



AGRONOMY SERIES

# TIMELY INFORMATION

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## **A Simplified Nutrient Management Plan for Poultry Broiler Operations (Updated 2003)**

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This publication will help the owner/operator of a broiler facility to develop a simple nutrient management plan that "meets or exceeds" NRCS nutrient management standards. This plan should help reduce or eliminate pollutant discharge into surface and ground waters from land application of broiler litter (bedding material and manure) and dead bird compost. Once developed, this plan should be used to guide nutrient applications on all fields and crops. Although not required, the owner/operator may wish to have his/her plan reviewed and approved by a local NRCS District Conservationist. Operations that have more than 125,000 birds at any time during the year are considered concentrated animal feeding operations (CAFOs). They are required to register with the Alabama Department of Environmental Management (ADEM) and file an approved comprehensive nutrient management plan.

### **Background**

Alabama's National Pollutant Discharge Elimination System (NPDES) Rules for Animal Feeding Operations (AFOs) requires all AFOs to implement best management practices (BMPs) to protect water quality. While the rules for the larger CAFOs require a registration procedure and an NRCS approved waste management system plan, all size AFOs are affected. Owners and/or operators of any animal feeding operation in Alabama must "... maintain adequate records to document compliance . . . and regularly maintain comprehensive waste management system BMPs to the maximum extent practicable which meet or exceed NRCS technical standards and guidelines to prevent and minimize discharges of pollution during construction and operation." (ADEM AFO/CAFO Rules adopted March 31, 1999). A BMP common to all size AFOs, a comprehensive nutrient management plan (CNMP), is one way to help meet this requirement. (ACES Circular ANR-1188, "Best Management Practices for Animal Feeding Operations", briefly explains the most important BMPs for all AFOs.) Nutrients of primary concern are nitrogen (N) that can leach into groundwater as nitrate-N, and phosphorus (P) that can run off land and enrich surface waters. Control of these nutrients will also limit bacterial contamination of both surface and ground waters.

## Five Things You Will Need

In order to proceed through the five steps of the CNMP, the owner/operator must have the following:

1. An **aerial photo** and/or topographic map of the farm showing all fields where nutrients (either fertilizer or manure) will be applied and potentially impacted streams and water bodies. These are available from the local Soil and Water Conservation District office (NRCS office), Farm Service Administration (FSA) office, or may be downloaded or purchased directly off the Internet (e.g., <http://www.terraserver.com>).
2. **Soil survey** (available from local Soil and Water Conservation District office).
3. **Soil test report** (within last year) and recommendations for each field where nutrients will be applied.
4. **Phosphorus Index** for each field where manure will be spread (The P Index can be done by the producer or a technical service provider. The plan can be completed without the P Index if the producer plans to follow the soil test report recommendations.)
5. **Knowledge of the overall operation** e.g., number of houses, number of birds produced, market weight of birds, dead bird disposal, etc.

## Five Easy Steps

The plan can be developed in five easy steps:

1. Estimate broiler litter and compost production and storage.
2. Determine nutrient value of broiler litter and compost
3. Map and calculate land area for spreading, considering required buffers
4. Determine target crop and nutrient needs and timing for each field.
5. Determine uses for excess litter/compost production and Certified Animal Waste Vendor needs.

### Step 1. Estimate broiler litter and compost production and storage

**A. First, calculate how many pounds of birds are produced on the farm each year:**

$$\text{Lb. market wt. birds per year} = \text{no. of houses} \times \text{flock size} \times \text{no. of batches} \times \text{pounds market wt. per bird}$$

About 0.5 pound of broiler litter will be produced for each pound of market weight bird produced (based on tests by AU Biosystems Engineering and the Alabama Poultry Industry). Therefore, use the following to estimate pounds of litter produced per year on a farm:

$$\text{Lb. manure per year} = \text{lb. market wt. birds per year} \times 0.5$$

#### **Example:**

*Ima B. Goode has 4 broiler houses that holds 28,000 birds each. He markets 4.5 pound birds and produces 6 flocks a year. How much litter can he expect to produce on this farm each year?*

*Market wt. birds:*

$4 \text{ houses} \times 28,000 \text{ birds/hse} \times 6 \text{ batches/yr} \times 4.5 \text{ lb/bird} = 3,024,000 \text{ pounds or } 1,512 \text{ tons market wt. birds}$

*Litter produced:*

$1,512 \text{ tons} \times 0.5 = 756 \text{ tons litter per year}$  (*Mr. Goode, like most producers, will probably need to plan to store up to 1/2 of this or about 380 tons in his dry stack or composting facility.*)

## **B. Dead Bird Compost produced (Skip this section if birds are incinerated or taken to a rendering plant.)**

Estimate the weight of dead birds that need to be composted each year (Table 1). The amount of litter needed in this composting process is estimated by multiplying the weight of dead birds by 2.5. During the composting process, assume about 20% weight loss.

### **Example:**

*Ima B. Goode assumes that the average size of his dead birds is 2.1 pounds (Table 1), and he expects about 5% mortality.*

*Dead bird weight:*

$4 \text{ houses} \times 28,000 \text{ birds/hse} \times 6 \text{ batches/yr} \times 0.05 \text{ mortality} \times 2.1 \text{ lb/bird} = 70,560 \text{ pounds dead birds or } 35.28 \text{ tons}$

*Litter needed to compost dead birds:*

$35.28 \text{ tons} \times 2.5 = 88.2 \text{ tons}$   
(*This can be subtracted from the total litter produced.*)

*Total compost produced:*

$(35.28 \text{ tons dead birds} + 88.2 \text{ tons litter needed}) \times 0.80 \text{ residual} =$   
**99 tons compost**

## **C. Litter and compost storage**

Adequate dry stack or temporary storage must be provided in order to store and/or spread litter according to this plan. This should be stated as part of the nutrient management plan. Mini-composters (single stage) may have no storage capacity beyond one flock. Determine your compost storage capacity needs to properly time application of generated compost on an actively growing crop. If manures must be land applied from 15 November through 15 February, cool season grasses such as rye should be included in the plan. Dead bird compost should be stored separately from normal broiler litter.

Example:

*Mr. Goode's NRCS-designed 2-stage composters will store 3 batches of compost or 1/2 of the 99 tons generated in a year.* He plans to build a dry stack facility that will hold 1/2 of the annual production of broiler litter or 380 tons.

## **Step 2. Estimate nutrient value of broiler litter and compost**

For the purposes of nutrient management planning, average values for litter and composted dead birds can be used from Table 1. These values are estimates of plant available nutrients during the first year under Alabama conditions. As a general rule, poultry broiler litter is a 3-3-2 fertilizer (60-60-40 pounds N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O per ton), but not all the N in broiler litter is available to crops. Since manure and compost are highly variable, they should be periodically tested to verify the actual nutrient value. Analyzed values are preferable to values from a table. If actual litter production is used in Step 1 rather than an estimated value, then actual laboratory analyses of the litter should be used in Step 2. Keep laboratory analyses as part of this plan.

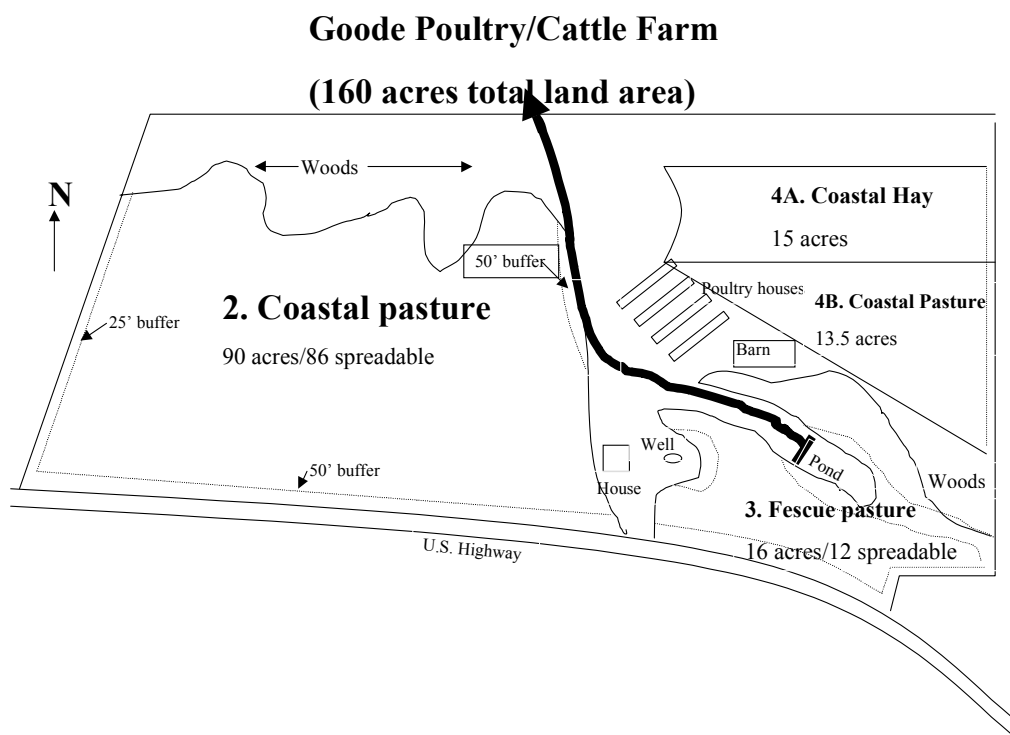
Example:

*From Table 1, Ima Goode estimates that his litter contains 56-58-45 pounds N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O per ton if incorporated. The dead bird compost contains 50-58-45 pounds N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O per ton. But since he will surface apply all litter to pastures and hayfields, he can multiply the N value by 0.84 to account for N volatilization.*

*Available nutrients of surface-applied litter = 47-58-45 per ton  
 Available nutrients of surface-applied compost = 42-58-45 per ton*

### Step 3. Map and calculate land area for spreading

To identify fields for litter and compost spreading and to calculate spreadable acreage, you will need a detailed farm map to scale. This can be a copy of your conservation plan map or a soil survey map of the farm from NRCS, a Farm Service Agency aerial photo of the fields or a sketch you draw yourself (see figure below). A topographic map of the farm can help identify steep slopes and waterways. High quality aerial photographs are always best.



On the field map show the following:

- Field identification (name or number)
- SPREADABLE acreage (total acreage minus buffers, borders, waterways, riparian zones, frequently flooded soils, etc.) (Table 2).
- All streams and ditches
- Wells, springs, and ponds
- Roads, forest land, and other areas impractical for spreading
- Houses, barns, and other buildings

Spreadable or useable acres in a field can be estimated if you know the scale of the map.

Rectangle or square field: (length in feet x width in feet)/43,560 = acres

Triangle-shaped field:  $\frac{1}{2}$  (length in feet x width in feet)/43,560 = acres

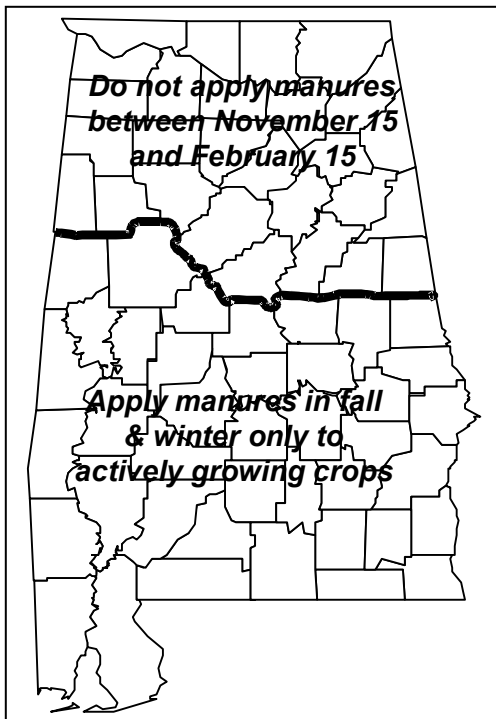
Round field: (3.14 x radius x radius)/43,560 = acres

Irregular shaped fields: estimate area in field

Another way of arriving at spreadable acres is to figure the border/buffer area removed from use and subtract this from the FSA figured field acres.

## Step 4. Determine crop and nutrient needs for each field

Soil samples should be taken from each field (no more than 10 acres per composite sample) every 3 years or less. Samples should be taken from the surface 0-3 inches from pastures and hayfields and the plow layer for cultivated cropland. Keep these reports as part of your nutrient management plan. This is a BMP. Failure to soil test could justify re-designating an AFO into a CAFO by ADEM.



Nutrients (fertilizer or manure) can be applied based on (1) a soil test report and recommendations using Auburn University's interpretations and recommendations or (2) a modification of the soil test recommendations based upon a PHOSPHORUS INDEX value for each field.

### P Index

Phosphorus application in excess of P recommended by soil test shall be based on the field vulnerability for offsite P losses to surface waters. This potential is estimated by calculating a P INDEX for every field (see USDA-NRCS publication *Phosphorus Index for Alabama*). The P index is a way of assessing the potential for soil and applied P to run off into surface waters. A low P index is desirable and may allow higher P applications to some soils. Best management practices such as grassed waterways, setbacks from streams, filter strips, limiting animal access to surface waters, and lower P applications can

decrease the P index. In some cases where soil test P is rated “EH”, a low P index may still allow for some litter or compost application. *The planned P rate cannot exceed the P application rate used in calculating the P Index.*

*Note: Always plan to use the dead bird compost on the farm where it was generated before spreading any litter. Dead bird compost cannot be transported without a special permit from the State Veterinarian’s office of the Alabama Department of Agriculture and Industries. Spreading of the litter at the proper time recommended for the crop to be grown and at the rate recommended is a Best Management Practice.*

P INDEX RATING (Field vulnerability)	Basis of P application rate	P Index Point Total
VERY LOW/LOW	Nitrogen rate	<65
MEDIUM	3x P removal by crop	66-75
HIGH	2x P removal by crop	76-85
VERY HIGH	1x P removal by crop	86-95
EXTREMELY HIGH	No P application	>95

**Nitrogen rate limit.** If the P Index is "LOW" for a field, litter or compost may be applied based only on the N recommended for the crop to be grown. In most cases, this will result in more P applied than is needed or recommended but this will be apparent in the next soil sample taken because soil test P will build rapidly.

**P Crop Removal.** If soil test P is already rated “high” (H), “very high” (VH) or “extremely high” (EH), then no more P is needed for maximum crop yields. However, since some crops, particularly hay and silage, can remove significant quantities of P, application based on crop removal (Table 3) is allowed. Additional fertilizer N and/or K may be needed for optimum crop production. *Note: Animals grazing pastures remove very little nutrients which may limit application of litter on pastures.*

The NPDES AFO Rules require the AFO operator to maintain detailed records of all land application of animal/broiler wastes. This includes date of application, weight and/or volume, destination, and acreage over which spread. These records should easily allow determination of spread rate in each field.

*Example: Goode Poultry Farm Field no. 2 (See Broiler Summary Worksheet #3)*

Field name or no.: Field 2 (Coastal Pasture)

Spreadable acres: 86

Crop(s) to be grown: coastal pasture

Soil test P rating: "MEDIUM"

Recommendations: 120-40-40 pounds per acre N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O

Phosphorus Index: 53 (LOW)

Basis of P application: "N LIMIT"

Source of nutrients: Spring = broiler litter

Summer = dead bird compost

*Recommendation for coastal pasture is 120-40-40 pounds per acre N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O. Half of the N will be applied in spring as broiler litter and the other half applied in mid-summer as*

compost. The Phosphorus Index for this field was calculated to be 53 (LOW) so we can apply nutrients based on the NITROGEN LIMIT.

April litter application:  $(60 \text{ pounds N/acre}) / (47 \text{ lb. N/ton of litter}) = 1.3 \text{ tons litter/acre}$   
Total nutrients applied per acre = 60-75-58  
 $1.3 \text{ tons/acre} \times 86 \text{ acres} = 112 \text{ tons litter needed}$

July compost application:

$(60 \text{ pounds N/acre}) / (42 \text{ lb. N/ton of compost}) = 1.4 \text{ tons compost/acre}$   
Total nutrients applied per acre in July =  $1.4 \times (42-58-45) = 60-81-63$   
 $1.4 \text{ tons/acre} \times 86 \text{ acres} = 120 \text{ tons compost needed}$

(NOTE: Earlier we calculated that we have only 99 tons compost each year. Therefore, this field can easily use all the compost we produce.)

Ima Goode does a similar calculation for each field on which he intends to apply nutrients. These can be tabulated on Broiler Summary Worksheet #3 in this document.

## Step 5. Determine uses for excess litter/compost production

From these calculations, you will now be able to determine if your present operation can effectively use all the nutrients in waste in an environmentally sound manner. Based on Step 4, determine how much litter or compost can be reasonably applied to each field and when it should be applied. Animal wastes should not be applied when there is no actively growing crop or more than 1 month before planting a crop. This is also a BMP. If cleanout of houses does not correspond with the proper time to apply to crops, then storage facilities e.g., dry stack barns or temporary, covered stacks may have to be constructed (see ACES Circular ANR-839, "Broiler Litter Storage"). Plans for using the litter and compost on the farm may be summarized using *Broiler Summary Worksheet #4*.

If more litter is produced than can be used on the farm based on Step 4, then it should be consigned to an Alabama Certified Animal Waste Vendor (CAWV). See ACES Circular ANR-1176, "Alabama's Certified Animal Waste Vendor Program: What You Need to Know", for more information. If you use a CAWV, include his/her name in the nutrient/waste management plan if possible. The owner/operator is responsible, to the extent allowed by law, for the proper use of any excess litter that is not consigned to a CAWV even if it is sold or given to a neighbor or spread on someone else's land. Any sale of litter should be accompanied with information on proper use of the litter and be fully documented with a record of the transaction.

## Worksheets

The attached worksheets may be used in preparing the nutrient/waste management plan or the owner/operator can develop his/her own worksheet. The important point is to plan the use of all nutrients/waste produced on the farm.

The process explained in this publication can also be done quickly using a Microsoft Excel Spreadsheet developed by USDA-NRCS and available at the following Internet web site:

<http://www.aces.edu/dept/aawm/ComputerTools.html>

Table 1. Characteristics of poultry operations and waste generated.

Category	Bird weight		No. of flocks per year	Mortality rate (%)	Available nutrients in manure+litter		
	Average (lb)	Mature (lb)			N <sup>1</sup>	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
					-----Pounds per ton-----		
Broiler	2.1	4.5	6	4	56	58	45
Broiler	3.2	6.5	5.5	7.5	56	58	45
Broiler (roaster)	4.2	8.5	4.5	6	56	58	45
Cornish hen	1.0	2.0	9.0	3.5	56	58	45
Pullets breeder replacement	4.0	4.5	2.2	4.0	29	57	35.
Pullets layer replacement	2.0	3.0	2.0	2.0	27	57	35
Breeding hens & roosters	6.0	7.5	0.8	11.0	32	53	35
Laying hen	4.0	4.5	0.8	14	31	57	46
Dead bird compost					50	58	45

<sup>1</sup>Values for N are for soil incorporated manure. Multiply N values by 0.84 if surface applied within 3 days to account for N volatilization losses.

NOTE: 1 cubic yard litter ≈ 810 pounds  
1 ton ≈ 2.5 cubic yards

Table 2. Recommended buffer widths for animal manure and organic by-product application

<u>Object, Site</u>	<u>Situation</u>	<u>Buffer width (ft.) from Object, Site</u>
Well	Well up-gradient of application site	200
Well	Well down-gradient of application site	300
Waterbody or Stream <sup>1/</sup>	Waste applied to pasture <sup>3/</sup> , hayland, or cultivated land <sup>4/</sup>	50 <sup>2/</sup>
Public Road	Irrigated wastewater	100
Public Road	Solids applied with spreader truck	50
Dwelling	Other than producer	100
Public Use Area	All	100
<u>Property Line</u>	<u>All</u>	<u>25</u>

<sup>1/</sup> Waterbody includes pond, lake, wetland, or sinkhole. Stream includes both perennial and intermittent streams.

<sup>2/</sup> On edges of the application field where runoff occurs to environmentally sensitive areas and to non-vegetated concentrated flow areas within the field, buffer widths must include a vegetated filter at least 50 feet wide that is established to permanent grasses (filter strip) with a stem density of at least 1 per square inch. If the filter incorporates a riparian forest buffer, in accordance with NRCS Conservation Practice Standard, Riparian Forest Buffer - Code 391A, the permanent grass filter strip may be 20 feet wide. The vegetated width must be located adjacent to the application field or concentrated flow area and be shaped so that flow from runoff is uniform (sheet flow) and does not concentrate.

<sup>3/</sup> If good grazing management (i.e. rotational grazing) is not used on pasture land, the vegetative filter must be protected from over grazing with a fence.

<sup>4/</sup> Cultivated land for waste application must have adequate erosion control practices in place.

Table 3. Nutrient removal by selected crops.

<b>Crop</b>	<b>Unit Yield</b>	<b>Nutrient removal</b>		
		<b>N</b>	<b>P<sub>2</sub>O<sub>5</sub></b>	<b>K<sub>2</sub>O</b>
Alfalfa hay	1 ton	52	12	50
Bahiagrass hay	1 ton	25	7	42
Bermudagrass hay	1 ton	50	12	43
Clover hay	1 ton	40	10	40
Corn grain	1 bushel	1.0	0.4	0.3
Corn silage	1 wet ton	10	4	10
Cotton lint and seed	1 bale	32	12	16
Oats, grain only	1 bushel	0.8	0.3	0.2
Oats, grain and straw	1 bushel	1.2	0.4	1.4
Pasture: bermuda or bahia	200 lb. beef	6	5	1
Pasture: fescue, ryegrass or orchardgrass	300 lb. beef	9	7	1
Peanuts, nuts	1 ton	70	11	16
Peanuts, nuts and vines	1 ton nuts + vines	120	15	93
Peas, vines & pods	1 ton	48	12	25
Ryegrass hay	1 ton	33	5	28
Sweet potatoes	100 bushel	13	6	32
White potatoes	100 pounds	0.3	0.2	0.5
Sorghum, grain	1 bu	0.8	0.4	0.2
Sorghum silage	1 wet ton	11	4	10
Soybean, grain	1 bushel	4	1	1.5
Switchgrass hay	1 ton	23	6	46
Tall fescue hay	1 ton	40	9	48
Tomatoes, fruit	100 pounds	4	1	9
Wheat, grain	1 bushel	1.2	0.6	0.3
Wheat, grain & straw	1 bushel	1.7	0.7	2.0

Source: Ala. Coop. Ext. Cir. ANR-449 and USDA-NRCS, AL Nutrient Management Code 590



**Nutrient Management Planning  
Broiler Summary Worksheet #2**

AFO OPERATION NAME \_\_\_\_\_ ANIMAL TYPE Broiler

TYPE OF WASTE \_\_\_\_\_ OPERATOR \_\_\_\_\_ DATE \_\_\_ / \_\_\_ / \_\_\_

**Step 3. Area for land application.** (Attach aerial photo OR topographic map AND soil survey of farm showing land application areas. Include all buffers and setbacks that apply. See Table 2.)

## Nutrient Management Planning Broiler Summary Worksheet #3

AFO OPERATION NAME \_\_\_\_\_ ANIMAL TYPE Broiler  
 TYPE OF WASTE \_\_\_\_\_ OPERATOR \_\_\_\_\_ DATE \_\_\_\_/\_\_\_\_/\_\_\_\_

Page \_\_\_\_\_ of \_\_\_\_\_

### Step 4. Determine crop and nutrient needs for each field.      δ Planning Sheet      δ Record Sheet

Field & Crop Information			Soil Test		P I N D E X	Basis of P application	Land application		
Field name or no.	Spread- able acres	Crop(s) to be grown	P rating	Recommendation N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O (lb/acre/yr)			Total nutrients N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O (lbs/acre/yr)	Source of nutrients (litter, compost, fertilizer, etc.)	Month of appli- cation
						! N limit			
						! 1x P <sub>2</sub> O <sub>5</sub>			
						! 2x P <sub>2</sub> O <sub>5</sub>			
						! 3x P <sub>2</sub> O <sub>5</sub>			
						! N limit			
						! 1x P <sub>2</sub> O <sub>5</sub>			
						! 2x P <sub>2</sub> O <sub>5</sub>			
						! 3x P <sub>2</sub> O <sub>5</sub>			
						! N limit			
						! 1x P <sub>2</sub> O <sub>5</sub>			
						! 2x P <sub>2</sub> O <sub>5</sub>			
						! 3x P <sub>2</sub> O <sub>5</sub>			
						! N limit			
						! 1x P <sub>2</sub> O <sub>5</sub>			
						! 2x P <sub>2</sub> O <sub>5</sub>			
						! 3x P <sub>2</sub> O <sub>5</sub>			
						! N limit			
						! 1x P <sub>2</sub> O <sub>5</sub>			
						! 2x P <sub>2</sub> O <sub>5</sub>			
						! 3x P <sub>2</sub> O <sub>5</sub>			

NOTE: 1 cubic yard litter ≈ 810 pounds  
 1 ton ≈ 2.5 cubic yards

**Nutrient Management Planning**  
**Broiler Summary Worksheet #4**  
 ♂ Planning Sheet      or      ♂ Record Sheet

AFO OPERATION NAME \_\_\_\_\_ ANIMAL TYPE Broiler

TYPE OF WASTE \_\_\_\_\_ OPERATOR \_\_\_\_\_ DATE \_\_\_/\_\_\_/\_\_\_

**Step 5. Determine uses for excess litter and compost.**

	Total amount planned or used	
	Litter (total tons)	Compost (total tons)
1. TOTAL ON-FARM PRODUCTION FROM WORKSHEET #1	(ITEM 1.F) _____	ITEM 1.E) _____
2. Field name or number	Litter (total tons)	Compost (total tons)
2. On-farm land application total (add above lines for fields)		
3. Other on-farm uses (explain):		
4. TOTAL ON-FARM USE (add lines 2 and 3)		
5. Excess to Certified Animal Waste Vendor * (Subtract line 4 from Line 1) CAWV name _____ CAWV no. _____		

\* Keep written records of all CAWV transactions to include tons of litter sold, to whom, and date.