

Massachusetts 2011 Periodic Emissions Inventory of VOC, NO_x, CO, SO₂, PM₁₀, PM_{2.5} and NH₃

February 2018

SECTION 3 STATIONARY AREA SOURCES (continued)

3.5 AGRICULTURAL LIVESTOCK AND OTHER ANIMALS

MassDEP adopted EPA's NEI 2011 emissions for livestock and other animals that are reported in the following website: <ftp://ftp.epa.gov/EmisInventory/2011nei/doc/>.

EPA obtained their agricultural and miscellaneous ammonia emissions¹ from Carnegie Mellon University (CMU) Ammonia Model Emissions Inventory (latest version 3.6 October 2004).² CMU initially developed NH₃ national emissions by county for 2002, which MassDEP adopted.

EPA did not update 2008 livestock and miscellaneous NH₃ emissions – therefore this report will assume that 2011 emissions are the same as 2008. For the 2008 NH₃ emissions, EPA applied 2007 animal population activity data to the CMU emission factors in order to estimate 2008 emissions. This version used the latest 2007 US Census of Agriculture data to estimate 2008 emissions. Emissions are estimated in kilograms per year as summarized in Table 3.5-1 and then converted to tons per year.

Although the CMU NH₃ model included POTW emissions, MassDEP did not include it in this section. MassDEP adopted EPA estimates of POTW NH₃ emissions as presented in Section 3.1 (Waste Management) of this report. The following are the livestock and other categories covered by the CMU NH₃ model.

¹ http://www.epa.gov/ttn/chief/net/2008neiv2/2008_neiv2_tsd_draft.pdf

² Carnegie Mellon University (CMU) Ammonia Emissions Model Inventory Version 3.6, October 2004. <http://www.cmu.edu/ammonia/>

Dairy Cattle/calves	Humans
Swine	Cats & Dogs
Poultry	Bears
Horses	Deer
Sheep	Miscellaneous wild animals
Goats	Fertilizers
Geese	Soils
Ducks	

The following is a description of the method used in the CMU NH3 Model.

3.5-1 Livestock Production

Emission calculations for livestock and poultry production were based on county-level animal population estimates. The latest National Agricultural Statistics Service (NASS) data at the time was for 2007 that was used in the CMU NH3 model. CMU also gathered data on animal populations at confined animal feeding operations (CAFOs) derived from state agricultural and environmental agencies and subtracted from NASS estimates to prevent double counting.

Updated livestock population estimates were used in conjunction with the CMU model's existing emission factors to generate emission estimates for all livestock types except dairy cattle. For dairy cattle, ammonia emission estimates produced by a recently developed dairy farm model were incorporated into the inventory. Other emissions from livestock and poultry were treated as area sources and spatially allocated according to county using the Census of Agriculture.³

3.5-2 Fertilizer Application

Emissions from fertilizer application were calculated by applying appropriate emission factors to county-level estimates of the amounts of fertilizers consumed in 2008. National fertilizer use data are available from the Association of American Plant Food Control Officials (AAPFCO).⁴ These data contain semi-annual sales distributions at a county-level for over 100 types of fertilizers, including those that emit ammonia. A fertilizer sales database prepared from 2008 AAPFCO data was used in the CMU model. Version 3.6 of the CMU model makes use of European emission factors that vary by fertilizer type, soil type, and climate.

NH3 emissions from fertilizer application were spatially allocated to cropland areas in the EPA's database. Emissions were seasonally allocated by using county-specific crop acreages published by NASS, and the crop calendars and fertilizer timing rates employed by the CMU model. Because nitric oxide fluxes arise from analogous biological processes but are better quantified than ammonia fluxes, a diurnal profile based on nitric oxide fluxes from soil was used for emissions from fertilizer.

³ See EPA's Animal Livestock Emissions 2011: <ftp://ftp.epa.gov/EmisInventory/2011nei/doc/> U.S. Department of Agriculture, 2007 Census of Agriculture, at <http://www.agcensus.usda.gov/>

⁴ See Ag Fertilizer Application section: <ftp://ftp.epa.gov/EmisInventory/2011nei/doc/> Institute Association of American Plant Food Control Officials in partnership with The Fertilizer, Commercial Fertilizers 2002 and Commercial Fertilizers 2007, at <http://www.aapfco.org/aapfcopubs.html>

Evaporative VOC emissions from fertilizer application are discussed in Section 3.3 Solvent Evaporation Section.

3.5-3 Biogenic Sources

MassDEP used the EPA-NEI NH₃ emissions from Biogenic 'soil' developed by the CMU model and presented in Table 3.5-2. Soil estimates are highly uncertain; literature sources indicate that the soil-plant canopy system can be a source of NH₃ emissions under some conditions and a sink under other conditions. Preliminary CMU model runs indicated that emissions from soil accounted for 50% of the total annual NH₃ inventory. CMU chose to apply emission factors selected for use by Battye et al.⁵

⁵ EPA "National Inventory of Ammonia Emissions from Animal Husbandry" Draft Work Plan Work Assignment I-7, Amendment No. 2, EPA Contract No. 68-D-01-078 Prepared by Eastern Research Group (ERG) RTP NC. May 16, 2003.