

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				
	NO _x	NM VOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC	CO	Pb	Cd	Hg	Diox	PAH	HCB
Key Category:	-	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 evaporated 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	2020	2021
PCs	10,926	9,239	8,537	7,512	7,075	6,691	6,379	6,324	6,169	6,081	5,770	5,720	5,713	5,495	5,491	5,598	5,313	5,328	4,901	4,807
LDVs	213	203	182	113	100	90	76	68	62.0	56.1	50.7	47.6	51.2	53.0	57.5	64.0	69.4	76.6	77.4	83.3
Mopeds	50.2	42.2	43.9	48.0	48.5	52.6	55.0	62.9	59.0	57.8	54.9	56.7	56.9	59.6	59.6	58.7	58.2	59.0	62.3	56.5
Motorcycles	105	97.0	204	220	211	201	187	171	156	144	132	125	131	137	139	144	136	139	145	129
Σ 1.A.3.b v	11,283	9,581	8,967	7,894	7,435	7,035	6,697	6,626	6,446	6,339	6,008	5,949	5,952	5,745	5,748	5,864	5,576	5,602	5,186	5,076

source: TREMOD

(Implied) Emission factors

Tier3 emission factors representing the effect of mitigation technologies are derived from TREMOD.

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

	Mitigation	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PCs	Euro_1_I	0,17	1,04	1,58	2,07	2,22	2,39	2,48	2,56	2,66	2,81	2,89	3,00	3,09	3,21	3,27	3,31	3,42	3,58	4,05
	Euro_2_II		1,13	1,61	2,10	2,24	2,40	2,46	2,58	2,72	2,91	3,07	3,28	3,48	3,75	3,96	4,15	4,46	4,84	5,57
	Euro_3_III			1,59	2,08	2,21	2,37	2,39	2,48	2,58	2,73	2,87	3,03	3,17	3,39	3,55	3,69	3,94	4,33	5,00
	Euro_4_IV			1,37	1,62	1,70	1,79	1,76	1,79	1,86	1,99	2,11	2,25	2,38	2,54	2,66	2,77	2,95	3,37	3,87
	Euro_5_V							1,39	1,39	1,46	1,53	1,60	1,69	1,77	1,91	2,04	2,16	2,35	2,89	3,33
	Euro_6ab_VI								1,47	1,63	1,56	1,56	1,42	1,43	1,48	1,53	1,58	1,67	2,24	2,62
	Euro_6c_VI																0,24	1,31	1,82	2,11
	Euro_6d_temp_VI																0,25	0,24	1,73	1,99
	Euro_6d_VI																	0,39	1,70	2,26
	pre-Euro	22,4	29,2	32,6	32,3	31,5	32,1	31,5	29,2	28,8	28,9	28,3	28,4	28,4	26,1	26,0	26,0	26,5	26,9	26,9
LDVs	Euro_1_I		0,72	1,11	1,75	1,89	2,12	2,24	2,55	2,82	3,18	3,40	3,73	3,58	3,66	3,55	3,40	2,95	2,74	2,86
	Euro_2_II			0,80	1,31	1,45	1,64	1,78	2,06	2,32	2,67	2,90	3,23	3,16	3,30	3,25	3,16	2,85	2,72	2,88
	Euro_3_III				0,81	0,95	1,07	1,20	1,40	1,60	1,87	1,98	2,24	2,24	2,37	2,38	2,37	2,18	2,14	2,32
	Euro_4_IV				0,63	0,85	0,90	0,91	0,98	1,09	1,26	1,49	1,74	1,78	1,91	1,97	2,02	1,97	2,08	2,30
	Euro_5_V							0,25	0,37	0,86	0,86	0,89	1,00	0,99	1,04	1,08	1,14	1,15	1,32	1,50
	Euro_6ab_VI										0,47	0,58	0,93	0,74	0,75	0,73	0,71	0,69	0,83	0,93
	Euro_6c_VI																	0,21	0,20	0,19
	Euro_6d_temp_VI																	0,19	0,18	0,18
	Euro_6d_VI												0,17	0,18	11,20	12,04	12,26	12,22	14,36	3,41
	pre-Euro	23,6	20,3	20,4	21,1	21,1	21,7	22,1	23,4	24,3	25,9	24,0	24,8	23,8	23,1	21,6	20,3	19,4	18,9	18,9

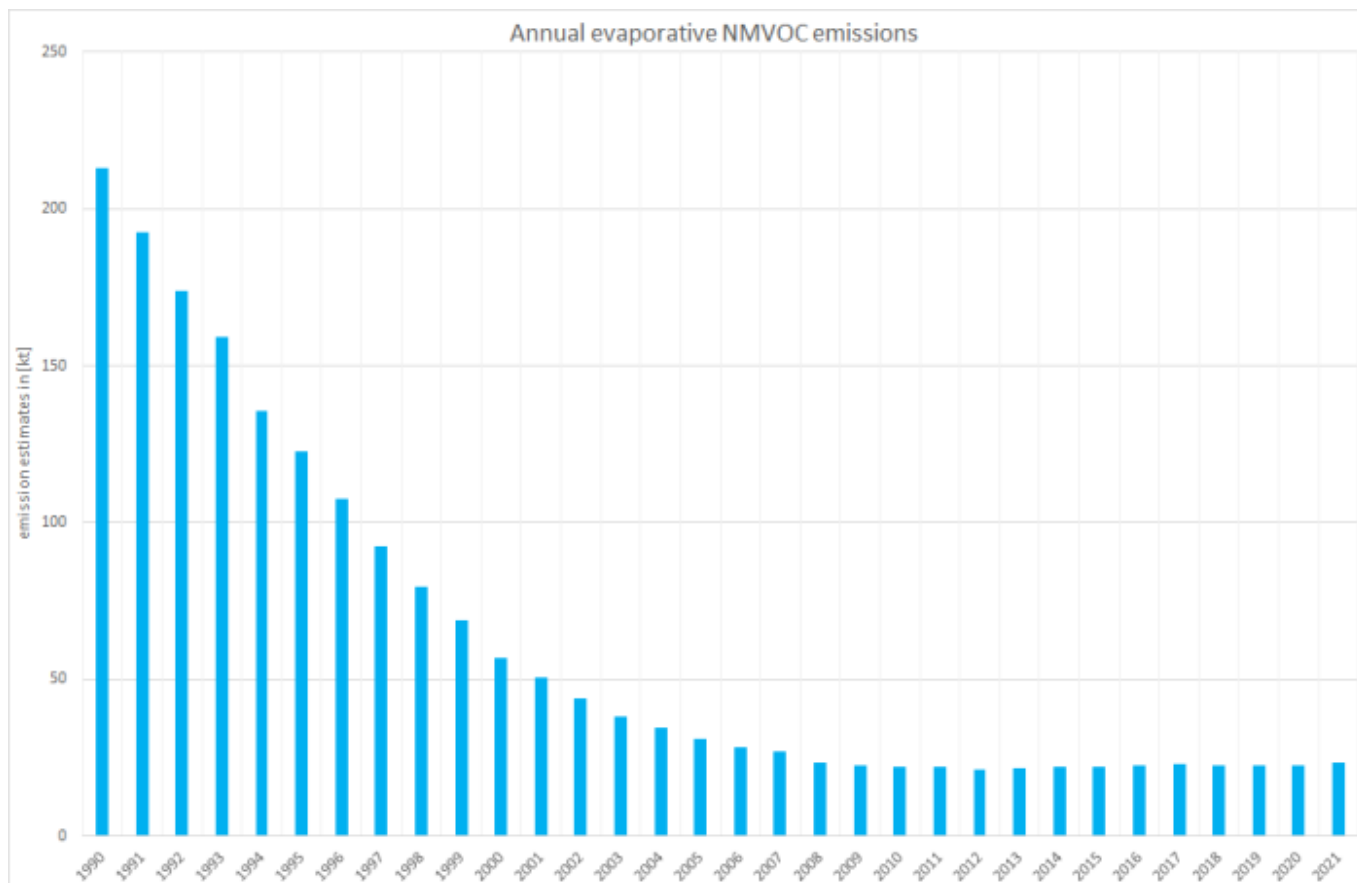
	Mitigation	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mopeds	Euro_1_I			16,6	15,0	14,9	14,7	14,6	14,3	14,6	14,9	15,2	15,4	15,8	16,0	16,4	16,9	17,1	17,3	17,6
	Euro_2_II			0	13,2	12,9	12,4	12,1	11,6	11,6	11,7	11,3	11,2	11,2	11,3	11,3	11,5	11,5	11,7	12,0
	Euro_4_IV																	9,34	9,26	9,33
	Euro_5_V																			
	pre-Euro	37,4	19,2	19,9	18,0	17,9	17,5	17,4	17,0	17,4	17,7	17,9	18,0	18,2	18,1	18,3	18,8	18,8	18,8	19,1
Motorcycles	Euro_1_I			14,2	14,0	14,6	15,5	15,4	17,1	18,8	21,0	23,0	25,5	25,9	25,7	26,7	27,2	28,3	28,3	28,9
	Euro_2_II				11,0	11,4	12,2	12,3	13,8	15,3	17,1	18,8	21,0	21,3	21,3	22,2	22,7	23,7	23,9	24,6
	Euro_3_III				10,7	8,5	8,8	8,9	10,0	11,0	12,3	13,3	14,6	14,6	14,3	14,6	14,8	15,6	15,7	16,2
	Euro_4_IV														14,0	14,6	15,2	15,8	15,8	16,2
	Euro_5_V																			
	pre-Euro	23,3	24,8	16,6	17,6	18,3	19,3	19,1	21,2	23,4	26,0	28,4	31,3	31,6	31,0	31,9	32,1	33,0	32,6	32,8

Discussion of emission trends

Table 3: Outcome of Key Category Analysis

for:	NMVO
by:	Level & Trend

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

Activity data have been revised for all years as of 2013.

Table 4: Revised annual amounts of evaporated gasoline, in kilotonnes

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
current submission	11,294	9,581	8,967	7,894	6,446	6,339	6,008	5,949	5,952	5,745	5,748	5,864	5,576	5,602	5,186
previous submission	11,239	9,521	8,928	7,871	6,440	6,335	6,006	5,948	5,951	5,745	5,748	5,865	5,577	5,601	5,187
absolute change	55.8	60.5	38.9	22.4	5.44	4.50	2.49	1.06	0.77	0.15	0.00	-0.63	-0.18	0.87	-1.61
relative change	0.50%	0.64%	0.44%	0.28%	0.08%	0.07%	0.04%	0.02%	0.01%	0.00%	0.00%	-0.01%	0.00%	0.02%	-0.03%

In addition, the NMVOC **emission factors** applied were revised for several years.

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

Table 5: Re-estimated NMVOC emissions, in kilotonnes

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
current submission	213	123	56.7	31.1	22.0	22.2	21.3	21.7	22.1	22.1	22.5	23.1	22.5	22.7	22.7
previous submission	201	116	52.9	28.6	19.9	20.0	19.3	19.6	20.0	19.9	20.2	20.7	20.1	22.2	22.8
absolute change	11.7	6.74	3.74	2.50	2.14	2.14	2.08	2.09	2.09	2.28	2.29	2.34	2.32	0.50	-0.08
relative change	5.79%	5.82%	7.07%	8.75%	10.79%	10.70%	10.81%	10.65%	10.46%	11.47%	11.33%	11.27%	11.53%	2.23%	-0.37%



For **pollutant-specific information on recalculated emission estimates for Base Year and 2019**, please see the recalculation tables following [chapter 8.1 - Recalculations](#).

Planned improvements

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

¹⁾ Knörr et al. (2021a): 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, 2021.