

KEEP THIS WORKSHEET FOR YOUR RECORDS DO NOT SUBMIT THIS WORKSHEET

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Farm Name: _____

Animal species and production stage ¹	Average capacity (number of animals)

Step 1: Estimate Lower Bound and Upper Bound of % ammonia loss by type of animal housing and manure storage:
For Lower Bound, use smaller value in range of typical losses. For Upper Bound, use larger value in range of typical losses.

Lower Bound

Animal housing: _____% (See Table 1)

Manure storage: _____% (See Table 2)

Upper Bound

Animal housing: _____% (See Table 1)

Manure storage: _____% (See Table 2)

Step 2a. Estimate **Lower Bound** % ammonia loss from the animal housing and storage system

$$\text{Ammonia Loss (\%)} = \text{Housing \% Loss} + [(100 - \text{Housing \% Loss}) \times \text{Storage \% Loss} / 100]$$

$$\text{Ammonia Loss (\%)} = \text{_____} + [(100 - \text{_____}) \times \text{_____} / 100]$$

$$\text{Lower Bound Ammonia Loss (\%)} = \text{_____} \%$$

Step 2a. Estimate **Upper Bound** % ammonia loss from the animal housing and storage system

$$\text{Ammonia Loss (\%)} = \text{Housing \% Loss} + [(100 - \text{Housing \% Loss}) \times \text{Storage \% Loss} / 100]$$

$$\text{Ammonia Loss (\%)} = \text{_____} + [(100 - \text{_____}) \times \text{_____} / 100]$$

$$\text{Upper Bound Ammonia Loss (\%)} = \text{_____} \%$$

Step 3. Identify the animal species row in Table 3 (along left side) that is most relevant to this estimation, and the ammonia loss (%) column (across the top) that best matches the estimated ammonia loss from Step 2. Find where this row (appropriate species) and this column (appropriate ammonia loss) intersect and record this value:

Lower Bound Unit ammonia emission rate = _____ lbs / animal / day.

Upper Bound Unit ammonia emission rate = _____ lbs / animal / day.

Step 4. Estimate daily herd ammonia (NH ₃) emissions					
	Average Capacity		NH ₃ Emission Rate (pounds/hd/day)		NH ₃ Lower Bound (pounds/day)
NH ₃ Lower Bound =		X		=	
	Average Capacity		NH ₃ Emission Rate (pounds/hd/day)		NH ₃ Upper Bound (pounds/day)
NH ₃ Upper Bound =		X		=	

Table 1. Typical ammonia losses from animal housing facilities expressed as a percentage of excreted manure nitrogen.²

Facility Description	Applicable Species	% Loss	Facility Description	Applicable Species	% Loss
Roofed facility (shallow pit under floor)	Swine	10 - 20	Roofed facility (bedded pack)	Swine	20 - 40
Roofed facility (flushed or scraped)	Swine	5 - 15	Roofed facility (deep pit under floor...includes storage loss)	Swine	30 - 40
Roofed facility (daily scrape and haul)					

¹ If more than one species, production stage, housing system or manure handling system is present on a given site, perform Steps 1-5 for each species, stage and/or system and sum resulting emissions.

² Most estimates are from USDA NRCS Agricultural Waste Management Field Handbook and LPES Lesson 21: Manure Storage Structures.

Table 2. Typical ammonia losses from manure storage as a percentage of nitrogen entering facility.²

Facility Description	% Loss	Facility Description	% Loss
Temporary stacked manure (no turning)	10-20	Pit below slatted floor (included in Table 1 values)	0
Composted manure (no carbon amendment)	30 to 40	Earthen storage pit (minimal treatment)	20 – 35
Composted manure (significant carbon amendment)	5 to 10	Formed manure storage (bottom loaded)	10
Bedded Pack Manure (included in Table 1 values)	0	Formed manure storage (top loaded)	30
Runoff holding pond (precipitation runoff only) ³	2 - 3	Anaerobic Lagoon (significant treatment)*	65-75

* Much of the lagoon loss can be due to denitrification (N₂ and N₂O), so the ammonia loss may only be half of what is shown.

Table 3. Estimates of ammonia nitrogen losses. Excretion estimates based upon 2005 ASAE Standard (proposal) for typical animals.

Livestock and Poultry Species	Typical Nitrogen Excretion (lbs per animal per day)	Ammonia Loss (% of excreted nitrogen)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Beef-Finishing Cattle	0.36	0.044	0.087	0.13	0.18	0.22	0.26	0.31	0.35	0.39
Beef – Cow (confinement)	0.42	0.051	0.10	0.15	0.20	0.26	0.31	0.367	0.41	0.46
Beef - Growing Calf (confinement)	0.29	0.035	0.070	0.11	0.14	0.18	0.21	0.25	0.28	0.32
Dairy – Lactating cow – 100 lbs milk/day	1.04	0.13	0.25	0.38	0.51	0.63	0.76	0.88	1.0	1.1
Dairy – Lactating cow – 88 lbs milk/day	0.99	0.12	0.24	0.36	0.48	0.60	0.72	0.84	0.96	1.1
Dairy – Lactating cow – 70 lbs milk/day	0.83	0.10	0.20	0.30	0.40	0.50	0.60	0.71	0.81	0.91
Dairy – Lactating cow – 50 lbs milk/day	0.66	0.080	0.16	0.24	0.32	0.40	0.48	0.56	0.64	0.72
Dairy – Dry cow	0.5	0.061	0.12	0.18	0.24	0.30	0.36	0.43	0.49	0.55
Dairy – Milk fed calves	0.017	0.0021	0.0041	0.0062	0.0083	0.010	0.012	0.014	0.017	0.019
Dairy - Calf	0.14	0.017	0.034	0.051	0.068	0.085	0.10	0.12	0.14	0.15
Dairy – Heifer	0.26	0.032	0.063	0.095	0.13	0.16	0.19	0.22	0.25	0.28
Dairy - Veal	0.033	0.0040	0.0080	0.012	0.016	0.020	0.024	0.028	0.032	0.036
Horse - Sedentary	0.2	0.024	0.049	0.073	0.097	0.12	0.15	0.17	0.19	0.22
Horse – Intense exercise	0.34	0.041	0.083	0.12	0.17	0.21	0.25	0.29	0.33	0.37
Poultry-Broiler	0.0025	0.00031	0.00061	0.00092	0.0012	0.0015	0.0018	0.0021	0.0024	0.0027
Poultry-Turkey (male)	0.0090	0.0011	0.0022	0.0033	0.0044	0.0055	0.0066	0.0077	0.0088	0.0099
Poultry-Turkey (females)	0.0054	0.00066	0.0013	0.0020	0.0026	0.0033	0.0040	0.0046	0.0053	0.0059
Poultry-Duck	0.0036	0.00044	0.00087	0.0013	0.0017	0.0022	0.0026	0.0031	0.0035	0.0039
Poultry - Layer	0.0035	0.00043	0.00085	0.0013	0.0017	0.0021	0.0026	0.0030	0.0034	0.0038
Swine-Nursery Pig(27.5 lb)	0.025	0.0031	0.0061	0.0092	0.012	0.015	0.018	0.021	0.025	0.028
Swine-Grow-finish (154 lb)	0.083	0.010	0.020	0.030	0.040	0.051	0.061	0.071	0.081	0.091
Swine – Gestating sow	0.071	0.0086	0.017	0.026	0.034	0.043	0.052	0.060	0.069	0.078
Swine – Lactating sow	0.19	0.023	0.046	0.069	0.092	0.12	0.14	0.16	0.18	0.21
Swine – Boar	0.061	0.0074	0.015	0.022	0.030	0.037	0.044	0.052	0.059	0.067

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