

2.B.1 - Ammonia Production

Short description

Category Code	Method					AD					EF				
2.B.1	T2					PS					D				
	NO _x	NM VOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC	CO	Pb	Cd	Hg	Diox	PAH	HCb
Key Category:	-/-	-	-	-/-	-	-	-	-	-/-	-	-	-	-	-	-

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

Methods	
D	Default
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/EEA Emission Inventory Guidebook - 2019, 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 (or surveys)
M	Model / Modelled
C	Confidential
EF - Emission Factors	
D	Default (EMEP Guidebook)
C	Confidential
CS	Country Specific
PS	Plant Specific data
M	Model / Modelled

Ammonia is synthesised from hydrogen and nitrogen, using the Haber-Bosch process. Hydrogen is produced from synthetic gas – which in turn is produced from natural gas – via a highly integrated process, steam reforming. Nitrogen is produced via air dissociation. The various plant types involved in the production of ammonia cannot be divided into individual units nor be considered as independent process parts, due to the highly integrated character of the procedure. In **steam reforming**, the following process parts are distinguished:

- ACP - Advanced Conventional Process - with a fired primary reformer and secondary reforming with excess air (stoichiometric H/N ratio)
- RPR - Reduced Primary Reformer Process - under mild conditions in a fired primary reformer and secondary splitting with excess air (sub-stoichiometric H/N ratio)

and

- HPR - Heat Exchange Primary Reformer Process – autothermic splitting with heat exchange using a steam reformer heated with process gas (heat exchange reformer) and a separate secondary reformer or a combined autothermic reformer using excess air or enriched air (sub-stoichiometric or stoichiometric H/N ratio).

The following process is also used for ammonia synthesis: **Partial oxidation**, which is the gasification of fractions of heavy mineral oil or vacuum residues in the production of synthetic gas. Most plants operate using steam-reforming, with naphtha or natural gas. Only 3 % of European plants use partial oxidation.

The production decrease of more than 15 % in the first year after German reunification was the result of a market shakeup, over 2/3 of which was borne by the new German Länder. The production level then remained nearly constant in the succeeding years until 1994. The reasons for the re-increase as of 1995 back to the 1990 level are not understood; the re-increase may however be due to a change in statistical survey methods. After 1990, production levels fluctuated only slightly. Since then, the rate of ammonia production has been stable.

Method

There were four plants in Germany which produced ammonia, using both steam reforming and partial oxidation. Since mid 2014 there are only four left, but both processes are still used.

Activity data

As the CO₂ emissions from ammonia production are a key category, activity data is collected plant-specifically: The AD is delivered based on a cooperation agreement with the ammonia producers and the IVA (Industrieverband Agrar). The plant specific data is made anonymous by the IVA and then is sent to the UBA.

Emission factor

For NO_x and NH₃ and CO, the default emission factors from the CORINAIR Guidebooks of 1 kg/t NH₃ for NO_x, 0.01kg/t NH₃ for NH₃ and 0.1 kg/t NH₃ for CO are used (EEA, 2019) ¹⁾. The CO emission factor has been newly included in this year's submission.

Recalculations

With the newly included CO emission factor, recalculations of CO have been carried out for this year's submission. The total CO emissions from 1990 to 2020 are calculated and listed in **Table 1**.

Table 1: CO emissions from ammonia production

Year	CO emission (in kt)
1990	0.27
1991	0.24
1992	0.24
1993	0.23
1994	0.24
1995	0.29
1996	0.30
1997	0.29
1998	0.30
1999	0.29
2000	0.32
2001	0.30
2002	0.32
2003	0.32
2004	0.30
2005	0.33
2006	0.32
2007	0.33
2008	0.31
2009	0.27
2010	0.31
2011	0.32

Year	CO emission (in kt)
2012	0.31
2013	0.32
2014	0.29
2015	0.27
2016	0.30
2017	0.30
2018	0.30
2019	0.29
2020	0.30



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

At the moment, no category-specific improvements are planned.

¹⁾ EEA, 2019: EMEP EEA Emission Inventory Guidebook 2019, Oct 2019: page 15, Table 3.2: Tier 1 emission factors for source category 2.B.1 Ammonia production