NFR 6 - Other Sources

6.A Human ammonia emissions from sweating and breathing

Short description

NFR-Code	Name of category	Method	AD	EF	Key Category
6.A	**Human ammonia emissions from sweating and breathing**	T1	NS	D	

In addition to animal-related excretion, nitrogen (N) is also introduced into the environment through human consumption of food and later disposed of. Mainly nitrogen is released into the wastewater system in the form of urine, but physiological processes also release nitrogen as ammonia through sweating and respiration. This emission source describes ammonia emissions produced by humans through sweating and breathing.

Methodology

The calculation of ammonia emissions in this area is made for the first time and is based on the methodological description of Visschendijk et al. (2022) [1)].

For the complete time series, the emissions are calculated as follows: Emission = Activity data x Emission factor

Activity data = the number of German inhabitants

Emission factor = kg emission per inhabitant

Activity data

The number of inhabitants in Germany is derived from the German statistic Agency (DESTATIS) on an annual basis. The number of people living in Germany at the end of June in a specific year is taken as activity data for that year. As of September 30, 2021, 83,2 million people lived in Germany. The following table shows the population figures over time.

Table 1: Population figures in Germany from 1990 onwards

Unit	Population
1990	79,753,227
1991	79,973,409
1992	80,499,815
1993	80,946,478
1994	81,147,486
1995	81,307,715
1996	81,466,408
1997	81,509,902
1998	81,445,957
1999	81,422,405
2000	81,456,617
2001	81,517,272
2002	81,578,375
2003	81,548,709
2004	81,456,460
2005	81,336,663
2006	81,173,139
2007	80,992,305
2008	80,763,506
2009	80,482,557
2010	80,284,071

Unit	Population
2011	80,274,983
2012	80,523,746
2013	80,767,463
2014	81,197,537
2015	82,175,684
2016	82,521,653
2017	82,792,351
2018	83,019,213
2019	83,166,711
2020	83,155,031
2021	83,237,124

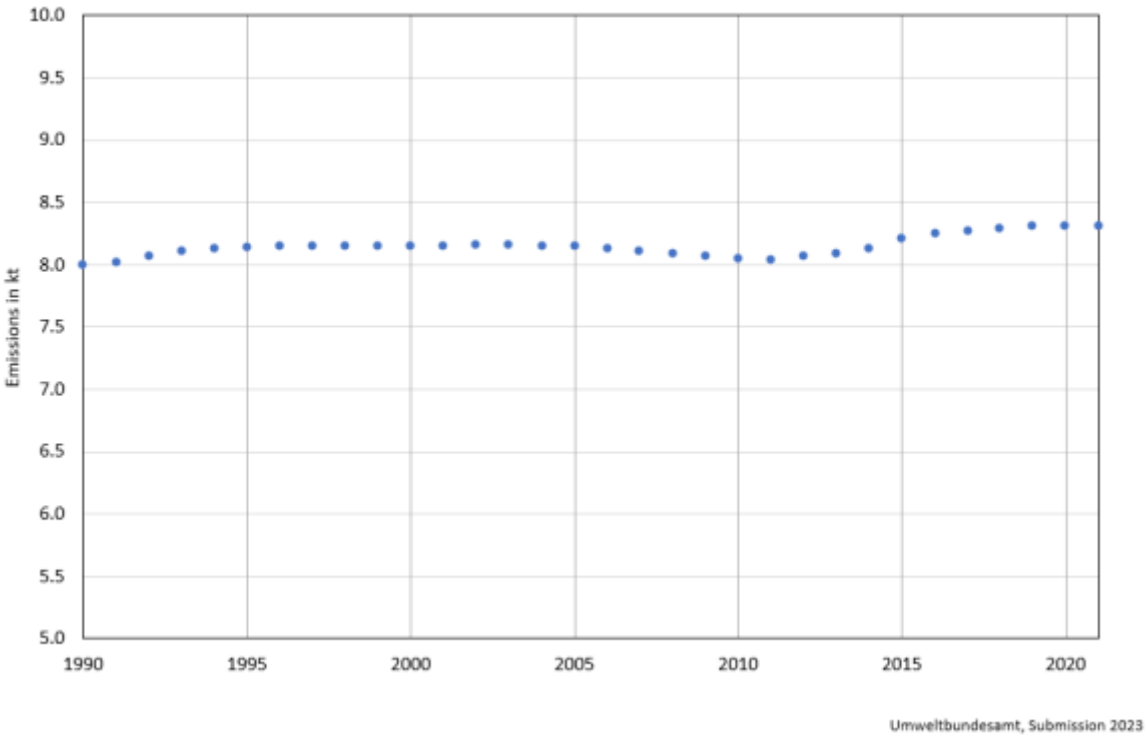
Emission factor

For the calculation of ammonia emissions in this category, the highest of the emission factors given in Sutton et al. (2000)[2)] are used, resulting in a total emission factor of 0.0826 kg NH_3-N per person per year (according to the assumptions sum of 74.88 (sweating) and 7.7 (breathing) grams NH_3-N per person per year, respectively). The higher EFs were used to avoid underestimating emissions. The amount was converted to the amount of ammonia using the stoichiometric factor (17/14).

Emission Trend

The average value of the last 10 years is 8.21 kt NH_3 emissions per year, so this category is not a major source of regional NH_3 emissions. The following figure shows the emission trend.

Figure 1: NFR 6.A, Ammonia emissions from human sweat & breath



Uncertainty and Quality checks

The AD from DESTATIS usually have an uncertainty of ± 3%. The uncertainties for the emission factors are estimated to be relatively high, as emission factors vary between different sources and the amount of ammonia volatilized is based on an assumption. Hence the overall uncertainty for the emission estimation of NH3 is qualified estimated by expert judgement to

be ± 95%.

Quality checks

No sector-specific quality checks are done.

Further Improvement

Currently no improvements are planned.

1)
Visschedijk, A.J.H., J.A.J. Meesters, M.M. Nijkamp, W.W.R. Koch, B.I. Jansen & R. Dröge, 2022. Methods used for the Dutch Emission Inventory. Product usage by consumers, construction and services. RIVM Report 2022-0003. RIVM, Bilthoven., chapter 19 [https://rivm.openrepository.com/bitstream/handle/10029/625730/2022-0003.pdf?sequence=1&isAllowed=y]
2)
Sutton, M.A., U. Dragosits, Y.S. Tang & D. Fowler, 2000. Ammonia emissions from non-agricultural sources in the UK. Atmospheric Environment 34 (2000), 855–869.