1.A.3.b v - Gasoline Evaporation

Short description

In category *1.A.3.b v - Road Transport: Gasoline evaporation* fugitive emissions from the evaporation of gasoline from road vehicles are reported.

Category Code	Method					AD					EF				
1.A.3.b v	T2					NS, M					CS, M				
Key Category	**SO_2**	**NO_x**	**NH_3**	**NMVOC**	**CO**	**BC**	**Pb**	**Hg**	**Cd**	**Diox**	**PAH**	**HCB**	**TSP**	**PM_{10}**	**$PM_{2.5}$**
1.A.3.b v	-	-	-	L/T	-	-	-	-	-	-	-	-	-	-	-

Methodology

Activity data

Specific data for gasoline evaporation from road vehicles are generated within TREMOD [1)]. - The following table provides an overview of annual amounts of gasoline evaported from road vehicles in Germany.

Table 1: Annual amount of gasoline evaporated from road vehicles, in kilotonnes

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
PCs	10.915	9.222	8.541	7.514	7.078	6.694	6.382	6.328	6.173	6.085	5.775	5.725	5.720	5.505	5.506	5.619	5.340	5.362
LDVs	174	164	147	95	85	76	66	60	55	51	46	43	47	49	53	59	63	69
Mopeds	48	41	43	47	48	52	54	62	58	57	54	56	56	59	59	59	58	59
Motorcycles	102	94	198	215	207	198	184	168	154	142	131	124	129	136	138	143	136	140
Σ 1.A.3.b v	**11.283**	**9.521**	**8.928**	**7.871**	**7.417**	**7.020**	**6.686**	**6.618**	**6.440**	**6.335**	**6.006**	**5.949**	**5.952**	**5.749**	**5.756**	**5.880**	**5.598**	**5.631**

source: TREMOD 6.02 [2)]

(Implied) Emission factors

Tier3 emission factors representing the effect of mitigation technologies are derived from TREMOD (Knörr et al., 2020a) [3)].

Table 2: Overview of implied emission factors per vehcile type, in kg/t

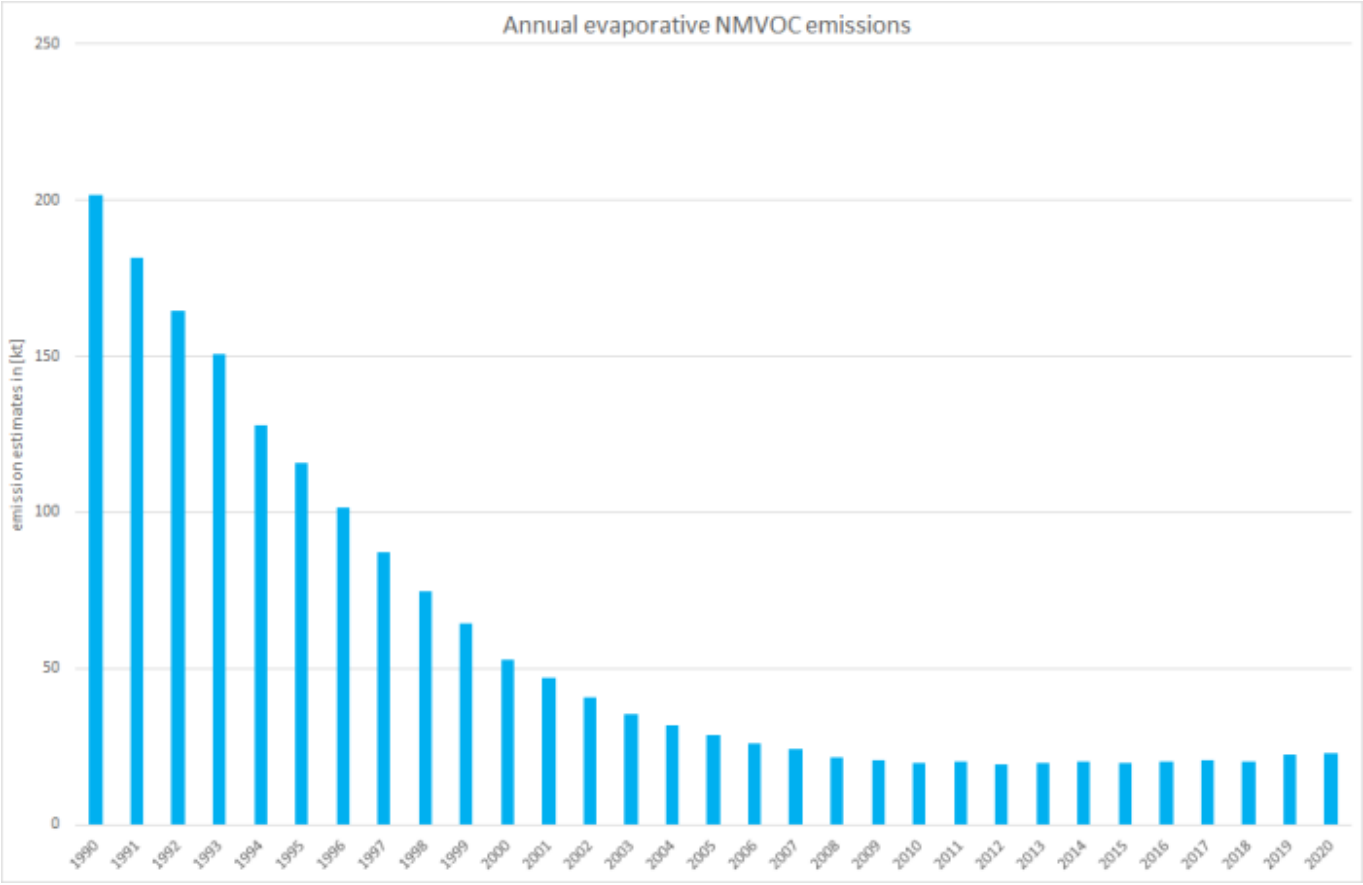
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
PCs	17.7	11.9	5.51	3.14	2.96	2.94	2.67	2.58	2.56	2.63	2.66	2.73	2.79	2.86	2.91	2.93	3.00	3.42
LDVs	23.6	19.2	12.9	8.9	8.67	8.22	6.67	6.26	5.91	5.83	5.47	5.50	5.11	5.00	4.76	4.45	4.01	3.80
Mopeds	37.4	19.2	18.4	16.4	16.1	15.5	15.2	14.6	14.6	14.7	14.7	14.5	14.5	14.3	14.3	14.4	14.3	14.3
Motorcycles	23.3	24.8	16.2	15.8	16.1	16.5	16.1	17.4	18.8	20.5	21.8	23.6	23.3	22.5	22.7	22.5	23.1	22.7

Discussion of emission trends

Table: Outcome of Key Category Analysis

for:	**NMVOC**
by:	L/T

NFR 1.A.3.b v is key source for emissions of Non-Methane Volatile Organic Compounds - NMVOC. *(fugitive emissions only; no NMVOC emissions from fuel combustion included)*



Since its maximum level of over 11,000 kilotonnes in 1990, the amount of evaporated gasoline is decreasing - and so are the related NMVOC emissions. The amounts of evaporated gasoline are connected directly with those of gasoline consumed. Here, the decrease becomes sharper from 2000 onwards following a growing switch from gasoline to diesel oil especially in passenger cars. Here, the annual amounts of NMVOC emissions from evaporation not only depend directly on the amount of evaporated gasoline but also on the number of vehicles equipped with mitigation technologies. Thus, the decrease is sharpest straight after 1990 and since then slowing down.

Recalculations

Due to a broad revision of the TREMOD model carried out to keep in line with the new HBEFA 4.1, **activity data** and **emission factors** have been checked and **revised for all years**.

Table 3: Revised annual amounts of evaporated gasoline, in kilotonnes

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Submission 2021	11.239	9.521	8.928	7.871	7.417	7.020	6.686	6.618	6.440	6.335	6.006	5.949	5.952	5.749	5.756	5.880	5.598
Submission 2020	11.267	9.561	8.964	7.895	7.424	7.030	6.695	6.625	6.447	6.342	6.015	5.959	5.948	5.747	5.730	5.752	5.392
absolute change	-28,8	-40,6	-35,4	-23,6	-6,25	-9,92	-8,21	-7,54	-7,08	-6,71	-8,68	-10,4	3,91	1,96	26,5	128	205
relative change	-0,26%	-0,42%	-0,39%	-0,30%	-0,08%	-0,14%	-0,12%	-0,11%	-0,11%	-0,11%	-0,14%	-0,18%	0,07%	0,03%	0,46%	2,22%	3,81%

In addition, the NMVOC **emission factors** applied were revised for all years. However, this revision can only be displayed for the implied emission factors:

Table 4: Revised implied emission factors for NMVOC emissions from evaporated gasoline, in kg/t

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
PASSENGER CARS																	
Submission 2021	17,7	11,9	5,51	3,14	2,96	2,94	2,67	2,58	2,56	2,63	2,66	2,73	2,79	2,86	2,91	2,93	3,00

Submission 2020	18,82	12,45	5,63	3,15	2,98	2,95	2,68	2,58	2,56	2,63	2,66	2,73	2,80	2,78	2,84	2,91	3,03
absolute change	-1,12	-0,57	-0,12	-0,01	-0,02	-0,02	-0,01	0,00	0,00	0,00	0,00	0,01	0,00	0,08	0,07	0,02	-0,02
relative change	-5,96%	-4,60%	-2,16%	-0,41%	-0,69%	-0,52%	-0,24%	-0,09%	0,03%	0,08%	0,13%	0,20%	-0,08%	2,97%	2,54%	0,75%	-0,79%
LIGHT-DUTY VEHICLES																	
Submission 2021	23,6	19,2	12,9	8,9	8,67	8,22	6,67	6,26	5,91	5,83	5,47	5,50	5,11	5,00	4,76	4,45	4,01
Submission 2020	24,9	20,0	13,9	10,33	9,6	9,3	7,86	7,47	7,13	7,11	6,65	6,69	6,49	6,01	5,92	5,74	5,29
absolute change	-1,3	-0,81	-1,02	-1,45	-0,97	-1,05	-1,19	-1,22	-1,22	-1,28	-1,19	-1,19	-1,38	-1,02	-1,16	-1,29	-1,28
relative change	-5,21%	-4,03%	-7,35%	-14,0%	-10,1%	-11,3%	-15,1%	-16,3%	-17,2%	-18,0%	-17,8%	-17,8%	-21,2%	-16,9%	-19,6%	-22,5%	-24,2%
MOPEDS																	
Submission 2021	37,4	19,2	18,4	16,4	16,1	15,5	15,2	14,6	14,6	14,7	14,7	14,5	14,5	14,3	14,3	14,4	14,3
Submission 2020	37,4	23,7	21,1	17,6	17,1	16,4	15,9	15,1	15,0	14,9	14,8	14,6	14,4	13,8	13,9	14,0	14,3
absolute change	0,00	-4,49	-2,76	-1,25	-1,05	-0,83	-0,66	-0,49	-0,38	-0,27	-0,15	-0,04	0,06	0,47	0,44	0,41	0,03
relative change	0,00%	-19,0%	-13,0%	-7,10%	-6,11%	-5,07%	-4,18%	-3,23%	-2,51%	-1,78%	-1,04%	-0,30%	0,41%	3,40%	3,17%	2,93%	0,24%
MOTORCYCLES																	
Submission 2021	23,3	24,8	16,2	15,8	16,1	16,5	16,1	17,4	18,8	20,5	21,8	23,6	23,3	22,5	22,7	22,5	23,1
Submission 2020	23,3	24,8	16,2	15,8	16,5	16,5	16,1	17,4	18,8	20,5	21,8	23,6	23,3	21,8	22,2	22,4	22,4
absolute change	0,00	0,00	0,00	0,00	-0,46	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,00	0,65	0,44	0,10	0,66
relative change	0,00%	0,00%	0,00%	0,00%	-2,81%	0,00%	0,00%	0,00%	0,00%	0,01%	0,05%	0,07%	0,00%	2,99%	1,98%	0,44%	2,95%

As a result, **NMVOC emissions from gasoline evaporation** were re-estimated as follows:

Table 6: Re-estimated NMVOC emissions, in kilotonnes

	1990	**1995**	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Submission 2021	201	116	52,9	28,6	25,8	24,4	21,3	20,5	19,9	20,0	19,3	19,6	20,0	19,9	20,3	20,8	20,3
Submission 2020	215	122	54,6	29,1	26,1	24,7	21,5	20,7	20,0	20,1	19,3	19,7	20,1	19,4	19,7	20,3	19,7
absolute change	-13,3	-6,30	-1,68	-0,49	-0,37	-0,31	-0,20	-0,16	-0,13	-0,11	-0,09	-0,08	-0,08	0,51	0,52	0,53	0,53
relative change	-6,2%	-5,2%	-3,1%	-1,7%	-1,4%	-1,3%	-0,9%	-0,8%	-0,6%	-0,5%	-0,5%	-0,4%	-0,4%	2,6%	2,6%	2,6%	2,7%

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

Besides a routine revision of the underlying model, no specific improvements are planned.

[1), 3)] Knörr et al. (2019a): Knörr, W., Heidt, C., Gores, S., & Bergk, F.: ifeu Institute for Energy and Environmental Research (Institut für Energie- und Umweltforschung Heidelberg gGmbH, ifeu): Fortschreibung des Daten- und Rechenmodells: Energieverbrauch und Schadstoffemissionen des motorisierten Verkehrs in Deutschland 1960-2035, sowie TREMOD, im Auftrag des Umweltbundesamtes, Heidelberg & Berlin, 2020.
[2)] (bibcite 1)