

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

## Short description



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

Method	AD	EF	Key Category Analysis
T2, T3	NS	CS, D	<b>L&amp;T</b> : NO <sub>x</sub> , SO <sub>x</sub> , PM <sub>2.5</sub> , PM <sub>10</sub> , BC, PAH; <b>L</b> : CO, NMVOC, TSP, Hg, PCDD/F, HCB

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

<b>Methods</b>	
<b>D</b>	Default
<b>RA</b>	Reference Approach
<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/CORINAIR Emission Inventory Guidebook - 2007, in the group specific chapters.	
<b>AD - Data Source for Activity Data</b>	
<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, surveys
<b>EF - Emission Factors</b>	
<b>D</b>	Default (EMEP Guidebook)
<b>C</b>	Confidential
<b>CS</b>	Country Specific
<b>PS</b>	Plant Specific data

## Methodology

### Activity data

For further information on activity data please refer to the [superordinate chapter](#) on small stationary combustion.

### Emission factors

For further information on the emission factors applied please refer to the [superordinate chapter](#) on small stationary combustion.

Table 1: Emission factors for domestic combustion installations

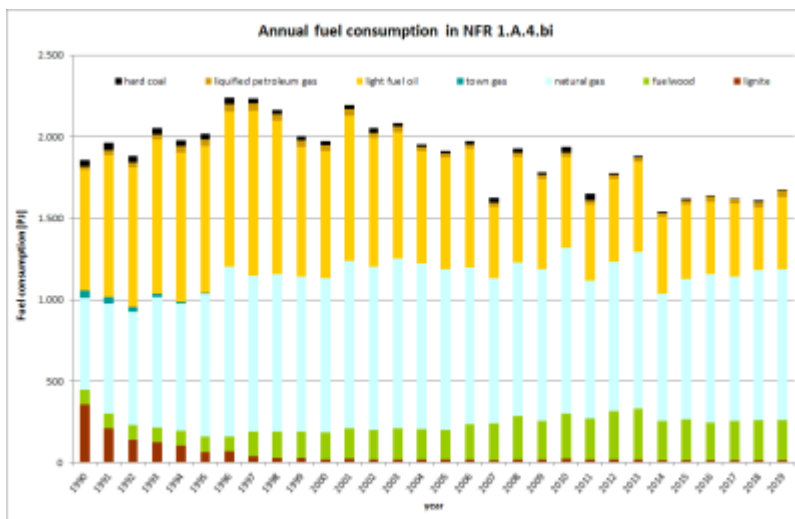
Pollutant	NO <sub>x</sub>	SO <sub>x</sub>	CO	NM <sub>VOC</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	PAH	PCDD/F
Fuel	[kg/TJ]							[mg/TJ]	[µg/TJ]
<b>Hard Coal</b>	61.1	385.5	3,422	67.0	18.5	17.6	15.7	60,000	20.8
<b>Hard Coal Coke</b>	40.0	458.6	5,448	11.5	16.6	15.8	14.2	100,000	45.7
<b>Hard Coal Briquettes</b>	50.4	563.5	4,875	184.1	265.4	252.8	227.3	100,000	20.2
<b>Lignite Briquettes</b>	87.0	421.6	2,349	158.0	79.5	76.5	68.2	90,000	24.8
<b>Natural Wood</b>	69.9	8.1	1,632	126.6	75.9	74.3	70.7	600,000	45.2

Pollutant	NO <sub>x</sub>	SO <sub>x</sub>	CO	NM VOC	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	PAH	PCDD/F
Fuel	[kg/TJ]							[mg/TJ]	[µg/TJ]
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 extent 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.

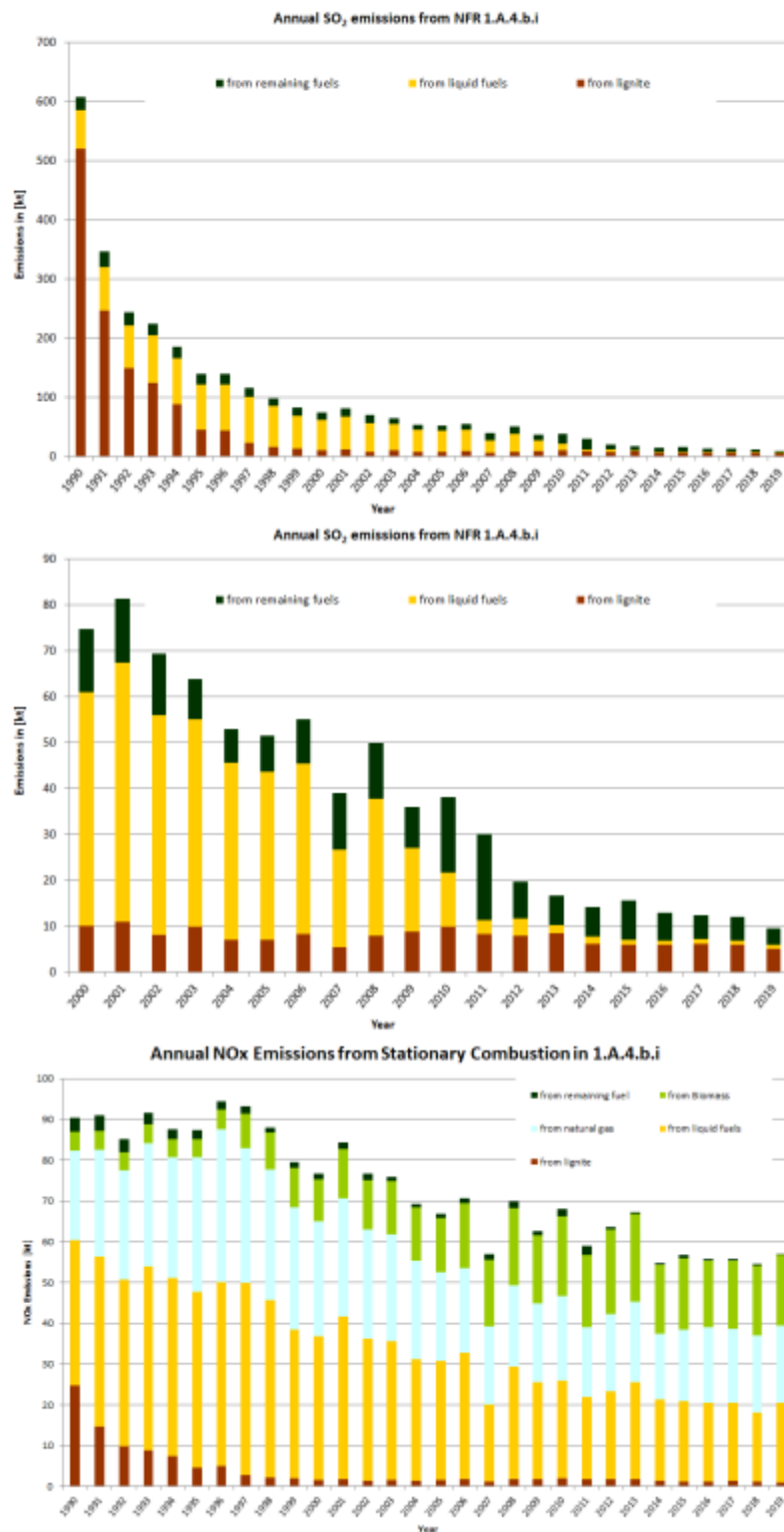
## Trend Discussion for Key Sources

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



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<sub>x</sub> & NO<sub>x</sub>



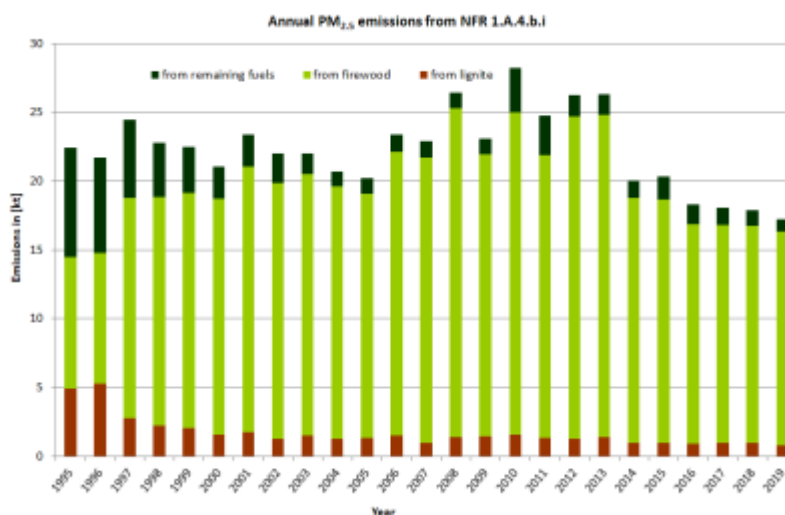
SO<sub>2</sub> emissions decrease due to the fuel switch from coal (especially lignite with a high emission factor) to natural gas with a lower emission factor. A further SO<sub>2</sub> reduction from 2008 onwards can be explained by the increasing use of low-sulfur fuel oil. Nowadays almost exclusively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

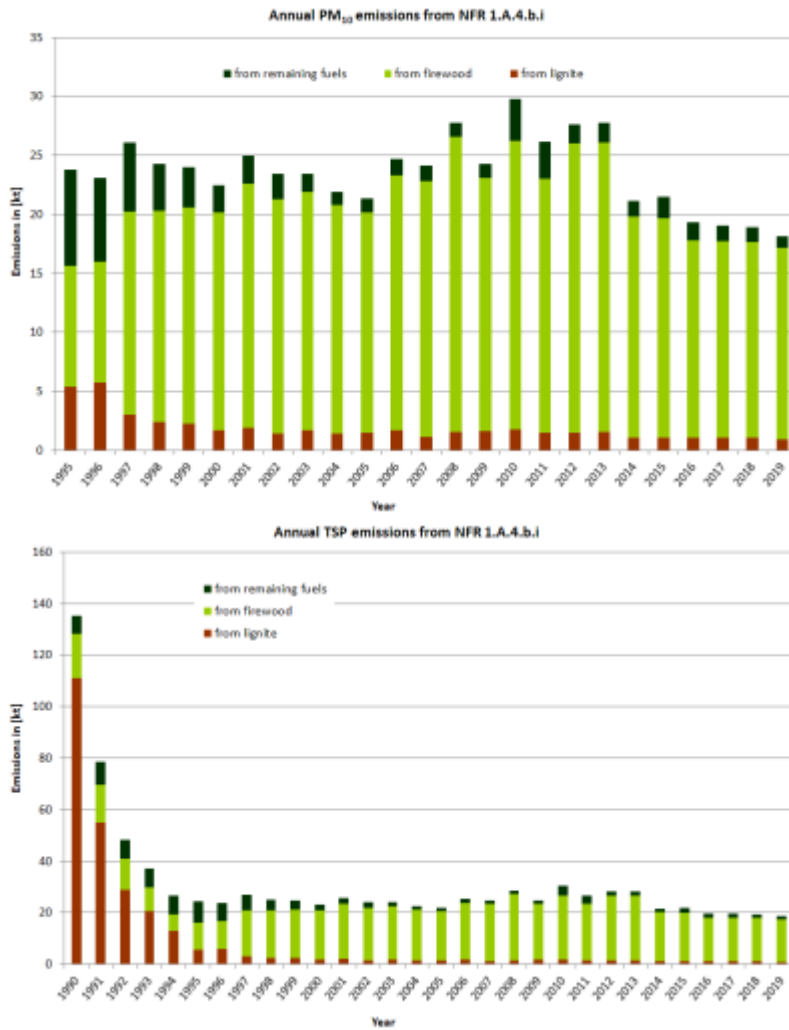
## Non-Methane Volatile Organic Compounds & Carbon Monoxide - NMVOC & CO



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  $\text{SO}_2$  and NMVOC. Since 1990 the fuel use changed from solid fuels, which causes high CO-emissions, to gaseous fuels, which produce less CO emissions.

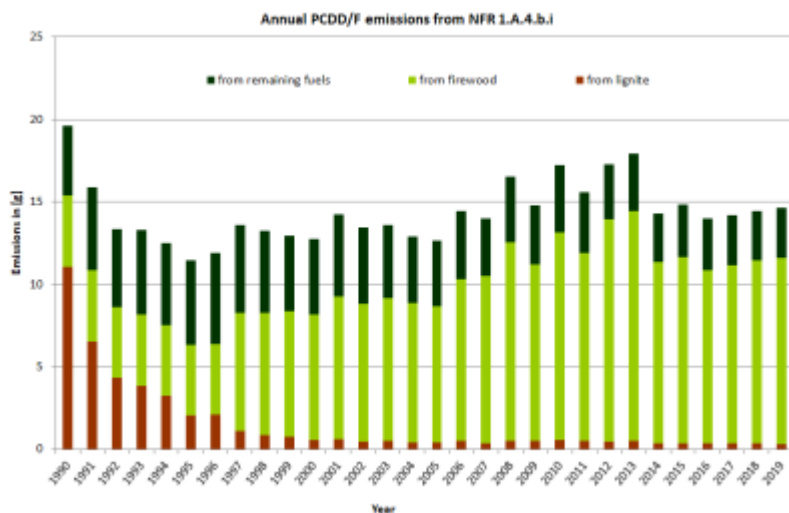
## Particulate Matter - PM<sub>2.5</sub> & PM<sub>10</sub> & TSP

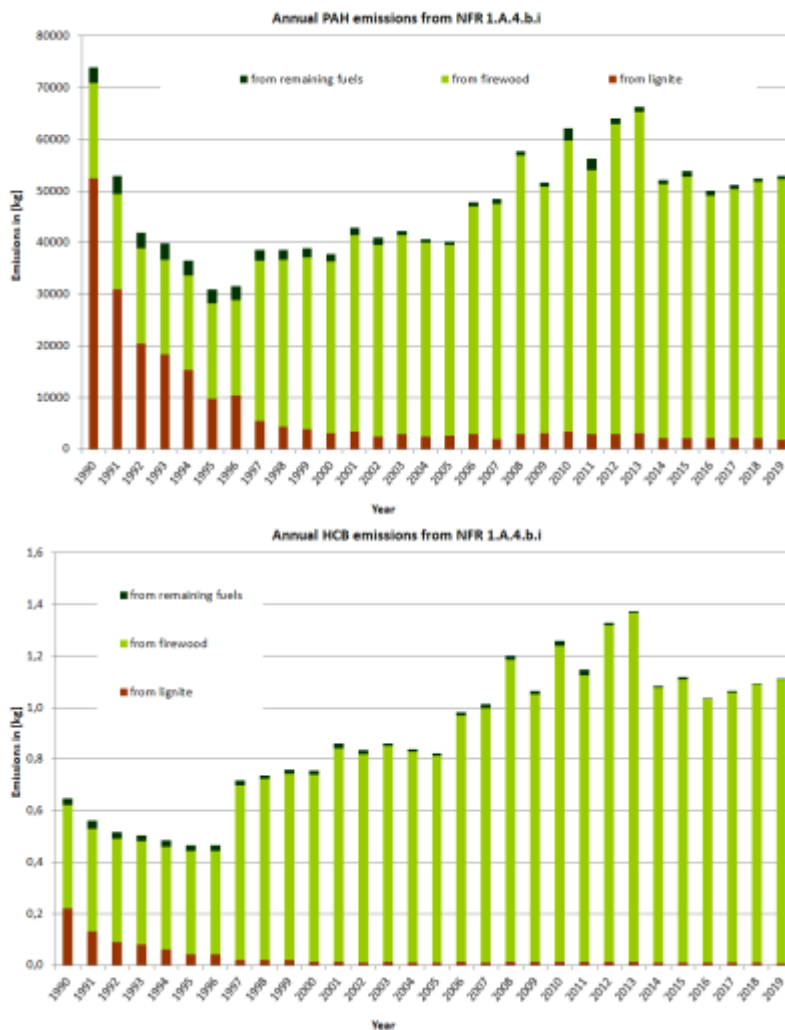




The emission trend for PM<sub>2.5</sub>, PM<sub>10</sub>, and TSP are also influenced severely by decreasing coal consumption in small combustion plants, particularly in the period from 1990 to 1994. Since 1995 the emission trend didn't change hardly. Increasing emissions in the last years are caused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

## Persistent Organic Pollutants





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 PAH Emission factors.



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

There is a running Project on new emission factors for small combustion plants using updated data from the chimney sweepers and new measurement data.