1.A.4.b i - Residential: Stationary Combustion

Short description

image Kaminofen.png size="medium"

In source category *1.A.4.b.i. - Other: Residential* emissions from small residential combustion installations are reported.

Method	AD	EF	Key Category
T2, T3	NS	CS, D	**L&T**: NO_x, SO_x, $PM_{2.5}$, PM_{10}, BC, PAH; **L**: CO, NMVOC, PCDD/F, TSP

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

Methodology

Activity data

For further information on activity data please refer to the superordinte chapter on small stationary combustion.

Emission factors

For further information on the emission factors applied please refer to the superordinte chapter on small stationary combustion.

Table 1: Emission factors for domestic combustion installations

= **Pollutant**	~ NO,,x,,	~ SO,,x,,	~ CO	~ NMVOC	~ TSP	~ PM,,10,,	~ PM,,2.5,,	~ PAH	~ PCDD/F
= **Fuel**							= [kg/TJ]	= [mg/TJ]	= [µg/TJ]
~ Hard Coal	> 61.1	> 385.5	> 3,422	> 67.0	> 18.5	> 17.6	> 15.7	> 60,000	> 20.8
~ Hard Coal Coke	> 40.0	> 458.6	> 5,448	> 11.5	> 16.6	> 15.8	> 14.2	> 100,000	> 45.7
~ Hard Coal Briquettes	> 50.4	> 563.5	> 4,875	> 184.1	> 265.4	> 252.8	> 227.3	> 100,000	> 20.2
~ Lignite Briquettes	> 87.0	> 421.6	> 2,349	> 158.0	> 79.5	> 76.5	> 68.2	> 90,000	> 24.8
~ Natural Wood	> 69.9	> 8.1	> 1,632	> 126.6	> 75.9	> 74.3	> 70.7	> 600,000	> 45.2
~ Light Fuel Oil	> 22.1	> 3.3	> 11.8	> 1.5	> 0.9	> 0.9	> 0.9	> 160.7	> 2.2
~ Natural Gas	> 20.5	> 0.1	> 13.2	> 0.6	> 0.03	> 0.03	> 0.03	> 40	> 2.1

TSP and PM emission factors are to a large extend based on measurements without condensed compounds, according to CEN-TS 15883, annex I. PAH measurement data contain the following individual substances: Benzo(a)pyrene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Benzo(b)fluoranthene, Benzo(j)fluoranthene, Benzo(ghi)perylene, Anthracene, Benzo(a)anthracene, Chrysene(+Trihenylene) and Dibenz(a,h)anthracene, as a specific part of US EPA.

Trend Discussion for Key Sources

The following charts give an overview and assistance for explaining dominant emission trends of selected pollutants.

gallery size="medium" : 1A4bi_AR.png gallery

Annual fluctuations of all fuel types in source category *1.A.4.b.i* depend on heat demand subject to winter temperatures. Between 1990 and 2002 the fuel use changed considerably from coal & lignite to natural gas. The consumption of light heating oil decreased as well. As the activity data for light heating oil is based on the sold amount, it fluctuates due to fuel prices and changing storage amounts. In 2010 and 2013 fuel consumption was particularly high due to the cold winter. From 2014 - 2017 fuel demand increased due to lower temperatures during the heating period.

++ Sulfur Oxides & Nitrogen Oxides - SO,,x,, & NO,,x,,

gallery size="medium" : 1A4bi_EM_SO2.PNG : 1A4bi_EM_SO2_2000.png : 1A4bi_EM_NOx.PNG gallery

SO,,2,, emissions decrease due to the fuel switch from coal (especially lignite with a high emission factor) to natural gas with a lower emission factor. A further SO,,2,, reduction from 2008 onwards can be explained by the increasing use of low-sulfur fuel oil. Nowadays almost exclusively low-sulfur fuel oil is used. In contrast to SO,,2,, emissions NO,,X,, emission trend is less influenced by fuel characteristics but more by combustion conditions. Therefore NO,,X,, emission values shows lower reduction. During the last years the use of firewood gain influence.

++ Non-Methane Volatile Organic Compounds & Carbon Monoxide - NMVOC & CO gallery size="medium" : 1A4bi_EM_NMVOC.PNG : 1A4bi_EM_CO.png gallery

Main driver of the NMVOC emission trend is the decreasing lignite consumption. In the residential sector the emission trend is also affected by the increasing use of firewood with high emission factors which levels off the emission reduction. The explanation for decreasing carbon monoxide emissions is similar to the trend discussion for SO,,2,, and NMVOC. Since 1990 the fuel use changed from solid fuels, which causes high CO-emissions, to gaseous fuels, which produce less CO emissions.

++ Particulate Matter - PM,,2.5,, & PM,,10,, & TSP gallery size="medium" : 1A4bi_EM_PM2.5.PNG : 1A4bi_EM_PM10.PNG : 1A4bi_EM_TSP.PNG gallery

The emission trend for PM,,2.5,,, PM,,10,,, and TSP are also influenced severely by decreasing coal consumption in small combustion plants, particularly in the period from 1990 to 1994. Since 1995 the emission trend didn't change hardly. Increasing emissions in the last years are caused by the rising wood combustion in residential fire places and stoves.

++ Persistent Organic Pollutants gallery size="medium" : 1A4bi_EM_PCDDF.PNG : 1A4bi_EM_PAH.png : 1A4bi_EM_HCB.PNG gallery

The main driver of the POP emission trend are coal and fuelwood. PCDD/F emissions from coal fired furnaces are declining but the effect is retarded by increasing wood consumption. The same influencing variables apply accordingly to the PAH emission trends. The emission trend of HCB shows a high dominance of emissions from wood-burning. Data source for HCB emission factors is the EMEP/Corinair inventory guidebook 2006. Insofar, emission factors are constant from 1990 to 2016. Furthermore, the difference between the EFs for coal and fuelwood is very big. Therefore, the emission trend depends solely on the development of fuelwood consumption. Regarding HCB emissions the inventory is incomplete. This is one of the reasons for the importance of emissions from small combustion plants. In 2010, 2012 and 2013 emissions are particularly high because of the cold winter. It's known that in spite of the existing legislation, an unknown quantity of waste wood is illegally burnt. However, it's impossible to ascertain the fuel quantity, since the use of waste wood for heating purposes in small combustion plants it's illegal. Therefore all emission factors and emissions refer to the use of untreated wood.

Recalculations

Recalculations were necessary for the latest reference year (2018) due to the availability of the National Energy Balance. Germany has a federal structure which causes a time lack of the National Energy Balance. Therefore recalculations are always necessary. Further recalculations due to a comprehensive revision of biomass data.

> For 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

Currently it's planned to measure PAH for wood and coal fired stoves in order to replace summarized PAH emission factors by individual PAH emission factors. Otherwise emissions from small combustion plants are not comparable with emissions from the transport sector. In the case of availability of PCB emission factors according to the WHO TEQ for iron and steel and cement industry it's planned to replace country specific PCB emission factors for small combustion plants by using default values.