2.B.10.a - Other Chemicals

Short description

In sub-category *2.B.10.a - Other Chemicals*, emissions from the production of organic chemicals,sulphuric acid, carbon black, fertilizers and from the chlor-alkali industry are reported. Relevant pollutants are NMVOC, CO, PCDD/F, SO_x, NH_3, $PM_{2.5}$, PM_{10}, TSP and Hg.

Table 1: Overview of emission sources covered

Emission sources	**Pollutants**	**Method**	**AD**	**EF**	**Key Category**
Large Volume Organic chemicals	NMVOC (PCDD/F $_{\text{only for Ethylene Dichloride}}$)	T2	NS	CS	
Carbon Black	CO, SO_2, TSP, PM_{10}, $PM_{2.5}$	T2	NS	D, CS	
Fertilizers	TSP, PM_{10}, $PM_{2.5}$, NH_3	T2	-	D, CS	
Sulphuric acid	SO_2	T2	NS	CS	L
Chlor-alkali industry	Hg	T3	PS	-	

T = key source by Trend **L** = key source by Level

Methods	
D	Default
RA	Reference Approach
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/CORINAIR Emission Inventory Guidebook - 2007, in the group specific chapters.	

AD - Data Source for Activity Data	
NS	National Statistics
RS	Regional Statistics
IS	International Statistics
PS	Plant Specific data
AS	Associations, business organisations
Q	specific questionnaires, surveys

EF - Emission Factors	
D	Default (EMEP Guidebook)
C	Confidential
CS	Country Specific
PS	Plant Specific data

Method

Large Volume Organic chemicals

The annual production volumes for all large volume organic chemicals are extracted from national production statistics by the Federal Statistical Office [1)]

These chemicals comprise:

- Acrylonitrile
- Ethylene
- Ethylbenzene

- Ethylene Dichloride
- Ethylene Oxide
- Formaldehyde (Methanal)
- Methanol
- Phthalic Anhydride
- Propene
- Styrene
- Vinyl Chloride
- Polyethylene (LD/HD)
- Polypropylene
- Polystyrene
- Polyvinyl Chloride
- Styrene Copolymeres

The emission factors for the production of organic chemicals as shown in Tables 2 and 3 are derived from best reference documents for polymers and LVOC mostly for the early years. For later years, plant-specific data on an aggregated level were used.

Table 2: national NMVOC emission factors for producing organic chemicals, in kg/t

Product	**Acrylonitrile**	**Ethylbenzene**	**Ethylene**	**Ethylene Dichloride**	**Ethylene Oxide**	**Formaldehyde (Methanal)**	**Methanol**	**Phthalic Anhydride**	**Propene**	**Styrene**	**Vinyl Chloride**
from 1990-1994	5	0.6	5	C	5	5	0.04	5	2.5	0.02	0.2
1995	0.07	0.02	0.4	C	0.06	0.02	0.04	0.2	0.2	0.02	0.2
1996	0.05	0.015	0.3	C	0.045	0.015	0.04	0.15	0.15	0.02	0.15
1997	0.05	0.015	0.3	C	0.045	0.015	0.04	0.15	0.15	0.02	0.15
1998	0.04	0.012	0.25	C	0.04	0.012	0.04	0.12	0.12	0.02	0.12
1999	0.04	0.012	0.25	C	0.04	0.012	0.04	0.12	0.12	0.02	0.12
from 2000	0.035	0.01	0.2	C	0.03	0.01	0.04	0.1	0.1	0.02	0.1

Table 3: national NMVOC emission factors for producing polymers, in kg/t

products	**Polyethylene (PE)**		**Polypropylen (PP)**	**Polystyrene (PS)**	**Polyvinyl Chloride (PVC)**	**Styrene Copolymeres**
	Low density (LD)	High density (HD)				
from 1990 to 1994	8	6	8	1	0.25	5
1995	2.2	1	1	0.6	0.25	0.6
1996	1.6	0.75	0.75	0.4	0.25	0.5
1997	1.6	0.75	0.75	0.4	0.25	0.5
1998	1.3	0.6	0.6	0.32	0.25	0.4
1999	1.3	0.6	0.6	0.32	0.25	0.4
from 2000	1.1	0.5	0.5	0.27	0.14	0.3

Carbon Black

The figures for carbon black production in the new German Länder in 1990 were taken from the Statistical Yearbook (Statistisches Jahrbuch) for the Federal Republic of Germany; the figures for 1991 and 1992 were estimated, due to confidentiality requirements. The other data for carbon-black production as of 1990 were obtained from national production statistics[1)].

From 2005 onwards, Germany uses activity data calculated from the CO_2 emissions of the Emission Trading System (ETS), delivered by the German emission trading authority (DEHSt), and the default CO_2 emission factor from the IPCC Guidelines 2006 for carbon black production. A comparison of the statistical data and the emission trading data leads to the conclusion, that the statistical data is most probably overestimated.

Table 4: Emission factors of carbon black in Germany, in kg/t

Pollutant	**CO**	**SO_2**	**TSP**	**PM_{10}**	**$PM_{2.5}$**
1990	4.80	19.16	0.28		

Pollutant	CO	SO_2	TSP	PM_{10}	$PM_{2.5}$
1991	4.60	19.01	0.28		
1992	4.40	18.50	0.27		
1993	4.20	18.00	0.26		
1994	4.00	17.50	0.25		
1995	3.75	17.00	0.25	0.23	0.12
1996	3.50	16.00	0.25	0.23	0.12
1997	3.25	15.00	0.25	0.23	0.12
1998	3.00	14.00	0.25	0.23	0.12
1999	2.90	13.40	0.25	0.23	0.12
2000	2.80	12.80	0.25	0.23	0.12
2001	2.70	12.54	0.25	0.23	0.12
2002	2.65	12.28	0.25	0.23	0.12
2003	2.60	12.00	0.25	0.23	0.12
2004	2.55	11.70	0.25	0.23	0.12
2005	2.50	11.50	0.25	0.23	0.12
2006	2.50	11.20	0.24	0.22	0.12
2007	2.50	10.90	0.23	0.21	0.11
2008	2.50	10.60	0.22	0.20	0.11
2009	2.50	10.30	0.21	0.19	0.10
from 2010	2.50	10.00	0.20	0.18	0.10

Fertilizer production

The activity data is also extracted from national production statistics by the Federal Statistical Office[1)] and consist of mono and multicomponent fertilizers.

The emission factors are country specific (Jörß et al. 2006)[2)] and are presented in the following table.

Table 5: Emission factors of fertilizers in Germany, in kg/t

Product	Fertilizers		
Pollutant	PM_{10}	$PM_{2.5}$	TSP
1990	NA	NA	1.420376946
from 1991 to 1994	NA	NA	2
from 1995 onwards	0.115938	0.0781395	0.1695

Urea production

The activity data is from the federal statistical office of Germany (GP 2015 31 300). The amount of urea is reported there in t-N. As the emission factor is in kg/t urea the reported amount of urea in t-N is multiplied with the molar mass of urea and divided with the molar mass of nitric (60.06/14).

ARurea (t urea) = AR urea (t-N) * molar mass urea/ molar mass N

The emission factor is a T2 EF from the EMEP/EEA Guidebook 2019, chapter 3.2.2, p. 32, table 3.2.9. The value is 2.5 kg/t urea.

Sulphuric acid

The activity data for sulphuric acid production is from the Federal Statistical Office of Germany.

For the SO_x EF for sulphuric acid production a survey was made in the year 2019. The producers were directly asked by the association. Based on the data from the producers, new EFs for the years 2017 and 2018 were developed. All emissions were measured by the producers respectively or limit values are specified in the permit decision for the installation. The EF is weighted by the amount of H_2SO_4 produced. Big producers have more influence on the EF than small producers. The EF is smaller than the Default-EF. This is due to significant process optimizations and technology improvements since 1990.

Chlor-alkali industry

For the mercury losses from the Chlor-alkali industry, Germany uses the yearly published data from OSPAR on the plant specific production capacity for the AD and the plant specific emissions from the chlor-alkali industry. Because of the BAT (best available technique) conclusion for the Chlor-alkali industry, the production has stopped in 2017. However, emissions of Hg are still ocurring, because two plants still produce alcoholates and dithionite and are not regulated by the BAT conclusions for Chlor-alkali production. In both plants Chlor-alkali was also produced. The Hg-emissions from the production of dithionite and alcoholates were so far reported together with the Hg-emissions from Chlor-alkali production. The OSPAR convention does not request the Hg-emissions from dithionite and alcoholate production to be reported, so CEFIC does no longer report these emissions to OSPAR.

Recalculations

For SO_2 emissions from sulphuric acid production, and for Hg emissions from chlor-alkali industry, the emissions of the two last years are always actualized. This is because the emissions of the last year are always a prediction, as the final emissions are still not published by the time of reporting.

From Submission 2022 the SO_2 emissions from titanium dioxide production are no longer confidential and are therefore reallocated to category 2.B.6. Thus, the SO_2 emissions reported here are only from the sulphuric acid production (See **Table 6**)

Table 6: SO_2 emission from sulphuric acid production

Year	SO_2 in kt
1990	23.47
1991	22.47
1992	22.07
1993	20.14
1994	18.86
1995	23.03
1996	20.98
1997	22.23
1998	23.58
1999	24.03
2000	24.04
2001	23.01
2002	22.89
2003	23.78
2004	25.65
2005	26.54
2006	26.83
2007	25.74
2008	24.1
2009	19.87
2010	20.39
2011	19.79
2012	18.25
2013	16.94
2014	13.89
2015	12.59
2016	11.06
2017	10.14
2018	10.22
2019	9.96
2020	9.69

So far Germany reported NH_3 and TSP emissions from nitric fertilizer production. Germany has decided to not report this category anymore, but to report emissions from the category urea production instead. There are several reasons to do this. First, the category nitric fertilizer production is a country specific category and there is no method described in the EMEP/EEA Guidebook for this. Second, Germany has no data source for the activity data for this category for many years. During the investigation Germany came to the assumption that there is a double counting of TSP emissions from nitric fertilizer production and fertilizer production. Therefore, instead of nitric fertilizer production Germany reports NH_3 emissions from urea production based on the Emep/EEA Guidebook method, using statistical data from the federal statistical office since the submission 2022, which will be available in future too. With this step Germany has improved the quality of the reporting of the fertilizer porduction in Germany.

Table 7: NH_3 and TSP emissions from urea production and nitric fertilizer production

	Subm2022		**Subm2021**			**Difference**	
Product	**urea fertilizer**	**urea fertilizer**	**nitric fertilizer**	**nitric fertilizer**	**nitric fertilizer**		
	AD	**EM**	**AD**	**EM**	**EM**	**EM**	**EM**
Pollutant		**NH_3**		**NH_3**	**TSP**	**NH_3**	**TSP**
Unit	**t**	**t**	**t**	**t**	**t**	**t**	**t**
1990	2.574.000	6.435	1.914.000	9.570	958,9	-3.135	-959,0
1991	2.574.000	6.435	1.423.000	7.115	1.423	-680	-1423
1992	2.574.000	6.435	1.365.000	6.825	1.365	-390	-1365
1993	2.574.000	6.435	1.303.000	6.515	1.303	-80	-1303
1994	2.574.000	6.435	1.199.000	5.995	1.199	440	-1199
1995	2.438.937,93	6.097,34	1.504.000	7.520	1.504	-1.423	-1504
1996	2.607.500,61	6.518,75	1.565.000	7.825	1.565	-1.306	-1565
1997	2.344.506,45	5.861,27	1.396.000	6.980	1.396	-1.119	-1396
1998	2.468.749,14	6.171,87	1.422.000	7.110	1.422	-938	-1422
1999	2.463.343,74	6.158,36	1.476.000	7.380	1.476	-1.222	-1476
2000	2.646.492,42	6.616,23	1.641.000	8.205	1.641	-1.589	-1641
2001	2.333.532,63	5.833,83	1.432.000	7.160	1.432	-1.326	-1432
2002	2.830.276,02	7.075,69	1.575.000	7.875	1.575	-799	-1575
2003	2.801.352,84	7.003,38	1.575.000	7.875	1.575	-872	-1575
2004	2.435.604,60	6.089,01	1.575.000	7.875	1.575	-1.786	-1575
2005	2.587.955,37	6.469,89	1.575.000	7.875	1.575	-1.405	-1575
2006	2.854.574,58	7.136,44	1.884.600	9.423	1.884,6	-2.287	-1884,6
2007	2.648.474,40	6.621,19	1.575.000	7.875	1.575	-1.254	-1575
2008	2.592.549,96	6.481,37	1.575.000	7.875	1.575	-1.394	-1575
2009	3.422.832,27	8.557,08	1.575.000	7.875	1.575	682	-1575
2010	3.074.359,86	7.685,90	1.575.000	7.875	1.575	-189	-1575
2011	1.854.138	4.635,35	1.575.000	7.875	1.575	-3.240	-1575
2012	1.819.491,96	4.548,73	1.575.000	7.875	1.575	-3.326	-1575
2013	1.716.231,66	4.290,58	1.575.000	7.875	1.575	-3.584	-1575
2014	1.691.259,57	4.228,15	1.575.000	7.875	1.575	-3.647	-1575
2015	1.369.174,95	3.422,94	1.575.000	7.875	1.575	-4.452	-1575
2016	1.733.301,57	4.333,25	1.575.000	7.875	1.575	-3.542	-1575
2017	2.237.758,38	5.594,40	1.575.000	7.875	1.575	-2.281	-1575
2018	2.161.469,31	5.403,67	1.575.000	7.875	1.575	-2.471	-1575
2019	2.129.006,88	5.322,52	1.575.000	7.875	1.575	-2.552	-1575
2020	2.124.257,85	5.310,64					

For specific **information on recalculated emission estimates for Base Year and 2019**, please see the pollutant specific recalculation tables following chapter 8.1 - Recalculations.

Planned improvements

For the mercury losses from the Chlor-alkali industry, because of the BAT conclusion for the Chlor-alkali industry the production has stopped in 2017. However, emissions of Hg are still ocurring, because two plants are still producing alcoholates and dithionite and were so far reported by CEFIC to OSPAR based on BAT regulation for Chlor-alkali production. Since the OSPAR convention does not request to report the Hg-emissions from dithionite and alcoholate production, CEFIC no longer reports these emissions to OSPAR. Germany is trying to ensure reporting of Hg emissions for that sources.

[1)] DESTATIS, Fachserie 4, Reihe 3.1, Produzierendes Gewerbe, Produktion im Produzierenden Gewerbe (“manufacturing industry; production in the manufacturing industry”)
[2)] Umweltbundesamt, W: Jörß, V. Handke, Emissionen und Maßnahmenanalyse Feinstaub 2000-2020, 31.12.2006, Annex A, chapter A.2.4.8