Composting Large Animal Mortality at the Shenandoah County Landfill

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Disposal of large animal mortalities is a priority for Northern Shenandoah Valley farmers. Most mortalities have been sent Valley Proteins Inc. in Harrisonburg or Winchester. Over several years, Valley Proteins Inc. shifted from paying farmers to accept their mortality to charging a small fee. There was concern that this option might disappear altogether.

Demonstrations were conducted on three Shenandoah County farms to show that large animals could be successfully composted with minimal effort. http://offices.ext.vt.edu/shenandoah/programs/anr/Composting_on_farm.pdf

Mortality burial has been permitted and practiced at the Shenandoah County landfill. There are however space constraints. Both farmers and landfill officials wanted to try composting.

Mixing Woodchips and Sludge at the Shenandoah County Landfill

Overview of Composting Demonstration at the Landfill

A large animal mortality composting demonstration was initiated in August 2008. Ground woody debris was used for a base and insulating blanket. A mixture of ground woody debris and waste water treatment plant sludge was used to initiate the composting process. The woody debris consisted of both vegetative waste (grass, leaves, and limbs) and woody construction debris that was hauled to the landfill by county residents and businesses. The sludge originated from the Woodstock Waste Water Treatment Plant and the Waste Water Treatment Plant at George's Poultry Plant near Edinburg.

Table 1: Analysis of Feedstock

	Woodchips	Woodstock Sludge	George's Sludge
Solids	67.68%	16.06%	16.24%
Total Nitrogen	0.50%	8.87%	5.14%
Total Carbon	47%	42%	36%
C:N Ratio	94	5	7
Phosphorus	0.04%	1.77%	5.83%
Potassium	0.21%	0.42%	0.81%
Sulfur	0.09%	0.86%	0.59%
Calcium	1.13%	3.97%	1.42%
Magnesium	0.10%	0.44%	1.05%

The analysis of the raw ingredients is shown in Table 1. As expected, both sludge samples have lower C:N ratio and higher concentrations of plant macronutrients than the woodchips. Table 2 shows the concentration of EPA 503 regulated trace elements. As shown, the sludge was well below EPA 503 limits.

The woodchips were not analyzed for EPA 503 trace elements. Copper and Zinc are shown because they were analyzed as part of the plant nutrient package offered by the laboratory. Since the woody debris used to make the woodchips can originate from construction waste, perhaps an analysis would be appropriate. This is especially important considering the material might contain lumber treated with Copper Chromium Arsenate.

Table 3 shows various recipes compared in our trial. When composting large animal mortality, the goal is to surround the mortality with material that will compost regardless of the mortality. Based on these analyses, it was determined that both the Woodstock and George's sludge should be mixed at a ratio of two parts woodchips to one part sludge (by volume). It is important to note that in practice a loader operator typically will carry a heaping loader bucket full of woodchips and a loader bucket barely full of the sludge. Thus, if the loader operator is told to mix two scoops of woodchips with one scoop of sludge the resulting mix is likely closer to a 3:1 mix than a 2:1 mix.

Table 2: Analysis of EPA 503 Regulated Trace Elements of the Sludge used in the Composting Process

		Woodchips	Woodstock Sludge	George's Sludge	EPA 503 CCL	EPA 503 PCL
Arsenic	mg/kg		3.5	6.0	75	41
Cadmium	mg/kg		1.0	<1	85	39
Copper	mg/kg	89	158	34	4300	1500
Lead	mg/kg		28	<5	840	300
Mercury	mg/kg		2.1	<0.4	57	17
Molybdenum	mg/kg		13	<5	75	
Nickel	mg/kg		23	8	420	420
Selenium	mg/kg		6.3	3.1	100	100
Zinc	mg/kg	166	446	139	7500	2800

CCL = (Ceiling Concentration Limits) = maximum concentration permitted for land application
PCL = (Pollutant Concentration Limits) = maximum concentration for biosolids whose trace element pollutant additions do not require tracking

Table 3: Recipe for Composting Animal Mortality at the Shenandoah County Landfill

	---------- Volume (Yards) ----------					
	Blend #1	Blend #2	Blend #3	Blend #4	Blend #5	Blend #6
George's Sludge	1	1	1			
Woodchips	2	3	4	2	3	4
Woodstock Sludge				1	1	1
C:N Ratio	28	35	41	19	24	29
Percent Moisture	61%	56%	52%	61%	56%	52%
Percent Moisture with 1,000 Pound Cow Added	67%	61%	57%	67%	61%	58%
* An acceptable C:N between 20:1 to 40:1 with 25:1 to 30:1 preferred						
** An acceptable moisture is between 40 to 65% with 50 to 60% preferred						
*** As acceptable bulk density is around 1,000 pounds per cubic yard						

Pictures below show the sludge and the process used to mix the sludge and woodchips.

Woodstock Sludge

Sludge from George's Poultry

Mixing Sludge and Woodchips

Large animal mortality were placed in the compost piles on the dates shown in Table 4. Temperature readings were measured by placing long stemmed thermometers in each pile in two places and taking readings at both a 1-½ foot and 3 foot depth. Mimimum temperature readings in each pile were recorded to demonstrate that a minimum temperature of 131 degrees farenheit for three consecutive days was achieved. As shown in Table 4 all of the animals achieved temperatures well above the desired goal.

The compost windrow containing cows 1-5, the goat, and the calf were turned on November 14 2008. The first animal in this pile had composted for 92 days, and the last cow placed in this pile composted for 64 days. As shown in the pictures, the only portions of the animals remaining are the bones. The material was stacked in a large pile (page 7) to complete the composting of bones. This material could have been used immediately in the composting of additional animals. Another option would have been to leave it in the pile for another 6-12 months to allow the composting process to fully decompose the bones. The finished compost was used as daily cover in the landfill before this could be documented or before a final sample could be collected.

Table 4: Temperature Readings from Compost Piles												
	Cow #1	Cow #2	Cow #3	Cow #4	Cow #5	Calf	Goat	Cow #6	Cow/Horse	Cow #7	Horse	Turned Pile
8/14	90											
8/16	120											
8/18	140	120										
8/19	136	120										
8/21	136	150										
8/21	145	150										
8/25		140	150				144					
8/27	140	140	144	136			144					
8/29	140	140	148	150			138					
9/2	140	140	144	140			150					
9/4	128	135	140	140			150					
9/8	140	140	130	130		146	140					
9/11		140	130	140	120	133	140					
9/15		120	110	120	150	140	130					
9/17	140	140	130	132	150	140	130					
9/19		136	138	140	150	136	130	100				
9/22	140	130	132	140	150	138	132	120				
9/23								150				
9/25					140	136		136				
9/30					140			148	132			
10/2					126			148	140			
10/6								150	150	136		
10/8								148	148	144		
10/10								140	150	150		
10/14									150	140		
10/18									150	130	140	
10/20									155	150	140	
10/21									155	150	138	
10/23									150	140	150	
10/28										130	144	
10/31											140	
11/3											140	
11/4											140	
11/7											140	140
11/13												150
11/19												150

Composting a Cow at the Shenandoah County Landfill

Step 1: Construct Base

Step 2: Place Cow on Top of Base

Step 3: Cover Cow with Woodchip and Sludge Mix

Cow Covered

Step 4: Cover Cow with Insulating Blanket

Composting a Horse at the Shenandoah County Landfill
Horse was Placed in the Compost Pile on October 13, 2008

Step 1: Place Horse on Top of Base and a Small Portion of Mix

Step 2: Place Woodchips-Sludge Mix on Top of the Horse

Step 3: Place Insulating Blanket on Top of the Mix

Step 4: Fully Constructed Pile

Composted Horse on December 9, 2008

Bones Remaining on November 14, 2008

Turned Pile

Summary of Large Animal Mortality Landfill Composting Demonstration

1. It appeared to be easier to get landfill operators than farmers to cover animals adequately. I presume that Likely due to a combination of the large buckets on the loaders and the abundance of woodchips.
2. During wet weather, one foot of woodchip base was not adequate for the large track loader machinery. The track loaders ground the chips into the underlying wet soil.
3. The area at the Shenandoah County Landfill was too flat. The area needs to have a slope of about two to three percent to allow rain water to drain off the composting area.
4. The woodchip/sludge mix heated very well.
5. Farmers delivering mortality need good signage indicating where they should unload their trucks at the Landfill. The location should be the same all the time or at least use the same sign all the time.
6. Constructing a pad on top of a landfill cell will require a significant base to hold up the machinery. This will be especially difficult if the machinery used is track loaders.
7. The compost (shown in the picture above labeled “turned pile”) was used as daily cover within the landfill as a substitute for soil. This material however would also be suitable as a soil amendment and nutrient source to help re-vegetate disturbed soils at the landfill.

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