# 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 $_{only\ for\ Ethylene\ Dichloride}$) | 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$_2$SO$_4$ 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 | SO2 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 |

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