

Preliminary National Emissions Inventory of Ammonia from Animal Husbandry Operations

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Sponsors and Staff

- Funding
 - State/local Emission Inventory Improvement Program (EIIP).
 - EPA Office of Air Quality Planning and Standards (OAQPS).
- Staffing
 - OAQPS: Bill Schrock, Phil Lorang, Dallas Safriet, Dennis Beauregard
 - Eastern Research Group: Deb Bartram, John Crenshaw, Danny Greene, Birute Vanatta
 - EIIP: about 10 volunteer reviewers.

Time for an Update to Ammonia from Animal Husbandry

- Inverse modeling suggests overestimation of ammonia.
- Shortcomings of current NEI
 - Probable errors in emission factor selections, especially for beef.
 - Does not make total use of available National Agricultural Statistics Service (NASS) data on different animal populations, by average live weight.
- Need to work towards better temporal and spatial resolution.

Time for an Update to Ammonia from Animal Husbandry (2)

- Effluent Guidelines project provides new information on production and waste handling practices.
- Confusion and questions by others about what EPA recommends.
- National Academy of Science (NAS) committee recommended a long data gathering effort.
 - Old NEI estimates are not the best we can do during this period.
- New air quality modeling efforts starting soon.

NEI Update Goals

- Incorporate best available data on populations, practices, and emissions.
- Make a start on a process-based framework.
- Create a common, transparent framework that allows partial updating as more data becomes available.
- Separate emissions by release location, to support progress on temporal characterization.
- Consistent projections for future years.
- Motivate and provide structure for relevant data collection.
- Educate users about data limitations and proper use.

Overall Estimation Methodology

- Step 1: Estimate average annual animal populations by animal group, state, and county.
- Step 2: Identify Manure Management Trains (MMT) used by each animal group and then estimate the distribution of the animal population using each MMT.
- Step 3: Estimate the amount of nitrogen excreted from the animals using each type of MMT, using general manure characteristics.
- Step 4: Identify or develop emission factors for each component of each MMT.
- Step 5: Estimate ammonia emissions from each animal group by MMT and county for 2002.
- Step 6: Estimate future ammonia emissions for years 2010, 2015, 2020, and 2030.

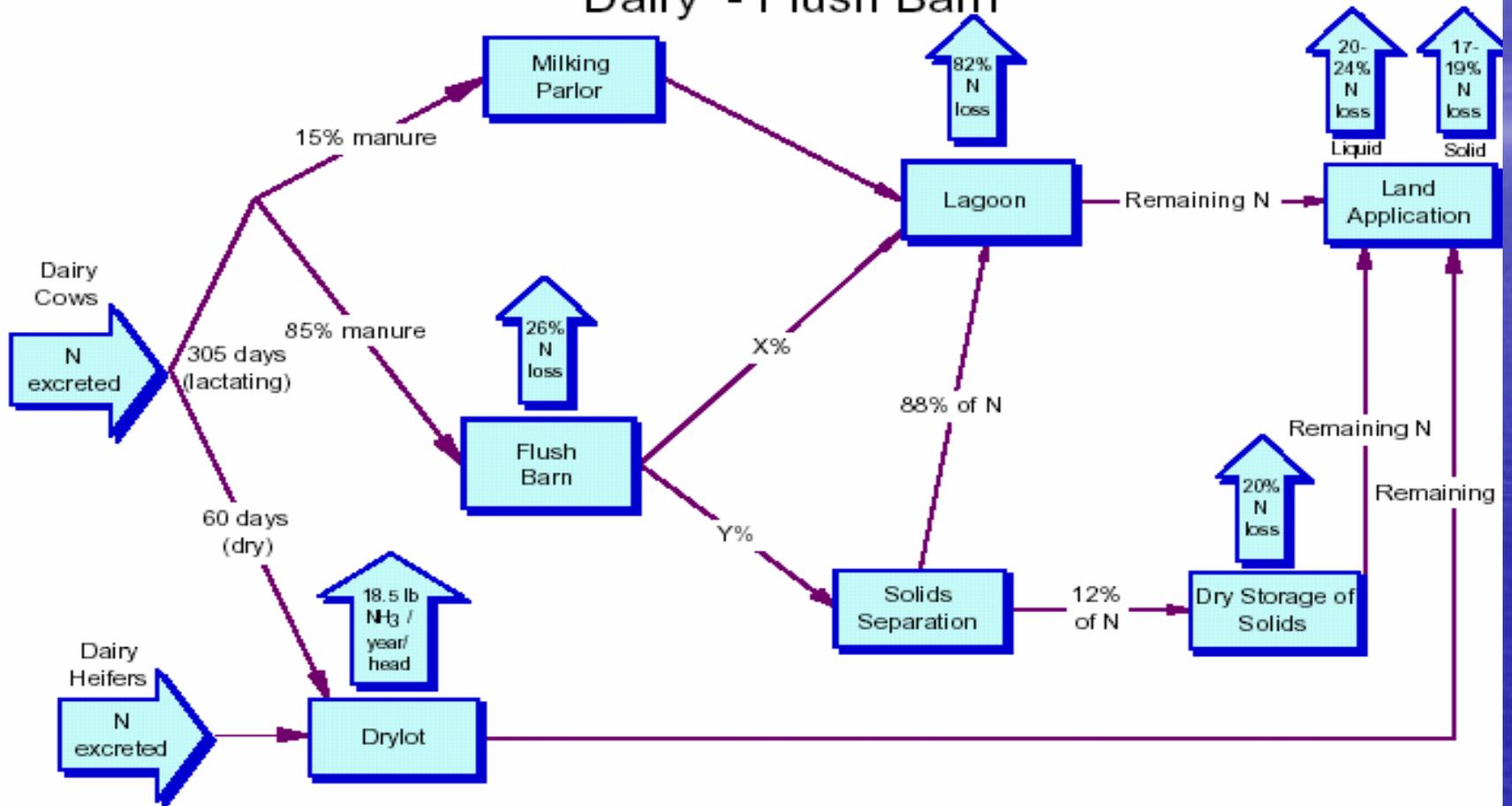
Step 1: Population Estimates

- Dairy, beef, swine, and poultry.
- 2002 NASS.
- Disaggregated to counties using 1997 Census of Agriculture.
- Where state and/or county is not disclosed, divide equally.
- Keeping weight groups distinct.

Step 2: Manure Management Trains

- 15 trains plus permutations (similar to “model farms” used in past approaches).
 - Housing type, waste storage type, land application type.
 - Non-feedlot outdoor confinement (e.g., pasture) is one of the trains for swine, dairy, and beef.
- Trains present different opportunities for escape of ammonia to the air.
- Swine population, etc. is allocated among the applicable trains.
 - Varies by state, same for all counties in a state.
 - Based on variety of information sources.

Dairy - Flush Barn



The percentage of nitrogen lost is calculated based on the amount of nitrogen managed in that component.
 The amount of nitrogen leaving the solids separator is based on the amount of nitrogen managed in the separator.
 X% and Y% vary by size of operation, and represent the proportion of production using each type of system.

Step 3: Nitrogen Excreted

- Typical animal weights (within a type and weight range)
- Nitrogen per 1000 kg of live weight from NRCS *Agricultural Waste Management Field Handbook*

Step 4: Emission Factors

- Select the emission factor for each stage of each manure management train.
 - Some are lb/animal, some are percent air release of input ammonia.
 - Both kinds also determine ammonia transferred to next stage.
 - Selected as average of the relevant literature, updated to May 2003.
 - Some copying between animal types and trains to fill in blanks in the literature.
- Air emissions can never be higher than original manure content.
- Using stage-specific emission factors sets the stage for applying temporal profiles later.

Step 5: Assemble for 2002

- Follow the ammonia through each manure management train for each animal type, calculating air releases and transfers to next stage.
- Final stage in each train is land application.
- Assuming no controls to reduce air emissions.
 - But can add control assumptions later, and see downstream consequences.
- Emissions will be summed up to animal type and county in released inventory, but database is also preserved with full detail for transparency and later revisions.

Step 6: Project Future Years

- 2010, 2013, 2020, and 2030.
- USDA and Food and Agricultural Policy Research Institute.
- Accounts for past observed cyclical populations.
- State-by-state population pattern.
 - Changes with time for dairy.
 - Fixed for others.

Schedule

- First draft complete and up on web
- States submit their own estimates of 2002 emissions or population, nitrogen excreted, farming practices, and E.F.s - 6/1/2004.
- Second version of 2002 NEI for comment - Fall or winter 2004.
- Final second version of 2002 NEI - Summer 2005.

Ongoing Additional Improvements

- Looking at more recent manure production and excretion rates by animal types and weight may provide lower overall estimates than currently indicated in draft report.
- Looking into ways to better address spatial, seasonal, and regional differences in emissions.

Preliminary Emission Estimates

Comparison of 1999 and 2002 Ammonia NEIs

Animal Group	1999 NEI			Preliminary 2002 NEI		
	Population	Emission Factor lb/head/yr	Emissions Tons/year	Population	Emission Factor lb/head/yr	Emissions Tons/year
Cattle and Calves Composite	100,126,106	50.5	2,528,184	100,939,728	24.1	1,214,742
Hogs and Pigs Composite	63,095,955	20.3	640,424	59,978,850	14.32	429,468
Poultry and Chickens Composite	1,754,482,225	0.394	345,633	2,201,945,253	0.60	664,238
Sheep, Goat, & Horses	11,166,954	-	72,654	13,974,799	-	110,148
Total	1,928,871,240	N/A	3,461,758	2,376,863,630	N/A	2,418,595