouri Cattle Marketing Centers

Livestock Auction	City	Means of Disposal	Average Monthly Dead
Buffalo Livestock Market	Buffalo	Halfway Pack Rendering	4
Joplin Regional Stockyards	Carthage	Compost	N/A
Diamond Sheep & Goat Auction	Diamond	N/A	N/A
Barry County Livestock Auction	Exeter	Halfway Pack Rendering	N/A
Wright County Livestock Auction, Inc.	Mountain Grove	Halfway Pack Rendering	3
Norwood Producers Auction Yards	Norwood	Halfway Pack Rendering	2
Lebanon Livestock Marketing Group	Phillipsburg	Halfway Pack Rendering	2*
Cattleman Livestock Inc.	Sarcoxie	Bury/Halfway Pack Rendering	1
Springfield Livestock Marketing Center	Springfield	Halfway Pack Rendering	6
Cameron Livestock Sales	Urbana	N/A	N/A
Ozark Regional Stockyards, Inc.	West Plains	Bury	12
Douglas County Livestock	Squires	Halfway Pack Rendering	5

**Dependent upon weather conditions*

Source: University of Missouri Survey, 2010

2.3 Potential Dead Animal Supply for Missouri

Estimates of the dead animal supply for various livestock species and the deer population for all Missouri counties is tabulated in Exhibit 2.3.1. Death loss assumptions and average animal weights were used to calculate an average annual animal mortality in pounds per county. This analysis concludes that Missouri has an annual total of 584 million pounds of mortalities from the beef, dairy, swine, horse and deer populations.

Beef mortality pounds were calculated on the county beef cow inventory, an average animal weight of 1,212 pounds and a 2% death loss. Dairy mortality pounds were calculated on the county dairy cow inventory, an average animal weight of 1,323 pounds and a 6% death loss. Swine mortality pounds were calculated on the county swine inventory, an average animal weight of 276 pounds and an 8% death loss. Horse mortality pounds were calculated on the county horse inventory, an average animal weight of 1,323 pounds and a 3% death loss. Deer mortality pounds were based on frequency of deer road kills per county and an average animal weight of 100 pounds.

Exhibit 2.3.1 Estimated Pounds of Mortality, By County, Per Year

County	Beef	Dairy	Hog	Horses	Deer	Beef + Dairy	All
Adair	4,726,800	2,778	25,260	50,168	1,000	4,729,578	4,806,006
Andrew	2,666,400	95,812	9,296	32,744	200	2,762,212	2,804,452
Atchison	1,866,480	0	8,125	11,669	800	1,866,480	1,887,074
Audrain	3,199,680	120,737	1,471,146	64,734	1,900	3,320,417	4,858,198
Barry	11,538,240	216,787	16,185	76,999	400	11,755,027	11,848,610
Barton	5,817,600	43,818	1,323,784	50,644	1,200	5,861,418	7,237,047
Bates	9,696,000	94,780	0	85,413	2,800	9,790,780	9,878,993
Benton	5,187,360	54,217	212,829	53,701	2,700	5,241,577	5,510,806
Bollinger	4,654,080	3,255	24,685	30,760	500	4,657,335	4,713,280
Boone	4,605,600	19,686	237,051	136,573	9,900	4,625,286	5,008,810
Buchanan	2,399,760	42,389	34,180	32,705	2,300	2,442,149	2,511,333
Butler	1,405,920	0	2,738	31,950	2,600	1,405,920	1,443,208
Caldwell	4,338,960	11,193	349,261	34,054	400	4,350,153	4,733,868
Callaway	5,938,800	57,074	1,571,036	105,893	5,400	5,995,874	7,678,203
Camden	3,757,200	36,674	245,176	40,801	3,600	3,793,874	4,083,451
Cape Girardeau	4,823,760	170,191	118,194	56,519	6,000	4,993,951	5,174,664
Carroll	3,781,440	23,814	87,923	25,124	600	3,805,254	3,918,900
Carter	1,236,240	0	48,399	10,994	900	1,236,240	1,296,533
Cass	6,423,600	45,961	604,837	131,731	7,000	6,469,561	7,213,130
Cedar	6,787,200	61,520	532,437	52,510	200	6,848,720	7,433,866
Chariton	4,629,840	12,621	319,100	20,996	1,800	4,642,461	4,984,358
Christian	6,302,400	103,432	2,760	114,625	1,400	6,405,832	6,524,617
Clark	2,496,720	4,445	113,337	18,773	1,200	2,501,165	2,634,475
Clay	2,302,800	556	40,914	74,935	19,300	2,303,356	2,438,505
Clinton	4,338,960	55,487	0	41,635	900	4,394,447	4,436,981
Cole	5,332,800	58,582	668,538	39,214	4,600	5,391,382	6,103,734
Cooper	5,332,800	90,890	301,789	24,330	1,600	5,423,690	5,751,410
Crawford	3,684,480	2,302	4,107	45,842	3,900	3,686,782	3,740,631
Dade	8,484,000	65,965	60,808	51,399	200	8,549,965	8,662,372
Dallas	5,575,200	244,570	8,920	134,748	400	5,819,770	5,963,838
Daviess	4,072,320	13,653	2,754,789	71,640	600	4,085,973	6,913,003
De Kalb	4,120,800	24,211	92,206	36,713	300	4,145,011	4,274,230
Dent	4,969,200	7,620	6,999	40,127	3,400	4,976,820	5,027,346
Douglas	6,060,000	249,015	6,889	74,776	400	6,309,015	6,391,080
Dunklin	290,880	0	4,173	12,899	600	290,880	308,552
Franklin	5,502,480	179,954	829,965	112,997	11,300	5,682,434	6,636,697
Gasconade	3,708,720	16,908	247,164	34,173	1,600	3,725,628	4,008,565
Gentry	4,726,800	29,450	0	42,627	800	4,756,250	4,799,677
Greene	8,338,560	192,814	11,592	153,958	5,200	8,531,374	8,702,124
Grundy	2,908,800	33,578	444,250	37,825	300	2,942,378	3,424,752
Harrison	6,908,400	28,101	88,475	38,460	1,500	6,936,501	7,064,935
Henry	8,120,400	46,279	979,623	59,972	1,900	8,166,679	9,208,173
Hickory	3,878,400	89,144	2,296	26,553	200	3,967,544	3,996,593
Holt	1,478,640	0	122,235	10,121	1,000	1,478,640	1,611,996
Howard	3,636,000	4,763	24,222	35,880	100	3,640,763	3,700,964
Howell	9,986,880	220,756	9,340	107,481	3,100	10,207,636	10,327,556
Iron	1,212,000	1,667	3,643	23,179	0	1,213,667	1,240,489
Jackson	1,478,640	9,287	7,021	88,945	33,300	1,487,927	1,617,194
Jasper	6,423,600	176,938	634,380	72,156	3,800	6,600,538	7,310,875
Jefferson	1,454,400	58,821	9,207	67,433	16,400	1,513,221	1,606,261
Johnson	9,623,280	94,938	107,706	117,760	10,300	9,718,218	9,953,985
Knox	2,811,840	74,776	662,687	16,551	200	2,886,616	3,566,054
Laclede	6,908,400	350,066	174,609	77,792	4,200	7,258,466	7,515,067
Lafayette	4,363,200	40,087	787,527	49,533	2,900	4,403,287	5,243,247

County	Beef	Dairy	Hog	Horses	Deer	Beef + Dairy	All
Lawrence	11,150,400	403,250	44,469	129,786	800	11,553,650	11,728,706
Lewis	2,617,920	0	188,961	31,514	1,300	2,617,920	2,839,695
Lincoln	2,714,880	44,929	210,732	52,034	7,300	2,759,809	3,029,874
Linn	7,078,080	45,723	113,933	26,672	900	7,123,803	7,265,307
Livingston	2,787,600	8,732	245,331	20,758	500	2,796,332	3,062,921
McDonald	6,835,680	57,630	0	59,972	100	6,893,310	6,953,381
Macon	6,787,200	16,749	766,331	85,730	1,400	6,803,949	7,657,410
Madison	2,424,000	1,349	0	20,123	100	2,425,349	2,445,572
Maries	5,599,440	35,324	495,630	46,715	2,000	5,634,764	6,179,109
Marion	2,593,680	22,703	2,224,957	25,997	4,300	2,616,383	4,871,637
Mercer	3,878,400	0	0	22,385	200	3,878,400	3,900,985
Miller	7,708,320	16,987	1,822,483	61,956	2,300	7,725,307	9,612,047
Mississippi	315,120	0	0	3,969	400	315,120	319,489
Moniteau	6,496,320	103,591	575,626	63,901	1,200	6,599,911	7,240,637
Monroe	4,532,880	41,516	1,143,744	26,870	300	4,574,396	5,745,310
Montgomery	2,545,200	0	269,663	40,404	1,500	2,545,200	2,856,767
Morgan	5,454,000	144,313	735,308	87,755	2,600	5,598,313	6,423,976
New Madrid	145,440	0	0	8,216	300	145,440	153,956
Newton	9,259,680	355,702	7,397	113,434	2,300	9,615,382	9,738,513
Nodaway	9,405,120	63,980	229,698	70,886	600	9,469,100	9,770,285
Oregon	6,229,680	36,753	2,981	51,041	1,700	6,266,433	6,322,155
Osage	8,120,400	41,357	1,101,660	23,377	1,400	8,161,757	9,288,194
Ozark	5,575,200	69,934	1,060	54,852	300	5,645,134	5,701,345
Pemiscot	72,720	0	0	3,771	300	72,720	76,791
Perry	3,442,080	92,954	153,213	25,362	1,200	3,535,034	3,714,809
Pettis	6,981,120	29,688	671,696	76,840	3,600	7,010,808	7,762,944
Phelps	4,411,680	35,245	5,873	75,292	7,900	4,446,925	4,535,990
Pike	3,805,680	33,260	719,411	57,868	1,600	3,838,940	4,617,819
Platte	2,060,400	0	0	42,905	20,400	2,060,400	2,123,705
Polk	12,604,800	335,142	90,064	108,592	1,200	12,939,942	13,139,799
Pulaski	3,102,720	2,858	0	42,706	6,400	3,105,578	3,154,684
Putnam	5,357,040	10,161	0	27,227	400	5,367,201	5,394,828
Ralls	2,230,080	0	470,370	28,934	1,400	2,230,080	2,730,784
Randolph	3,636,000	9,923	433,254	58,582	3,800	3,645,923	4,141,559
Ray	4,484,400	17,702	83,573	68,148	2,000	4,502,102	4,655,822
Reynolds	1,454,400	556	707	29,291	100	1,454,956	1,485,053
Ripley	2,714,880	5,318	0	24,052	1,100	2,720,198	2,745,351
St. Charles	969,600	0	313,823	30,680	11,000	969,600	1,325,103
St. Clair	7,078,080	9,843	108,413	40,881	1,000	7,087,923	7,238,217
Ste. Genevieve	3,151,200	11,510	233,319	37,031	5,100	3,162,710	3,438,160
St. Francois	3,151,200	2,461	1,501	53,939	6,600	3,153,661	3,215,701
St. Louis	169,680	0	0	30,522	16,700	169,680	216,902
Saline	3,296,640	4,922	2,170,663	22,107	1,800	3,301,562	5,496,132
Schuyler	3,636,000	17,146	15,942	44,016	100	3,653,146	3,713,204
Scotland	2,375,520	187,178	489,536	22,703	1,100	2,562,698	3,076,036
Scott	945,360	0	0	22,981	1,200	945,360	969,541
Shannon	3,030,000	0	1,236	33,578	600	3,030,000	3,065,414
Shelby	2,908,800	0	1,270,969	17,067	500	2,908,800	4,197,336
Stoddard	1,696,800	1,191	949	37,269	1,600	1,697,991	1,737,809
Stone	3,417,840	91,684	3,467	46,953	1,400	3,509,524	3,561,344
Sullivan	7,756,800	13,018	7,687,527	35,046	200	7,769,818	15,492,592
Taney	3,272,400	14,606	5,255	32,625	3,200	3,287,006	3,328,086
Texas	11,271,600	381,342	4,637	88,707	2,100	11,652,942	11,748,385
Vernon	7,999,200	0	7,475,604	56,558	1,400	7,999,200	15,532,762
Warren	1,454,400	0	480,483	40,484	5,100	1,454,400	1,980,467

County	Beef	Dairy	Hog	Horses	Deer	Beef + Dairy	All
Washington	2,472,480	8,494	3,246	42,230	3,000	2,480,974	2,529,450
Wayne	1,721,040	0	14,794	24,211	2,500	1,721,040	1,762,545
Webster	6,181,200	573,362	167,057	182,217	500	6,754,562	7,104,336
Worth	3,005,760	0	36,167	17,543	500	3,005,760	3,059,970
Wright	6,302,400	717,516	0	71,363	400	7,019,916	7,091,678
Totals	520,190,400	7,799,958	49,746,527	5,920,359	341,900	527,990,358	583,999,144

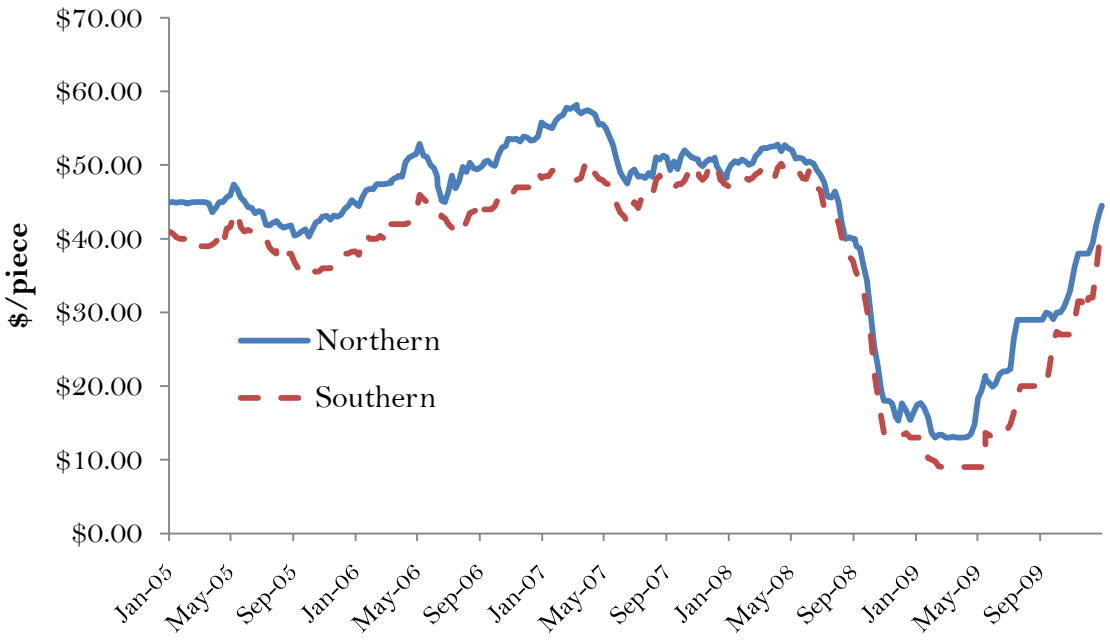
Source: USDA - Census of Agriculture, 2007; Composting Animal Mortalities: A Producer's Guide, Saskatchewan Agriculture, Food and Rural Revitalization, 2005; and Analysis of Deer Involvement in Missouri Traffic Crashes, Missouri State Highway Patrol, 2007

2.4 Markets for Animal By-Products and Composted Material

The two main products of the composting process are hides and the compost itself. The value of these products contributes to economic viability of the large animal composting enterprise. Trends in prices for cattle hides are shown for the northern and southern U.S. regions in Exhibit 2.4.1. Hides usually sell for $40.00 to $55.00 per hide with some regional price variations.

Skinning carcasses accelerates the composting process and provides additional value to overall mortality composting enterprise. The economic downturn in 2008 caused hide prices to plummet; however, hide prices have started to recover. Revenue streams from hide sales are influenced by the state of the economy and can be uncertain.

Exhibit 2.4.1 Heavy Native Cow U.S. Hide Prices ($/Hide)



Source: The Jacobsen Publishing Company

High value markets for compost, such as horticultural uses, typically require mixtures that deliver nutrients that are conducive for growth of these plants. Nutrient profiles for mixtures including a carbon feedstock before animal composting and after the process is complete are presented in exhibits 2.4.2 and 2.4.3, respectively. Notably, the process does not yield high levels of key components such as nitrogen and phosphorus and mostly contributes dry matter.

Exhibit 2.4.2 Composting Mixture Analyses prior to Animal Composting

Nutrient	Sample #1	Sample #2	Sample #3	Average
Carbon (%)	42.8	47.8	4.3	44.8
Nitrogen (%)	4.2	3.4	.	3.8
C:N	10:1	14:1	.	12:1
Phosphorus (%)	0.01	0.01	.	0.01
Dry Matter	19.4	25.4	21.7	22.2
pH	8.5	8.4	8.0	8.3

Exhibit 2.4.3 Composting Mixture Analyses after Animal Composting

Nutrient	Sample #1	Sample #2	Sample #3	Average
Carbon (%)	17.9	18.1	28.9	21.6
Nitrogen (%)	2.3	1.3	2.3	2.0
C:N	8:1	14:1	13:1	11:1
Phosphorus (%)	0.01	0.01	0.04	0.02
Dry Matter	40.4	47.5	51.4	46.4
pH	8.6	8.7	8.2	8.5

Analysis of swine mortality compost using sawdust as a carbon source had an average fertilizer yield of the following on pounds of nutrients per ton on wet basis (as applied to the soil):

- Dry Matter - 1000 lb/ton
- Total Nitrogen - 20 lb/ton
- Ammonia Nitrogen - 4 lb/ton
- Phosphate (P_2O_5) - 2 lb/ton
- Potash (K_2O) - 6 lb/ton

Source: University of Missouri WQ Guide 225, "Composting Dead Swine" Fulhage, Charles, Extension Agricultural Engineer

Exhibit 2.4.4 compares nitrogen levels and pricing of organic ruminant compost with other fertilizers. Ruminant compost is among the lowest fertilizers as a source of nitrogen, and as such, is the lowest valued. While ruminant compost seems price competitive in terms of the dollar cost per part nitrogen, large amounts would be needed given the high proportion of dry matter. Due to low fertilizer value and potential zoonotic disease liability associated with animal-based compost, use in high end horticultural markets is not advisable. However, nutrient composition is sufficient for nearby farmers to utilize the compost as a soil amendment if they can pick it up from the composting site for free. Thus, the compost would not be a revenue source but also would not pose a cost as farmers would provide free removal.

Exhibit 2.4.4 Economic Comparison of Organic Ruminant Compost
(Conversion Is $29/Ton of Product)

Fertilizer	%N	#N/50#	price/50#	Price per #N	#N/ $1.00
Alfalfa Meal	2%	1.20	$19.00	$15.00	0.07
Blood Meal	12%	6.00	$45.00	$7.50	0.13
Fertrell 3-2-3	3%	1.50	$19.00	$12.67	0.08
Fish Meal	8%	4.00	$26.00	$6.50	0.15
Soybean Meal	7%	3.50	$28.00	$8.00	0.12
Chemical Lawn Fertilizer (Agway's for example)	10%	5.00	$12.50	$2.50	0.40
Ruminant Compost	2%	1.00	$0.73^	$0.73^	1.37

^ Imputed from lowest value of commercial compost available in bulk

2.5 Biomass Feedstock for Composting

Composting is an aerobic process. Selection of the best biomass feedstock to use for composting depends upon the price, availability, and ease of use in creating a proper compost recipe. Composting requires a carbon:nitrogen (C:N) ratio range between 20:1 and 40:1. The C:N ratios of all the ingredients used in the composting recipe must be known and mixed in approximately the correct proportions for the process to proceed efficiently.

A moisture content in the 50% to 60% range is desirable for compost piles to proceed efficiently through the composting process. The body composition of cattle is approximately 55%. Efficient composting operations make special efforts to utilize recipes that achieve a moisture content and C:N ratio in the optimum ranges.

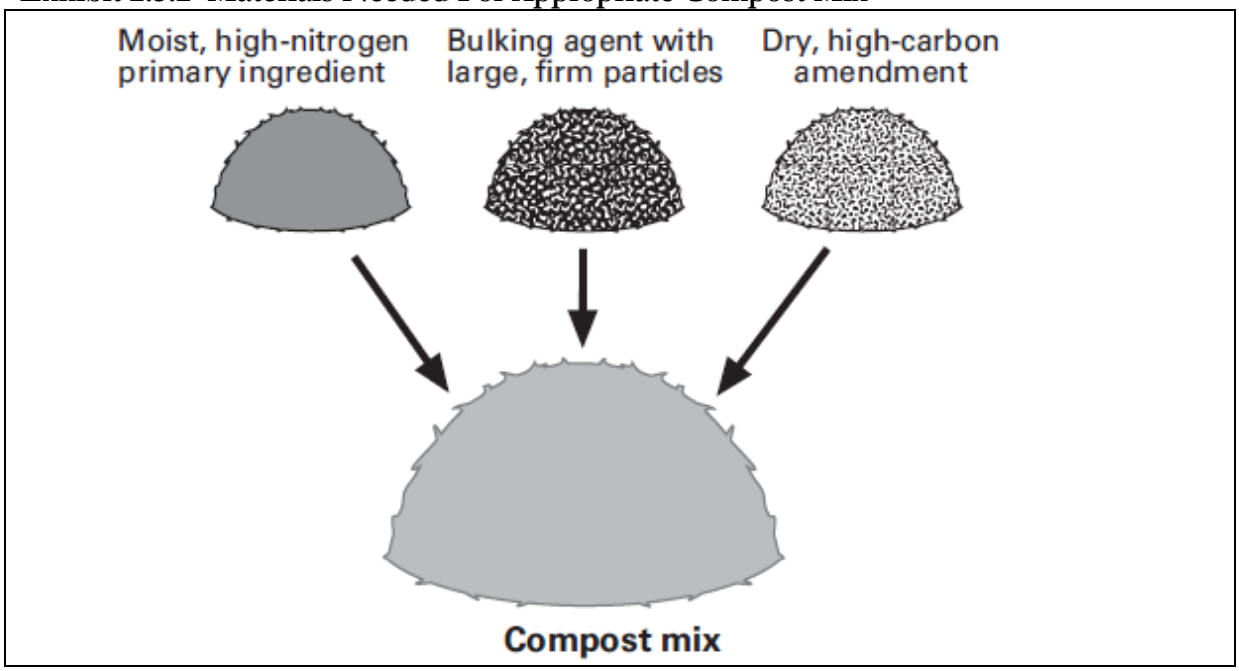
Bulk density of the composting ingredients is another useful property. The moisture content, C:N ratio, and bulk density of six carbon sources are shown in Exhibit 2.5.1 below.

Exhibit 2.5.1 Characteristic Comparison of Available Carbon Sources

	C:N	Moisture Content (%)	Bulk density (lbs/cu.yd)
Sawdust	276:1	41	400
Fescue Hay	39:1	12.1	680
Straw	33:1	14.5	227
Corn Stalks	67:1	12	32
Cardboard	563:1	8	259
Newsprint	625:1	6	218

Source: Romine, Boone, Darren Wankum and Benjamin Runge. Mortality Composting. University of Missouri ASM 4970 Capstone Class, 2009

Exhibit 2.5.2 Materials Needed For Appropriate Compost Mix



2.6 Regulatory and Site Considerations for a Composting Business

Regulations

MDNR is the agency in charge of regulating composting facilities in the state of Missouri. Composing operations that are less than 2 acres (composting area perimeter, which includes unloading, storage and handling of composting materials and finished compost) and are a no-discharge facility (discharge only allowed in a chronic or catastrophic event) are not required to obtain a state operating permit. MDNR can require any operation (regardless of size) to have an operating permit if a discharge occurs or the potential to impair state water quality exists. Good storm water management is essential for mortality compost operations under the 2 acre size limitation to maintain the operating permit exemption.

MDNR general operating permit (MO-G090000) was developed for composting operations less than 20 acres that utilize feedstocks from agricultural, wood, and food product sources. These composting facilities must be designed and operated as a no-discharge facility. Composting and material storage facilities must be sited at least 100 feet from a water course, 300 feet from a lake, 1,000 feet from a losing stream or sinkhole, and 300 feet from a water supply well. The composting area must have an impervious base, which may be made of asphalt, concrete, compacted earth or other suitable materials. MDNR requires annual reports that contain operational information to verify compliance with the operating permit requirements.

Site Selection

A minimum two acre site would be required to start the large animal mortality composting facility. Additional acreage should be available if business growth would warrant expansion of the composting facility.

- The mortality composting site should be located on a relatively level to gently sloping area. The site must allow for surface water to be drained from the site. It might be necessary to have the potential to collect any leachate from the compost and land apply so that no runoff would occur.

- The mortality composting site needs to be isolated from livestock production facilities to provide improved bio-security and from neighbors for protection from any possible odor and public relations issues.

- The site requires a road network that will allow large trucks to have all-weather access to the site.

- The site should be naturally screened from view from persons traveling the roads that provide access to the mortality composting area. It is also desirable that traffic "in and out" of the facility not pass any close neighbors on a regular schedule

- The mortality composting area would require fence construction that would prevent access by animal scavengers. Access to the site should also be restricted to improve bio-security and prevent bio-terrorism from anti-animal organizations.

- A water supply will be required to provide the potential to add moisture to the carbon source. This water supply should be located, "off-site" with a setback distance from the facility of at least 300 feet to comply with DNR regulations for composters without concrete floors.

- Facility operator should have adequate cropland acres available nearby to land apply the nutrients produced at the facility in an approved manner. This would probably require acquiring and following a written nutrient management plan. Part of this plan would be to determine the nutrient content of finished compost by laboratory testing on a regular schedule and land apply based on soil test requirements for the crops grown on the selected fields.

2.7 Dead Animal Accumulation Costs

Operating rendering companies interviewed early in 2010 indicated that the costs to operate a covered truck pickup route accumulating dead animals ran about $1.50 per loaded mile. Gasoline prices during this period were about $2.60 per gallon and routes seldom went beyond 75 miles from the rendering site.

Rendering companies surveyed indicated that established routes into livestock concentration areas usually yielded about 10,000 pounds of dead animals. A typical route required about 350 miles of travel to fill the truck. Mortality pickup costs based on these surveys would be approximately $0.05 per pound.

A 1,200 pound carcass would incur an average $60 pickup charge based on the $0.05 per pound for hauling cost. Lower carcass pickup costs would exist for shorter haul distances or when multiple mortalities were at a site. Hauling costs may be a major economic factor to centralized dead animal disposal options; especially, if the rendering value of the carcass is low and does not provide adequate income to aid in offsetting transportation costs.

The Missouri State Veterinarian's office requires that all dead animals carcasses hauled on highways be transported in a covered truck or wagon. One potential option for livestock producers seeking to lower their dead animal pickup costs may be for the centralized mortality disposal facility to rent carcass transporting equipment for a nominal charges. Covered bumper hitch and gooseneck trailers equipped with winches might provide livestock producers with a method to transport dead animal carcasses to the mortality processing center. This option does have some inherent bio-security issues as the trailers would be picked up and returned to the mortality composting facility.

3. Feasibility of Different Composting Systems

The following four dead animal composting systems were examined in detail for their technical feasibility, flexibility, and financial viability. These systems were identified as strong alternatives that could be potentially developed into a value-added farmer owned entity. Findings on each system are explained in the following sections.

Two Mechanical Composting Systems

- Dutch Composter – Vertical Mechanical Composter
- BIOvator – Horizontal Mechanical Composter

The mechanical systems have been very popular in Canada where stricter rendering and disposal regulations are already in place. The mechanical systems have also been very popular in large livestock complexes where the arrival of dead animal pickup vehicles has spurred bio-security concerns that have outweighed the high capital costs of the mechanical systems.

Two Static Pile Passive Compost Systems

- Static Compost Piles (Unroofed)
- Static Compost Piles (Under Roof)

In the following analysis, all four systems were assumed to be built into a facility capable of handling one (1) dead cow per day. This was the minimum starting point thought to be practical. All of the systems are scalable simply by adding more mechanical compost units or adding more compost pile space. Selecting a one cow per day compost facility was done so that all of the systems could be compared against a standard size.

3.1 Dutch Composter

This vertical mechanical composting mixer was developed by Dutch Industries, which is located in Saskatchewan, Canada (website: http://www.dutchcomposter.com/). The development of this product was due to the need for environmentally friendly and onsite disposal of livestock mortalities for Canadian farmers. Dutch Industries works in conjunction with SEMA Equipment Inc. (Dutch Valley, Minnesota) and offers retail sales of the Dutch Composter units to U.S. farmers. The following sections and pictures are summarized from Dutch Composter booklet and operating manual.

The Dutch Composter unit is designed to compost a variety of animals, such as hogs, sheep, poultry, cattle, and road kill (deer, etc). To add material to the composter, you can either use dumpster type bucket or use your loader (pay or skid) to dump mortalities and carbon materials in.

Exhibit 3.1.1 Dutch Composter Unit

The Dutch Composter is an in-vessel composter designed to digest and compost from 50 to 1000 pounds of carcasses per day and achieve pathogen destruction in the completed compost. The system is capable of grinding, mixing and the physical break down of 2000+ pounds per day of mortalities; however, temperature and time required for proper pathogen destruction at these high loading rates may not be achieved. If the recommended temperatures, to insure pathogen destruction, are not reached, the partially composted material needs to unload from the machine and be placed into a static pile to complete the composting cycle.

A Dutch Composter owner using the composter to digest dairy cows indicates that cows composted for two (2) days will require additional composting time in a secondary compost pile to complete composting of the animal hides. The owner stated that complete composting of dairy cows can be achieved in four (4) days using the Dutch Composting system.

Teeth on the floor of the Dutch Composter break up bones and tear hides. A stirring arm inside the composter assists in the physical destruction of the carcass materials. There are very few visible animal bones after the first day of operation of the composter. A second day of composter operation is required to break down most of the hide. Large carcasses and high loading rates require additional time for physical destruction of the bones and hide. A four (4) day composting period will usually be required to complete the composting process.

Exhibit 3.1.2 Dutch Composter Inside View

The stirring arm on the inside of the Dutch Composter is set on a timer to regulate the frequency and length of time that the stirring arm operates. Stirring arm operational time is determined by the amount of material added to the tank. The stirring arm is powered by a seven (7) horse power motor that requires 12-20 amps of electricity to operate.

Carbon sources used for composting vary with the geographic area where the machine is operated. Cornstalks, woodchips, wood shavings, sawdust and wheat straw are the most available and commonly used with the Dutch Composter System in the Midwest United States. Carbon source amounts used varies with the moisture of the materials being composted. Composting mixtures usually are 1 pound of carbon material to 2-3 pounds of mortality to achieve an acceptable carbon: nitrogen ratio and moisture content for composting. In many cases, drier carbon source material will allow reduced use.

The Dutch Composter is easily unloaded. A door on the side bottom of the machine must be opened, the unloading button activated and the stirring arm will push the composted material out of the machine for transport to the next step in the composting or compost distribution system.

Exhibit 3.1.3 Dutch Composter Unloading and Composted Material

3.1.1 Strengths and Weaknesses

A strengths and weaknesses analysis is used to summarize Dutch Composter composting system.

Strengths

- Fast: Large carcasses + carbon source will be converted into compost within 2 to 4 days
- Can process an entire animal mortality per batch
- Bones are reduced to thumb nail size
- Small area footprint needed for installation
- Proven technology
- Environmentally compatible and provides good control of leachate, odor and flies
- Only 400 to 500 pounds of carbon material needed per animal

Weaknesses

- Electricity costs of $25.00 to $50.00 are required to process each large carcass
- Large capital outlay of $60,000 for each composter unit
- Proven technology for smaller animal mortalities; however, drive-train is being re-designed for large carcass processing to ensure equipment life of ten years
- Does not have flexibility to handle surges of animal mortalities
- With two day compost period, a secondary static compost pile will be necessary to complete the composting of hides
- Will not function with hay as a carbon source due to wrapping problems

3.1.2 Capital Investments and Start Up Assumptions

Exhibit 3.1.2.1 displays a summary and breakdown of the capital and start up investments required for composting large animals using the Dutch Composter technology.

Exhibit 3.1.2.1 Capital and Start Up Investment Summary—Dutch Composter

Capital Investments	Amount
Land and Improvements	
Land	$4,000
Fence and Gate	$1,500
Landscaping	$1,000
Gravel Area	$4,000
Land Grading	$2,000
Electrical Connection	$1,500
Concrete Pad (8'x8'x0.5')	$1,200
Buildings	
Storage (Covered)	$10,000
Machinery	
Dutch Composter (4 Units @ $60,000 per unit)	$240,000
Auger Elevator	$1,000
Payloader	$20,000
Shipping Container	$1,500
Misc. Tools and Equipment	$1,000
Water Source	$7,000
Total Capital Investment	**$295,700**
Working Capital Investment	$50,000
Total Start Up Investment	**$345,700**

The largest capital expense is the Dutch Composter unit. The Dutch Composter base unit quoted cost is $48,300, according to SEMA Equipment in Minnesota. This quoted price does not include shipping, warranty, any optional features or installation costs. An estimated installed cost of $60,000 per unit is used in this economic analysis. The cost displayed in the exhibit for the Dutch Composter is the total cost for the purchase and installation of four separate composting units.

It was assumed that two acres of land would be required for the operation and purchased for $2,000 per acre. Various improvements would need to be made to the site and are detailed in the above exhibit.

A building would be required for the storage of finished compost. This building would have a concrete floor and be approximately 1,000 square feet and provide 60 days of compost storage.

A shipping container was utilized as office space and miscellaneous storage. An assumed working capital investment of $50,000 is provided to create a beginning cash balance for the operation. The remaining required investments are summarized in the exhibit.

The total start up investment in this operation would be $345,700. The financial model assumes that this amount is financed in its entirety by owner investment. However, this assumption does not eliminate outside investment(s) and/or bank financing of the operation. Financing options for the operation would ultimately be made by the owner(s) of the operation.

3.1.3 Financial Projections

A financial analysis of the investment required to establish and operate a Dutch Composter mortality composting facility is presented in this section. The analysis also discusses the effect of government subsidies on the financial model. The model does not include a route truck or account for the transporting of animals from the carcass pickup location to the compost site. A discussion of the investment option of a covered trailer that could be utilized to transport the animals is provided.

The model does not account for any revenue from selling the finished compost (final product). This is because the finished compost has low nutrient values and also a perceived potential risk of pathogen transfer. The finished compost can be utilized for the fertilizer nutrient content and as a soil conditioner on row crop or forage production areas. It is assumed that with these utilization options, disposal of the finished compost will not incur an operational cost to the firm.

3.1.3.1 Operating Assumptions

It was projected the operation would be required to compost 1,500 pounds of animal mortality per day. A single Dutch Composter would require four days to completely compost 1,500 pounds animal mortality. Four Dutch Composters would be utilized to meet the operational requirements of the composting facility. The owner of the composting operation will determine the composting service fee. This financial model assumes a fee of $75.00 per 1500 pounds of animal mortality composted. This fee was not adjusted for potential inflation. The firm could adjust the fee structure to account for rising inflation costs. Operating assumptions are summarized in Exhibit 3.1.3.1.1.

Exhibit 3.1.3.1.1 Key Operating Assumptions—Dutch Composter

Operational Assumptions	
Incoming Animals/Day	1
Pounds/Animal	1500
Days/Animal *(to complete composting process)*	4
Composting Units Needed	4
Operating Days/Year	365
Animals Composted/Year	365
Per Animal Fee *(Charged to Customer)*	$75.00

Exhibit 3.1.3.1.2 displays operational expense assumptions for the Dutch Composter mortality facility. It is assumed that one (1) hour of labor per day would be required to operate the mortality composter facility. An hourly labor rate of $10 was used. Operational inputs necessary for composting the animal mortalities are electricity and a source of carbon.

The electricity expense was computed based on usage information supplied by the Dutch Composter manufacturer and local electricity rates. The carbon source expense was calculated from Dutch Composter operational requirements and adjusted for the prices of local carbon sources. An annual miscellaneous fuel expense of $500 was included for regional travel that may be necessary to secure carbon source materials and other administrative travel expenses. This miscellaneous fuel expense does not include any costs incurred due the operation of a route truck (as noted earlier). Other operational expenses shown in the exhibit are estimated operational costs. The expenses displayed are for the year 2011. An annual inflation rate of three percent is applied to each of these expenses in years two through five of operation in the financial analysis.

Exhibit 3.1.3.1.2 Assumptions Utilized to Project the Expenses

Operating Expenses	
Personnel	
Employees	1
Hourly Rate	$10.00
Hours/Day	1
Inputs	
Electricity Expense/Animal Composted	$60
Carbon Expense/Animal Composted	$8.75
Annual Fuel Expense	$500
Annual Maintenance/Repairs Expense	$1,500
General/Administrative Expenses	
Annual Insurance Expense	$500
Annual Property Tax Expense	$500

3.1.3.2 Income Statement

Five years of financial statements were created based on the previously discussed assumptions and projections. Exhibit 3.1.3.2.1 shows the pro forma income statements for a composting operation using the Dutch Composter technology.

Gross margin displays a firm's ability to cover the variable expenses associated with the production and/or sale of a good. This is important because firms can have the ability to operate short-term as long as they have a positive gross margin. Gross margin is calculated by subtracting the direct costs (cost of sales) associated with the production of the compost from the total sales amount. The annual sales amount is based on the fee received by the firm for composting the animals. The animal is the material being composted so there is no expense for materials/packaging/goods. The labor expense is based on the assumptions displayed in Exhibit 3.1.3.1.2. The other direct costs are associated with the electricity, carbon sources, fuel, and maintenance expenses which were shown in Exhibit 3.1.3.1.2.

Overhead expenses are subtracted from gross margin to compute income from operations. These are expenses that are incurred to the firm even if compost is not being produced. There is no selling or management staff expenses included in this analysis. It was assumed that marketing would not be necessary for this type of operation and no other selling expenses would be applicable.

The operation is not very management intensive and the owner(s) would be responsible for all management tasks and decisions. The owner/manager would probably require some amount of salary to be paid from the firm; however, no attempt was made to forecast this in the financial model. General expenses include insurance and tax expenses discussed in Exhibit 3.1.3.1.2. Depreciation was calculated using the straight-line method. A ten-year life span, paired with a zero salvage value, was utilized in the depreciation calculation. As previously mentioned, a three percent annual inflation rate was applied to all expenses in years 2012-2015.

No interest expense was used in the financial model as owner(s) financing was assumed. Tax liabilities and dividend payouts are dependent upon business structure. No assumptions were made about tax liability or dividend payouts in this financial analysis.

Exhibit 3.1.3.2.1 Pro Forma Annual Income Statements—Dutch Composter

Income Statements	2011	2012	2013	2014	2015
Years Ending Dec	$	$	$	$	$
Total Sales	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**
Cost of Sales:					
-Materials/Packaging/Goods	0.0	0.0	0.0	0.0	0.0
-Direct Labor	3,650.0	3,759.5	3,872.3	3,988.5	4,108.1
-Other Direct	27,093.8	27,906.6	28,743.8	29,606.1	30,494.3
Cost of Sales	**30,743.8**	**31,666.1**	**32,616.0**	**33,594.5**	**34,602.4**
Gross Margin	**(3,368.8)**	**(4,291.1)**	**(5,241.0)**	**(6,219.5)**	**(7,227.4)**
Overhead Expenses:					
-Selling	0.0	0.0	0.0	0.0	0.0
-Management/Admin Staff	0.0	0.0	0.0	0.0	0.0
-General	1,000.0	1,030.0	1,060.9	1,092.7	1,125.5
Depreciation	29,570.0	29,570.0	29,570.0	29,570.0	29,570.0
Operating Lease Payments	0.0	0.0	0.0	0.0	0.0
Total Operating Expenses	**30,570.0**	**30,600.0**	**30,630.9**	**30,662.7**	**30,695.5**
Income From Operations	**(33,938.8)**	**(34,891.1)**	**(35,871.9)**	**(36,882.3)**	**(37,922.9)**
Total Other Income (Expenses)	0.0	0.0	0.0	0.0	0.0
Earnings Before Interest & Taxes	**(33,938.8)**	**(34,891.1)**	**(35,871.9)**	**(36,882.3)**	**(37,922.9)**
Interest Expense/Income:					
-Interest Expense	0.0	0.0	0.0	0.0	0.0
-Interest Income	0.0	0.0	0.0	0.0	0.0
Net Interest Expense (Income)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Net Income Before Taxes	**(33,938.8)**	**(34,891.1)**	**(35,871.9)**	**(36,882.3)**	**(37,922.9)**
Taxes	0.0	0.0	0.0	0.0	0.0
Net Income	**(33,938.8)**	**(34,891.1)**	**(35,871.9)**	**(36,882.3)**	**(37,922.9)**
Dividends Declared	0.0	0.0	0.0	0.0	0.0
Transferred To Reserves	**(33,938.8)**	**(34,891.1)**	**(35,871.9)**	**(36,882.3)**	**(37,922.9)**

Income statements for the operation show a negative gross margin in all years. This is mostly due to the electricity expense associated with operating the Dutch Composter. This negative gross margin alone prohibits an operation using the Dutch Composter technology from being financially feasible.

3.1.3.3 Cash Flow Statement

Exhibit 3.1.3.3.1 displays the pro forma cash flow statements for the operation. The cash flow statement provides an analysis of all actual cash receipts and expenditures. Cash receipts are limited to the fee collected for animals composted in this mortality composting operation. The initial capital investment of $345,700 is also included in the cash receipts for 2011. Cash payments are made for all actual expenses associated with operation excluding depreciation. In 2011, the operation also shows a cash expenditure for the capital investments discussed in section 3.1.2.

Exhibit 3.1.3.3.1 Pro Forma Annual Cash Flow Statements—Dutch Composter

Cash Flow Projections	2011	2012	2013	2014	2015
Years Ending Dec			*In U.S. Dollars*		
Cash Receipts:					
Cash Sales & Accounts Receivable	27,375.0	27,375.0	27,375.0	27,375.0	27,375.0
Equity Investments	345,700.0	0.0	0.0	0.0	0.0
Increases in Long-term Debt/Notes	0.0	0.0	0.0	0.0	0.0
Miscellaneous Income Received	0.0	0.0	0.0	0.0	0.0
Interest Received	0.0	0.0	0.0	0.0	0.0
Total Cash Receipts	**373,075.0**	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**
Cash Payments:					
Materials/Goods Accounts Payable	0.0	0.0	0.0	0.0	0.0
Total Direct Cost Payments	30,743.8	31,666.1	32,616.0	33,594.5	34,602.4
Total Overhead Expense Payments	1,000.0	1,030.0	1,060.9	1,092.7	1,125.5
Federal/State Taxes Paid	0.0	0.0	0.0	0.0	0.0
Dividends Paid	0.0	0.0	0.0	0.0	0.0
Total Capital Expend. Payments	295,700.0	0.0	0.0	0.0	0.0
Long-term Debt/Note Repayments	0.0	0.0	0.0	0.0	0.0
Interest Paid	0.0	0.0	0.0	0.0	0.0
Total Cash Payments	**327,443.8**	**32,696.1**	**33,676.9**	**34,687.3**	**35,727.9**
Net Cash Flow	**45,631.3**	**(5,321.1)**	**(6,301.9)**	**(7,312.3)**	**(8,352.9)**
Closing Net Cash Balance (Deficit)	**45,631.3**	**40,310.2**	**34,008.2**	**26,696.0**	**18,343.1**

All years, except 2011, experience a negative cash flow. This would also be true of 2011except the initial equity investment made includes $50,000 for working capital. This working capital investment allows for the closing cash balance to remain positive for all five years projected. This cash balance decreases annually due to the negative cash flow experienced annually by the firm. The annual negative cash flow also keeps this operation from being financially feasible.

3.1.3.4 Balance Sheet

The pro forma annual balance sheets are displayed in Exhibit 3.1.3.4.1. The sole current asset for the firm will be the cash balance. The cash balance is the amount calculated on the cash flow statements displayed in Exhibit 3.1.3.3.1. It was assumed all composting service fees would be received at the time the animal is transferred from the original pickup location to the composter facility. This assumption allows accounts receivable to maintain a zero balance. Due to the nature of the operation, inventory of animal mortality numbers are not maintained. This allows the inventory balance to remain at zero. The fixed asset portion of the balance sheets is comprised of the value of the capital investments detailed in Exhibit 3.1.2.1 minus the accumulated installation and equipment depreciation.

The liabilities section has no value associated with it. It was assumed that the firm would pay all bills within 30 days. This assumption prohibits accounts payable from carrying a balance. As previously stated, no assumptions were made about dividends or taxes. The operation is assumed financed solely by owner investment so no short or long-term loans are utilized. The equity section displays the original equity investment adjusted by retained earnings. The amounts shown as retained earnings are calculated from the income statements found in Exhibit 3.1.3.2.1.

Exhibit 3.1.3.4.1 Pro Forma Annual Balance Sheets—Dutch Composter

Balance Sheets	2011	2012	2013	2014	2015
Years Ending Dec			*In U.S. Dollars*		
ASSETS					
Current Assets:					
Cash at Bank	45,631.3	40,310.2	34,008.2	26,696.0	18,343.1
Accounts Receivable	0.0	0.0	0.0	0.0	0.0
Inventory	0.0	0.0	0.0	0.0	0.0
Total Current Assets	**45,631.3**	**40,310.2**	**34,008.2**	**26,696.0**	**18,343.1**
Fixed Assets:					
Fixed Assets (Gross)	295,700.0	295,700.0	295,700.0	295,700.0	295,700.0
Less: Accumulated Depreciation	29,570.0	59,140.0	88,710.0	118,280.0	147,850.0
Net Fixed Assets	**266,130.0**	**236,560.0**	**206,990.0**	**177,420.0**	**147,850.0**
Net Intangible Assets	0.0	0.0	0.0	0.0	0.0
Total Assets	**311,761.3**	**276,870.2**	**240,998.2**	**204,116.0**	**166,193.1**
LIABILITIES					
Current Liabilities:					
Accounts Payable	0.0	0.0	0.0	0.0	0.0
Dividends	0.0	0.0	0.0	0.0	0.0
Federal/State Tax	0.0	0.0	0.0	0.0	0.0
Short-Term Loans/Credit	0.0	0.0	0.0	0.0	0.0
Total Current Liabilities	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Long-term Liabilities:	0.0	0.0	0.0	0.0	0.0
Long-term Debt/Notes	0.0	0.0	0.0	0.0	0.0
Total Long-term Liabilities	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Equity:					
Equity Investments	345,700.0	345,700.0	345,700.0	345,700.0	345,700.0
Retained Earnings	(33,938.8)	(68,829.8)	(104,701.8)	(141,584.0)	(179,506.9)
Total Owners' Equity	**311,761.3**	**276,870.2**	**240,998.2**	**204,116.0**	**166,193.1**
Total Liabilities & Equity	**311,761.3**	**276,870.2**	**240,998.2**	**204,116.0**	**166,193.1**

A review of the income and cash flow statements shows the overall value of the business declines each year of operation. This assumed venture looses almost half of its original worth after the fifth year of operation.

3.1.3.5 Analysis of the Effect of Government Subsidies

There are currently no federal or state level programs offering subsidies for this type of operation. It is possible that an animal composting operation could qualify for some type of government subsidy in the future. A partially subsidized animal composting operation would reduce the start up investment amount. The owner(s) investment would be reduced by the amount of subsidies received. These subsidies would not affect the annual net income, cash flows, or net worth discussed previously in this economic analysis. The subsidies would serve to supplement the owner investment for the capital expenditures required at business start up.

3.1.3.6 Trailer Purchase Discussion and Summary

A route truck was not utilized in this financial model. It was questioned whether the added expense associated with the route truck would provide a positive economic advantage for the mortality composting facility. The purchase of a 6' x 12' enclosed utility trailer with a wench capable of handling 2,000 pounds might provide an improved economic option.

A trailer and winch system could be purchased for less than $5,000. The composting operation could offer customers needing to transport animal mortalities the option of renting the trailer. A daily rental fee of five to ten dollars would be sufficient to cover depreciation and mileage expenses associated with the use of the trailer. Rental fees would not be sufficient to provide a revenue stream that would affect the economic analysis of the operation.

3.2 BIOvator™

The BIOvator™ in-vessel composter (website: http://nioex.com/biovator/) is another alternative for composting animal mortalities. Nioex Systems Inc. acquired the rights to the BIOvator products in October 2008 and offer units for sale through Nioex Systems USA, Inc. located in Mankato, Minnesota and Southeastern Composting Systems LLC in Clinton, North Carolina. The BIOvator™ is an all-steel, in-vessel composter and is currently in use on more than 150 locations throughout Canada and the US. BIOvator™ units are used mostly to compost swine and poultry mortalities.

Exhibit 3.2.1 BIOvator™ Unit

Features of the BIOvator™ include:

- 4 ft diameter x 30-42 ft long insulated vessel with stainless steel shell - other sizes are available.
- Two loading doors 7.5' x 2' with inspection openings and one 18" discharge opening.
- Stainless steel paddles mounted on the inside vessel walls.
- Galvanized steel skid, with heavy-duty nylon rollers to support the composting vessel.
- Driving system: 1 hp motor – 110 V, 2 gear boxes, heavy duty bearings, sprockets and drive chain.

The BIOvator™ system operates by loading animal mortalities along with carbon sources (wood shavings) into the vessel and operating the composting vessel. Compost is moved through the rotating drum from the loading end to the discharge opening. The composting temperature inside the BIOvator™ is supposed to be above 100˚F/38˚C regardless of outdoor weather conditions. The BIOvator™ is a continuously operating composting machine that will process mortalities into compost in less than 7 days in the summer and 14 days in the winter.

Exhibit 3.2.2 BIOvator™ Inside View with Animals and Carbon

BIOvator™ company personnel contend the larger sized composting cylinders are sufficient to physically process cattle carcasses; however, the large carcasses do not oxygenate in an acceptable manner. The company current sells their smaller diameter units to dairy production operations. These smaller diameter units require that no more than 500 pounds per day of mortality be loaded into the composting unit.

The complexity of composting large bones and hides requires increased composting process time for large animal carcasses than for swine or poultry carcasses. The system requires a carbon source (usually saw dust or woodchips) to allow composting of the carcass. The BIOvator™ is low cost to operate; however, additional carcass preparation is required to ensure a continuous flow of carcasses into the composting chamber.

3.2.1 Strengths and Weaknesses

A strengths and weaknesses analysis is used to summarize the BIOvator™ composting system.

Strengths

- Fast: Compost normally finished within 7 days
- Low operating costs – small turning motor uses little electricity
- Can be continuously loaded each day
- Bones are screened at exit and may be returned for further composting or other processing
- Small area footprint needed for installation
- Proven technology

Weaknesses

- Only handles 500 pounds of mortality per day, so large carcasses must be cut up before loading into BIOvator™
- Large capital outlay needed per each BIOvator™ unit- $50,000
- Proven technology for smaller animal mortality, but the 500 pound per day per unit loading limitation limits the desirability for large animal mortality composting
- Does not have flexibility to handle surges of animal mortalities
- Will not work with hay as a carbon source due to wrapping problems.

3.2.2 Capital Investments and Start Up Assumptions

Exhibit 3.2.2.1 displays a summary and breakdown of the capital and start up investments required for composting large animals with BIOvator™ technology.

Exhibit 3.2.2.1 Capital and Start Up Investment Summary—BIOvator™

Capital Investments	Amount
Land and Improvements	
Land	$4,000
Fence and Gate	$1,500
Landscaping	$1,000
Gravel Area	$4,000
Land Grading	$2,000
Electrical Connection	$1,500
Buildings	
Storage (Covered)	$10,000
Machinery	
BIOvator (3 Units @ $50,000 per unit)	$150,000
Screener	$1,100
Auger Elevator	$1,000
Payloader	$20,000
Shipping Container	$1,500
Misc. Tools and Equipment	$1,000
Water Source	$7,000
Total Capital Investment	**$205,600**
Working Capital Investment	$50,000
Total Start Up Investment	**$255,600**

The largest capital expense will be the BIOvator™ units. The cost displayed for the BIOvator™ is the total cost for the purchase of three separate BIOvator™ units priced at $50,000 per unit. It was assumed that two acres of land would be required for the operation and purchased for $2,000 per acre. Various improvements would need to be made to the site and are detailed in the above exhibit.

A building would be required for the storage of finished compost. This building would have a concrete floor and be approximately 1,000 square feet and provide 60 days of compost storage.

A shipping container was utilized as office space and miscellaneous storage. An assumed working capital investment of $50,000 is provided to create a beginning cash balance for the operation. The remaining required investments are summarized in the exhibit.

The total start up investment in this operation would be $255,600. The financial model assumes that this amount is financed in its entirety by owner investment. However, this assumption does not eliminate outside investment(s) and/or bank financing of the operation. Financing options for the operation would ultimately be made by the owner(s) of the operation.

3.2.3 Financial Projections

A financial analysis of the investment required to establish and operate a BIOvator ™ mortality composting facility is presented in this section. The analysis also discusses the effect of government subsidies on the financial model. The model does not include a route truck or account for the transporting of animals from the carcass pickup location to the compost site. A discussion of the investment option of a covered trailer that could be utilized to transport the animals is provided.

The model does not account for any revenue from selling the finished compost (final product). This is because the finished compost has low nutrient values and also a perceived potential risk of pathogen transfer. The finished compost can be utilized for the fertilizer nutrient content and as a soil conditioner on row crop or forage production areas. It is assumed that with these utilization options, disposal of the finished compost will not incur an operational cost to the firm.

3.2.3.1 Operating Assumptions

It was projected the operation would be required to compost 1,500 pounds of animal mortality per day. A single BIOvator ™ composting unit has the capacity to compost 500 pounds of mortality per day. Three BIOvator™ composters units would be utilized to meet the operational requirements of composting 1,500 pounds of animal mortality per day at the composting facility. Carcasses would have to be divided into 500 pound lots before loading into the composter units. The owner of the composting operation will determine the composting service fee. This financial model assumes a fee of $75.00 per 1500 pounds of animal mortality composted. This fee was not adjusted for potential inflation. The firm could adjust the fee structure to account for rising inflation costs. Operating assumptions are summarized in Exhibit 3.2.3.1.1.

Exhibit 3.2.3.1.1 Key Operating Assumptions—BIOvator™

Operational Assumptions	
Incoming Animals/Day	1
Pounds/Animal	1500
Days/Animal *(to complete composting process)*	1
Composting Units Needed *(500lb maximum/day)*	3
Operating Days/Year	365
Animals Composted/Year	365
Per Animal Fee *(Charged to Customer)*	$75.00

Exhibit 3.2.3.1.2 displays operational expense assumptions for the BIOvator™ Composter mortality facility. It is assumed that one (1) hour of labor per day would be required to operate the mortality composter facility. An hourly labor rate of $10 was used. Operational inputs necessary for composting the animal mortalities are electricity and a source of carbon.

The electricity expense was computed based on usage information supplied by the manufacturer and local electricity rates. The carbon source expense was calculated from operational requirements and adjusted for the prices of local carbon sources. An annual miscellaneous fuel expense of $500 was included for regional travel that may be necessary to secure carbon source materials and other administrative travel expenses. This miscellaneous fuel expense does not include any costs incurred due the operation of a route truck (as noted earlier). Other operational expenses shown in the exhibit are estimated operational costs. The expenses displayed are for the year 2011. An annual inflation rate of three percent is applied to each of these expenses in years two through five of operation in the financial analysis.

Exhibit 3.2.3.1.2 Assumptions Utilized to Project the Expenses

Operating Expenses	
Personnel	
Employees	1
Hourly Rate	$10.00
Hours/Day	1
Inputs	
Electricity Expense/Animal Composted	$1.65
Carbon Expense/Animal Composted	$8.75
Annual Fuel Expense	$500
Annual Maintenance/Repairs Expense	$1,000
General/Administrative Expenses	
Annual Insurance Expense	$500
Annual Property Tax Expense	$500

3.2.3.2 Income Statement

Five years of financial statements were created based on the previously discussed assumptions and projections. Exhibit 3.2.3.2.1 shows the pro forma income statements for a composting operation using the BIOvator™ composter technology.

Gross margin displays a firm's ability to cover the variable expenses associated with the production and/or sale of a good. This is important because firms can have the ability to operate short-term as long as they have a positive gross margin. Gross margin is calculated by subtracting the direct costs (cost of sales) associated with the production of the compost from the total sales amount. The annual sales amount is based on the fee received by the firm for composting the animals. The animal is the material being composted so there is no expense for materials/packaging/goods. The labor expense is based on the assumptions displayed in Exhibit 3.2.3.1.2. The other direct costs are associated with the electricity, carbon sources, fuel, and maintenance expenses which are shown in Exhibit 3.2.3.1.2.

Overhead expenses are subtracted from gross margin to compute income from operations. These are expenses that are incurred to the firm even if compost is not being produced. There is no selling or management staff expenses included in this analysis. It was assumed that marketing would not be necessary for this type of operation and no other selling expenses would be applicable.

The operation is not very management intensive and the owner(s) would be responsible for all management tasks and decisions. The owner/manager would require some amount of salary to be paid from the firm; however, no attempt was made to forecast this in the financial model. General expenses include insurance and tax expenses discussed in Exhibit 3.2.3.1.2. Depreciation was calculated using the straight-line method. A ten-year life span, paired with a zero salvage value, was utilized in the depreciation calculation. As previously mentioned, a three percent annual inflation rate was applied to all expenses in years 2012-2015.

No interest expense was used in the financial model as owner(s) financing was assumed. Tax liabilities and dividend payouts are dependent upon business structure. No assumptions were made about tax liability or dividend payouts in this financial analysis.

Exhibit 3.2.3.2.1 Pro Forma Annual Income Statements—BIOvator™

Income Statements	2011	2012	2013	2014	2015
Years Ending Dec			*In U.S. Dollars*		
Total Sales	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**
Cost of Sales:					
-Materials/Packaging/Goods	0.0	0.0	0.0	0.0	0.0
-Direct Labor	3,650.0	3,759.5	3,872.3	3,988.5	4,108.1
-Other Direct	5,293.8	5,452.6	5,616.1	5,784.6	5,958.2
Cost of Sales	**8,943.8**	**9,212.1**	**9,488.4**	**9,773.1**	**10,066.3**
Gross Margin	**18,431.3**	**18,162.9**	**17,886.6**	**17,601.9**	**17,308.7**
Overhead Expenses:					
-Selling	0.0	0.0	0.0	0.0	0.0
-Management/Admin Staff	0.0	0.0	0.0	0.0	0.0
-General	1,000.0	1,030.0	1,060.9	1,092.7	1,125.5
Depreciation	20,560.0	20,560.0	20,560.0	20,560.0	20,560.0
Operating Lease Payments	0.0	0.0	0.0	0.0	0.0
Total Operating Expenses	**21,560.0**	**21,590.0**	**21,620.9**	**21,652.7**	**21,685.5**
Income From Operations	**(3,128.8)**	**(3,427.1)**	**(3,734.3)**	**(4,050.8)**	**(4,376.8)**
Total Other Income (Expenses)	0.0	0.0	0.0	0.0	0.0
Earnings Before Interest & Taxes	**(3,128.8)**	**(3,427.1)**	**(3,734.3)**	**(4,050.8)**	**(4,376.8)**
Interest Expense/Income:					
-Interest Expense	0.0	0.0	0.0	0.0	0.0
-Interest Income	0.0	0.0	0.0	0.0	0.0
Net Interest Expense (Income)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Net Income Before Taxes	**(3,128.8)**	**(3,427.1)**	**(3,734.3)**	**(4,050.8)**	**(4,376.8)**
Taxes	0.0	0.0	0.0	0.0	0.0
Net Income	**(3,128.8)**	**(3,427.1)**	**(3,734.3)**	**(4,050.8)**	**(4,376.8)**
Dividends Declared	0.0	0.0	0.0	0.0	0.0
Transferred To Reserves	**(3,128.8)**	**(3,427.1)**	**(3,734.3)**	**(4,050.8)**	**(4,376.8)**

Income statements for the operation show a net loss in all years. This operation; however, does maintain a positive gross margin which makes this firm more viable than a firm utilizing the Dutch Composter technology. The net loss is due to the depreciation expense associated with the BIOvator™ composter system.

3.2.3.3 Cash Flow Statement

Exhibit 3.2.3.3.1 displays the pro forma cash flow statements for the operation. The cash flow statement provides an analysis of all actual cash receipts and expenditures. Cash receipts are limited to the fee collected for animals composted in this mortality composting operation. The initial capital investment of $255,600 is also included in the cash receipts for 2011. Cash payments are made for all actual expenses associated with operation excluding depreciation. In 2011, the operation also shows a cash expenditure for the capital investments discussed in section 3.2.2.

Exhibit 3.2.3.3.1 Pro Forma Annual Cash Flow Statements—BIOvator™

Cash Flow Projections	2011	2012	2013	2014	2015
Years Ending Dec			*In U.S. Dollars*		
Cash Receipts:					
Cash Sales & Accounts Receivable	27,375.0	27,375.0	27,375.0	27,375.0	27,375.0
Equity Investments	255,600.0	0.0	0.0	0.0	0.0
Increases in Long-term Debt/Notes	0.0	0.0	0.0	0.0	0.0
Miscellaneous Income Received	0.0	0.0	0.0	0.0	0.0
Interest Received	0.0	0.0	0.0	0.0	0.0
Total Cash Receipts	**282,975.0**	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**
Cash Payments:					
Materials/Goods Accounts Payable	0.0	0.0	0.0	0.0	0.0
Total Direct Cost Payments	8,943.8	9,212.1	9,488.4	9,773.1	10,066.3
Total Overhead Expense Payments	1,000.0	1,030.0	1,060.9	1,092.7	1,125.5
Federal/State Taxes Paid	0.0	0.0	0.0	0.0	0.0
Dividends Paid	0.0	0.0	0.0	0.0	0.0
Total Capital Expend. Payments	205,600.0	0.0	0.0	0.0	0.0
Long-term Debt/Note Repayments	0.0	0.0	0.0	0.0	0.0
Interest Paid	0.0	0.0	0.0	0.0	0.0
Total Cash Payments	**215,543.8**	**10,242.1**	**10,549.3**	**10,865.8**	**11,191.8**
Net Cash Flow	**67,431.3**	**17,132.9**	**16,825.7**	**16,509.2**	**16,183.2**
Closing Net Cash Balance (Deficit)	**67,431.3**	**84,564.2**	**101,389.9**	**117,899.1**	**134,082.3**

All years experience a positive cash flow. The initial equity investment made includes $50,000 for working capital to allow for the firm to have a starting cash balance. However, after the first year of operation, it is likely that a portion or all of this working capital investment could be paid out to the investor(s). The continued annual positive cash flow allows for an operation utilizing the BIOvator™ composting system to be financially feasible even though it experiences a net loss annually.

3.2.3.4 Balance Sheet

The pro forma annual balance sheets are displayed in Exhibit 3.2.3.4.1. The sole current asset for the firm will be the cash balance. The cash balance is the amount calculated on the cash flow statements displayed in Exhibit 3.2.3.3.1. It was assumed all composting service fees would be received at the time the animal is transferred from its original pickup location to the composter facility. This assumption allows accounts receivable to maintain a zero balance. Due to the nature of the operation, inventory of animal mortalities is not maintained. This allows the inventory balance to remain at zero. The fixed asset portion of the balance sheets is comprised of the value of the capital investments detailed in Exhibit 3.2.2.1 minus the accumulated installation and equipment depreciation.

The liabilities section has no value associated with it. It was assumed that the firm would pay all bills within 30 days. This assumption prohibits accounts payable from carrying a balance. As previously stated, no assumptions were made about dividends or taxes. The operation is assumed financed solely by owner investment so no short or long-term loans are utilized. The equity section displays original equity investment adjusted by retained earnings. The amounts shown as retained earnings are calculated on the income statements found in Exhibit 3.2.3.2.1.

Exhibit 3.2.3.4.1 Pro Forma Annual Balance Sheets—BIOvator™

Balance Sheets	2011	2012	2013	2014	2015
Years Ending Dec			*In U.S. Dollars*		
ASSETS					
Current Assets:					
Cash at Bank	67,431.3	84,564.2	101,389.9	117,899.1	134,082.3
Accounts Receivable	0.0	0.0	0.0	0.0	0.0
Inventory	0.0	0.0	0.0	0.0	0.0
Total Current Assets	**67,431.3**	**84,564.2**	**101,389.9**	**117,899.1**	**134,082.3**
Fixed Assets:					
Fixed Assets (Gross)	205,600.0	205,600.0	205,600.0	205,600.0	205,600.0
Less: Accumulated Depreciation	20,560.0	41,120.0	61,680.0	82,240.0	102,800.0
Net Fixed Assets	**185,040.0**	**164,480.0**	**143,920.0**	**123,360.0**	**102,800.0**
Net Intangible Assets	0.0	0.0	0.0	0.0	0.0
Total Assets	**252,471.3**	**249,044.2**	**245,309.9**	**241,259.1**	**236,882.3**
LIABILITIES					
Current Liabilities:					
Accounts Payable	0.0	0.0	0.0	0.0	0.0
Dividends	0.0	0.0	0.0	0.0	0.0
Federal/State Tax	0.0	0.0	0.0	0.0	0.0
Short-Term Loans/Credit	0.0	0.0	0.0	0.0	0.0
Total Current Liabilities	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Long-term Liabilities:	0.0	0.0	0.0	0.0	0.0
Long-term Debt/Notes	0.0	0.0	0.0	0.0	0.0
Total Long-term Liabilities	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Equity:					
Equity Investments	255,600.0	255,600.0	255,600.0	255,600.0	255,600.0
Retained Earnings	(3,128.8)	(6,555.8)	(10,290.1)	(14,340.9)	(18,717.7)
Total Owners' Equity	**252,471.3**	**249,044.2**	**245,309.9**	**241,259.1**	**236,882.3**
Total Liabilities & Equity	**252,471.3**	**249,044.2**	**245,309.9**	**241,259.1**	**236,882.3**

The overall value of the business declines slightly each year of operation. The loss in value is due to the depreciation of the capital investments. A review of the cash flow statements shows that most of this loss is offset by the positive annual cash flows experienced by the firm. The venture looses approximately $16,000 of its original worth after the fifth year of operation.

3.2.3.5 Analysis of the Effect of Government Subsidies

There are currently no federal or state level programs offering subsidies for this type of operation. It is possible that an animal composting operation could qualify for some type of government subsidy in the future. A partially subsidized animal composting operation would reduce the start up investment amount. The owner(s) investment would be reduced by the amount of subsidies received. These subsidies would not affect the annual net income, cash flows, or net worth discussed previously in this economic analysis. The subsidies would serve to supplement the owner investment for the capital expenditures required at business start up.

3.2.3.6 Trailer Purchase Discussion and Summary

A route truck was not utilized in this financial model. It was questioned whether the added expense associated with the route truck would provide a positive economic advantage for the mortality composting facility. The purchase of a 6' x 12' enclosed utility trailer with a wench capable of handling 2,000 pounds might provide an improved economic option.

A trailer and winch system could be purchased for less than $5,000. The composting operation could offer customers needing to transport animal mortalities the option of renting the trailer. A daily rental fee of five to ten dollars would be sufficient to cover depreciation and mileage expenses associated with the use of the trailer. Rental fees would not be sufficient to provide a revenue stream that would affect the economic analysis of the operation.

3.3 Static Composting Piles (Unroofed)

Composting dead animals in a static pile unroofed is a simple mortality composting system that requires minimal capital investment. Moisture control of compost piles and carbon source materials is difficult to control and the potential of leachate runoff must be addressed in this system.

A sawdust or other acceptable biomass carbon source base at least one foot thick is placed at a location that allows for surface water drainage and surface water can be diverted. This biomass base must collect liquids that are released during carcass composting and any rainfall that would pass through the composting materials.

Carcasses are placed on the sawdust or other carbon source base so that each carcass has a six (6) inch (1-foot preferred) minimum carbon source cover on all sides, over and under each carcass. Do not stack carcasses on top of one another. Large animal carcasses need to have the abdominal cavity opened and other areas opened so that there is additional contact area with the carbon source material.

Cover each carcass with 1 to 2 feet of damp carbon source material. This carbon source cover acts as a bio-filter for odor control around the pile and insulates the pile to retain heat. It is important to maintain the moisture content of the composting pile materials in the 40 – 65% range. Odors are released when an inadequate depth of cover is used or when the carbon

source material is too dry. Mortality compost pile odors also tend to attract scavenging animals that will disturb the compost pile.

Additional carcasses are placed in the composting pile by hollowing out a hole in the compost and placing the carcass in the pile. The compost pile should be covered with 1 - 2 feed of carbon source material. Storage pile size is determined by the number and size of the animals composted. Static pile composting of large animals will require 6 – 12 months for the compost process to be complete and allow the finished compost to be land applied.

Exhibit 3.3.1 Layout for a Static Composting Piles System

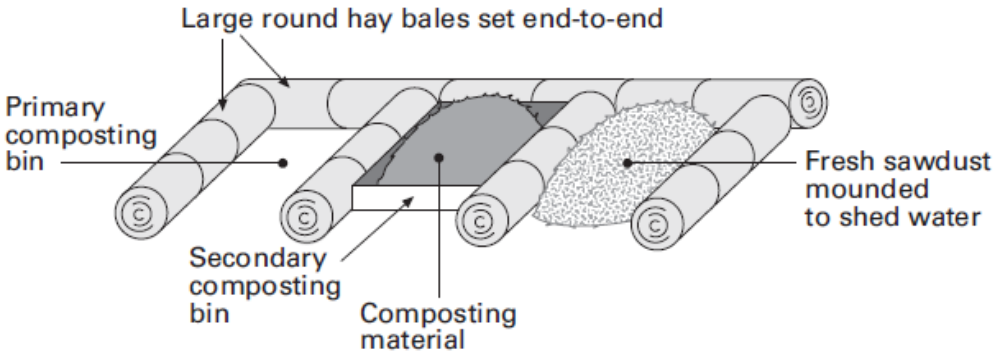


Exhibit 3.3.2 On-Farm Use of a Static Composting Piles System

3.3.1 Strengths and Weaknesses

A strengths and weaknesses analysis is used to summarize the static pile unroofed composting system.

Strengths

- Flexibility to handle surges of multiple animals at one time or no animals during other time periods
- Lowest capital investment per animal composted
- Low operating costs
- Simple system to scale as demand for large animal composting grows
- Can be continuously every day, if weather permits
- Proven technology

Weaknesses

- Slow – 6 to 12 months or more may be needed to completely compost animals
- Inability to control compost moisture environment
- Choice of carbon sources may be limited by the fact that some compost materials will not shed rainfall adequately to insure rainfall events do not create runoff
- May not be able to gain a permit from the MO Department of Natural Resources (DNR) if facility is greater than the 2 acres exemption allowed by DNR. The facility may require surface water containment and treatment of runoff water during rainfall events.
- Potential for mortalities to become exposed and attract scavengers in addition to the possibility of odor problems.
- Visual perception by casual observers may not be positive
- Larger bones will need to be screened from finished compost and discarded or added to new mortality compost for further degradation.

3.3.2 Capital Investments and Start Up Assumptions

Exhibit 3.3.2.1 displays a summary and breakdown of the capital and start up investments required for composting large animals through the use of uncovered static piles.

Exhibit 3.3.2.1 Capital and Start Up Investment Summary—Static Piles (unroofed)

Capital Investments	Amount
Land and Improvements	
Land	$4,000
Fence and Gate	$1,500
Landscaping	$1,000
Gravel Area	$4,000
Land Grading	$2,000
Electrical Connection	$1,500
Machinery	
Screener	$1,100
Payloader	$20,000
Shipping Container	$1,500
Misc. Tools and Equipment	$1,000
Water Source	$7,000
Total Capital Investment	**$44,600**
Working Capital Investment	$50,000
Total Start Up Investment	**$94,600**

Static pile composting does not require the purchase of composting systems or technology. The largest capital expense will be the purchase of the machinery to move and place mortalities, carbon source materials and finished compost.

It was assumed that two acres of land would be required for the operation and purchased for $2,000 per acre. Various improvements would need to be made to the land and are detailed in the above exhibit. A building for the storage of finished compost would not be necessary in this operation.

A shipping container was utilized as office space and miscellaneous storage. An assumed working capital investment of $50,000 is provided to create a beginning cash balance for the operation. The remaining required investments are summarized in the exhibit.

The total start up investment in this operation would be $94,600. The financial model assumes that this amount is financed in its entirety by owner investment. However, this assumption does not eliminate outside investment(s) and/or bank financing of the operation. Financing options for the operation would ultimately be made by the owner(s) of the operation.

3.3.3 Financial Projections

A financial analysis of the investment required to establish and operate an uncovered static pile mortality composting facility is presented in this section. The analysis also discusses the effect of government subsidies on the financial model. The model does not utilize a route truck or account for the transporting of animals from the carcass pickup location to the compost site.

A discussion of the investment option of a covered trailer that could be utilized to transport the animals is provided.

The model does not account for any revenue from selling the finished compost (final product). This is because the finished compost has low nutrient values and also a perceived potential risk of pathogen transfer. The finished compost can be utilized for the fertilizer nutrient content and as a soil conditioner on row crop or forage production areas. It is assumed that with these utilization options, disposal of the finished compost will not incur an operational cost to the firm.

3.3.3.1 Operating Assumptions

It was projected the operation would be required to compost 1,500 pounds of animal mortality per day. A new static pile would be started as necessary to provide adequate mortality composting capacity. Two acres of land will provides sufficient space for multiple compost piles. Composting should proceed so that 365 animals per year can be composted in the facility. Care is needed to insure that active compost piles that are in the heating mode are available for composting during very cold temperatures.. The owner of the composting operation will determine the composting service fee. This financial model assumes a fee of $75.00 per 1500 pounds of animal mortality composted. This fee was not adjusted for potential inflation. The firm could adjust their fee structure to account for rising inflation costs. Operating assumptions are summarized in Exhibit 3.3.3.1.1.

Exhibit 3.3.3.1.1 Key Operating Assumptions—Static Piles (unroofed)

Operational Assumptions	
Incoming Animals/Day	1
Pounds/Animal	1500
Operating Days/Year	365
Animals Composted/Year	365
Per Animal Fee *(Charged to Customer)*	$75.00

Exhibit 3.3.3.1.2 displays operational expense assumptions for the unroofed static piles mortality composting facility. It is that one (1) hour of labor per day would be required to operate the mortality composter facility. An hourly rate of $10 was used. The only input necessary for composting the animal mortalities is a source of carbon.

The carbon source expense was calculated based on the mortality composting requirements from several operating sources. The carbon source expense was calculated from operational requirements and adjusted for the prices of local carbon sources. An annual miscellaneous fuel expense of $500 was included for, regional travel that may be necessary to secure carbon source materials and other administrative travel expenses. This miscellaneous fuel expense does not include any costs incurred due the operation of a route truck (as noted earlier). Other operational expenses shown in the exhibit are estimated operational costs. The expenses displayed are for the year 2011. An annual inflation rate of three percent is applied to each of these expenses in years two through five of operation in the financial analysis.

Exhibit 3.3.3.1.2 Assumptions Utilized to Project the Expenses

Operating Expenses	
Personnel	
Employees	1
Hourly Rate	$10.00
Hours/Day	1
Inputs	
Carbon Expense/Animal Composted	$8.75
Annual Fuel Expense	$500
Annual Maintenance/Repairs Expense	$1,000
General/Administrative Expenses	
Annual Insurance Expense	$500
Annual Property Tax Expense	$500

3.3.3.2 Income Statement

Five years of financial statements were created based on previously discussed assumptions and projections. Exhibit 3.3.3.2.1 shows the pro forma income statements for a composting operation using uncovered static piles.

Gross margin displays a firm's ability to cover the variable expenses associated with the production and/or sale of a good. This is important because firms can have the ability to operate short-term as long as they have a positive gross margin. Gross margin is calculated by subtracting the direct costs (cost of sales) associated with the production of the compost from the total sales amount. The annual sales amount is based on the fee received by the firm for composting the animals. The animal is the material being composted so there is no expense for materials/packaging/goods. The labor expense is based on the assumptions displayed in Exhibit 3.3.3.1.2. The other direct costs are associated with the carbon sources, fuel, and maintenance expenses which are shown in Exhibit 3.3.3.1.2.

Overhead expenses are subtracted from gross margin to compute income from operations. These are expenses that are incurred to the firm even if compost is not being produced. There are no selling or management staff expenses included in this analysis. It was assumed that marketing would not be necessary for this type of operation and no other selling expenses would be applicable.

The operation is not very management intensive and the owner(s) would be responsible for all management tasks and decisions. The owner/manager would require some amount of salary to be paid from the firm; however, no attempt was made to forecast this in the financial model. General expenses include insurance and tax expenses discussed in Exhibit 3.3.3.1.2. Depreciation was calculated using the straight-line method. A ten-year life span, paired with a zero salvage value, was utilized in the depreciation calculation. As previously mentioned, a three percent annual inflation rate was applied to all expenses in years 2012-2015.

No interest expense was used in the financial model as owner(s) financing was assumed. Tax liabilities and dividend payouts are dependent upon business structure. No assumptions were made about tax liability or dividend payouts in this financial analysis.

Exhibit 3.3.3.2.1 Pro Forma Annual Income Statements—Static Piles (unroofed)

Income Statements	**2011**	**2012**	**2013**	**2014**	**2015**
Years Ending Dec			*In U.S. Dollars*		
Total Sales	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**
Cost of Sales:					
-Materials/Packaging/Goods	0.0	0.0	0.0	0.0	0.0
-Direct Labor	3,650.0	3,759.5	3,872.3	3,988.5	4,108.1
-Other Direct	4,693.8	4,834.6	4,979.6	5,129.0	5,282.9
Cost of Sales	**8,343.8**	**8,594.1**	**8,851.9**	**9,117.4**	**9,391.0**
Gross Margin	**19,031.3**	**18,780.9**	**18,523.1**	**18,257.6**	**17,984.0**
Overhead Expenses:					
-Selling	0.0	0.0	0.0	0.0	0.0
-Management/Admin Staff	0.0	0.0	0.0	0.0	0.0
-General	1,000.0	1,030.0	1,060.9	1,092.7	1,125.5
Depreciation	4,460.0	4,460.0	4,460.0	4,460.0	4,460.0
Operating Lease Payments	0.0	0.0	0.0	0.0	0.0
Total Operating Expenses	**5,460.0**	**5,490.0**	**5,520.9**	**5,552.7**	**5,585.5**
Income From Operations	**13,571.3**	**13,290.9**	**13,002.2**	**12,704.8**	**12,398.5**
Total Other Income (Expenses)	0.0	0.0	0.0	0.0	0.0
Earnings Before Interest & Taxes	**13,571.3**	**13,290.9**	**13,002.2**	**12,704.8**	**12,398.5**
Interest Expense/Income:					
-Interest Expense	0.0	0.0	0.0	0.0	0.0
-Interest Income	0.0	0.0	0.0	0.0	0.0
Net Interest Expense (Income)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Net Income Before Taxes	**13,571.3**	**13,290.9**	**13,002.2**	**12,704.8**	**12,398.5**
Taxes	0.0	0.0	0.0	0.0	0.0
Net Income	**13,571.3**	**13,290.9**	**13,002.2**	**12,704.8**	**12,398.5**
Dividends Declared	0.0	0.0	0.0	0.0	0.0
Transferred To Reserves	**13,571.3**	**13,290.9**	**13,002.2**	**12,704.8**	**12,398.5**

Income statements for the uncovered static pile mortality composting operation, because of the minimal expenses incurred, shows a positive net income in all years.

3.3.3.3 Cash Flow Statement

Exhibit 3.3.3.3.1 displays the pro forma cash flow statements for the operation. The cash flow statement provides an analysis of all actual cash receipts and expenditures. Cash receipts are limited to the fee collected for animals composted in this mortality composting operation. The initial capital investment of $94,600 is also included in the cash receipts for 2011. Cash payments are made for all actual expenses associated with operation excluding depreciation. In 2011, the operation also shows a cash expenditure for the capital investments discussed in section 3.3.2.

Exhibit 3.3.3.3.1 Pro Forma Annual Cash Flow Statements—Static piles (unroofed)

Cash Flow Projections	2011	2012	2013	2014	2015
Years Ending Dec	*In U.S. Dollars*				
Cash Receipts:					
Cash Sales & Accounts Receivable	27,375.0	27,375.0	27,375.0	27,375.0	27,375.0
Equity Investments	94,600.0	0.0	0.0	0.0	0.0
Increases in Long-term Debt/Notes	0.0	0.0	0.0	0.0	0.0
Miscellaneous Income Received	0.0	0.0	0.0	0.0	0.0
Interest Received	0.0	0.0	0.0	0.0	0.0
Total Cash Receipts	**121,975.0**	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**
Cash Payments:					
Materials/Goods Accounts Payable	0.0	0.0	0.0	0.0	0.0
Total Direct Cost Payments	8,343.8	8,594.1	8,851.9	9,117.4	9,391.0
Total Overhead Expense Payments	1,000.0	1,030.0	1,060.9	1,092.7	1,125.5
Federal/State Taxes Paid	0.0	0.0	0.0	0.0	0.0
Dividends Paid	0.0	0.0	0.0	0.0	0.0
Total Capital Expend. Payments	44,600.0	0.0	0.0	0.0	0.0
Long-term Debt/Note Repayments	0.0	0.0	0.0	0.0	0.0
Interest Paid	0.0	0.0	0.0	0.0	0.0
Total Cash Payments	**53,943.8**	**9,624.1**	**9,912.8**	**10,210.2**	**10,516.5**
Net Cash Flow	**68,031.3**	**17,750.9**	**17,462.2**	**17,164.8**	**16,858.5**
Closing Net Cash Balance (Deficit)	**68,031.3**	**85,782.2**	**103,244.4**	**120,409.2**	**137,267.8**

All years experience a positive cash flow. The initial equity investment made includes $50,000 for working capital to allow for the firm to have a starting cash balance. However, after the first year of operation, it is likely that a portion or all of this working capital investment could be paid out to the investor(s). The continued annual positive cash flow allows for an operation utilizing the unroofed static piles mortality composting system to be financially feasible in all years projected in the financial model.

3.3.3.4 Balance Sheet

The pro forma annual balance sheets are displayed in Exhibit 3.3.3.4.1. The sole current asset for the firm will be the cash balance. The cash balance is the amount calculated on the cash flow statements displayed in Exhibit 3.3.3.3.1. It was assumed all composting service fees would be received at the time the animal is transferred from its original pickup location to the composter facility. This assumption allows accounts receivable to maintain a zero balance. Due to the nature of the operation, inventory of animal mortalities is not maintained. This allows the inventory balance to remain at zero. The fixed asset portion of the balance sheets is comprised of the value of the capital investments detailed in Exhibit 3.3.2.1 minus the accumulated installation and equipment depreciation.

The liabilities section has no value associated with it. It was assumed that the firm would pay all bills within 30 days. This assumption prohibits accounts payable from carrying a balance. As previously stated, no assumptions were made about dividends or taxes. The operation is assumed financed solely by owner investment so no short or long-term loans are utilized. The equity section displays original equity investment adjusted by retained earnings. The amounts shown as retained earnings are calculated on the income statements found in Exhibit 3.3.3.2.1.

Exhibit 3.3.3.4.1 Pro Forma Annual Balance Sheets—Static piles (unroofed)

Balance Sheets	2011	2012	2013	2014	2015
Years Ending Dec			*In U.S. Dollars*		
ASSETS					
Current Assets:					
Cash at Bank	68,031.3	85,782.2	103,244.4	120,409.2	137,267.8
Accounts Receivable	0.0	0.0	0.0	0.0	0.0
Inventory	0.0	0.0	0.0	0.0	0.0
Total Current Assets	**68,031.3**	**85,782.2**	**103,244.4**	**120,409.2**	**137,267.8**
Fixed Assets:					
Fixed Assets (Gross)	44,600.0	44,600.0	44,600.0	44,600.0	44,600.0
Less: Accumulated Depreciation	4,460.0	8,920.0	13,380.0	17,840.0	22,300.0
Net Fixed Assets	**40,140.0**	**35,680.0**	**31,220.0**	**26,760.0**	**22,300.0**
Net Intangible Assets	0.0	0.0	0.0	0.0	0.0
Total Assets	**108,171.3**	**121,462.2**	**134,464.4**	**147,169.2**	**159,567.8**
LIABILITIES					
Current Liabilities:					
Accounts Payable	0.0	0.0	0.0	0.0	0.0
Dividends	0.0	0.0	0.0	0.0	0.0
Federal/State Tax	0.0	0.0	0.0	0.0	0.0
Short-Term Loans/Credit	0.0	0.0	0.0	0.0	0.0
Total Current Liabilities	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Long-term Liabilities:	0.0	0.0	0.0	0.0	0.0
Long-term Debt/Notes	0.0	0.0	0.0	0.0	0.0
Total Long-term Liabilities	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Equity:					
Equity Investments	94,600.0	94,600.0	94,600.0	94,600.0	94,600.0
Retained Earnings	13,571.3	26,862.2	39,864.4	52,569.2	64,967.8
Total Owners' Equity	**108,171.3**	**121,462.2**	**134,464.4**	**147,169.2**	**159,567.8**
Total Liabilities & Equity	**108,171.3**	**121,462.2**	**134,464.4**	**147,169.2**	**159,567.8**

The overall value of the business increases each year of operation. The increase in value can be contributed to the increase in retained earnings due to positive annual net profits, as well as the positive cash flows experienced annually. The venture gains approximately $50,000 from its original worth after the fifth year of operation.

3.3.3.5 Analysis of the Effect of Government Subsidies

There are currently no federal or state level programs offering subsidies for this type of operation. It is possible that an animal composting operation could qualify for some type of government subsidy in the future. A partially subsidized animal composting operation would

reduce the start up investment amount. The owner(s) investment would be reduced by the amount of subsidies received. These subsidies would not affect the annual net income, cash flows, or net worth discussed previously in this economic analysis. The subsidies would serve to supplement the owner investment for the capital expenditures required at business start up.

3.3.3.6 Trailer Purchase Discussion and Summary

A route truck was not utilized in this financial model. It was questioned whether the added expense associated with the route truck would provide a positive economic advantage for the mortality composting facility. The purchase of a 6' x 12' enclosed utility trailer with a wench capable of handling 2,000 pounds might provide an improved economic option.

A trailer and winch system could be purchased for less than $5,000. The composting operation could offer customers needing to transport animal mortalities the option of renting the trailer. A daily rental fee of five to ten dollars would be sufficient to cover depreciation and mileage expenses associated with the use of the trailer. Rental fees would not be sufficient to provide a revenue stream that would affect the economic analysis of the operation.

3.4 Static Composting Piles (Under Roof)

Composting dead animals in a static pile under roof is similar to the unroofed static piles composting system. Covered static pile composting is done under a roof. An impervious layer of packed clay, asphalt, or concrete is constructed under the roof and provides a pad on which compost piles are placed.

The covered static pile compost system is environmentally preferred, and may be required because runoff from the compost piles is eliminated. Covered static pile composting allows moisture level of the compost material to be more easily managed. The result is improved composting conditions, reduced possibility of leachate runoff and possibly the use of more carbon source materials.

A sawdust or other acceptable biomass carbon source base at least one foot thick is placed at a location that allows for surface water drainage and surface water can be diverted. This biomass base must collect liquids that are released during carcass composting and any rainfall that would pass through the composting materials

Carcasses are placed on the sawdust or other carbon source base so that each carcass has a six (6) inch (1-foot preferred) minimum carbon source cover on all sides, over and under each carcass. Do not stack carcasses on top of one another. Large animal carcasses need to have the abdominal cavity opened a other areas opened so that there is additional contact area with the carbon source material.

Cover the each carcass with 1 to 2 feet of damp carbon source material. This carbon source cover acts as a bio-filter for odor control around the pile and insulates the pile to retain heat. It is important to maintain the moisture content of the composting pile materials in the 40 – 65%

range. Odors are released when an inadequate depth of cover is used or when the carbon source material is too dry. Mortality compost pile odors also tend to attract scavenging animals that will disturb the compost pile.

Additional carcasses are placed in the composting pile by hollowing out a hole in the compost and placing the carcass in the pile. The compost pile should be covering with 1-2 feet of carbon source material. Storage pile size is determined by the number and size of the animals composted. Static pile composting of large animals will require 6–12 months for the compost process to be complete and allow the finished compost to be land applied.

Exhibit 3.4.1 Static Composting Piles System (under roof)

3.4.1 Strengths and Weaknesses

A strengths and weaknesses analysis is used to summarize this composting system.

Strengths

- Flexibility to handle surges of multiple animal mortalities at one time or no mortalities for time periods
- Low capital investment per animal
- Low operating costs
- Can potentially be used with alternative carbon materials (hay, newspaper, cardboard, corn stover, etc.)
- Compost moisture levels can be controlled and maintained at optimal levels
- Can be continuously loaded every day, without regard to weather events
- May be scaled incrementally by adding to shed as demand for large animal composting grows
- More environmentally acceptable by the DNR because compost piles are protected from rainfall and snow so potential leachate discharge is reduced
- Proven technology

Weaknesses

- Slow – 6 months or more may be needed to completely compost animals
- Larger bones will need to be screened from finished compost and discarded or added to new mortality compost for further degradation.

3.4.2 Capital Investments and Start Up Assumptions

Exhibit 3.4.2.1 displays a summary and breakdown of the capital and start up investments required for composting large animals through the use of covered static piles).

Exhibit 3.4.2.1 Capital and Start Up Investment Summary—Static Piles (under roof)

Capital Investments	Amount
Land and Improvements	
Land	$4,000
Fence and Gate	$1,500
Landscaping	$1,000
Gravel Area	$4,000
Land Grading	$2,000
Electrical Connection	$1,500
Buildings	
Composting Facility	$150,000
Machinery	
Screener	$1,100
Payloader	$20,000
Shipping Container	$1,500
Misc. Tools and Equipment	$1,000
Water Source	$7,000
Total Capital Investment	**$194,600**
Working Capital Investment	$50,000
Total Start Up Investment	**$244,600**

Covered static piles composting does not require the purchase of composting systems or technology. The largest capital expense will be construction of the building to cover the compost piles. The building covering the piles was projected to be 15,000 square feet and would be a basic design. The building would probably be a pre-engineered building that could be easily constructed.
It was assumed that two acres of land would be required for the operation and purchased for $2,000 per acre. Various improvements would need to be made to the land and are detailed in the above exhibit. A building for the storage of finished compost would not be necessary in this operation. A shipping container was utilized as office space and miscellaneous storage.

An assumed working capital investment of $50,000 is provided to create a beginning cash balance for the operation. The remaining required investments are summarized in the exhibit.

The total start up investment in this operation would be $244,600. The financial model assumes that this amount is financed in its entirety by owner investment. However, this assumption does not eliminate outside investment(s) and/or bank financing of the operation. Financing options for the operation would ultimately be made by the owner(s) of the operation.

3.4.3 Financial Projections

A financial analysis for the investment required to establish and operate a roofed static pile mortality composting facility is presented in this section. The analysis also discusses the effect of government subsidies on the financial model. The model does not utilize a route truck or account for the transporting of animals from their original carcass pickup location to the compost site. A discussion of the investment option of a covered trailer that could be utilized to transport the animals is provided.

The model does not account for the revenue stream from selling of the finished compost (final product). This is because the finished compost has low nutrient values and also a perceived potential risk of pathogen transfer. The finished compost can be utilized for the fertilizer nutrient content and as a soil conditioner on row crop or forage production areas. It is assumed that with these utilization options, disposal of the finished compost will not incur an operational cost to the firm.

3.4.3.1 Operating Assumptions

It was projected the operation would be required to compost 1,500 pounds of animal mortality per day. A new static pile would be started as necessary to provide adequate mortality composting capacity. Two acres of land will provides sufficient space for multiple compost piles. Composting should proceed so that 365 animals per year can be composted in the facility. Care is needed to insure that active compost piles that are in the heating mode are available for composting during very cold temperatures. The owner of the composting operation will determine the composting service fee. This financial model assumes a fee of $75.00 per 1500 pounds of animal mortality composted. This fee was not adjusted for potential inflation. The firm could adjust their fee structure to account for rising inflation costs. Operating assumptions are summarized in Exhibit 3.4.3.1.1

Exhibit 3.4.3.1.1 Key Operating Assumptions—Static Piles (under roof)

Operational Assumptions	
Incoming Animals/Day	1
Pounds/Animal	1500
Operating Days/Year	365
Animals Composted/Year	365
Per Animal Fee *(Charged to Customer)*	$75.00

Exhibit 3.4.3.1.2 displays operational expense assumptions for the roofed static piles mortality composting facility. It is that one (1) hour of labor per day would be required to operate the mortality composter facility. An hourly rate of $10 was used. The only input necessary for composting the animal mortalities is a source of carbon.

The carbon source expense was calculated based on the mortality composting requirements from several operating sources. The carbon source expense was calculated from operational requirements and adjusted for the prices of local carbon sources. An annual miscellaneous fuel expense of $500 was included for regional travel that may be necessary to secure carbon source materials and other administrative travel expenses. This miscellaneous fuel expense does not include any costs incurred due the operation of a route truck (as noted earlier). Other operational expenses shown in the exhibit are estimated operational costs. The expenses displayed are for the year 2011. An annual inflation rate of three percent is applied to each of these expenses in years two through five of operation in the financial analysis

Exhibit 3.4.3.1.2 Assumptions Utilized to Project the Expenses

Operating Expenses	
Personnel	
Employees	1
Hourly Rate	$10.00
Hours/Day	1
Inputs	
Carbon Expense/Animal Composted	$8.75
Annual Fuel Expense	$500
Annual Maintenance/Repairs Expense	$1,000
General/Administrative Expenses	
Annual Insurance Expense	$500
Annual Property Tax Expense	$500

3.4.3.2 Income Statement

Using the assumptions and projections previously discussed, five years of financial statements were created based on previously discussed assumptions and projections. Exhibit 3.4.3.2.1 shows the pro forma income statements for a composting operation using roofed static piles.

Gross margin displays a firm's ability to cover the variable expenses associated with the production and/or sale of a good. This is important because firms can have the ability to operate short-term as long as they have a positive gross margin. Gross margin is calculated by subtracting the direct costs (cost of sales) associated with the production of the compost from the total sales amount. The annual sales amount is based on the fee received by the firm for composting the animals. The animal is the material being composted so there is no expense for materials/packaging/goods. The labor expense is based on the assumptions displayed in Exhibit 3.4.3.1.2. The other direct costs are associated with the carbon sources, fuel, and maintenance expenses which are shown in Exhibit 3.4.3.1.2.

Overhead expenses are subtracted from gross margin to compute income from operations. These are expenses that are incurred to the firm even if compost is not being produced. There is no selling or management staff expenses included in this analysis. It was assumed that marketing would not be necessary for this type of operation and no other selling expenses would be applicable.

The operation is not very management intensive and the owner(s) would be responsible for all management tasks and decisions. The owner/manager would require some amount of salary to be paid from the firm; however, no attempt was made to forecast this in the financial model. General expenses include insurance and tax expenses discussed in Exhibit 3.4.3.1.2. Depreciation was calculated using the straight-line method. A ten-year life span, paired with a zero salvage value, was utilized in the depreciation calculation. As previously mentioned, a three percent annual inflation rate was applied to all expenses in years 2012-2015.

No interest expense was used in the financial model as owner(s) financing was assumed. Tax liabilities and dividend payouts are dependent upon business structure. No assumptions were made about tax liability or dividend payouts in this financial analysis.

Exhibit 3.4.3.2.1 Pro Forma Annual Income Statements—Static Piles (under roof)

Income Statements	2011	2012	2013	2014	2015
Years Ending Dec			*In U.S. Dollars*		
Total Sales	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**
Cost of Sales:					
-Materials/Packaging/Goods	0.0	0.0	0.0	0.0	0.0
-Direct Labor	3,650.0	3,759.5	3,872.3	3,988.5	4,108.1
-Other Direct	4,693.8	4,834.6	4,979.6	5,129.0	5,282.9
Cost of Sales	**8,343.8**	**8,594.1**	**8,851.9**	**9,117.4**	**9,391.0**
Gross Margin	**19,031.3**	**18,780.9**	**18,523.1**	**18,257.6**	**17,984.0**
Overhead Expenses:					
-Selling	0.0	0.0	0.0	0.0	0.0
-Management/Admin Staff	0.0	0.0	0.0	0.0	0.0
-General	1,000.0	1,030.0	1,060.9	1,092.7	1,125.5
Depreciation	19,460.0	19,460.0	19,460.0	19,460.0	19,460.0
Operating Lease Payments	0.0	0.0	0.0	0.0	0.0
Total Operating Expenses	**20,460.0**	**20,490.0**	**20,520.9**	**20,552.7**	**20,585.5**
Income From Operations	**(1,428.8)**	**(1,709.1)**	**(1,997.8)**	**(2,295.2)**	**(2,601.5)**
Total Other Income (Expenses)	0.0	0.0	0.0	0.0	0.0
Earnings Before Interest & Taxes	**(1,428.8)**	**(1,709.1)**	**(1,997.8)**	**(2,295.2)**	**(2,601.5)**
Interest Expense/Income:					
-Interest Expense	0.0	0.0	0.0	0.0	0.0
-Interest Income	0.0	0.0	0.0	0.0	0.0
Net Interest Expense (Income)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Net Income Before Taxes	**(1,428.8)**	**(1,709.1)**	**(1,997.8)**	**(2,295.2)**	**(2,601.5)**
Taxes	0.0	0.0	0.0	0.0	0.0
Net Income	**(1,428.8)**	**(1,709.1)**	**(1,997.8)**	**(2,295.2)**	**(2,601.5)**
Dividends Declared	0.0	0.0	0.0	0.0	0.0
Transferred To Reserves	**(1,428.8)**	**(1,709.1)**	**(1,997.8)**	**(2,295.2)**	**(2,601.5)**

Income statements for the operation show a net loss in all years. The covered static pile composting system does maintain a positive gross margin which makes this firm more viable than a firm utilizing the Dutch Composter technology. The net loss is due to the depreciation expense of the building the housing for the static piles.

3.4.3.3 Cash Flow Statement

Exhibit 3.4.3.3.1 displays the pro forma cash flow statements for the operation. The cash flow statement provides an analysis of all actual cash receipts and expenditures. Cash receipts are limited to the fee collected for animals composted in this mortality composting operation. The initial capital investment of $244,600 is also included in the cash receipts for 2011. Cash payments are made for all actual expenses associated with operation excluding depreciation. In 2011, the operation also has a cash expenditure for the capital investments discussed in section 3.4.2.

Exhibit 3.4.3.3.1 Pro Forma Annual Cash Flow Statements—Static piles (under roof)

Cash Flow Projections	2011	2012	2013	2014	2015
Years Ending Dec	$	$	$	$	$
Cash Receipts:					
Cash Sales & Accounts Receivable	27,375.0	27,375.0	27,375.0	27,375.0	27,375.0
Equity Investments	244,600.0	0.0	0.0	0.0	0.0
Increases in Long-term Debt/Notes	0.0	0.0	0.0	0.0	0.0
Miscellaneous Income Received	0.0	0.0	0.0	0.0	0.0
Interest Received	0.0	0.0	0.0	0.0	0.0
Total Cash Receipts	**271,975.0**	**27,375.0**	**27,375.0**	**27,375.0**	**27,375.0**
Cash Payments:					
Materials/Goods Accounts Payable	0.0	0.0	0.0	0.0	0.0
Total Direct Cost Payments	8,343.8	8,594.1	8,851.9	9,117.4	9,391.0
Total Overhead Expense Payments	1,000.0	1,030.0	1,060.9	1,092.7	1,125.5
Federal/State Taxes Paid	0.0	0.0	0.0	0.0	0.0
Dividends Paid	0.0	0.0	0.0	0.0	0.0
Total Capital Expend. Payments	194,600.0	0.0	0.0	0.0	0.0
Long-term Debt/Note Repayments	0.0	0.0	0.0	0.0	0.0
Interest Paid	0.0	0.0	0.0	0.0	0.0
Total Cash Payments	**203,943.8**	**9,624.1**	**9,912.8**	**10,210.2**	**10,516.5**
Net Cash Flow	**68,031.3**	**17,750.9**	**17,462.2**	**17,164.8**	**16,858.5**
Closing Net Cash Balance (Deficit)	**68,031.3**	**85,782.2**	**103,244.4**	**120,409.2**	**137,267.8**

All years experience a positive cash flow. The initial equity investment made includes $50,000 for working capital to allow for the firm to have a starting cash balance. However, after the first year of operation, it is likely that a portion or all of this working capital investment could be paid out to the investor(s). The continued annual positive cash flow allows for an operation utilizing the covered static piles mortality composting system to be financially feasible in all years projected in the financial model.

3.4.3.4 Balance Sheet

The pro forma annual balance sheets are displayed in Exhibit 3.4.3.4.1. The sole current asset for the firm will be the cash balance. The cash balance is the amount calculated on the cash flow statements displayed in Exhibit 3.4.3.3.1. It was assumed all composting service fees would be received at the time the animal is transferred from its original pickup location to the composter facility. This assumption allows accounts receivable to maintain a zero balance. Due to the nature of the operation inventory of animal mortalities is not maintained. This allows the inventory balance to remain at zero. The fixed asset portion of the balance sheets is comprised of the value of the capital investments detailed in Exhibit 3.4.2.1 minus the accumulated installation and equipment depreciation.

The liabilities section has no value associated with it. It was assumed that the firm would pay all bills within 30 days. This assumption prohibits accounts payable from carrying a balance. As previously stated, no assumptions were made about dividends or taxes. The operation is assumed financed solely by owner investment so no short or long-term loans are utilized. The equity section displays original equity investment adjusted by retained earnings. The amounts shown as retained earnings are calculated on the income statements found in Exhibit 3.4.3.2.1.

Exhibit 3.4.3.4.1 Pro Forma Annual Balance Sheets—Static piles (under roof)

Balance Sheets	2011	2012	2013	2014	2015
Years Ending Dec	$	$	$	$	$
ASSETS					
Current Assets:					
Cash at Bank	68,031.3	85,782.2	103,244.4	120,409.2	137,267.8
Accounts Receivable	0.0	0.0	0.0	0.0	0.0
Inventory	0.0	0.0	0.0	0.0	0.0
Total Current Assets	**68,031.3**	**85,782.2**	**103,244.4**	**120,409.2**	**137,267.8**
Fixed Assets:					
Fixed Assets (Gross)	194,600.0	194,600.0	194,600.0	194,600.0	194,600.0
Less: Accumulated Depreciation	19,460.0	38,920.0	58,380.0	77,840.0	97,300.0
Net Fixed Assets	**175,140.0**	**155,680.0**	**136,220.0**	**116,760.0**	**97,300.0**
Net Intangible Assets	0.0	0.0	0.0	0.0	0.0
Total Assets	**243,171.3**	**241,462.2**	**239,464.4**	**237,169.2**	**234,567.8**
LIABILITIES					
Current Liabilities:					
Accounts Payable	0.0	0.0	0.0	0.0	0.0
Dividends	0.0	0.0	0.0	0.0	0.0
Federal/State Tax	0.0	0.0	0.0	0.0	0.0
Short-Term Loans/Credit	0.0	0.0	0.0	0.0	0.0
Total Current Liabilities	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Long-term Liabilities:	0.0	0.0	0.0	0.0	0.0
Long-term Debt/Notes	0.0	0.0	0.0	0.0	0.0
Total Long-term Liabilities	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Equity:					
Equity Investments	244,600.0	244,600.0	244,600.0	244,600.0	244,600.0
Retained Earnings	(1,428.8)	(3,137.8)	(5,135.6)	(7,430.8)	(10,032.2)
Total Owners' Equity	**243,171.3**	**241,462.2**	**239,464.4**	**237,169.2**	**234,567.8**
Total Liabilities & Equity	**243,171.3**	**241,462.2**	**239,464.4**	**237,169.2**	**234,567.8**

The overall value of the business declines slightly each year of operation. The loss in value is due to the depreciation of the capital investments. A review of the cash flow statements show that most of this loss is offset by the annual positive cash flows. The venture loses approximately $8,500 of its original worth after the fifth year of operation.

3.4.3.5 Analysis of the Effect of Government Subsidies

There are currently no federal or state level programs offering subsidies for this type of operation. It is possible that an animal composting operation could qualify for some type of government subsidy in the future. A partially subsidized animal composting operation would reduce the start up investment amount. The owner(s) investment would be reduced by the amount of subsidies received. These subsidies would not affect the annual net income, cash flows, or net worth discussed previously in this economic analysis. The subsidies would serve to supplement the owner investment for the capital expenditures required at business start up.

3.4.3.6 Trailer Purchase Discussion and Summary

A route truck was not utilized in this financial model. It was questioned whether the added expense associated with the route truck would provide a positive economic advantage for the mortality composting facility. The purchase of a 6' x 12' enclosed utility trailer with a wench capable of handling 2,000 pounds might provide an improved economic option.

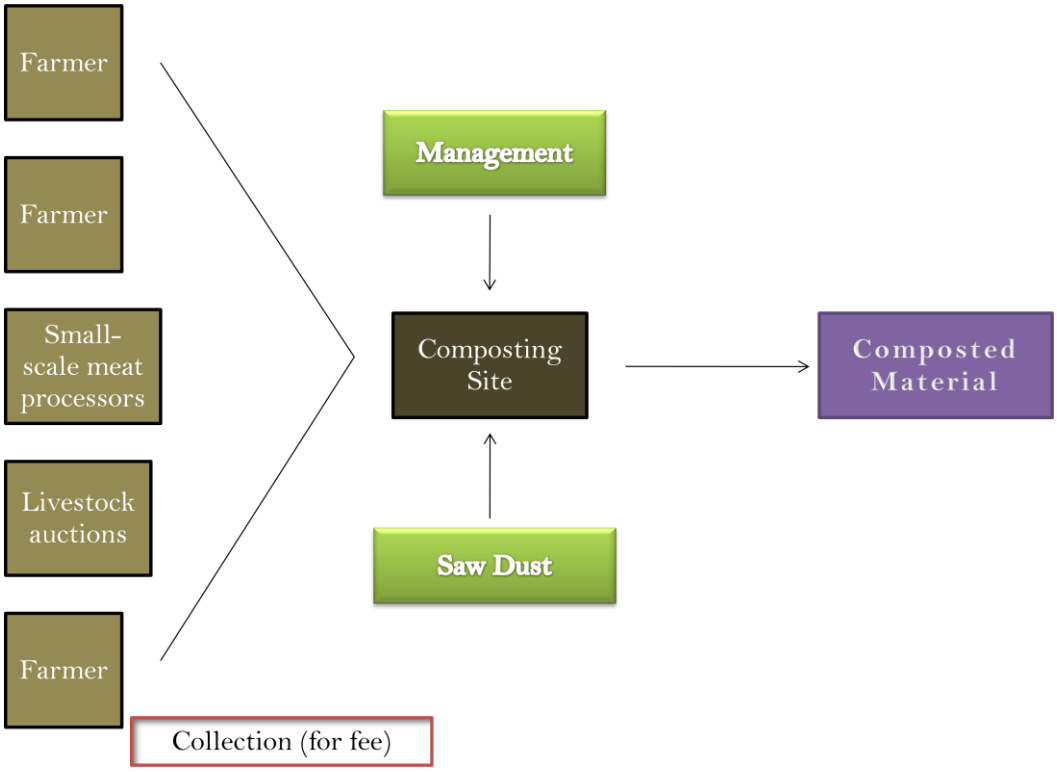
A trailer and winch system could be purchased for less than $5,000. The composting operation could offer customers needing to transport animal mortalities the option of renting the trailer. A daily rental fee of five to ten dollars would be sufficient to cover depreciation and mileage expenses associated with the use of the trailer. Rental fees would not be sufficient to provide a revenue stream that would affect the economic analysis of the operation.

4. Recommendations

Opportunities for Composting Businesses

The diagram below shows one way of creating a regional animal mortality compost facility. In addition to farmers utilizing the composting facility, livestock auction operators and small-scale meat processors are all potential customers.

Exhibit 4.1 Composting Business Supply Chain

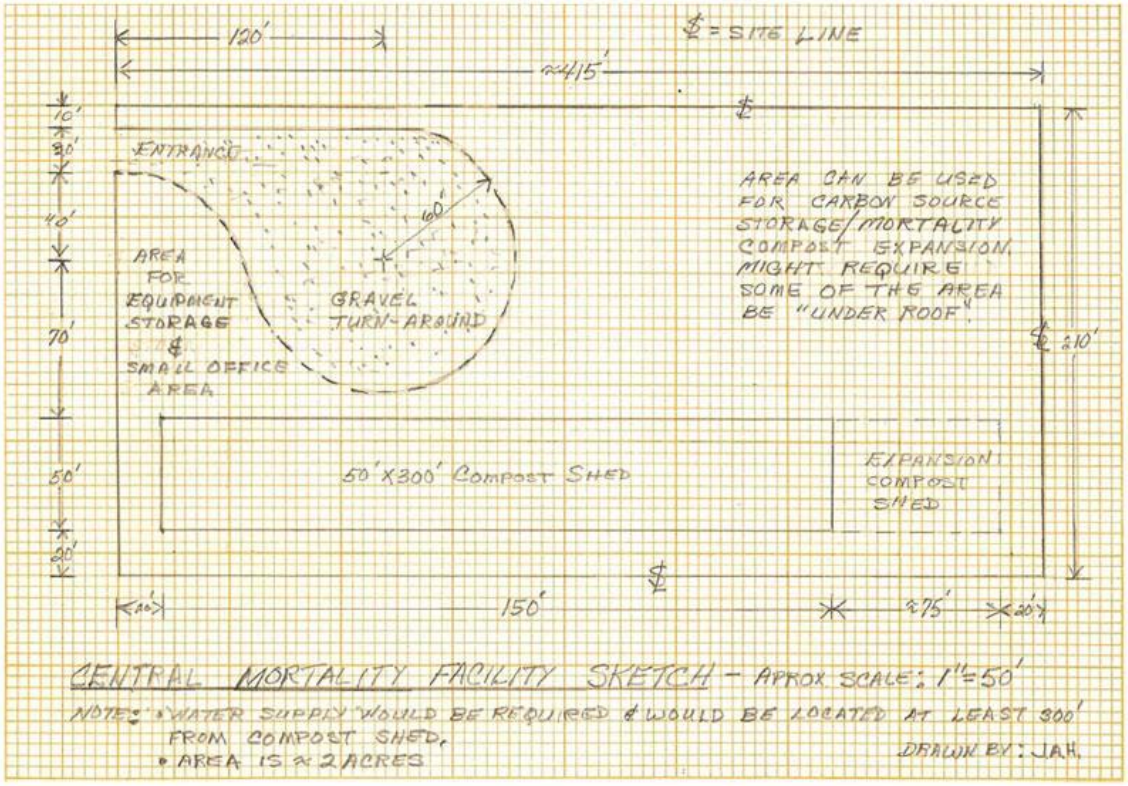


Recommended Compost System Selection

The recommended compost system for a regional animal mortality facility is system #4: Static Piles under Roof. This system was chosen for the following reasons:

- Offers minimal environmental risks and minimal handling of dead animals
- Roofed composter are perceived and should be more readily accepted by the public
- This system offers the most flexibility of scale and throughput volume of dead animals
- This system can operate in almost all weather conditions
- Most easily implemented system with minimal management.
- Capital investment and operating costs are lower than the two mechanical options
- Roofed buildings might be built with public assistance and then potentially operated for decades with minimal additional repairs or investments.

Exhibit 4.2 Example Composting Facility Layout



Source: John A. Hoehne, P.E.

Site Selection Comments and Suggestions

- S/L is a reference of the site line. The sketch is drawn at an approximate scale of 1" = 50'. The size is 210' X 415' = 87,150 ft^2. Two (2) acres = 87,120 ft^2. The actual longitudinal length would be 414.86'.

- A water supply will be required to provide the potential to add moisture to the carbon source. This water supply should be located, "off-site" because the DNR distance listed for mortality composters without concrete floors is 300'.

- The sketch shows a graveled area that will allow for turning a "semi". The radius is slightly larger than is listed in MWPS-2, "Farmstead Planning Handbook". A 10-20' area is allowed between road and buildings for vegetation control (mowing).

- The facility is planned for the composting of 1500 lb/day of animal mortality. The facility can be scaled as necessary by building additional roofed space.

- Calculations by Hoehne show a slightly larger roofed area requirement; especially, if the carbon source used is not sawdust. These calculations are based on the size of large animals and the floor area "foot-print" that might be required. Also, if the carbon source has a lower C:N ratio than sawdust, more volume of the carbon source will be

needed to complete the composting process. Hoehne's calculations indicated a roofed area of approximately 16,425 ft^2.

- Possible areas for the expansion of the mortality composting shed and storage of carbon source materials are shown on the "sketch". Depending on what carbon source material is used, the requirement for covering those materials with a roof to prevent runoff would have to be determined based on the pollution potential of the materials.

- The mortality composting area would require construction that would prevent access by animal scavengers. Access to the site should also be restricted to improve bio-security and prevent bio-terrorism from anti-animal organizations.

- The site requires a road network that will allow large trucks to have all-weather access to the site.

- The mortality composting site needs to be isolated from livestock production facilities to provide improved bio-security and from neighbors for protection from any possible odor and public relations issues.

- The mortality composting site should be located on a relatively level to gently sloping area. The site must allow for surface water to be drained from the site. It might be necessary to have the potential to collect any leachate and land apply when no runoff would occur.

- The site should be naturally screened from view from persons using the roads that provide access to the mortality composting area. It is also desirable that traffic "in and out" of the facility not pass any close neighbors on a regular schedule.

- Facility operator should have adequate land area available to land apply the nutrients produced at the facility in an approved manner. This would probably require acquiring and following a written nutrient management plan. Part of this plan would be to determine the nutrient content of finished compost by laboratory testing on a regular schedule and land apply based on soil test requirements for the crops grown on the selected fields.