2.C.3 - Aluminium Production

Short description

Category Code	Method					AD					EF				
2.C.3	T2, T3					AS					D, CS				
Key Category	**SO_2**	**NO_x**	**NH_3**	**NMVOC**	**CO**	**BC**	**Pb**	**Hg**	**Cd**	**Diox**	**PAH**	**HCB**	**TSP**	**PM_{10}**	**$PM_{2.5}$**
2.C.3	-	-	-	-	-	-	-	-	-	-	-/T	L/T (till 2001)	-	-	-

The category *2.C.3 - Aluminium production* is sub-divided into primary aluminium and secondary aluminium production.

In Germany, primary aluminium is produced in electrolytic furnaces with pre-baked anodes. The pre-baked anodes are produced in separate anode production plants, where petroleum coke and tar pitch are mixed subsequently baked. This process produces PAH emissions. Hence, the aluminium production is a trend key category for PAH (TIER-2-method, TIER-3-method).

Secondary aluminium is produced in several different furnace types. According to different scrap qualities, the emissions are varying. The use of hexachloroethane for degassing purposes in refining operations of secondary aluminium production has been prohibited by law in Germany since 2002 resulting in an omission of the source for HCB. But for the period 1990-2001 no data on national emissions of HCB in secondary aluminium industries is available. To overcome this data gap the default emission factor for HCB was used.

Method

Activity data

The yearly production figures were taken from the annual statistical report of the German association for non-ferrous metals [Lit. 1].

The total quantity of waste gas incurred per tonne of aluminium during the production of primary aluminium was multiplied by an average concentration value formed from several individual figures, from various different plants, with appropriate weighting.

Emission factors

The emission factors are either default values according to the 2019 EMEP/EEA air pollutant emission inventory guidebook [Lit. 2] or determined in research Projects [Lit. 3]. The emission factors also make allowance for fugitive emission sources, such as emissions via hall roofs.

The emission figures used for CO are the results of emission measurements within the context of investment projects. The emission factors for SO_2 are calculated from the specific anode consumption. The anodes consist of petrol coke; this material has a specific sulphur concentrations of about 1.2 %, from which an SO_2 emission factor of 10.4 kg/t Al can be calculated. The average anode consumption is 430 kg of petrol coke per tonne of aluminium.

The following tables show some process-related emission factors.

Table 1: Emission factors applied for anode production

pollutant	Activity / Process	EF	unit	Trend
PAH	anode production	300	mg/t	constant

Table 2: Emission factors applied for primary aluminium production

pollutant	Activity / Process	EF	unit	Trend
CO	primary aluminium	180	kg/t	constant
SO_2	primary aluminium	7.341	kg/t	constant

pollutant	Activity / Process	EF	unit	Trend
TSP	primary aluminium	0.83	kg/t	falling
PM_{10}	primary aluminium	0.7055	kg/t	falling
$PM_{2.5}$	primary aluminium	0.581	kg/t	falling
Cd	primary aluminium	0.15	g/t	constant
Ni	primary aluminium	0.162	g/t	
Zn	primary aluminium	10	g/t	constant
NOx	primary aluminium	1	kg/t	constant

Table 3: Emission factors applied for secondary aluminium production

pollutant	Activity / Process	EF	unit	Trend
TSP	resmelted aluminium	0.055	kg/t	constant
PM_{10}	resmelted aluminium	0.047	kg/t	constant
$PM_{2.5}$	resmelted aluminium	0.03843	kg/t	constant
Cd	resmelted aluminium	7	mg/t	constant
Cu	resmelted aluminium	8.411	mg/t	
Hg	resmelted aluminium	1.7	mg/t	constant
Pb	resmelted aluminium	4.452	mg/t	
Zn	resmelted aluminium	4	g/t	constant
HCB (years 1990-2001)	resmelted aluminium	5	g/t	constant

Nitrogen oxides essentially arise from the nitrogen content of the fuels in combustion processes and at temperatures above 1,000 ° C also from air nitrogen. Another source of NO_x is the electrolysis in primary aluminium production due to the presence of nitrogen in the anode, which can be oxidized to NO_x. All these emission sources resulting from energy related processes are included in 1.A.2.b. If other sources of NO_x have quantitative effects is not known. In order not to miss process related NO_x emissions the standard emission factor is also used. Germany is following recommendations provided by the Expert Review Team for the NECD Review 2017.

Recalculations

No recalculations have been carried out compared to last year's Submission.

For more 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 improvements are planned.

Bibliography

Lit. 1: German association for non-ferrous metals (WirtschaftsVereinigung Metalle): Annual statistical report: https://www.wvmetalle.de
Lit. 2:
Lit. 3: Ökopol, IER, IZT, IfG: Bereitstellung einer qualitätsgesicherten Datengrundlage für die Emissionsberichterstattung zur Umsetzung von internationalen Luftreinhalte- und Klimaschutzvereinbarungen für ausgewählte Industriebranchen Teilvorhaben 2: NE-Metallindustrie, Kalkindustrie, Gießereien.
Lit. 4: