CHAPTER 5: NFR 3 - Agriculture (OVERVIEW)

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

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).

As burning of agricultural residues is prohibited by law (see Vos et al., 2026)[1)], Germany does not report emissions in category field burning (NFR 3.F) (notation key: 'NO'),

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 2024, the agricultural sector emitted 484.0 kt of NH_3, 98.0 kt of NO_x, 300.6 kt of NMVOC, 60.4 kt of TSP, 34.7 kt of PM_{10} and 5.3 kt of $PM_{2.5}$ and 0.53 kg HCB.

The trends from 1990 onwards is shown in the graph at the bottom of this page. Here, 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 emission source also affects NO_x emissions. The decrease of NH_3 emissions since 2015 is mostly due to a decline in the amounts of mineral fertilizer sold and stricter regulations concerning application of urea fertilizers, as well as declining livestock numbers Further details concerning trends can be found in Vos et al. (2026) chapter “Emissions results submission 2026”.

As depicted in the chart below, in 2024 91.7 % of Germany’s total NH_3 emissions derived from the agricultural sector, while nitric oxides reported as NO_x contributed 12.1 % and NMVOC 31.5 % to the total NO_x and NMVOC emissions of Germany. Regarding the emissions of $PM_{2.5}$, PM_{10} and TSP the agricultural sector contributed 7.1 % ($PM_{2.5}$), 20.4 % (PM_{10}) and 19.6 % (TSP) to the national particle emissions. HCB emissions of pesticide use contributed 13.5 % to the total German emissions.

Mitigation measures

The agricultural inventory model can represent several abatement measures for emissions of NH_3 and particles. The measures comprise:

- changes in animal numbers and amount of applied fertilizers
- air scrubbing techniques: yearly updated data on frequencies of air scrubbing facilities and the removal efficiency are provided by KTBL (Kuratorium für Technik und Bauwesen in der Landwirtschaft / Association for Technology and Structures in Agriculture) and also based on the agricultural census 2020. The average removal efficiency of NH_3 is 80 % for swine and 70 % for poultry, while for TSP and PM_{10} the rates are set to 90 % and for $PM_{2.5}$ to 70 % for both animal categories. For swine two types of air scrubbers are distinguished: first class systems that remove both NH_3 and particles, and second class systems that remove only particles reliably and have an ammonia removal efficiency of 20%.
- reduced raw protein content in feeding of fattening pigs: the German animal nutrition association (DVT, Deutscher Verband Tiernahrung e.V.) provides data on the raw protein content of fattening pig feed, therefore enabling the inventory to depict the changes in N-excretions over the time series. The time series is calibrated using data from

official and representative surveys conducted by the Federal Statistical Office.

- reduced raw protein content in feeding and feed conversion rates of broilers: the German animal nutrition association (DVT, Deutscher Verband Tiernahrung e.V.) provides data on the raw protein content of fattening broiler feed, and feed conversion rates of broilers. This makes it possible to model the changes in N-excretions over the timeseries.
- low emission spreading techniques of manure: official agricultural censuses survey the prevalence of different manure spreading techniques and how fast organic fertilizers are incorporated into the soil. Germany uses distinct emission factors for different methods, techniques and incorporation durations.
- Depicting effects of changes in dairy cow feeding reflecting optimization of raw protein content over the time series, as the N and TAN excretions are estimated using milk urea content and milk protein content.
- covering of slurry storage: agricultural censuses survey the prevalence of different slurry covers. Germany uses distinct emission factors for the different covers.
- use of urease inhibitors: for urea fertilizer the German fertilizer ordinance prescribes the use of urease inhibitors or the direct incorporation into the soil from 2020 onwards. The NH_3 emission factor for urea fertilizers is therefore reduced by 70% from 2020 onwards for the direct incorporation, according to Bittman et al. (2014, Table 15)[2]. For the use of urease inhibitors the NH_3 emission factor is reduced by 60% from 2020 onwards, see Vos et al. (2026), Chapter 5.2.1.2[3].

For NO_x and NMVOC no mitigation measures are included.

Reasons for recalculations

(see Chapter 9.1 - Recalculations)

The following list summarizes the most important reasons for recalculations. Recalculations result from improvements in input data and methodologies (for details see Vos et al. (2026), Chapter 1.3)[4].

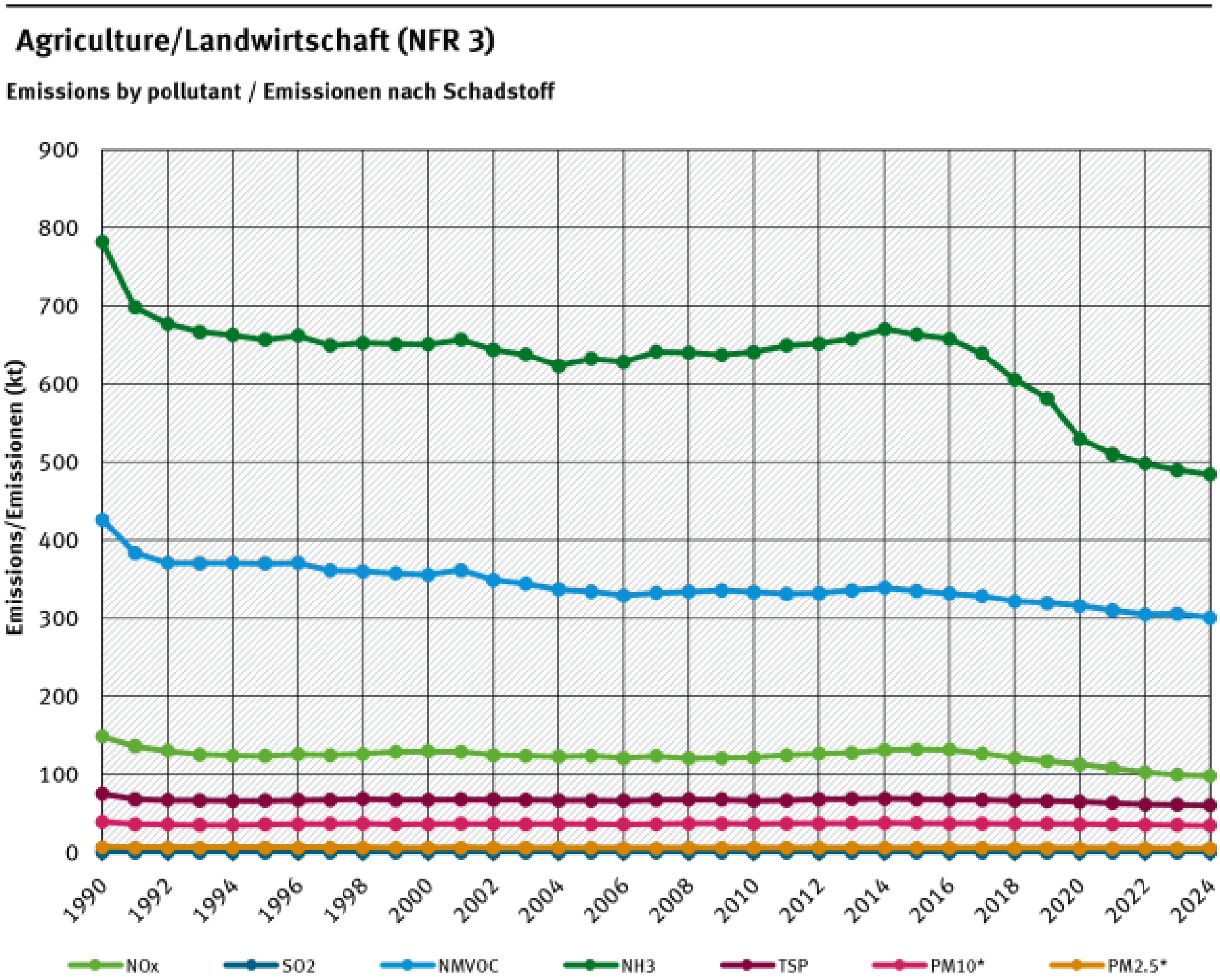
1. Adding of a transport module in the inventory model PY-GAS-EM: substrate transports to biogas plants and manure transports across district borders (NUTS 3 areas) are considered. Since manure application techniques differ between the NUTS 3 areas, this leads to slightly different NH_3 emissions at the federal level compared with the situation in the last submission without transports across district borders.
2. Mineral fertilizers: The NH_3 emission factors for straight fertilizers used in the last sub-mission (0.084 kg NH_3 per kg N) has been corrected to a lower value (0.024 NH_3 per kg N) following a correction in EMEP/EEA (2023)[5].
3. Dairy cows: N and TAN excretions are now estimated from milk yield, milk urea content and protein content of milk instead of from the modeled feed.
4. Dairy cows: The officially recorded final milk yields for 2023 are significantly higher than the preliminary official figures used in the 2025 submission. This is due to an improved calculation method that will continue to be used in the future and which was subsequently applied for 2022. For reporting purposes a method was developed to adjust the officially recorded milk yields for the years before 2022 upwards, to achieve time series consistency.
5. Sows: The animal category sow was subdivided into gilts and old sows, with different weights and therefore different energy requirements. In comparison with Submission 2025 the mean animal weight and energy requirements are lower in aggregate. As a consequence, the NH_3 emissions are also lower.
6. Horses: Due to updated feed recommendations for heavy horses, N excretions were adjusted (increased) for the year 2020. The respective values used for Submission 2025 are still used until the year 2010; between the years 2010 and 2020, they are linearly interpolated.
7. Deer: Due to new data for 2023, the number of animals from 2009 onwards is slightly reduced by interpolation.
8. Dairy cows: Milk yield and slaughter weights for 2023 have been slightly corrected in the official statistics.
9. Heifers: 2023 slaughter weights have been slightly corrected in the official statistics.
10. Male beef cattle: In some years, slaughter ages and slaughter weights have been updated in the HIT database.
11. Air scrubber systems pigs: new information on replaced facilities with minor effects on the number of animal places with air scrubbers in one federal state back to the year 2005.
12. Sows: For several federal states, the number of piglets per sow for 2023 and 2019 were corrected.
13. Fattening pigs: for several federal states growth rates, start weights and final weights for 2023 and 2019 were corrected.
14. Broilers: Update of the national gross production of broiler meat for 2022 and 2023.
15. Crop residues: The number of grassland cuts were updated for all years due to the introduction of a new procedure for outlier identification..
16. Application of sewage sludge: Replacement of extrapolated activity data in 2023 with data from the Federal

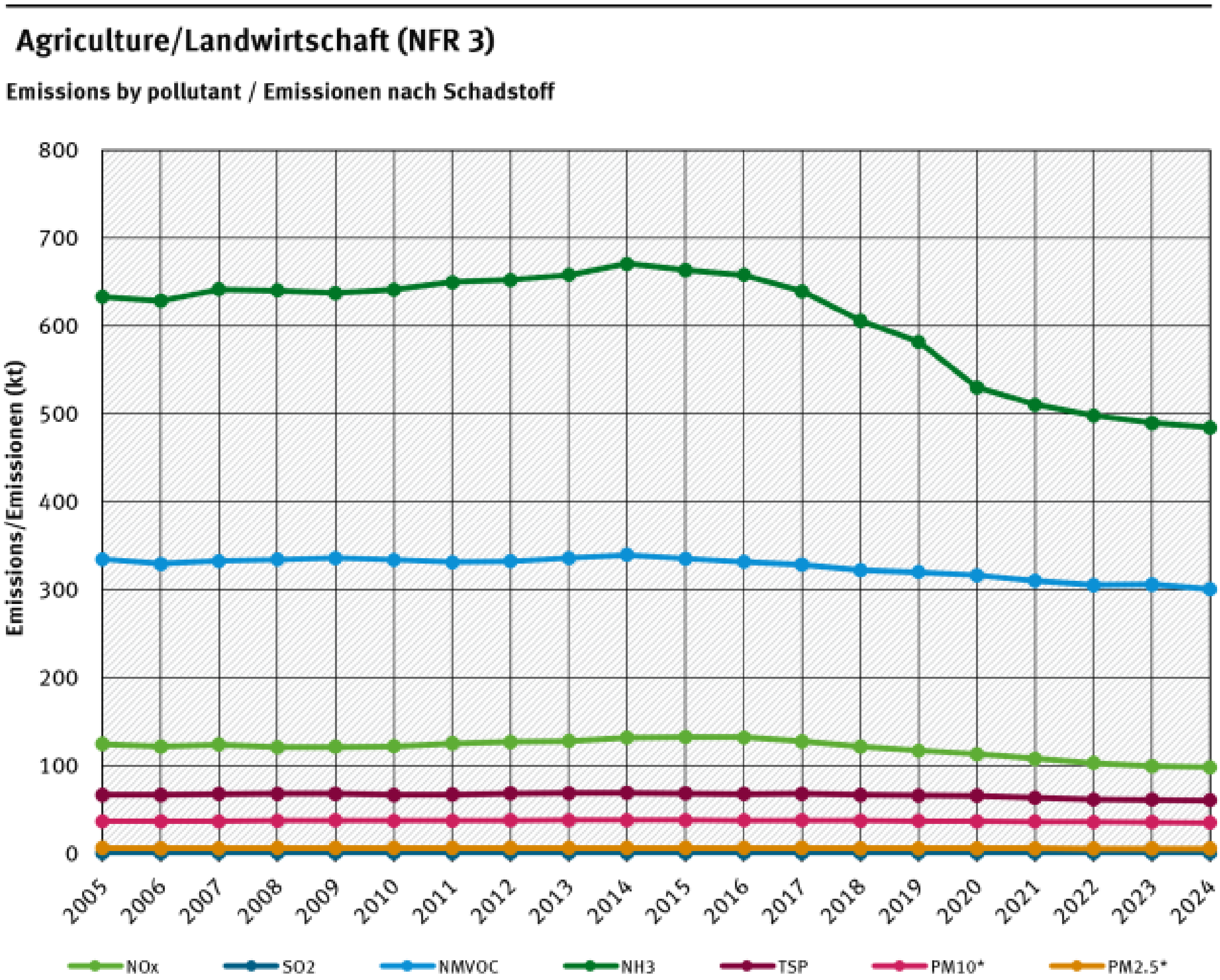
Statistical Office.

17. Anaerobic digestion: Due to the newly introduced substrate transports, the percentage of digested manure N in the total production of manure is no longer used as the input variable, but the absolute amount of N that goes into digestion.
18. Anaerobic digestion of energy crops: dry matter input for 2023 has been updated.
19. Imported manure: The amounts of imported manure from the Netherlands have been updated for years after 2009 in official NL statistics. This results in higher N application rates except for 2012, 2016, 2018 and 2022.
20. Compost and digested waste: input data for 2023 has been updated.

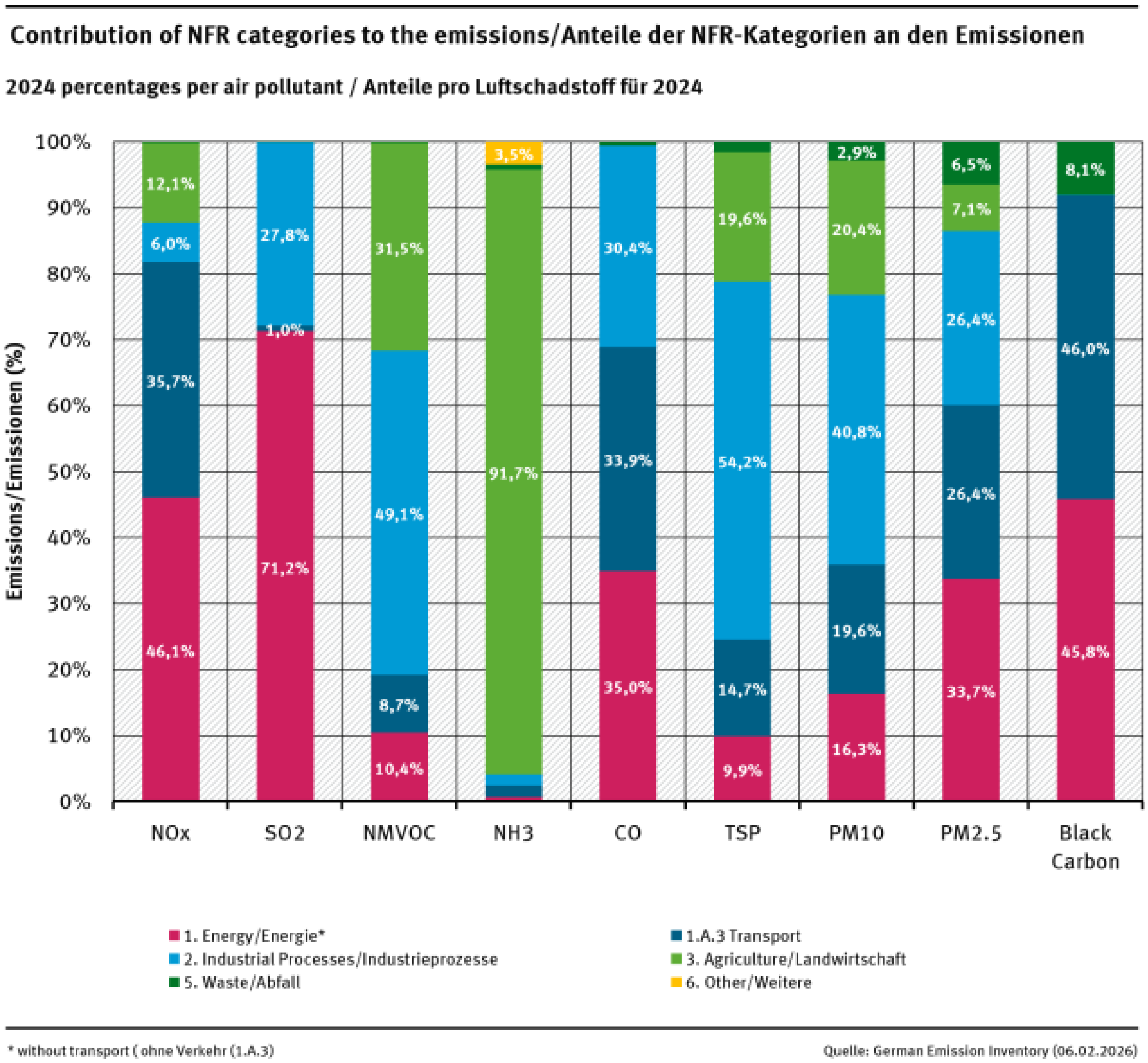
Visual overview

Emission trends for main pollutants in *NFR 3 - Agriculture*:





[Contribution of NFRs 1 to 6 to the National Totals]



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 Vos et al., 2026). Changes of data and methodologies are documented in detail (see Vos et al. 2026, Chapter 1.3).

A comprehensive review of the emission calculations was carried out by comparisons with the results of Submission 2025 and by plausibility checks.

Once emission calculations with the German inventory model Py-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 Py-GAS-EM.

Furthermore, in addition to UNFCCC, UNECE and NEC reviews, the Py-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), 3), 4)] Vos, C., Rösemann, C., Haenel, H.-D., Dämmgen, U., Döring, U., Wulf, S., Eurich-Menden, Döhler, H., Steuer, B., Osterburg, B., Fuß, R. (2026): Calculations of gaseous and particulate emissions from German agriculture 1990 – 2024: Report on methods and data (RMD) Submission 2026. www.eminv-agriculture.de, 2026
[2)] Bittman, S., Dedina, M., Howard C.M., Oenema, O., Sutton, M.A., (eds) (2014): Options for Ammonia Mitigation. Guidance

from the UNECE task Force on Reactive Nitrogen. Centre for Ecology and Hydrology, Edinburgh, UK, 2014