3.D - Agricultural Soils

Short description

NFR-Code	Name of Category	Method	AD	EF
3.D	**Agricultural Soils**			
consisting of / including source categories				
3.D.a.1	Inorganic N-fertilizers (includes also urea application)	T2 (NH_3), T1 (NO_x)	NS, RS	D (NH_3), D (NO_x)
3.D.a.2.a	Animal manure applied to soils	T2, T3 (NH_3), T1 (NO_x)	M	CS (NH_3), D (NO_x)
3.D.a.2.b	Sewage sludge applied to soils	T1 (NH_3, NO_x)	NS, RS	D (NH_3), D (NO_x)
3.D.a.2.c	Other organic fertilisers applied to soils (including compost)	T2 (NO_x, NH_3)	M	CS
3.D.a.3	Urine and dung deposited by grazing animals	T1 (NH_3, NO_x)	NS, RS	D
3.D.a.4	Crop residues applied to soil	T2 (NH_3)	NS, RS	D
3.D.c	Farm-level agricultural operations including storage, handling and transport of agricultural products	T2 (TSP, PM_{10}, $PM_{2.5}$)	NS, RS	D
3.D.d	Off-farm storage, handling and transport of bulk agricultural products	NA & NR (Black Carbon only)		
3.D.e	Cultivated crops	T2 (NMVOC)	NS, RS	D
3.D.f	Use of pesticides	T2 (HCB)	NS	D

Method(s) applied	
D	Default
T1	Tier 1 / Simple Methodology *
T2	Tier 2*
T3	Tier 3 / Detailed Methodology *
C	CORINAIR
CS	Country Specific
M	Model
* as described in the EMEP/EEA Emission Inventory Guidebook - 2019, in category chapters.	
(source for) Activity Data	
NS	National Statistics
RS	Regional Statistics
IS	International Statistics
PS	Plant Specific
As	Associations, business organisations
Q	specific Questionnaires (or surveys)
M	Model / Modelled
C	Confidential
(source for) Emission Factors	
D	Default (EMEP Guidebook)
CS	Country Specific
PS	Plant Specific
M	Model / Modelled
C	Confidential

	NO_x	**NMVOC**	SO_2	**NH_3**	**$PM_{2.5}$**	**PM_{10}**	**TSP**	BC	CO	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	PCDD/F	B(a)P	B(b)F	B(k)F	I(x)P	PAH1-4	**HCB**	PCBs
3.D.a.1	**L/T**	NA	NA	**L/T**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D.a.2.a	**L/-**	IE	NA	**L/T**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D.a.2.b	-/-	NA	NA	-/-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D.a.2.c	-/-	NA	NA	**L/T**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D.a.3	-/-	IE	NA	-/-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D.a.4	NA	NA	NA	-/-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D.c	NA	NA	NA	NA	**L/-**	**L/-**	**L/-**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D.e	NA	-/-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D.f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**L/-**	NA

L/-	key source by **L**evel only
-/T	key source by **T**rend only
L/T	key source by both **L**evel and **T**rend
-/-	no key source for this pollutant
IE	emission of specific pollutant **I**ncluded **E**lsewhere (i.e. in another category)
NE	emission of specific pollutant **N**ot **E**stimated (yet)
NA	specific pollutant not emitted from this source or activity = **N**ot **A**pplicable
*	no analysis done

Country specifics

NH_3 and NO_x

In 2024, agricultural soils emitted 295.1 kt NH_3 or 61.0 % of the total agricultural NH_3 emissions in Germany (484.0 kt NH_3). The main contributions to the total NH_3 emissions from agricultural soils are the application of manure (3.D.a.2.a), with 171.4 kt (58.1 %), the application of other organic N-fertilizers (3.D.a.2.c) with 57.2 kt (19.4 %), and the application of inorganic N-fertilizers (3.D.a.1) with 42.9 kt (14.5 %).

N excretions on pastures (3.D.a.3) have a share of 15.2 kt NH_3 (5.2 %), emissions from crop residues (3.D.a.4) are 7.1 kt NH_3 (2.4 %), and the application of sewage sludge (3.D.a.2.b) 1.4 kt NH_3 (0.5 %).

In 2024, agricultural soils were the source of 98.3 % (96.4 kt) of the total of NO_x emissions in the agricultural category (98.0 kt). The NO_x emissions from agricultural soils are primarily due to application of inorganic fertilizer (3.D.a.1) (40.5 kt) and manure (3.D.a.2.a) (36.1 kt) Application of other organic N-fertilizers (3.D.a.2.c) contributes 14.7 kt, 5.3 kt are due to excretions on pastures (3.D.a.3). Emissions from application of sewage sludge (3.D.a.2.b) contribute 0.4 kt.

NMVOC

In 2024, the category of agricultural soils contributed 8.9 kt NMVOC or 2.9 % to the total agricultural NMVOC emissions in Germany (300.6 kt NMVOC). The only emission source was cultivated crops (3.D.e).

TSP, PM_{10} & $PM_{2.5}$

In 2024, agricultural soils contributed, respectively, 38.4 % (23.2 kt), 66.7 % (23.2 kt) and 33.6 % (1.8 kt) to the total agricultural TSP, PM_{10} and $PM_{2.5}$ emissions (60.4 kt, 34.7 kt, 5.3 kt, respectively). The emissions are reported in category 3.D.c (Farm-level agricultural operations including storage, handling and transport of agricultural products).

3.D.a.1 - Inorganic N-fertilizers

The calculation of NH_3 and NO_x (NO) emissions from the application of synthetic fertilizers is described in Vos et al. (2026)[1], Chapters 5.2.1.2 and 5.2.2.2 1).

Activity Data

German statistics report the amounts of fertilizers sold which are assumed to equal the amounts that are applied. Since the 2021 submission, storage effects are approximated by applying a moving average to the sales data (moving centered three-year average, for the last year a weighted two-year average, which assigns 2/3 of the weight to the last year). Since the year 2022, data for the sales of urea that is stabilized with urease inhibitor is available. It cannot be published because of data-privacy issues. Therefore, the emissions are calculated and provided by the federal statistical office using the emission factors as described below. The activity data are published in aggregate for urea, urea+inhibitor and nitrogen solutions to maintain confidentiality. For details see Vos et al. (2026), Chapter 2.8.

Table 1: AD for the estimation of NH_3 and NO_x emissions from application of synthetic fertilizers

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Application of fertilizers (total)	2,195	1,723	1,922	1,797	1,635	1,736	1,731	1,622	1,499	1,404	1,327	1,245	1,123	1,048	1,028
calcium ammonium nitrate	1,368	1,044	982	824	689	618	605	571	543	520	497	470	422	396	388
urea and ammonia nitrate urea solutions (AHL)	369	403	508	526	542	590	604	539	460	385	342	318	293	276	262
ammonium phosphates	85	55	66	55	64	84	82	77	65	64	58	51	41	36	38
other NK and NPK	246	162	175	126	63	67	62	54	52	51	51	47	40	34	31
other straight fertilizers	127	60	191	266	277	377	377	381	378	383	379	359	328	306	309

Methodology

NH_3 emissions from the application of synthetic fertilizers are calculated using the Tier 2 approach according to EMEP (2023)-3D-16ff [2], distinguishing between various fertilizer types, see Table 2. For NO_x, the Tier 1 approach described in EMEP (2023) [10]-3D-15 is applied.

Emission factors

The emission factors for NH_3 depend on fertilizer type, see EMEP (2023)-3D-17. Table 2 lists the EMEP emission factors for the fertilizers used in the inventory. In order to reflect average German conditions, the emission factors for cool climate and a pH value lower than 7 was chosen. For urea fertilizer the German fertilizer ordinance prescribes the use of urease inhibitors or the immediate 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 immediate incorporation of urea, according to Bittman et al. (2014, Table 15)[3]. For the use of urease inhibitors the emission factor for urea fertilizer is reduced by 60%. For details see Vos et al. (2026), Chapter 5.2.1.2.

Table 2: Synthetic fertilizers, emission factors in kg NH_3 per kg fertilizer N

Fertilizer type	EF
calcium ammonium nitrate	0.024
ammonia nitrate urea solutions (AHL)	0.087
urea (up to 2019)	0.195
urea (from 2020 with urease inhibitor)	0.078
urea (from 2020 if incorporated)	0.0585
ammonium phosphates	0.084
other NK and NPK	0.084
other straight fertilizers	0.024

For NO_x, the simpler methodology by EMEP (2023)-3D-13 was used. The emission factor 0.040 from EMEP, 2023-3D, Table 3.1 has the unit of [kg N_2O per kg fertilizer N] and was derived from Stehfest and Bouwman (2006)[4].

The German inventory uses the emission factor 0.012 kg NO-N per kg N derived from Stehfest and Bouwman (2006) directly. This is equivalent to an emission factor of 0.03943 kg NO_x per kg fertilizer N (obtained by multiplying 0.012 kg NO-N per kg N with the molar weight ratio 46/14 for NO_2: NO). The inventory uses the unrounded emission factor.

Table 3: Emission factor for NO_x emissions from fertilizer application

Emission factor	kg NO-N per kg fertilizer N	kg NO_x per kg fertilizer N
EF_{fert}	0.012	0.039

Trend discussion for Key Sources

Since 2016, fertilizer sales have fallen dramatically (by around a third). Emissions have fallen accordingly. This is even more pronounced for NH_3 than for NO_x, as total NH_3 from the application of mineral fertilizers is, until the year 2019, very strongly correlated with the amount of urea applied (R^2 = 0.64), the sales of which have decreased more than for all other mineral fertilizers. Since 2020 the negative trend is reinforced as urea fertilizer has to be either used with urease inhibitors or has to be incorporated into the soil directly, which reduces emissions.

Recalculations

Table 4 shows the effects of recalculations on NH_3 and NO_x emissions. The big differences for NH_3 emissions are due to the correction of the EMEP (2023) emission factor for straight fertilizers (**recalculation No. 2**). Concerning NO_x, emissions differences only occur in 2023, resulting from applying the moving average to sales data (see activity data).

Table 4: Comparison of NH_3 and NO_x emissions [kt] with previous submission

NH_3 and NO_x emissions from inorganic fertilizer application, in kt																
	Submission	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Ammonia	**current**	121.93	99.21	119.19	118.44	120.16	133.00	135.03	121.47	105.50	91.66	54.81	52.05	47.52	44.08	42.89
	previous	129.55	102.80	130.65	134.39	136.77	155.61	157.68	144.31	128.19	114.66	77.56	73.59	67.18	61.79	
	absolute change	-7.61	-3.59	-11.46	-15.96	-16.61	-22.61	-22.65	-22.84	-22.69	-23.01	-22.75	-21.54	-19.66	-17.71	
	relative change [%]	-5.88	-3.49	-8.77	-11.87	-12.14	-14.53	-14.36	-15.83	-17.70	-20.06	-29.33	-29.27	-29.27	-28.67	
Nitrogen oxides	**current**	86.53	67.93	75.77	70.84	64.48	68.46	68.24	63.95	59.11	55.34	52.31	49.08	44.29	41.31	40.55
	previous	86.53	67.93	75.77	70.84	64.48	68.46	68.24	63.95	59.11	55.34	52.31	49.08	44.29	40.89	
	absolute change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	
	relative change [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01	

Planned improvements

No improvements are planned at present.

3.D.a.2.a - Animal manure applied to soils

In this sub-category Germany reports the NH_3 and NO_x (NO) emissions from application of manure (including application of anaerobically digested manure). An overview is given in Vos et al. (2026), Chapters 5.2.1.2 and 5.2.2.2.

Germany uses the Tier 2 methodology for estimating NMVOC emissions for cattle in sector 3.B (manure management). The use of this methodology yields NMVOC emissions which formally could be reported in the sectors 3.D.a.2.a and 3.D.a.3 (grazing emissions). However, to be congruent with the NMVOC emissions for other animal categories, Germany reports these emissions in the NMVOC emissions reported from manure management (3.B). For the NFR codes 3.D.a.2.a and 3.D.a.3 the notation key IE is used for NMVOC emissions.

Activity data

The calculation of the amount of N in manure applied is based on the N mass flow approach (see 3.B). It is the total of N excreted by animals in the housing and the N imported with bedding material minus N losses by emissions of N species from housing and storage. Hence, the amount of total N includes the N contained in anaerobically digested manures to be applied to the field.

The frequencies of application techniques and incorporation times as well as the underlying data sources are described in Vos et al. (2026), Chapter 2.5. The frequencies are provided. in the NID 2026[5], Chapter 17.3.1.

Table 5: AD for the estimation of NH_3 and NO_x emissions from application of manure

Application of manure in kt N														
1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
1,236	1,088	1,047	1,009	996	1,036	1,032	1,036	1,020	1,007	987	953	927	924	915

Methodology

NH_3 emissions from manure application are calculated separately for each animal species in the mass flow approach by multiplying the respective TAN amount with NH_3 emission factors for the various manure application techniques. For details see [3-b-manure-management 3.B] and Vos et al. (2026), Chapter 5.2.1.2. For NO_x emissions from manure application the inventory calculates NO-N emissions (see Vos et al. (2026), Chapter 5.2.2.2, that are subsequently converted into NO_x emissions by multiplying with the molar weight ratio 46/14. The Tier 1 approach as described in EMEP (2023)-3D-13 is used.

Emission factors

The following table shows the time series of the overall German NH_3 IEF defined as the ratio of total NH_3-N emission from manure application to the total amount of N spread with manure. For NO_x the same emission factor like for the application of synthetic fertilizer was used (see Table 3).

Table 6: IEF for NH_3–N from application of manure

IEF in kg NH_3-N per kg N in applied manure														
1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
0.216	0.204	0.196	0.183	0.175	0.165	0.163	0.162	0.159	0.157	0.154	0.154	0.157	0.155	0.154

Trend discussion for Key Sources

Both NH_3 and NO_x emissions from the application of animal manure are key sources. Total NO_x is calculated proportionally to the total N applied with manure which decreased remarkably from 1990 to 1991 due to the decline in animal numbers following the German reunification (reduction of livestock numbers in Eastern Germany). In the 1990s and 2000s this was followed by a weakened decline in animal manure amounts. From 2010 to 2014 there was a slight increase and since then the amount of N in manure applied has been declining again, see Table 5. The NO_x emissions follow these trends. For total NH_3 emissions there is a negative trend. This is due to the decreasing amounts of animal manure and the increasing use of application practices with lower NH_3 emission factors.

Recalculations

Until 2000, the total emissions of NH_3 from application of manure are higher than those of last year's submission and thereafter they are lower. For NO_x the changes are similar, however the change from higher to lower values takes place 20 years later.

These differences are predominantly caused by different estimates of manure N, which is applied, compared to the last submission. Many of the recalculations have an effect on this, especially the **recalculations No. 2, No. 3, No. 4, No. 5, and No. 6**. The two most important ones are **No. 3** (the new methodology to calculate N and TAN excretions of dairy cows leads to higher N excretion at the beginning and lower N excretions at the end of the time series, the percentage shares of TAN are lower for all years. The latter is responsible for the earlier change in the trend of NH_3 emissions) and **No. 4** (higher milk yields generally increase excretions), see main page of the agricultural sector, list of recalculation reasons. Further details on recalculations are described in Vos et al. (2026), Chapter 1.3.

Table 7: Comparison of NH_3 and NO_x emissions [kt] with previous submission

NH_3 and NO_x emissions from application of manure, in kt																
	Submission	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Ammonia	**current**	324.37	268.83	249.29	224.08	211.68	207.35	204.72	203.36	197.44	192.54	184.02	178.16	176.66	174.47	171.37
	previous	320.57	265.78	249.01	225.69	217.80	215.60	211.87	208.09	202.39	197.93	192.18	188.44	185.70	185.00	
	absolute change	3.79	3.05	0.28	-1.61	-6.12	-8.26	-7.15	-4.73	-4.95	-5.39	-8.17	-10.28	-9.04	-10.52	
	relative change [%]	1.18	1.15	0.11	-0.71	-2.81	-3.83	-3.38	-2.27	-2.45	-2.72	-4.25	-5.45	-4.87	-5.69	
Nitrogen oxides	**current**	48.75	42.89	41.29	39.77	39.27	40.85	40.69	40.83	40.20	39.72	38.91	37.56	36.55	36.44	36.08
	previous	45.94	40.69	39.69	38.54	38.63	40.23	39.98	39.81	39.26	38.98	38.66	37.68	36.65	36.65	
	absolute change	2.81	2.20	1.60	1.23	0.64	0.62	0.71	1.02	0.94	0.74	0.26	-0.13	-0.10	-0.21	
	relative change [%]	6.11	5.42	4.04	3.19	1.65	1.55	1.77	2.57	2.40	1.90	0.67	-0.34	-0.27	-0.58	

Planned improvements

No improvements are planned at present.

3.D.a.2.b – Sewage sludge applied to soils

The calculation of NH_3 and NO_x (NO) emissions from application of sewage sludge is described in Vos et al. (2026), Chapters 5.2.1.2 and 5.2.2.2.

Activity data

N quantities from application of sewage sludge were calculated from data of the German Environment Agency and (since 2009) from data of the Federal Statistical Office.

Table 8: AD for the estimation of NH_3 and NO_x emissions from application of sewage sludge

Application of sewage sludge in kt N														
1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
27	35	33	27	26	19	19	14	13	16	14	12	12	10	10

Methodology

A Tier 1 methodology is used (EMEP, 2023, 3D, Chapter 3.3.1). NH_3 and NO_x emissions are calculated by multiplying the amounts of N in sewage sludge applied with the respective emission factors.

Emission factors

EMEP (2023)-3.D, Table 3-1 provides a Tier 1 emission factor for NH_3 (0.13 kg NH_3 per kg N applied) emissions from application of sewage sludge. The German inventory uses the equivalent emission factor in NH_3-N units which is 0.11 kg NH_3-N per kg N applied (cf. the derivation of the emission factor described in the appendix of EMEP (2023)-3D, page 35). For NO_x the same emission factor like for the application of synthetic fertilizer was used (see Table 3).

Trend discussion for Key Sources

NH_3 and NO_x emissions from the application of sewage sludge are no key sources.

Recalculations

There were no recalculations concerning sewage sludge except the replacement of extrapolated activity data in 2023 with data from the Federal Statistical Office. Further details on recalculations are described in Vos et al. (2026), Chapter 1.3.

Table 9: Comparison of NH_3 and NO_x emissions [kt] with previous submission

NH_3 and NO_x emissions from application of sewage sludge, in kt																
	Submission	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Ammonia	**current**	3.66	4.71	4.40	3.66	3.51	2.52	2.51	1.87	1.78	2.14	1.85	1.61	1.61	1.39	1.39
	previous	3.66	4.71	4.40	3.66	3.51	2.52	2.51	1.87	1.78	2.14	1.85	1.61	1.61	1.61	
	absolute change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.22	
	relative change [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-13.84	
Nitrogen oxides	**current**	1.08	1.39	1.30	1.08	1.04	0.74	0.74	0.55	0.52	0.63	0.55	0.47	0.48	0.41	0.41
	previous	1.08	1.39	1.30	1.08	1.04	0.74	0.74	0.55	0.52	0.63	0.55	0.47	0.48	0.48	
	absolute change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.07	
	relative change [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-13.84	

Planned improvements

No improvements are planned at present.

3.D.a.2.c - Other organic fertilizers applied to soils

This sub category contains the total of Germany’s NH_3 and NO_x (NO) emissions from application of

- residues from digested energy crops,
- residues from digested waste,
- compost from biowaste,
- compost from green waste, and
- imported animal manures.

For details see Vos et al. (2026), Chapters 5.2.1.2 and 5.2.2.2.

Activity data

Activity data is the amount of N in residues from anaerobic digestion of energy crops and waste and of compost from biowaste and green waste when leaving storage, as well as the amount of N in imported animal manures. For energy crops this is the N contained in the energy crops when being fed into the digestion process minus the N losses by emissions of N species from the storage of the residues (see 3.I). N losses from pre-storage are negligible and there are no N losses from fermenter (see Vos et al. (2026), Chapter 5.1). For residues from digested waste, compost from biowaste and compost from green waste the amount of N was derived from the waste statistics of the Federal Statistical Office (see Vos et al. (2026), Chapter 2.8). For imported manure the amounts of N were derived from statistics published by CBS (Statistics Netherlands) and RVO (Rijksdienst voor Ondernemend Nederland) The imported manure is categorized into cattle slurry, pig slurry, poultry manure, horse manure and mixed solid manure. Only imported manures from The Netherlands are taken into account, as for other countries the amounts of imported manures are unknown as are the amounts of exported manure. For details see Vos et al. (2026), Chapter 2.8.

Table 10: AD for the estimation of NH_3 and NO_x emissions emissions from application of other organic fertilizers

Application of other organic fertilizers in kt N															
	1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Residues, digested energy crops	0.05	0.59	5.12	43.36	158.69	289.08	287.80	283.33	279.45	279.98	286.48	281.57	302.37	293.35	293.35

Residues, digested waste	0.00	0.00	1.55	4.97	10.46	15.05	13.97	13.79	14.00	13.75	13.40	15.13	15.62	17.49	18.20
Compost, biowaste	4.51	19.54	31.87	28.82	22.64	22.59	23.34	21.90	25.14	24.31	25.42	22.98	23.10	19.90	18.53
Compost, greenwaste	1.13	4.90	7.67	9.46	11.27	13.67	14.29	14.87	14.92	15.89	16.74	15.95	15.93	14.62	13.85
Imported manure	5.19	19.26	15.56	21.48	28.15	28.75	30.26	27.52	22.17	21.27	18.14	15.32	14.24	16.59	16.51
TOTAL	**10.87**	**44.30**	**61.77**	**108.09**	**231.21**	**369.15**	**369.65**	**361.40**	**355.67**	**355.21**	**360.19**	**350.95**	**371.26**	**361.95**	**360.44**

Methodology

The NH_3 emissions are calculated the same way as the NH_3 emissions from application of animal manure (3.D.a.2.a). The frequencies of application techniques and incorporation times as well as the underlying data sources are provided e. g. in the NID 2025, Chapter 17.3.1. It is assumed that residues of digested waste are applied in the same way and have the same emission factors as residues from digested energy crops. For compost from biowaste and green waste it is assumed that they are applied in the same way and have the same emission factors as cattle solid manure. The amounts of TAN in the residues from digested energy crops applied are obtained from the calculations of emissions from the storage of the digested energy crops (3.I). The amounts of TAN in the residues from digested waste, compost from biowaste and compost from green waste are derived from industry data (provided by Bundesgütegemeinschaft Kompost, BGK). For the imported manures it is assumed that the different imported manure types (see above) were applied in the same way as the corresponding domestic animal manure types. Mixed manure was treated like solid manure from goats, sheep and horses. Corresponding TAN contents were derived from publications of the German federal states. As published TAN contents vary strongly, for each imported manure type the maximum of published TAN contents was assumed to prevent an underestimation of the NH_3 emissions. For details see Vos et al. (2026), Chapter 2.8.

For NO_x emissions the Tier 1 approach as described in EMEP (2023)-3D-13 is used. The inventory calculates NO emissions that are subsequently converted into NO_x emissions by multiplying with the molar weight ratio 46/30.

Emission factors

For NH_3 the emission factors for untreated cattle slurry were adopted for residues from digested energy crops and residues from waste. The emission factors for cattle solid manure were adopted for compost from biowaste and compost from green waste, see Vos et al. (2026), Chapters 5.2.1.2 and 5.2.2.2. For imported manures the corresponding emission factors of the same type of domestic manure were used.

For NO_x the same emission factor like for the application of synthetic fertilizer was used (see Table 3).

Table 11: IEF for NH_3-N emissions from application of other organic fertilizers

IEF in kg NH_3-N per kg N of other organic fertilizers															
	1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Residues, digested energy crops	0.182	0.185	0.184	0.184	0.186	0.154	0.152	0.149	0.145	0.142	0.139	0.140	0.140	0.140	0.140
Residues, digested waste	0.000	0.000	0.192	0.193	0.193	0.171	0.164	0.156	0.163	0.162	0.163	0.162	0.160	0.157	0.159
Compost, biowaste	0.042	0.037	0.038	0.036	0.034	0.032	0.032	0.032	0.029	0.033	0.034	0.036	0.037	0.033	0.031
Compost, greenwaste	0.016	0.014	0.014	0.014	0.013	0.015	0.015	0.020	0.013	0.012	0.012	0.012	0.013	0.012	0.011
Imported manure	0.209	0.206	0.202	0.186	0.173	0.150	0.145	0.145	0.151	0.149	0.145	0.144	0.145	0.151	0.149
TOTAL	**0.120**	**0.110**	**0.092**	**0.131**	**0.161**	**0.142**	**0.139**	**0.137**	**0.132**	**0.130**	**0.127**	**0.128**	**0.130**	**0.130**	**0.131**

Trend discussion for Key Sources

The application of other organic fertilizers is a key source for NH_3. Emissions are dominated by the emissions from digested energy crops. They have become important since about 2005 and have risen sharply until 2013. Since then, they have changed little each year and tend to decrease slightly in the last few years. The latter is mostly due to the increasing use of application practices with lower NH_3 emission factors.

Recalculations

Recalculations after 2009 are mainly due to the update of activity data. Concerning NH_3 emissions, small differences occur in all years. This is because the underlying spatial distribution of imported manure is different, which results in different IEFs compared to last year's submission (see main page of the agricultural sector, list of recalculation **reasons No. 19 and No. 1** (for the year 2023 also **reason No. 18 and No. 20**), and Vos et al. (2026), Chapter 1.3).

Table 12: Comparison of NH_3 and NO_x emissions from application of other organic fertilizers [kt] with previous submission

NH_3 and NO_x emissions from application of other organic fertilizers, in kt																
	Submission	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Ammonia	**current**	1.58	5.90	6.92	17.15	45.25	63.68	62.30	60.02	57.00	56.01	55.66	54.60	58.38	57.13	57.18
	previous	1.58	5.87	6.89	17.02	44.70	63.07	61.72	59.21	56.73	55.57	55.40	54.25	58.24	58.35	
	absolute change	0.00	0.03	0.02	0.13	0.54	0.61	0.57	0.81	0.27	0.44	0.27	0.35	0.15	-1.23	
	relative change [%]	-0.02	0.56	0.36	0.74	1.22	0.97	0.93	1.36	0.48	0.79	0.48	0.64	0.25	-2.10	
Nitrogen oxides	**current**	0.43	1.75	2.44	4.26	9.12	14.55	14.57	14.25	14.02	14.01	14.20	13.84	14.64	14.27	14.21
	previous	0.43	1.75	2.44	4.26	9.09	14.51	14.57	14.23	14.02	13.99	14.19	13.82	14.67	14.61	
	absolute change	0.00	0.00	0.00	0.00	0.03	0.05	0.00	0.02	0.00	0.02	0.02	0.01	-0.03	-0.34	
	relative change [%]	0.00	0.00	0.00	0.00	0.32	0.33	0.00	0.16	0.00	0.13	0.11	0.10	-0.20	-2.31	

Planned improvements

No improvements are planned at present.

3.D.a.3 - Urine and dung deposited by grazing animals

The calculation of NH_3 and NO_x (NO) emissions from N excretions on pasture is described in Vos et al. (2026), Chapters 5.2.1.1 and 5.2.2.1.

Activity data

Activity data for NH_3 emissions during grazing is the amount of TAN excreted on pasture, while for NO_x emissions it is the amount of N excreted.

The TAN excretions are derived by multiplying the share of N excretion on pastures with the N excretions and TAN contents provided in 3.B, Table 2.

Table 13: Shares of N excretions on pasture, in [%]

	1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Dairy cows	19.8	15.0	12.4	11.2	9.9	8.5	8.2	7.9	7.6	7.3	7.4	7.4	7.4	7.3	7.3
Other cattle	15.1	17.3	18.9	19.0	19.6	20.5	20.7	20.9	21.2	21.4	21.5	21.4	21.4	21.7	21.9
Sheep	55.1	55.5	55.1	55.4	54.8	55.4	55.4	55.4	55.6	55.5	55.4	55.5	55.8	55.6	55.4
Goats	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2
Horses	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
Laying hens	0.1	0.1	0.5	1.0	1.7	2.3	2.4	2.3	2.5	2.6	2.8	2.7	2.9	3.0	3.1
Deer	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ostriches	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

Methodology

NH_3 emissions from grazing are calculated by multiplying the respective animal population (3.B, Table 1) with corresponding N excretions and relative TAN contents (3.B, Table 2) and the fraction of N excreted on pasture (Table 13). The result is multiplied with the animal specific emission factor (Table 14). NO emissions are calculated the same way with the exception that the emission factor is related to N excreted instead of TAN.

Emission Factors

The emission factors for NH_3 are taken from EMEP (2023)-3B-29, Table 3.9. They relate to the amount of TAN excreted on pasture. For laying hens, deer and ostriches there are no emission factors given in this table. Germany uses for laying hens an emission factor of 0.35 kg NH_3-N per kg TAN excreted, based on an expert judgement from KTBL (see Vos et al. 2026, Chapter 5.2.1.1). The same EF is used by UK. It was also used for ostriches. For deer the emission factor of sheep was adopted.

Following the intention of EMEP, 2023-3D, Table 3.1, the inventory uses for NO_x the same emission factor as for the application of synthetic fertilizer (see Table 3). In order to obtain NO_x emissions (as NO_2) the NO-N emission factor of 0.12 kg NO-N per kg N excreted is multiplied by 46/14.

Table 14: Emission factors for emissions of NH_3 and NO from grazing

Dairy cows	0.14 kg NH_3-N per kg TAN excreted
Other cattle	0.14 kg NH_3-N per kg TAN excreted
Horses	0.35 kg NH_3-N per kg TAN excreted
Sheep, goats	0.09 kg NH_3-N per kg TAN excreted
Laying hens	0.35 kg NH_3-N per kg TAN excreted
Deer	0.09 kg NH_3-N per kg TAN excreted
Ostriches	0.35 kg NH_3-N per kg TAN excreted
All animals	0.012 kg NO-N per kg N excreted

Trend discussion for Key Sources

Emissions from urine and dung deposited by grazing animals are no key sources.

Recalculations

Until 2012, NH_3 grazing emissions are lower than those of last year's submission and thereafter they are higher. For NO_x emissions from grazing in all years are higher than those of last year's submission. **Recalculations No. 3** (new methodology to calculate N and TAN excretions of dairy cows) and **No. 4** (higher milk yields) lead in combination to higher N excretion of dairy cows, especially at the beginning of the time series, but to lower TAN excretions for all years. Since NH_3 emissions are related to TAN excretion and NO_x emissions are related to N excretion, this leads to lower NH3 and higher NO emissions. **Recalculation No. 6** (higher N (and TAN) excretion for heavy horses as of 2011) is the reason why, after 2012, NH_3 emissions are higher compared with last year's submission. Further details on recalculations are described in Vos et al. (2026), Chapter 1.3.

Table 15: Comparison of NH_3 and NO_x emissions [kt] with previous submission

NH_3 and NO_x emissions from grazing, in kt																
	Submission	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Ammonia	**current**	24.50	20.91	18.53	16.75	15.95	15.98	15.85	15.83	15.67	15.55	15.33	15.12	15.20	15.35	15.20
	previous	24.58	21.15	18.79	17.00	16.26	15.94	15.73	15.56	15.33	15.19	15.00	14.85	14.93	15.09	
	absolute change	-0.08	-0.24	-0.26	-0.25	-0.31	0.04	0.11	0.27	0.34	0.36	0.33	0.26	0.27	0.25	
	relative change [%]	-0.32	-1.15	-1.38	-1.47	-1.90	0.22	0.71	1.76	2.22	2.36	2.22	1.78	1.84	1.68	

Nitrogen oxides	**current**	9.44	7.67	6.83	6.12	5.78	5.63	5.56	5.53	5.43	5.35	5.25	5.15	5.15	5.19	5.12
	previous	8.84	7.38	6.66	6.00	5.72	5.55	5.47	5.40	5.30	5.24	5.17	5.11	5.11	5.17	
	absolute change	0.59	0.29	0.17	0.13	0.06	0.07	0.08	0.13	0.13	0.11	0.08	0.04	0.04	0.03	
	relative change [%]	6.73	3.93	2.58	2.09	1.00	1.31	1.55	2.35	2.38	2.05	1.46	0.80	0.70	0.52	

Planned improvements

No improvements are planned at present.

3.D.a.4 - Crop residues applied to soil

The calculation of NH_3 from crop residues is described in Vos et al. (2026), Chapter 5.2.1.3. According to EMEP (2023) NH_3 emissions are only occurring in a significant amount from crop residues on the soil surface, which are present more than three days and have an N content of more than 0.0132 kg N per kg dry matter. This means that there are no NH_3 emissions from most crop residues of the most commonly used crops in Germany. The major source of the emissions are residues of grassland cuts.

Activity data

The NH_3 emissions are calculated proportionally to the amounts of N stored in the above-ground biomass, according to EMEP (2023). This requires the knowledge of the areas of cultivation, of crop yields and of the N contents of the above ground crop residues.

Table 16: AD for the estimation of NH_3 emissions from crop residues

N in aboveground crop residues in kt N														
1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
370	377	418	429	411	417	416	443	348	391	403	425	413	424	424

Methodology

According to EMEP (2023) the NH_3 emissions from crop residues can be neglected when the crop residues are on the field for less than three days. Thus the first step in the emission calculation is determining which share of the crop residues of each crop are incorporated into the soil or removed in the first three days after harvesting the crop. The remaining amounts are multiplied with their respective N contents and the resulting amounts of N are then multiplied with the NH_3-emission factor.

Emission factors

According to the methodology given in EMEP (2023) the emission factor for the NH_3 emissions from crop residues applied to the soil is zero if the N content of the above ground crop residues is below or equal to the threshold of 0.0132 kg N per kg dry matter. In all other cases the NH_3 emission factor is determined using the following linear regression, see EMEP (2023):

$$EF\left(NH_{3_x}\right)=\frac{\left(410\times N_{(above\,dmx)}\text{-}5.42\right)}{100}$$

EF_NH$_{3x}$=*(410×N$_{above\ dmx}$ -5.42)/100* *Where x is the according crop and N$_{above\ dm}$ is the N content of the above ground dry matter. The implied emission factors provided in the following table are defined as ratio of the total NH_3-N emissions from crop residues to the total N in aboveground crop residues.* Table 17: IEF for NH_3-N emissions from crop residues *^ IEF in kg NH_3-N per kg N in aboveground crop residues |||||||||||||| ^ 1990 ^ 1995 ^ 2000 ^ 2005 ^ 2010 ^ 2015 ^ 2016 ^ 2017 ^ 2018 ^ 2019 ^ 2020 ^ 2021 ^ 2022 ^ 2023 ^ 2024 ^ | 0.019 | 0.016 | 0.014 | 0.014 | 0.013 | 0.013 | 0.014 | 0.013 | 0.013 | 0.013 | 0.013 | 0.014 | 0.013 | 0.013 | 0.014 | ==== Trend discussion for Key Sources ==== NH_3 emissions from crop residues are no key source. ==== Recalculations ==== For all years, NH_3 emissions from crop residues are slightly higher than those of last year's submission. The main reason for this is* ***recalculation No. 15*** *(update of number of grassland cuts). Further details on recalculations are described in Vos et al. (2026), Chapter 1.3.* Table 18: Comparison of NH_3 emissions [kt] with previous submission *^ NH_3 emissions from crop* *residues, in kt ^^^^^^^^^^^^^^^^^ ^ ^ Submission ^ 1990 ^ 1995 ^ 2000 ^ 2005 ^ 2010 ^ 2015 ^ 2016 ^ 2017 ^ 2018 ^ 2019 ^ 2020 ^ 2021 ^ 2022 ^ 2023 ^ 2024 ^ ^ Ammonia ^ current | 8.73 | 7.34 | 7.17 | 7.08 | 6.58 | 6.45 | 6.98 | 7.13 | 5.50 | 6.32 | 6.59 | 7.38 | 6.67 | 6.94 | 7.06 | ^ ::: ^ previous | 8.70 | 7.32 | 7.14 | 7.06 | 6.55 | 6.43 | 6.95 | 7.11 | 5.47 | 6.27 | 6.51 | 7.35 | 6.62 | 6.89 | | ^ ::: ^ absolute change | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.03 | 0.03 | 0.04 | 0.05 | 0.08 | 0.03 | 0.05 | 0.05 | | ^ ::: ^ relative change [%] | 0.34 | 0.35 | 0.35 | 0.36 | 0.40 | 0.39 | 0.39 | 0.39 | 0.68 | 0.75 | 1.18 | 0.47 | 0.76 | 0.75 | | ==== Planned improvements ==== No improvements are planned at present. ===== 3.D.c - Farm-level agricultural operations including storage, handling and transport of agricultural products ===== In this category Germany reports TSP, PM_{10} and $PM_{2.5}$ emissions from crop production according to EMEP (2023)-3D-22. For details see Vos et al. (2026), Chapter 5.2.4. ==== Activity data ==== The activity data is the total area of agricultural land (arable land, grassland and horticultural land) including areas with cover crops. This data is provided by official statistics.* Table 19: Agricultural land (including areas with cover crops), in [1000*ha] *^ Agricultural land (including areas with cover crops) in 1000*ha ^^^^^^^^^^^^^^^ ^ 1990 ^ 1995 ^ 2000 ^ 2005 ^ 2010 ^ 2015 ^ 2016 ^ 2017 ^ 2018 ^ 2019 ^ 2020 ^ 2021 ^ 2022 ^ 2023 ^ 2024 ^ | 17,542 | 16,285 | 16,457 | 16,555 | 17,010 | 17,447 | 17,484 | 17,532 | 17,509 | 17,559 | 17,498 | 17,431 | 17,386 | 17,367 | 17,142 | ==== Methodology ==== The Tier 2 methodology used is described in EMEP (2023)-3D-22. ==== Emission factors ==== Emission factors given in EMEP (2023)-3D-18, Tables 3.6 and 3.8 are used with the exception of „Harvesting" PM_{10}-factors for Wheat, Rye, Barley and Oat which were taken from the Danish IIR. These Guidebook-EFs are obviously too high by a factor of 10 and were corrected in the Danish IIR. The missing default-EFs for „other arable" in the 2023 EMEP/EEA Guidebook were replaced with the average of the EFs of wheat, rye, barley and oat, as it was done in the Danish IIR. The PM_{10} EFs were also used as TSP EFs. The Guidebook does not indicate whether EFs have considered the condensable component (with or without). For details on country specific numbers of agricultural crop operations see Vos et al. (2026), Chapter 5.2.4.* Table 20: Implied emission factors for PM emissions from agricultural soils, in kg ha^{-1} | *^ 1990 ^ 1995 ^ 2000 ^ 2005 ^ 2010 ^ 2015 ^ 2016 ^ 2017 ^ 2018 ^ 2019 ^ 2020 ^ 2021 ^ 2022 ^ 2023 ^ 2024 ^ ^ TSP | 1.42 | 1.41 | 1.42 | 1.41 | 1.39 | 1.38 | 1.37 | 1.37 | 1.37 | 1.36 | 1.36 | 1.36 | 1.36 | 1.36 | 1.35 | ^* PM_{10} *| 1.42 | 1.41 | 1.42 | 1.41 | 1.39 | 1.38 | 1.37 | 1.37 | 1.37 | 1.36 | 1.36 | 1.36 | 1.36 | 1.36 | 1.35 | ^* $PM_{2.5}$ *| 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.10 | 0.10 | 0.10 | 0.11 | 0.10 | ==== Trend discussion for Key Sources ==== TSP and* PM_{10} *are key sources. Emissions depend on the areas covered, crop types and number of crop operations. With the exception of the numbers of soil cultivations, which is slightly decreasing, these data are relatively constant. Overall this is reflected in a slight decline of emissions in the last years. ==== Recalculations ==== There were no recalculations. Further details on recalculations are described in Vos et al. (2026), Chapter 1.3.* Table 21: Comparison of particle emissions (TSP, PM_{10} & $PM_{2.5}$) [kt] with previous submission *^ TSP,* PM_{10}, $PM_{2.5}$ *emissions from crop production, in Gg ^^^^^^^^^^^^^^^^^ ^ ^ Submission ^ 1990 ^ 1995 ^ 2000 ^ 2005 ^ 2010 ^ 2015 ^ 2016 ^ 2017 ^ 2018 ^ 2019 ^ 2020 ^ 2021 ^ 2022 ^ 2023 ^ 2024 ^ ^ TSP ^ current | 24.88 | 22.99 | 23.38 | 23.27 | 23.64 | 24.06 | 24.03 | 24.07 | 23.92 | 23.94 | 23.73 | 23.70 | 23.71 | 23.69 | 23.16 | ^ ::: ^ previous | 24.88 | 22.99 | 23.38 | 23.27 | 23.64 | 24.06 | 24.03 | 24.07 | 23.92 | 23.94 | 23.73 | 23.70 | 23.71 | 23.69 | | ^ ::: ^ absolute change | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | ^ ::: ^ relative change [%] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | ^* PM_{10} *^ current | 24.88 | 22.99 | 23.38 | 23.27 | 23.64 | 24.06 | 24.03 | 24.07 | 23.92 | 23.94 | 23.73 | 23.70 | 23.71 | 23.69 | 23.16 | ^ ::: ^ previous | 24.88 | 22.99 | 23.38 | 23.27 | 23.64 | 24.06 | 24.03 | 24.07 | 23.92 | 23.94 | 23.73 | 23.70 | 23.71 | 23.69 | | ^ ::: ^ absolute change | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | ^ ::: ^ relative change [%] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | ^* $PM_{2.5}$ *^ current | 1.90 | 1.78 | 1.85 | 1.85 | 1.87 | 1.88 | 1.87 | 1.87 | 1.85 | 1.84 | 1.81 | 1.81 | 1.82 | 1.82 | 1.77 | ^ ::: ^ previous | 1.90 | 1.78 | 1.85 | 1.85 | 1.87 | 1.88 | 1.87 | 1.87 | 1.85 | 1.84 | 1.81 | 1.81 | 1.82 | 1.82 | | ^ ::: ^ absolute change | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | ^ ::: ^ relative change [%] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | ==== Planned improvements ==== No improvements are planned at present. ===== 3.D.e - Cultivated crops ===== In this category Germany reports NMVOC emissions from crop production according to EMEP (2023)-3D-21. For details see Vos et al. (2026), Chapter 5.2.3. ==== Activity data ==== The* total area of arable land and grassland *applied as activity data is provided by official statistics.* Table 22: Arable land and grassland, in [1000 ha] *^ 1990 ^ 1995 ^ 2000 ^ 2005 ^ 2010 ^ 2015 ^ 2016 ^ 2017 ^ 2018 ^ 2019 ^ 2020 ^ 2021 ^ 2022 ^ 2023 ^ 2024 ^ | 16,506 | 15,312 | 15,498 | 15,561 | 15,734 | 15,719 | 15,662 | 15,647 | 15,570 | 15,563 | 15,447 | 15,376 | 15,336 | 15,322 | 15,093 | ==== Methodology ==== The Tier 2 methodology described in EMEP (2023)-3D-21ff is used. ==== Emission Factors ==== The emission factors for wheat, rye, rape and grass (15°C) given in EMEP (2023)-3D-21, Table 3.4 were used. For all grassland areas the grass (15°C) EF is used, for all other crops except rye and rape the EF of wheat is used. The implied emission factors provided in the following table are defined as ratio of the total NMVOC emissions from cultivated crops to the total area given by activity data.* Table 23: IEF for NMVOC emissions from crop production, in [kg ha-1] *^ 1990 ^ 1995 ^ 2000 ^ 2005 ^ 2010 ^ 2015 ^ 2016 ^ 2017 ^ 2018 ^ 2019 ^ 2020 ^ 2021 ^ 2022 ^ 2023 ^ 2024 ^ | 0.47 | 0.53 | 0.57 | 0.59 | 0.61 | 0.63 | 0.62 | 0.62 | 0.50 | 0.55 | 0.59 | 0.61 | 0.58 | 0.60 | 0.59 | ==== Trend discussion for Key Sources ==== NMVOC emissions from crop production are no key source. ==== Recalculations ==== There were no recalculations. Further details on recalculations are described in Vos et al. (2026), Chapter 1.3.* Table 24: Comparison of NMVOC emissions [kt] with previous submission *^ ^ Submission ^ 1990 ^ 1995 ^ 2000 ^ 2005 ^ 2010 ^ 2015 ^ 2016 ^ 2017 ^ 2018 ^ 2019 ^ 2020 ^ 2021 ^ 2022 ^ 2023 ^ 2024 ^ ^ NMVOC ^ current | 7.69 | 8.19 | 8.79 | 9.17 | 9.53 | 9.91 | 9.69 | 9.74 | 7.82 | 8.56 | 9.16 | 9.44 | 8.91 | 9.23 | 8.87 | | ::: ^ previous | 7.69 | 8.19 | 8.79 | 9.17 | 9.53 | 9.91 | 9.69 | 9.74 | 7.82 | 8.56 | 9.16 | 9.44 | 8.91 | 9.23 | | | ::: ^ absolute change | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | ::: ^ relative* *change [%]* | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | |

For **pollutant-specific information on recalculated emission estimates for Base Year and 2023**, please see the pollutant specific recalculation tables following chapter 9.1 - Recalculations.

==== Planned improvements ====

At the moment, no category-specific improvements are planned.

==== Uncertainty ==== Details are described in chapter 1.7.

[1]
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[2]
EMEP/EEA air pollutant emission inventory guidebook 2023, EEA Report No 06/2023, https://www.eea.europa.eu/en/analysis/publications/emep-eea-guidebook-2023.
[3]
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.
[4]
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[5]
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