Technical Discussion of Poultry Grow Houses – Comparison to Animal Feeding Operations
Presentation to Senate Agriculture and Natural Resources Committee, State of Kansas, 2018
Testimony by Kathy J. Martin on Senate Bill 405

To the Senate Agriculture and Natural Resources Committee:

My name is Kathy J. Martin and I am an engineer from Oklahoma that was asked by the Kansas Chapter of the Sierra Club to come speak to you today about the poultry industry and specifically the waste management issues related to broiler poultry houses. I have a BS in Petroleum Engineering and a MS in Civil Engineering from the University of Oklahoma. Upon graduation I worked for the Oklahoma Water Resources Board to develop the rules and regulations for non-hazardous industrial wastewater and to serve as a permit writer and as the Project Officer of the Tar Creek Superfund Site. In 1993, I transferred to the Oklahoma Department of Environmental Quality Customer Assistance Program and received training in the Clean Air Act Amendments of 1990 and the Title V Air Permitting Program.

In 1996, I branched out on my own and have been an environmental consultant for the past twenty some odd years. My focus on animal feeding operations began in 1997 in response to Seaboard constructing hundreds of swine operations in the Oklahoma panhandle. Since that time I have worked on animal feeding operation issues now in 21 states across the country. I have participated in rule-making related to the permitting of animal feeding operations in Oklahoma, Kansas, Nebraska, Colorado, Indiana, South Dakota, and New Mexico. In 1998, I was hired by Seward County Commissioners to write their county CAFO regulations and delivered a 50 page stand alone permitting program. My environmental work includes the review of CAFO/AFO environmental permit applications, construction plans and specs, nutrient management plans, and mortality compost design. My work focuses on assisting adjacent landowners and other concerned citizens during the public hearing and appeals processes.

Over the past 20 years, I have worked on 100's of CAFO/AFO cases including swine, dairy, and poultry facilities (turkey, egg layer and broiler). During that time, I have learned much about the poultry industry and their waste management strategies.

I would like to take this opportunity to express concerns about the proposed change to animal unit calculations. My oral comments will focus on three areas of concern:

a. Comparison of manure/nitrogen/phosphorus across all species
b. Poultry litter disposal/reuse and the industry's preference for manure brokers
c. Mortality disposal/composting

a. Comparison of manure/nitrogen/phosphorus across all species

I will explain my calculations of the pounds manure, pounds nitrogen, and pounds phosphorus (see three page handout) and how a comparison between animal species at 1000 pounds of animal/bird – the amounts of manure and nutrients is not comparable. In fact, in the case of poultry – 1 beef cattle at 1000 pounds is equivalent in weight to 500 broilers (assuming an average weight of 2.5 pounds). Clearly if your neighbor had either one cow or 500 chickens, you would surely be able to tell a difference just in the noise alone.

However, what is not obvious is whether the amount of manure generated is the same. My tables and supporting calculations clearly show that – no, the amounts of manure are not even remotely the same. In fact, 500 chickens defecate 95 lbs per day as compared to 49 lbs per day for the beef cattle – or twice the amount. Those same chickens produce three times more nitrogen in the fecal material and over six times the amount of phosphorus.

Comparing the amount of manure generated by 1000 pounds of chickens versus 1000 pounds of any other species, my calculations show that the poultry out-poops even a lactating dairy cow. In my oral testimony I will make a few more observations from the comparison tables to help the Senators make the best use of the information.

It is my contention that if the Senate intends on providing adequate protection of public health and the environment, that they need to have a clear understanding of just how much poop these poultry facilities will generate. One must also acknowledge that the contract grower facilities will be within a small economical radius from the processing plant and the animal waste products (poultry litter and mortalities) will most likely be land applied within that same small radius.

b. Poultry litter disposal/reuse and the industry's preference for manure brokers

I believe Craig Volland of the Sierra Club will speak today about the real concerns related to what types of nutrient management plans or waste management plans would be required of these contract grower facilities, so I won't spend much time on that topic. What I would like to discuss is the current industry trends related to waste management at the contract farms.

In Pennsylvania, Delaware, Virginia, and Indiana – I have reviewed numerous 'waste management plans' presented by contract poultry facilities (contracting with several different integrators) that dash cold water on any warm thoughts that a comprehensive nutrient management plan or any nutrient management plan is relied upon for waste disposal. The fact is that the majority of poultry operators today use the 'I am selling to a third party' option (some states call this a manure broker) and the regulations of those four states do not have any mechanism to enforce adequate protections of public health and the environment through the contract grower environmental permit. The evolution of the 'manure broker' in the waste disposal scheme of poultry operators means the public has no idea where the manure is going and where it is being land applied. The public doesn't know and for the most part the state agencies have no idea either because there is no online database of land application sites where one could query a particular piece of land and find out all of the 'manure brokers' that were using that land for disposal. There is literally no clear path to enforcement and thus no clear path to protect surface and ground water quality.

c. Mortality disposal/composting

Unless Tyson provides for a poultry rendering facility, it is most likely that all of the dead birds will be composted on-site at the various contract grower facilities. Mortality can be broken down into acute events (whole barns die due to power failure, disease, and fire) and normal mortality events. Normal mortality events in a poultry grower facility start with the first week when chicks are delivered. This time frame can see large losses of the small chicks because of the stress of transportation and lack of learning how to use the feeder system. The second time frame where one would experience normal but large losses is during the last weeks of the grow out cycle. This is when the birds are the largest, they are tightly packed into the barns and have much less floor space, they can be more aggressive and they can die from stress related problems, as well as disease. The rest of the time there is just normal mortality due to respiratory problems, ammonia burn, aggressive behavior, and other avian health issues.

During my oral testimony I will discuss mortality rates and pros/cons of using on-site mortality composting.

Thank you for considering my testimony today.

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Calculating lbs per day of Nitrogen-N, Phosphorus-P and Manure per 1000 lbs animal weight
Using Published Design Factors

Comparison of lbs Nitrogen-N per day per 1000 lbs animal weight		
Type of Livestock	**MWPS**	**NRCS**
1 Dairy Heifer (avg wt 1000 lbs)	0.3	0.27
0.714 Dairy Lactating (avg wt 1400 lbs)	0.721	0.76
0.714 Dairy Dry Cow (avg wt 1400 lbs)	0.3	0.30
0.91 Beef Cattle finisher (avg wt 1100 lbs)	0.363	0.36
500 Poultry – broiler (avg wt 2 lbs)	1.05	0.96
6.67 Swine – finisher (avg wt 150 lbs)	0.6	0.54
2.67 Swine – lactating sow (avg wt 400 lbs)	0.453	0.45
40 Swine – nursery (avg wt 25 lbs)	0.80	0.92

1. NRCS Animal Waste Management Field Handbook – Chapter 4 Waste Characteristics
Design Factors provided in Chapter 4 are in units of lbs N/day per 1000 lbs animal weight.

2. Midwest Planning Service – Manure Characteristics
Design factors provided in lbs N/head/day according to particular average weights so I calculated the number of animals to get to a weight of 1000 lbs of animal weight.

Dairy Heifer (avg wt 1000 lbs) or 1 dairy heifer per 1000 lbs of animal weight
1 dairy heifer x 0.30 lbs N/heifer/day = 0.3 lbs N/day/1000 lbs animal weight

Dairy Lactating (avg wt 1400 lbs) or 0.714 dairy lactating per 1000 lbs of animal weight
0.714 dairy lactating x 1.01 lbs N/head/day = 0.721 lbs N/day/1000 lbs animal weight

Dairy Dry Cow (avg wt 1400 lbs) or 0.714 dairy dry per 1000 lbs of animal weight
0.714 dairy dry x 0.42 lbs N/head/day = 0.3 lbs N/day/1000 lbs animal weight

Beef finisher (avg wt 1100 lbs) or 0.91 beef finisher per 1000 lbs of animal weight
0.91 beef finisher x 0.40 lbs N/head/day = 0.363 lbs N/day/1000 lbs animal weight

Poultry broiler (avg wt 2 lbs) or 500 birds per 1000 lbs of animal weight
500 broilers x 0.0021 lbs N/head/day = 1.05 lbs N/day/1000 lbs animal weight

Swine finisher (avg wt 150 lbs) or 6.67 swine per 1000 lbs animal weight
6.67 swine finishers x 0.09 lbs N/head/day = 0.6 lbs N/day/1000 lbs animal weight

Swine lactating sow (avg wt 375 lbs) or 2.67 lactating sows per 1000 lbs of animal weight
2.67 lactating sow x 0.17 lbs N/head/day = 0.453 lbs N/day/1000 lbs animal weight

Swine nursery (avg wt 25 lbs) or 40 nursery swine per 1000 lbs of animal weight
40 nursery swine x 0.02 lbs N/head/day = 0.8 lbs N/day/1000 lbs animal weight

Comparison of lbs Phosphorus-P per day per 1000 lbs animal weight		
Type of Livestock	MWPS	NRCS
1 Dairy Heifer (avg wt 1000 lbs)	0.04	0.05
0.714 Dairy Lactating (avg wt 1400 lbs)	0.16	0.14
0.714 Dairy Dry Cow (avg wt 1400 lbs)	0.046	0.042
0.91 Beef Cattle finisher (avg wt 1100 lbs)	0.047	0.044
500 Poultry – broiler (avg wt 2 lbs)	0.30	0.28
6.67 Swine – finisher (avg wt 150 lbs)	0.087	0.09
2.67 Swine – lactating sow (avg wt 400 lbs)	0.128	0.13
40 Swine – nursery (avg wt 25 lbs)	0.17	0.15

1. NRCS Animal Waste Management Field Handbook – Chapter 4 Waste Characteristics
Design Factors provided in Chapter 4 are in units of lbs P/day per 1000 lbs animal weight.

2. Midwest Planning Service – Manure Characteristics
Design factors provided in lbs P2O5/head/day according to particular average weights so I calculated the number of animals to get to a weight of 1000 lbs of animal weight. Also converted from P2O5 to P by multiplying by 0.4364 as follows:

Dairy Heifer (avg wt 1000 lbs) or 1 dairy heifer per 1000 lbs of animal weight
1 dairy heifer x 0.10 lbs P2O5/heifer/day = 0.10 lbs P2O5/day/1000 lbs animal weight
Convert to P = 0.4364 x 0.10 = 0.04364 lbs P/day/1000 lbs animal weight

Dairy Lactating (avg wt 1400 lbs) or 0.714 dairy lactating per 1000 lbs of animal weight
0.714 dairy lactating x 0.52 lbs P2O5/head/day = 0.37 lbs P2O5/day/1000 lbs animal weight
Convert to P = 0.4364 x 0.37 = 0.16 lbs P/day/1000 lbs animal weight

Dairy Dry Cow (avg wt 1400 lbs) or 0.714 dairy dry per 1000 lbs of animal weight
0.714 dairy dry x 0.15 lbs P2O5/head/day = 0.1 lbs P2O5/day/1000 lbs animal weight
Convert to P = 0.4364 x 0.10 = 0.046 lbs P/day/1000 lbs animal weight

Beef finisher (avg wt 1100 lbs) or 0.91 beef finisher per 1000 lbs of animal weight
0.91 beef finisher x 0.12 lbs P2O5/head/day = 0.11 lbs P2O5/day/1000 lbs animal weight
Convert to P = 0.4364 x 0.11 = 0.047 lbs P/day/1000 lbs animal weight

Poultry broiler (avg wt 2 lbs) or 500 birds per 1000 lbs of animal weight
500 broilers x 0.0014 lbs P2O5/head/day = 0.70 lbs P2O5/day/1000 lbs animal weight
Convert to P = 0.30 x 0.70 = 0.04364 lbs P/day/1000 lbs animal weight

Swine finisher (avg wt 150 lbs) or 6.67 swine per 1000 lbs animal weight
6.67 swine finishers x 0.03 lbs P2O5/head/day = 0.20 lbs P2O5/day/1000 lbs animal weight
Convert to P = 0.4364 x 0.20 = 0.087 lbs P/day/1000 lbs animal weight

Swine lactating sow (avg wt 375 lbs) or 2.67 lactating sows per 1000 lbs of animal weight
2.67 lactating sow x 0.11 lbs P2O5/head/day = 0.29 lbs P2O5/day/1000 lbs animal weight
Convert to P = 0.4364 x 0.29 = 0.128 lbs P/day/1000 lbs animal weight

Swine nursery (avg wt 25 lbs) or 40 nursery swine per 1000 lbs of animal weight
40 nursery swine x 0.01 lbs P2O5/head/day = 0.4 lbs P2O5/day/1000 lbs animal weight
Convert to P = 0.4364 x 0.40 = 0.17 lbs P/day/1000 lbs animal weight

Comparison of lbs manure excreted per day per 1000 lbs animal weight			
Type of Livestock		**MWPS**	**NRCS**
1 Dairy Heifer	(avg wt 1000 lbs)	45	56
0.714 Dairy Lactating	(avg wt 1400 lbs)	101	119
0.714 Dairy Dry Cow	(avg wt 1400 lbs)	51	51
0.91 Beef Cattle finisher	(avg wt 1100 lbs)	49	65
500 Poultry – broiler	(avg wt 2 lbs)	95	88
6.67 Swine – finisher	(avg wt 150 lbs)	49	65
2.67 Swine – lactating sow	(avg wt 400 lbs)	48	59
40 Swine – nursery	(avg wt 25 lbs)	76	88

1. NRCS Animal Waste Management Field Handbook – Chapter 4 Waste Characteristics
Design Factors provided in Chapter 4 are in units of lbs manure/day per 1000 lbs animal weight.

2. Midwest Planning Service – Manure Characteristics
Design factors provided in lbs manure/head/day according to particular average weights so I calculated the number of animals to get to a weight of 1000 lbs of animal weight.

Dairy Heifer (avg wt 1000 lbs) or 1 dairy heifer per 1000 lbs of animal weight
1 dairy heifer x 45 lbs manure/heifer/day = 45 lbs manure/day/1000 lbs animal weight

Dairy Lactating (avg wt 1400 lbs) or 0.714 dairy lactating per 1000 lbs of animal weight
0.714 dairy lactating x 155 lbs manure/hd/day = 101 lbs manure/day/1000 lbs animal weight

Dairy Dry Cow (avg wt 1400 lbs) or 0.714 dairy dry per 1000 lbs of animal weight
0.714 dairy dry x 71 lbs manure/hd/day = 51 lbs manure/day/1000 lbs animal weight

Beef finisher (avg wt 1100 lbs) or 0.91 beef finisher per 1000 lbs of animal weight
0.91 beef finisher x 54 lbs manure/hd/day = 49 lbs manure/day/1000 lbs animal weight

Poultry broiler (avg wt 2 lbs) or 500 birds per 1000 lbs of animal weight
500 broilers x 0.19 lbs manure/hd/day = 95 lbs manure/day/1000 lbs animal weight

Swine finisher (avg wt 150 lbs) or 6.67 swine per 1000 lbs animal weight
6.67 swine finishers x 7.4 lbs manure/hd/day = 49 lbs manure/day/1000 lbs animal weight

Swine lactating sow (avg wt 375 lbs) or 2.67 lactating sows per 1000 lbs of animal weight
2.67 lactating sow x 17.5 lbs manure/hd/day = 48 lbs manure/day/1000 lbs animal weight

Swine nursery (avg wt 25 lbs) or 40 nursery swine per 1000 lbs of animal weight
40 nursery swine x 1.9 lbs manure/hd/day = 76 lbs manure/day/1000 lbs animal weight

Table 6. Daily manure production and characteristics, as-excreted (per head per day)[a].

Values are as-produced estimations and do not reflect any treatment. Use these values only for planning purposes. The actual characteristics of manure for individual situations can vary ± 30% or more from table values due to genetics, dietary options and variations in feed nutrient concentration, animal performance, and individual farm managment.

	Size[a]	Total manure[b]			Water[c]	Density[c]	TS[d]	VS[c]	BOD_5	Nutrient content		
Animal	(lbs)	(lbs)	(cu ft)	(gal)	(%)	(lb/ft³)	(lb/day)	(lb/day)	(lb/day)	(lbs N)[d]	(lbs P_2O_5)[d]	(K_2O)
Dairy												
Calf	150	12	0.18	1.38	88	65	1.4	1.2	0.19	0.06	0.01[c]	0.05
	250	20	0.31	2.30	88	65	2.4	2.0	0.31	0.11	0.02[c]	0.09
Heifer	750	45	0.70	5.21	88	65	6.7	5.7	0.69	0.23	0.08[c]	0.23
	1,000	60	0.93	6.95	88	65	8.9	7.6	0.92	0.30	0.10[c]	0.31
Lactating cow	1,000	111	1.79	13.36	88	62	14.3	12.1	1.67	0.72	0.37[c]	0.40
	1,400	155	2.50	18.70	88	62	20.0	17.0	2.34	1.01	0.52[c]	0.57
Dry cow	1,000	51	0.82	6.14	88	62	6.5	5.5	0.75	0.30	0.11[c]	0.24
	1,400	71	1.15	8.60	88	62	9.1	7.7	1.04	0.42	0.15[c]	0.33
	1,700	87	1.40	10.45	88	62	11.0	9.3	1.27	0.51	0.18[c]	0.40
Veal	250	6.6	0.11	0.79	96	62	0.26	0.11	0.04	0.03	0.02	0.05[d]
Beef												
Calf (confinment)	450	48	0.76	5.66	92	63	3.81	3.20	1.06	0.20	0.09	0.16
	650	69	1.09	8.18	92	63	5.51	4.63	1.54	0.29	0.13	0.23
Finishing	750	37	0.59	4.40	92	63	2.97	2.42[d]	0.60	0.27	0.08	0.17
	1,100	54	0.86	6.46	92	63	4.35	3.55[d]	0.89	0.40	0.12	0.25
Cow (confinment)	1,000	92	1.46	10.91	88	63	11.0	9.38	2.04	0.35	0.18	0.29
Swine												
Nursery	25	1.9	0.03	0.23	89	62	0.21	0.17	0.06	0.02	0.01	0.01
	40	3.0	0.05	0.37	89	62	0.33	0.27	0.10	0.03	0.01	0.02
Finishing	150	7.4	0.12	0.89	89	62	0.82	0.65	0.23	0.09	0.03	0.04
	180	8.9	0.14	1.07	89	62	0.98	0.78	0.28	0.10	0.04	0.05
	220	10.9	0.18	1.31	89	62	1.20	0.96	0.34	0.13	0.05	0.06
	260	12.8	0.21	1.55	89	62	1.41	1.13	0.41	0.15	0.05	0.08
	300	14.8	0.24	1.79	89	62	1.63	1.30	0.47	0.17	0.06	0.09
Gestating	300	6.8	0.11	0.82	91	62	0.61	0.52	0.21	0.05	0.03	0.04
	400	9.1	0.15	1.10	91	62	0.82	0.70	0.28	0.06	0.04	0.05
	500	11.4	0.18	1.37	91	62	1.02	0.87	0.35	0.08	0.05	0.06
Lactating	375	17.5	0.28	2.08	90	63	1.75	1.58	0.58	0.17	0.11	0.13
	500	23.4	0.37	2.78	90	63	2.34	2.11	0.78	0.22	0.15	0.18
	600	28.1	0.45	3.33	90	63	2.81	2.53	0.93	0.27	0.18	0.21
Boar[c]	300	6.2	0.10	0.74	91	62	0.57	0.51	0.20	0.04	0.03	0.03
	400	8.2	0.13	0.99	91	62	0.75	0.67	0.26	0.06	0.05	0.05
	500	10.3	0.17	1.24	91	62	0.94	0.84	0.33	0.07	0.06	0.06
Poultry												
Broiler	2	0.19	0.003	0.023	74	63	0.050	0.038	0.011	0.0021	0.0014	0.0010
Layer	3	0.15	0.002	0.017	75	65	0.037	0.027	0.008	0.0026	0.0008	0.0012
Turkey (female)	10	0.47	0.007	0.056	75	63	0.117	0.088	0.034	0.0078	0.0051	0.0034
Turkey (male)	20	0.74	0.012	0.088	75	63	0.186	0.139	0.054	0.0111	0.0074	0.0048
Duck	4	0.44	0.007	0.053	73	62	0.118	0.089	0.016	0.0043	0.0034	0.0026
Sheep												
Feeder lamb[c]	100	4.1	0.06	0.5	75	63	1.05	0.91	0.10	0.04	0.02	0.04
Horse												
Sedentary	1,000	54.4	0.88	6.56	86[d]	62	7.61	6.5	1.52	0.18	0.06	0.06[d]
Intense exercise	1,000	55.5	0.90	6.70	86[d]	62	7.78	6.6	1.56	0.30	0.15	0.23[d]

TS = total solids; VS = volatile solids; BOD_5 = the oxygen used in the biochemical oxidations of organic matter in five days at 68 F, which is an industry standard that shows wastewater strength.

[a] Use linear interpolation to obtain values for weights not listed in the table.

[b] Calculated using TS divided by the solids content percentage.

[c] Based on MWPS historical data.

[d] Values calculated or interpreted using diet based formulas being considered for the ASAE Standards D384: *Manure Production and Characteristics.*