Chapter 5 - NFR 3 - Agriculture (OVERVIEW)

Emissions occurring in the agricultural sector in Germany derive from manure management (NFR 3.B), agricultural soils (NFR 3.D) and agriculture other (NFR 3.I).

Germany did not allocate emissions to category field burning (NFR 3.F) (key note: NO), because burning of agricultural residues is prohibited by law (see Rösemann et al., 2021 [1)].

NFR-Code	Name of Category
3.B	3.B Manure Management
3.D	3.D Agricultural Soils
3.F	3.F Field Burning Of Agricultural Residues
3.I	3.I Agricultural: Other

Short description

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The pollutants reported are:

- ammonia (NH_3),
- nitric oxides (NO_x),
- volatile organic compounds (NMVOC),
- particulate matter ($PM_{2.5}$, PM_{10} and TSP) and
- hexachlorobenzene (HCB).

No heavy metal emissions are reported.

In 2019 the agricultural sector emitted 557,9 Gg of NH_3, 112,2 Gg of NO_x, 304,4 Gg of NMVOC, 60,3 Gg of TSP, 30,4 Gg of PM_{10} and 4,4 Gg of $PM_{2.5}$ and 8.8 kg HCB. The trend from 1990 onwards is shown in the graph below. The sharp decrease of emissions from 1990 to 1991 is due to a reduction of livestock population in the New Länder (former GDR) following the German reunification. The increase of NH_3 emissions since 2005 is mostly due to the expansion of anaerobic digestion of energy crops, especially the application of the digestion residues. This is a new emission source which also effects NO_x emissions. However, these emissions are excluded from emission accounting by adjustment, as they are not part of the NEC and Gothenburg commitments. The decrease of NH_3 emissions since 2015 is mostly due to a decline in the amounts of mineral fertilizer sold. Further details concerning trends can be found in Rösemann et al., 2021, Chapter 2.

As displayed in the diagram below, in 2019 95,1 % of Germany's total NH_3 emissions derived from the agricultural sector, while nitric oxides reported as NO_x contributed 9,9 % and NMVOC 27,2 % to the total NOx and NMVOC emissions of Germany. Regarding the emissions of $PM_{2.5}$, PM_{10} and TSP the agricultural sector contributed 4,8 % (PM2.5), 14,9 and 15,9 %, respectively, to the national particle emissions. HCB emissions of pesticide use contributed 69,5 % to total German emissions.

Recalculations and reasons

(see Chapter 8.1 - Recalculations)**#Must be updated**

In the following, the most important reasons for recalculations are summarized. The need for recalculations arose from improvements in input data and methodologies (for details see Rösemann et al. (2021), Chapter 3.5.2).

1. All Cattle: Following a reviewer recommendation (NECD review 2019), NMVOC emissions are now calculated with the Tier2 methodology.

2. Dairy cows: Update of milk yields in several years.

3. Dairy cows, heifers, male beef cattle: Update of weight data concerning the years 2016 and 2017 and (only for male beef cattle) also the year 1999.

4. Suckler cows: Based on re-analysis of the underlying literature, the default N-excretion was increased from 82 to 90.7 kg per place and year.

5. Pigs: Update of animal numbers and weight data in 2016 and 2017.

6. Pigs: In the case of air scrubbing systems in pig housings, a distinction between certified and non-certified systems has been introduced in accordance with improved data availability for Submission 2020: For certified systems, removal of NH3 and particulate matter is taken into account, while non-certified systems are assumed to only remove particulate matter reliably.

7. Laying hens and broilers: For the present submission 2020, air scrubbing in housings was taken into account for the first time as activity data is now available.

8. Laying hens: Update of animal numbers in 2017.

9. Broilers: Update of the national gross production of broiler meat in 2017.

10. Pullets: The calculation of N excretions was corrected after internal review.

11. Anaerobic digestion of animal manures: Update of activity data in all years.

12. Anaerobic digestion of energy crops: Update of the amounts of energy crops in all years.

13. Application of sewage sludge to soils: Update of the activity data in 2017.

14. Starting with the present Submission 2020, the emission factors for spreading of liquid manure and anaerobically digested manure with trailing shoe on bare soil were updated; they are now assumed to be identical to the emission factors for spreading with trailing hose on bare soil. This was judged to be more realistic than the previous assumption of them being identical to those for trailing shoe on grassland.

15. The emissions of TSP and PM from agricultural soils differ slightly from the corresponding emissions in Submission 2019. These changes are due to the fact that for the first time the acreage of strawberries and cereals for whole plant harvesting were considered. The differences to the submission 2019 are between 0.05% (1990) and 1.1% (2015).

16. Emissions of HCB: Update of the activity data in 2017. Visual overview

Chart showing emission trends for main pollutants in NFR 3 - Agriculture:

2018 emissions by sector

Click to enlarge.

Specific QA/QC procedures for the agriculture sector

Numerous input data were checked for errors resulting from erroneous transfer between data sources and the tabular database used for emission calculations. The German IEFs and other data used for the emission calculations were compared with EMEP default values and data of other countries (see Rösemann et al. (2021) [1]). Changes of data and methodologies are documented in detail (see Rösemann et al. 2021, Chapter 3.5.2).

A comprehensive review of the emission calculations was carried out by comparisons with the results of Submission 2020 and by plausibility checks.

Once emission calculations with the German inventory model GAS-EM are completed for a specific submission, activity data (AD) and implied emission factors (IEFs) are transferred to the CSE database (Central System of Emissions) to be used to calculate the respective emissions within the CSE. These CSE emission results are then cross-checked with the emission results obtained by GAS-EM.

Model data have been verified in the context of a project by external experts (Zsolt Lengyel, Verico SCE). Results show that input data are consistent with other data sources (Eurostat, Statistisches Bundesamt / Federal Statistical Office) and that the performed calculations are consistently and correctly applied in line with the methodological requirements.

Furthermore, in addition to UNFCCC, UNECE and NEC reviews, the GAS-EM model is continuously validated by experts of KTBL (Kuratorium für Technik und Bauwesen in der Landwirtschaft, Association for Technology and Structures in Agriculture) and the EAGER group (European Agricultural Gaseous Emissions Inventory Researchers Network).

1)

Rösemann et al. (2021): Rösemann C, Haenel H-D, Dämmgen U, Döring U, Wulf S, Eurich-Menden B, Freibauer A, Döhler H, Schreiner C, Osterburg B & Fuß, R (2021): Calculations of gaseous and particulate emissions from German Agriculture 1990 –2019. Report on methods and data (RMD), Submission 2021. Thünen Report XX.
https://www.thuenen.de/de/ak/arbeitsbereiche/emissionsinventare/