



## 2.B.6 - Titanium Dioxide Production

### Short description

| Category Code | Method          |        |                 |                 |                   | AD               |     |    |     |    | EF |    |      |     |     |
|---------------|-----------------|--------|-----------------|-----------------|-------------------|------------------|-----|----|-----|----|----|----|------|-----|-----|
| 2.B.6         | T3              |        |                 |                 |                   | C                |     |    |     |    | C  |    |      |     |     |
|               | NO <sub>x</sub> | NM VOC | SO <sub>2</sub> | NH <sub>3</sub> | PM <sub>2.5</sub> | PM <sub>10</sub> | TSP | BC | CO  | Pb | Cd | Hg | Diox | PAH | HCB |
| Key Category: | -/-             | -      | -/-             | -               | -                 | -                | -/- | -  | -/- | -  | -  | -  | -    | -   | -   |

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

| Methods   |                                 |
|-----------|---------------------------------|
| <b>D</b>  | Default                         |
| <b>T1</b> | Tier 1 / Simple Methodology *   |
| <b>T2</b> | Tier 2*                         |
| <b>T3</b> | Tier 3 / Detailed Methodology * |
| <b>C</b>  | CORINAIR                        |
| <b>CS</b> | Country Specific                |
| <b>M</b>  | Model                           |

\* as described in the EMEP/EEA Emission Inventory Guidebook - 2019, in the group specific chapters.

| AD - Data Source for Activity Data |                                      |
|------------------------------------|--------------------------------------|
| <b>NS</b>                          | National Statistics                  |
| <b>RS</b>                          | Regional Statistics                  |
| <b>IS</b>                          | International Statistics             |
| <b>PS</b>                          | Plant Specific data                  |
| <b>As</b>                          | Associations, business organisations |
| <b>Q</b>                           | specific Questionnaires (or surveys) |
| <b>M</b>                           | Model / Modelled                     |
| <b>C</b>                           | Confidential                         |
| EF - Emission Factors              |                                      |
| <b>D</b>                           | Default (EMEP Guidebook)             |
| <b>C</b>                           | Confidential                         |
| <b>CS</b>                          | Country Specific                     |
| <b>PS</b>                          | Plant Specific data                  |
| <b>M</b>                           | Model / Modelled                     |

In *NFR 2.B.6*, SO<sub>2</sub>, CO, NO<sub>x</sub> 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 Office<sup>1)</sup>.

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 (480 kt/y) and the production capacity via chloride process (165 kt/y)<sup>2)3)</sup>.

## Emission Factors

Emission factors for Titanium dioxide production are the Tier 2 emission factors from EMEP Guidebook: NO<sub>x</sub>, CO, and TSP are provided for the chloride process, while only factors for NO<sub>x</sub> and TSP are available for the sulfate process.

The applied Tier 2 emission factors are listed in Table 1 <sup>4)</sup>.

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

| Pollutant       | Name of process | EF    |
|-----------------|-----------------|-------|
| CO              | Chloride        | 159   |
| NO <sub>x</sub> | Chloride        | 0.1   |
| TSP             | Chloride        | 0.2   |
| NO <sub>x</sub> | Sulfate         | 0.108 |
| TSP             | Sulfate         | 0.3   |

## Emissions

The association of the titanium producers reports the sum of SO<sub>2</sub> emissions from both processes directly to the UBA. Here, since submission 2022, these emissions are no longer confidential.

Except for SO<sub>2</sub>, 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 SO<sub>2</sub> 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 SO<sub>2</sub> emissions from titanium dioxide are no longer confidential, they are reallocated from 2.B.10 to this category (see Table 2 ).

Furthermore, CO, NO<sub>x</sub> 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 <sup>5)</sup>.

|      | Activity data (kt) | Emission (kt)   |      |       |                 |
|------|--------------------|-----------------|------|-------|-----------------|
|      |                    | NO <sub>x</sub> | TSP  | CO    | SO <sub>2</sub> |
| 1990 | 350.00             | 0.04            | 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 | 0.04 | 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 | 0.04 | 0.09 | 18.87 | 0.96 |



For **pollutant-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 1990 and 1991 for reasons of confidentiality the SO<sub>x</sub>-emissions were replaced by the emissions value from 1992. Meanwhile the confidentiality does not anymore exist. So for the next submission the real SO<sub>x</sub> for 1990 and 1991 will be published.

<sup>1), 5)</sup> Production statistics: Until 1994 GP89 - 4612 50, 1995 until 2008 GP241211500 and GP201211500 from 2009 onwards

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

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

<sup>4)</sup> 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