



2.B.6 - Titanium Dioxide Production

Short description

| Category Code | Method | | | | | AD | | | | | EF | | | | |
|---------------|-----------------|-----------------|-----------------|--------|-----|----|----|----|----|------|-----|-----|-----|------------------|-------------------|
| 2.B.6 | T3 | | | | | C | | | | | C | | | | |
| Key Category | SO ₂ | NO _x | NH ₃ | NM VOC | CO | BC | Pb | Hg | Cd | Diox | PAH | HCB | TSP | PM ₁₀ | PM _{2.5} |
| 2.B.6 | -/- | -/- | - | - | -/- | - | - | - | - | - | - | - | -/- | - | - |

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 |

In *NFR 2.B.6*, SO₂, CO, NO_x and TSP emissions from the production of titanium dioxide are reported.

Method

Activity Data

There are two kinds of processes called chloride process and sulfate process for the production of titanium dioxide. The total production amount is attained from the German Federal Statistical Office¹⁾. For the calculation of individual production of each process, the fraction of chloride process is determined based on the estimated total production capacity in Germany (480kt/y) and the production capacity via chloride process (165kt/y)²⁾³⁾.

Emission Factors

Emission factors for Titanium dioxide production are the Tier 2 emission factors from EMEP Guidebook: NO_x, CO, and TSP are provided for the chloride process, while only factors for NO_x and TSP are available for the sulfate process.

The applied Tier 2 emission factors are listed in Table 1 ⁴⁾.

Table 1: Tier 2 emission factors for Titanium dioxide production, in [kg/t]

| Pollutant | Name of process | EF |
|-----------------|-----------------|-------|
| CO | Chloride | 159 |
| NO _x | Chloride | 0.1 |
| TSP | Chloride | 0.2 |
| NO _x | Sulfate | 0.108 |
| TSP | Sulfate | 0.3 |

Emissions

The association of the titanium producers reports the sum of SO₂-emissions from both processes directly to the UBA. Since the Submission 2022 the SO₂-emissions are no longer confidential.

Except for SO₂ emission, emissions of the mentioned pollutants are calculated through the multiplication of activity data and corresponding emission factors.

As the emission factors are constant over the time the emission trend is influenced only by the development of the production.

Recalculations

For SO₂ emissions from the production of **titanium dioxide** and **sulphuric acid**, estimates reported for the *second to last year* of the time series are routinely actualised by the producers. Furthermore, definite emissions for the *last year of the time series* are not yet available at the time the inventory is compiled. Here, the reported values represent a prediction and are therefore updated with each new submission as well.

As the SO₂ emissions from titanium dioxide are no longer confidential, they are reallocated from 2.B.10 to this category (see Table 2).

Furthermore, CO, NO_x and TSP emissions are reported for the first time (see also Table 2).

Table 2: Activity data and emissions for Titanium dioxide production from 1990 to 2020 ⁵⁾.

| | Activity data (kt) | Emission (kt) | | | |
|------|--------------------|-----------------|------|-------|-----------------|
| | | NO _x | TSP | CO | SO ₂ |
| 1990 | 350.00 | 0.03 | 0.09 | 19.48 | 1.73 |
| 1991 | 330.00 | 0.03 | 0.08 | 18.36 | 1.73 |
| 1992 | 317.21 | 0.03 | 0.08 | 17.65 | 1.73 |
| 1993 | 300.07 | 0.03 | 0.08 | 16.70 | 1.64 |
| 1994 | 332.36 | 0.03 | 0.08 | 18.50 | 1.74 |
| 1995 | 300.63 | 0.03 | 0.08 | 16.73 | 2.00 |
| 1996 | 405.19 | 0.04 | 0.11 | 22.55 | 1.60 |
| 1997 | 450.49 | 0.05 | 0.12 | 25.07 | 0.87 |
| 1998 | 315.41 | 0.03 | 0.08 | 17.55 | 0.67 |
| 1999 | 309.59 | 0.03 | 0.08 | 17.23 | 0.62 |
| 2000 | 407.45 | 0.04 | 0.11 | 22.67 | 0.77 |
| 2001 | 377.01 | 0.04 | 0.10 | 20.98 | 0.57 |
| 2002 | 411.57 | 0.04 | 0.11 | 22.90 | 0.71 |
| 2003 | 417.82 | 0.04 | 0.11 | 23.25 | 0.77 |
| 2004 | 439.06 | 0.05 | 0.12 | 24.43 | 0.94 |

| | | | | | |
|------|--------|------|------|-------|------|
| 2005 | 445.32 | 0.05 | 0.12 | 24.78 | 0.90 |
| 2006 | 463.24 | 0.05 | 0.12 | 25.78 | 0.86 |
| 2007 | 460.14 | 0.05 | 0.12 | 25.61 | 0.9 |
| 2008 | 452.09 | 0.05 | 0.12 | 25.16 | 1.01 |
| 2009 | 334.62 | 0.03 | 0.09 | 18.62 | 0.76 |
| 2010 | 423.29 | 0.04 | 0.11 | 23.56 | 0.70 |
| 2011 | 411.81 | 0.04 | 0.11 | 22.92 | 0.59 |
| 2012 | 367.75 | 0.04 | 0.10 | 20.47 | 0.45 |
| 2013 | 376.87 | 0.04 | 0.10 | 20.97 | 0.57 |
| 2014 | 381.26 | 0.04 | 0.10 | 21.22 | 0.54 |
| 2015 | 381.12 | 0.04 | 0.10 | 21.21 | 0.61 |
| 2016 | 391.15 | 0.04 | 0.11 | 21.77 | 0.68 |
| 2017 | 416.34 | 0.04 | 0.11 | 23.17 | 0.94 |
| 2018 | 377.69 | 0.04 | 0.10 | 21.02 | 0.94 |
| 2019 | 376.02 | 0.04 | 0.10 | 20.93 | 0.95 |
| 2020 | 338.99 | 0.03 | 0.09 | 18.87 | 0.96 |



For pollutant-specific information on recalculated emission estimates for Base Year and 2018, please see the pollutant specific recalculation tables following [chapter 8.1 - Recalculations](#).

Planned improvements

No category-specific improvements are planned.

^{1), 5)} Production statistics: Until 1994 GP89 - 4612 50, 1995 until 2008 GP241211500 and GP201211500 from 2009 onwards

²⁾ <https://forum-titandioxid.de/2020/03/12/sachlage-zu-titandioxid-und-titandioxidhaltigen-farben-und-lacken/>

³⁾ <https://kronostio2.com/en/manufacturing-facilities/leverkusen-germany>

⁴⁾ European Environment Agency: EMEP/EEA air pollutant emission inventory guidebook 2019, Part B: sectoral guidance chapters, 2.B Chemical industry (Oct 2019): pp.25-26, table 3.19 and table 3.20