COMPOSTING POULTRY WASTE ON THE FARM

Composting is a viable method of managing the solid waste generated by on-farm poultry[1] processing activities. In order to do so in a manner that protects public health and environmental quality, we have compiled the following best management practices (BMPs) for composting operations[2].

[From *Cornell Waste Management Institute*, *"Natural Rendering: Composting Poultry Mortality"* 2008 and *University of Georgia Cooperative Extension Bulletin 1266:* Poultry Mortality Composting Management Guide, 2015]

Site Selection:

Select a site that is well-drained and away from watercourses, sinkholes, seasonal seeps or other landscape features that indicate the area is hydrologically sensitive. Make sure the piles are set up in a way that minimizes risk to healthy animals. Moderately to well-drained, hard-packed soils with gentle slopes are well suited as composting sites. A slope of about two percent is desirable to prevent ponding of water. Steep slopes are not satisfactory because of potential problems with erosion, vehicular access, and equipment operation.

Some poultry mortality composting structures consist of various sized bins constructed of lumber set on a concrete slab with a roof overhead. The roof helps avoid excessive moisture levels within the compost. The concrete slab helps prevent leachate from the compost piles from entering the soil under the compost and makes clean-up of the facility easier.

Exposed compost windrows should run up and down the slope, rather than across, to allow runoff water to move between the piles rather than through them (see figure 1). The initial site preparation may require grading and may require an improved surface such as enzyme or lime treated soil, asphalt or concrete (see Cornell Compost Fact Sheet #6: Compost Pads). Siting is very important to help avoid environmental and neighbor issues. Determine the dominant wind direction, and if most airflow is directed toward populated areas, look for another site.

Composting operations shall be set back at least 100 feet from the nearest surface water body and/or the nearest water supply well. A lesser setback distance may be allowed by the Regional Water Board if the Discharger can demonstrate that the groundwater, geologic, topographic, and well construction conditions at the site are adequate to protect water quality.

Regulatory Note:
Marin County Department of Environmental Health is the enforcement agency (EA) for composting operations in Marin. On-farm composting may be exempt from direct regulation by the EA if it complies with two essential criteria. However, even exempt operations cannot create hazards or jeopardize health, safety, or the environment via excessive odors, dust, feathers or vectors. At all times, the EA has the ability to inspect your compost operation to insure that you are complying with the terms of the exemption.

Areas used for receiving, processing, or storing feedstocks, additives, amendments, or compost (active, curing, or final product) must be designed to limit water quality degradation. Working surfaces and containment structures must be designed, constructed, operated and maintained to:

a) Facilitate drainage and minimize ponding by sloping or crowning pads to reduce infiltration of liquids;
b) Reliably transmit free liquid present during storage, treatment, and processing of materials to a containment structure to minimize the potential for waste constituents to enter groundwater or surface water; and
c) Prevent conditions that could contribute to, cause, or threaten to cause a condition of contamination, pollution, or nuisance.

1 Although Poultry Processing as a land-use in Marin County includes both fowl and rabbits, California State law says that mammalian tissue cannot be composted, so offal from rabbit processing must be taken to a licensed rendering plant for disposal.

2 Special thanks to Laurie Taul, Environmental Scientist with Region II Water Quality Control Board, and Jeff Creque, Director of the Carbon Cycle Institute

Building & Maintaining Compost Windrows:
The essential elements for the microorganisms involved in composting are carbon (C), nitrogen (N), oxygen (O^2), and moisture (H^20). If any of these elements are lacking, or if they are not provided in the proper proportion to one another, the microorganisms will not flourish nor generate adequate heat for rapid decomposition and pathogen reduction. These elements are best supplied from an ingredient profile that has a carbon to nitrogen ratio of between 25 and 40 to 1. Birds have a C:N ratio of 5:1, litter ranges from 7:1 to 25:1, straw 80:1, peanut hulls 50:1, and wood shavings are 200-700:1. A good carbon source will perform two functions: provide carbon and act as a bulking agent that creates pore space within the pile, allowing oxygen to flow through the material. If poultry litter is to be used as the carbon source, 2-3 parts by volume of litter combined with one part by volume of dead birds and one part shavings should reach the desired C:N ratio and be adequate for the composting process to proceed.

The microorganisms that are best at composting are aerobic; that is, they require oxygen to live. During the composting process oxygen is used up quickly by microorganisms inside the compost pile. Aerating the compost by turning or through forced air infrastructure resupplies it with oxygen and allows the microorganisms to continue the composting process at a rapid rate. Water is essential to the growth of all living organisms. Composting microorganisms thrive best in moist -but not wet- conditions. Desirable moisture levels in the composting materials should be 50 to 60 percent. Too much water can cause the compost pile to become soggy and anaerobic, which will result in noxious odors; too little water will prevent microorganisms from reproducing to adequately high numbers. The amount of water needed depends on the moisture content of the litter and/or carbon bulking material, time of year, wind conditions, air temperature and rate of compost decomposition. As a rule of thumb regarding proper moisture content, well-watered compost when squeezed into a ball will not drip water and will retain its shape when released.

Compost Building Procedure:

1. Lay a 24-inch deep bed of coarse wood chips, 8-12 feet wide (depending upon structure and equipment constraints) and as long as space permits.
2. Add a 12-15-inch layer of litter and birds, then cover with a 12-15-inch layer of wood chips or other carbon source. Place carcasses no closer than 18 inches from the edges of the pile. Carcasses placed too near the edges will not compost as rapidly due to lower temperatures there and may contribute to odors attract vermin to the pile
3. Add another layer of litter and birds, followed by carbonaceous material until the windrow is at least 4' and not more than 6' high and as long as needed. A pile can be built all at once if sufficient mortalities and other feedstocks are on hand, or it can be built over time, but each layer of birds must be completely covered by at least 12" of chips, shavings or other "clean" carbon material
4. Cover the finished windrow with a 2-foot layer of wood chips or other carbon sources. The finished pile should be 5-7 feet high.
5. Make sure all mortalities are well-covered to prevent odors, insulate the pile and keep vermin and other unwanted animals out of the windrow.
6. If properly assembled, the primary thermophilic phase, where the compost reaches temperatures between 131-165 degrees, should begin within a few days and will take 10-14 days. During this time, no turning, agitating or active aeration should occur. Take temperatures at a depth of 24" ensure the thermophilic range is reached throughout the windrow. Use a 36" compost thermometer for this purpose.
7. Daily temperature Monitoring using a compost thermometer or digital Temperature probes will be used to measure temperatures, which should range from 131°-150°F or 55°-65°C during most of this time period. The heat produced by the microorganisms not only contributes to their own growth but also speeds up the decomposition process and helps kill pathogenic microorganisms that may be present.

Moisture Note:
If litter is very dry, add water to the layers as you are building them. The compost feedstock should be at 40%- 60% moisture. If incorporating blood into the compost, consult [Cornell Compost Fact Sheet #8: Composting Liquids] for practices that account for additional liquids and nitrogen in the pile.

Turning Note:
This is a process that requires little turning or pile movement as it is primarily a passively aerated system. These windrows consist of feedstock that is not well mixed and C:N ratios that are hard to access but the process works. If temperatures do not reach the thermophilic range, turning may be required to reach temperatures thus killing pathogens. If windrows are close to the range, let the windrow work and turn after 10-14 days. If windrow stays at ambient temperatures for more than 3 days, it is not working. Consider rebuilding windrows with additional carbon but ask for guidance if there is a disease concern.

8. Because biocidal temperatures are not reached at the outer edges of the compost pile, the pile will either need to be turned (5 times at 3-day intervals during a 15-day pathogen reduction phase), or, if not turned, the windrow must be covered with a 6" "blanket" of finished compost to insulate the pile and insure uniform heating of the outer pile layer. Turning and mixing the compost at least 5 times, or the use of a compost "blanket" if the pile is not turned, is needed to ensure the destruction of pathogens. Monitoring compost temperatures and maintaining good management practices throughout the entire process helps ensure the elimination of insect larvae and pathogens in the final product.
9. After the required time/temperature duration, windrows can be moved or turned for further curing prior to beneficial use
10. Site cleanliness is a critically important aspect of composting; it deters scavengers, helps control odors and keeps good neighbor relations.
11. Let sit for 1 to 12 months to cure.

Application of finished compost:

Rates of compost application will depend on soil conditions, compost nutrient content, crop nutrient demand and goals of the producer. For a rough guide on minimum effective rates of application for finished compost consult the CDFA's *Compost Application Rates for California Croplands and Rangelands for a CDFA Healthy Soils Incentives Program*, 2016 . See excerpt below:

Table 6. Recommendations of the subcommittee for compost application to agricultural lands distributed by type of agricultural system, C:N ratio and type of farming. *The rates to use are the "equivalent dry compost application rates", which should be converted to corresponding moist compost application rates on a batch-specific basis using moisture data from the compost facility.*

System	Management	Crop Type	Compost Type	Moist Compost Application Rate (tons/acre)	Equivalent Dry Compost Application Rate (tons/acre)
Cropland	Conventional	Annual	Higher N (C:N ≤ 11)	3 – 5	2.2 – 3.6
Cropland	Organic	Annual	Higher N (C:N ≤ 11)	3 – 5	2.2 – 3.6
Cropland	Conventional	Annual	Lower N (C:N > 11)	6 – 8	4.0 – 5.3
Cropland	Organic	Annual	Lower N (C:N > 11)	6 – 8	4.0 – 5.3
Cropland	Conventional	Tree	Higher N (C:N ≤ 11)	2 – 4	1.5 – 2.9
Cropland	Organic	Tree	Higher N (C:N ≤ 11)	2 – 4	1.5 – 2.9
Cropland	Conventional	Tree	Lower N (C:N > 11)	6 – 8	4.0 – 5.3
Cropland	Organic	Tree	Lower N (C:N > 11)	6 – 8	4.0 – 5.3
Rangeland	--	--	Lower N (C:N > 11)	6 – 8	4.0 – 5.3

Final Note:

All Poultry Processing operators should develop a site-specific Pollution Prevention Plan (narrative and map) as a means of assessing their unique infrastructure, location in relation to waterways, scope of activity, etc. and developing the set of composting practices that will protect surface and groundwater.