In-vessel livestock mortality composters



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Proper disposal of animal mortalities is critical to sustainable livestock production. Composting has been identified as the preferred method by the biosecurity agencies in the North America. Composting utilizes aerobic microorganisms to decompose mortalities and destroy pathogens. Successful mortality composting requires regular management of composting sites, which can be labor intensive and time consuming. Invessel composting systems were developed to hasten primary phase of the composting process. This fact sheet summarizes the use of an in-vessel composter (Biovator[™]) at a sow farm in southwestern Michigan.

Site visit

A 2,400 sow farm that produce 1,400 piglets per week was visited in December 2018. Weather temperature was 28°F (RH: 89%, wind speed: 2 mph south). Annual sow and piglet mortality rates of the site are 8% and 15%, respectively. The farm is equipped with a large size Biovator[™] model #442. It is 42 ft long and has a diameter of 4 ft. It has a 1-HP motor (1725 RPM, 60 Hz). While all piglet mortalities are composted in the vessel, only 50% of the sow mortalities are added to avoid exceeding the max capacity. The vessel is loaded with 200 lbs of mortality per day. The carbon source is kiln dried softwood shavings. Wood shavings are added to the vessel at the ratio of 0.055 cubic ft per lb of mortality (3.4 L/kg). This ratio corresponds to two bags of wood shavings per day (5.5 cubic ft per bag or 155 L per bag). No water is added to adjust the moisture content of the wood shavings. Stainless steel paddles are mounted on the inside walls of the vessel. The compost material turnes 8 times a day. Each turn takes about 10 mins. In 3 weeks, the primary composting phase is completed and the compost material reaches to the discharge opening.



Figure 1. 42-ft long in-vessel composter

Three weeks later, compost material is moved to the secondary bin where it is held up to 6 months. Finished compost is field applied. Maximum temperatures reached during the process vary depending on the ambient temperature (on average 60°F in winter and 130°F in summer). The site did not report any PRRS or PED outbreaks in the last 5 years. The successful management of the animal mortalities might have contributed to avoid having a disease outbreak.



Thermometers

Figure 2. The inspection windows and the thermometers



Gas measurements

A common concern related to in-vessel composters is odor generation during the process. In this study, concentrations of ammonia and reduced sulfur compounds were measured as odor surrogates. Ammonia concentrations were measured with an Eagle 2 (RKI Instruments), which was equipped with an electrochemical sensor (range: 0-75 ppm). Total reduced sulfur compounds (approximately 95% hydrogen sulfide and 5% other sulfur-containing compounds) were measured with a Jerome-meter 631X from Arizona Instruments (range: 0.003-50 ppm).



Figure 3. Gas sampling locations:

#1 inside the vessel, #2 downwind of the loading door when the door is open, #3 downwind of the loading door when the door is closed, #4 by discharge opening, #5 & #6 10 and 20 ft far from the discharge opening, respectively, #7 upwind of the loading door, #8 by the surface of the secondary composting bin, #9, #10 & #11 10, 20, 40 ft far from the surface of the secondary composting bin, respectively.



Figure 4. Gas sampling when loading door is open

Location	NH_3	NH_3	TRS	TRS
	(ppmv)	(mg/m³)	(ppmv)	(mg/m³)
1	29	22.0	0.35	0.53
2	2	1.5	0	0.00
3	0	0.0	0	0.00
4	70	53.1	0.21	0.32
5	1	0.8	0.01	0.02
6	1	0.8	0	0.00
7	0	0.0	0	0.00
8	9	6.8	0.03	0.05
9	2	1.5	0	0.00
10	0	0.0	0	0.00
11	0	0.0	0	0.00

Table 1. Ammonia (NH3) and total reduced sulfur (TRS) concentrations

measured at multiple locations

Gas concentrations except inside the vessel (#1) and at the discharge opening (#4) were lower than offensive odor levels (Table 1 &2). About 20 ft far from the surface of the compost pile, gas concentrations were below detection limits. Gas concentrations didn't exceed the immediately dangerous to life and health limits at any location. More measurements are needed to make solid conclusions but based on this preliminary study, it can be said that in-vessel composters are not expected to be a significant source of odor emissions. The impact on occupational health is anticipated to be minimum.

Table 2. Odor detection threshold, offensive odor level, NIOSH Recommended Exposure Limit (REL), and Immediately Dangerous to Life and Health (IDLH) limit

	NH ₃ (ppmv)	H ₂ S (ppmv)
Odor detection	>5 [1]	0.01-1.5 [3]
threshold		
Offensive odor level	50 ^[1]	2-5 [3]
NIOSH REL	25 (8 h) ^[2]	10 (10 min) ^[3]
IDLH	300 [2]	100 [3]

The purpose of this factsheet is to provide information. The University of Illinois Extension does not promote the use or purchase of a particular product. The incomplete list of composting companies include Advanced Composting, Biovator, Dutch Composter, and Ecodrum.

More information/references

- 1. Ammonia Acute Exposure Guideline Levels
- 2. Ammonia REL and IDLH
- 3. Hydrogen Sulfide Health Hazards

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