

Emission factors used in the estimations of emissions from combustion

In the calculations the numbers are used with the highest available accuracy. In these tables though, they are only shown rounded off.

In the tables, dotted cells indicate combinations of fuel and source without consumption. Last update: November 2021

CO₂, SO₂ and heavy metals - Stationary and mobile combustion

Table 1. General emission factors for CO₂, SO₂ and heavy metals

	CO ₂ tonne/tonne ²	SO ₂ ¹ kg/tonne ²	Pb g/tonne ²	Cd g/tonne ²	Hg g/tonne ²	As g/tonne ²	Cr g/tonne ²	Cu g/tonne ²
Coal	2.52	16 ³	0.2 ³	0.003 ³	0.05 ³	0.089 ³	0.065 ³	0.087 ³
Coke	3.19	18	0.2 ³	0.003 ³	0.05 ³	0.089 ³	0.065 ³	0.087 ³
Petrol coke	3.59	18	0.2	0.003	0.05	0.089	0.065	0.087
Charcoal.....	0	0.32	0.8	0.38	0.02	0.01	0.68	0.18
Motor gasoline	3.13	0.010	0.03 ⁴	0.01	0,0084	0.05	0.05	1.7
Aviation gasoline	3.13	0.4	675.7	0.01	0	0.05	0.05	1.7
Kerosene (heating)	3.15	0.382	0.07	0.01	0.03	0.05	0.04	0.05
Jet kerosene	3.15	0.318	0.07	0.01	0.03	0.05	0.05	0.05
Auto diesel	3.17 ⁵	0.0156⁶	0.1	0.01	0,0023	0.05	0.05	1.7
Marine gas oil/diesel	3.17	1.156	0.1	0.01	0.05	0.05	0.04	0.05
Light fuel oils	3.17	1.442	0.1	0.01	0.05	0.05	0.04	0.05
Heavy distillate	3.17	5.3826	0.1	0.01	0.05	0.05	0.04	0.05
Heavy fuel oil	3.2	18.62⁷	1	0.1	0.2	0.057	1.35	0.53
Crude oil	3.2	17.88	1	0.1	0.2	0.057	1.35	0.53
Bio ethanol ¹⁰	1.91	0.0092	0.03	0.01	0.01	0.05	0.05	1.7
Bio diesel ¹⁰	2.85	0.0148	0.1	0.01	0	0.05	0.05	1.7
Natural gas (1000 Sm ³)	1.99/ 2.34⁸	0	0.00025	0.002	0.001	0.004	0.021	0.016
LPG	3	0	0	0	0	0.004	0.021	0.016
Refinery gas	2.8	0	0	0	0	0.004	0.021	0.016
CO gas	1.571	0	0	0	0	0.004	0.021	0.016
Fuel gas	2.5	0	0	0	0	0.004	0.021	0.016
Landfill gas	0	0.019	0	0	0	0.004	0.021	0.016
Biogas	0	0	0.00025	0.0017	0.001	0.0038	0.021	0.016
Fuel wood	0	0.348	0.487	0.16	0.0025	0.00036	0.152	0.354
Wood waste	0	0.37	0.05	0.1	0.010244	0.159	0.152	0.354
Wood pellets	0	0.37	0.05	0.1	0.1	0.159	0.152	0.354
Wood briquettes	0	0.37	0.05	0.1	0.1	0.159	0.152	0.354
Black liquor	0	0.37	0.05	0.1	0.010244	0.159	0.152	0.354
Municipal waste	0.5498⁹	1.4	0.00304	0.00015	0.00016	0.022	0.001	0.000985
Special waste	3.2	9.2	14	0.6	0.2	1	31	25

¹ Applies to 2019 for petroleum products; the factors change yearly, in accordance with changes in the sulphur content in the products.

² Natural gas: 1000 Sm³.

³ Exceptions: Direct-fired furnaces in cement production = 9.1 and small stoves in households = 20.

⁴ From 1997 - considerably higher earlier years. Earlier used factors are not shown in this Appendix.

⁵ Bio ethanol and bio diesel are established as separate products

⁶ Applies to road traffic.

⁷ Stationary combustion.

⁸ Respectively dry gas (domestic use) and rich gas (continental shelf).

⁹ The factor increases through the period, from 0.4874 in 1990. Exact figures can be given at request.

¹⁰ CO₂ emission from biofuels are set to 0 in the statistics Emissions to air. They are included in international reports.

Numbers in italics have exceptions for some sectors, see table 2 and 5. Bold numbers are different for different years, see table B3, B4 and B5. Source: Rosland (1987), (Norwegian pollution control authority (1990), (Sandgren *et al.* (1996), Finstad *et al.* (2001) Finstad *et al.* (2002) and Finstad and Rypdal (2003).

Table 2. Exceptions from the general emission factors for heavy metals: Solid fuels in small stoves (households)

	Pb g/tonne	Cd g/tonne	Hg g/tonne	As g/tonne	Cr g/tonne	Cu g/tonne
Coal	2.5	0.15	0.3	1.2	0.9	1.2
Coke	2.5	0.15	0.3	1.2	0.9	1.2

Table 3. Time series for variable emission factors for SO₂ (kg/tonne)

Years	V11 Motor gasoline/V23 Bio ethanol	V13 Kerosene (heating)	V14 Jet kerosene	V15 Auto diesel/V24 Bio diesel/V25 fossil part of bio diesel			V17 Marine gas oil/diesel	V18 Light fuel oils	V19 Heavy distillate	V20 Heavy fuel oil (LS-oil)	V20 Heavy fuel oil (NS-oil)	
	General	General	General	General	M.1A3B.1 Passenger cars	M.1A3B.2 Light duty vehicles	M.1A3B.3 Heavy duty vehicles	General	General	General	General	General
1980	1	0.2	0.2	6.6	.	.	.	6.6	6.6	15	19	46
1987	0.7	0.4	0.4	4.4	.	.	.	4.4	4.4	9	19	44
1989	0.6	0.4	0.4	3.4	.	.	.	3.4	3.4	7.6	18.2	40
1990	0.6	0.3	0.3	3.2	.	.	.	3.2	3.2	6	17	39.4
1991	0.6	0.38	0.38	2.8	.	.	.	2.8	2.8	4.6	16.8	43.6
1992	0.6	0.32	0.32	2.6	.	.	.	2.6	2.6	4.4	16.4	42.6
1993	0.6	0.42	0.42	2.2	.	.	.	2.2	2.2	4.4	16.2	45.8
1994	0.6	0.36	0.36	1.4	.	.	.	1.4	1.4	4.2	14.2	44.8
1995	0.24	0.46	0.46	1.4	.	.	.	1.4	1.4	4.6	11.8	43.4
1996	0.22	0.46	0.5	1.2	.	.	.	1.2	1.2	3.8	12.6	46.6
1997	0.16	0.46	0.46	1.2	.	.	.	1.2	1.2	3.8	12.6	47.2
1998	0.16	0.42	0.42	0.8	.	.	.	1.8	1.8	4.2	12.4	42.8
1999	0.22	0.32	0.32	0.6	.	.	.	1.6	1.6	4.4	12.8	39
2000	0.18	0.36	0.36	1.4	0.1174	0.1174	0.1174	1.8	1.8	4.6	14.4	31
2001	0.18	0.46	0.46	0.8	0.0885	0.0885	0.0885	1.8	1.8	4.8	13.2	44.4
2002	0.2	0.32	0.32	0.6	0.0708	0.0708	0.0708	1.6	1.2	4.8	12	43.8
2003	0.1	0.3	0.3	0.8	0.0748	0.0748	0.0748	2	0.8	4.6	14	44.2
2004	0.06	0.3	0.3	0.8	0.0748	0.0748	0.0748	1.8	0.8	5	14.2	44.2
2005	0.01	0.28	0.28	0.8	0.0278	0.0278	0.0278	1.8	0.8	4.6	13.6	39.2
2006	0.01	0.27	0.27	1.38	0.0393	0.0393	0.0393	2	1.38	4.44	10.4	26.2
2007	0.01	0.296	0.296	0.73	0.0244	0.0244	0.0244	1.53	0.73	4.17	17.8	20
2008	0.01	0.286	0.286	0.786	0.0285	0.0285	0.0285	1.562	0.986	3.098	17.5	28.5
2009	0.01	0.302	0.371	0.016	0.016	0.016	0.016	1.069	0.949	4.31	17.4	27.8
2010	0.01	0.324	0.294	0.015	0.015	0.015	0.015	1.184	0.978	4.31	17.5	28
2011	0.01	0.334	0.296	0.015	0.015	0.015	0.015	1.196	0.984	4.32	17.8	28.4
2012	0.01	0.326	0.294	0.015	0.015	0.015	0.015	1.038	0.658	4.295	17.5	27.4
2013	0.009	0.298	0.252	0.014	0.014	0.014	0.014	1.026	0.642	3.957	15.4	26.4
2014	0.01	0.342	0.252	0.014	0.014	0.014	0.014	1.054	0.648	4.263	15.5	27.0
2015	0.01	0.346	0.274	0.015	0.015	0.015	0.015	1.158	0.928	4.375	17.8	28.6
2016	0.009	0.372	0.286	0.015	0.015	0.015	0.015	1.188	0.986	4.586	17.9	29.2
2017	0.009	0.362	0.278	0.015	0.015	0.015	0.015	1.066	0.95	4.428	17.9	28.4
2018	0.009	0.344	0.282	0.015	0.015	0.015	0.015	1.07	0.95	4.427	17.9	28.6
2019	0.009	0.342	0.274	0.015	0.015	0.015	0.015	1.058	1.22	4.427	17.8	26.8
2020	0.010	0.382	0.318	0.016	0.016	0.016	0.016	1.156	1.44	5.383	18.6	37.4

Table 4. Time series for variable emission factors for heavy metals, stationary combustion. g/tonne

Sector	Source	Fuel	1990-1991			1992-		
			Pb	Cd	Hg	Pb	Cd	Hg
General	S.03	V51	0.0085	0.00047	0.00035	0.00304	0.00015	0.00016

Table 5. Exceptions with time series for variable emission factors for natural gas combusted by oil exploration, tonne CO₂/1000 Sm³ natural gas

Sector	Source	Fuel	Component	1990-1994	1995	1996	1997	1998	1999	2000	2001	2002*
230600.1	S.02	V31	CO ₂	2.34	2.29	2.3	2.3	2.31	2.5	2.48	2.47	2.45
230600.1	S.1B2C	V31	CO ₂	2.34	2.42	2.34	2.34	2.34	2.48	2.52	2.42	2.47

*For the years after 2002 reported emissions are used

Aviation - CH₄, N₂O, NO_x, NMVOC, CO, particles and PAH

Table 6. General emission factors for aviation

Source	Fuel	CH ₄ kg/ tonne	N ₂ O kg/ tonne	NO _x kg/ tonne	NMVOC kg/ tonne	CO kg/ tonne	NH ₃ kg/ tonne	TSP, PM ₁₀ , PM _{2.5} kg/tonne	Dioxins µg I- TEQ/ tonne
M.1A3A.11 Jet/turboprop 0-1000 m	V14 Jet kerosene	0.215	0.1	12.624	1.938	16.01	0	0.139	0.06
M.1A3A.12 Jet/turboprop cruise	V14 Jet kerosene	0	0.1	16.01	0.404	3.765	0	0.154	0.06
M.1A3A.21 Helicopter 0-1000 m	V14 Jet kerosene	3.2	0.1	6.67	28.8	36.6	0	0.025	0.06
M.1A3A.22 Helicopter cruise	V14 Jet kerosene	0	0.1	6.67	32	36.6	0	0.007	0.06
M.1A3A.31 Small aircraft 0-1000 m	V14 Jet kerosene	0.432	0.1	4.792	3.892	18.789	0	0	0
M.1A3A.32 Small aircraft cruise	V14 Jet kerosene	0	0.1	6.738	0.406	2.125	0	0	0.06
M.1A3A.11 Jet/turboprop 0-1000 m	V12 Aviation gasoline	0.215	0.1	12.624	1.938	16.010	0	0.139	2
M.1A3A.12 Jet/turboprop cruise	V12 Aviation gasoline	0	0.1	16.010	0.404	3.765	0	0.154	2
M.1A3A.21 Helicopter 0-1000 m	V12 Aviation gasoline	1.891	0.1	3.019	17.022	926.929	0	0.025	2
M.1A3A.22 Helicopter cruise	V12 Aviation gasoline	0	0.1	2.92	19.48	926	0	0.007	2
M.1A3A.31 Small aircraft 0-1000 m	V12 Aviation gasoline	0.402	0.1	4.792	3.892	18.789	0	0	2
M.1A3A.32 Small aircraft cruise	V12 Aviation gasoline	0	0.1	6.738	0.406	2.125	0	0	2

Table 6 (cont.). General emission factors for aviation

Source	Fuel	benzo(a)pyrene g/tonne	benzo(b)fluoranthene g/tonne	benzo(k)fluoranthene g/tonne	indeno(1,2,3-cd)pyrene g/tonne
M.1A3A.11 Jet/turboprop 0-1000 m	V14 Jet kerosene	0.005	0.009	0.003	0.011
M.1A3A.12 Jet/turboprop cruise	V14 Jet kerosene	0.005	0.009	0.003	0.011
M.1A3A.21 Helicopter 0-1000 m	V14 Jet kerosene	0.005	0.009	0.003	0.011
M.1A3A.22 Helicopter cruise	V14 Jet kerosene	0.005	0.009	0.003	0.011
M.1A3A.31 Small aircraft 0-1000 m	V14 Jet kerosene	0.005	0.009	0.003	0.011
M.1A3A.32 Small aircraft cruise	V14 Jet kerosene	0.005	0.009	0.003	0.011
M.1A3A.11 Jet/turboprop 0-1000 m	V12 Aviation gasoline	0.005	0.009	0.003	0.011
M.1A3A.12 Jet/turboprop cruise	V12 Aviation gasoline	0.005	0.009	0.003	0.011
M.1A3A.21 Helicopter 0-1000 m	V12 Aviation gasoline	0.005	0.009	0.003	0.011
M.1A3A.22 Helicopter cruise	V12 Aviation gasoline	0.005	0.009	0.003	0.011
M.1A3A.31 Small aircraft 0-1000 m	V12 Aviation gasoline	0.005	0.009	0.003	0.011
M.1A3A.32 Small aircraft cruise	V12 Aviation gasoline	0.005	0.009	0.003	0.011

Numbers in italics have exceptions for some sectors, see table 7, and bold numbers are different for different years, see table 8.

Source: Statistics Norway, Finstad *et al.* (2001), Finstad *et al.* (2002), EEA (2016). PAHs: Jet kerosene: EEA (2013), Aviation gasoline: Aarhus University (2016)

Table 7. Exceptions from the general factors for aviation

Component	Emission factor	Fuel	Source	Sectors
CH ₄	0.35	V14	Jet kerosene	M1A3A.21 248422
NO _x	13.857	V14	Jet kerosene	M1A3A.21 248422
NO _x	11.7	V14	Jet kerosene	M.1A3A.32 248422
NMVOG	7.372	V14	Jet kerosene	M1A3A.21 248422
NMVOG	4.3	V14	Jet kerosene	M.1A3A.22 248422
CO	23.236	V14	Jet kerosene	M1A3A.21 248422
CO	20.9	V14	Jet kerosene	M.1A3A.22 248422

Table 8. Time series, variable emission factors for aviation, jet kerosene

Component	Year	General			
		M.1A3A.11	M.1A3A.12	M.1A3A.31	M.1A3A.32
		(LTO 0-1000 m)	(cruise)	(LTO 0-1000 m)	(cruise)
CH ₄	1989-2010	0.187	0	0.429	0
	2011	0.19	0	0.467	0
	2012	0.188	0	0.453	0
	2013	0.189	0	0.498	0
	2014	0.192	0	0.543	0
	2015	0.189	0	0.524	0
	2016	0.186	0	0.5	0
	2017	0.178	0	0.47	0
	2018	0.171	0	0.471	0
	2019	0.166	0	0.402	0
	2020	0.215	0	0.432	0
NO _x	1989-2010	11.24	14.379	4.792	6.732
	2011	11.384	14.623	4.785	11.7
	2012	11.681	14.794	4.788	6.729
	2013	11.959	14.97	4.78	6.703
	2014	12.109	15.029	4.772	6.71
	2015	12.331	15.344	4.775	6.716
	2016	12.084	15.191	4.78	6.714
	2017	12.598	15.677	4.785	6.714
	2018	12.782	15.784	4.785	6.716
	2019	12.86	15.82	4.797	6.723
	2020	12.624	16.01	4.792	6.717
NMVOC	1989-2010	1.685	0.342	3.858	6.738
	2011	1.708	0.35	4.202	0.441
	2012	1.687	0.349	4.076	0.463
	2013	1.697	0.343	4.483	0.636
	2014	1.725	0.345	4.888	0.59
	2015	1.703	0.347	4.718	0.609
	2016	1.672	0.344	4.502	0.675
	2017	1.599	0.335	4.234	0.665
	2018	1.537	0.329	4.238	0.601
	2019	1.495	0.325	3.621	0.562
	2020	1.938	0.404	3.892	0.534

Table 8 (cont.) Time series for variable emission factors for aviation

Component	Year	General			
		M.1A3A.11 (LTO 0-1000 m)	M.1A3A.12 (cruise)	M.1A3A.31 (LTO 0-1000 m)	M.1A3A.32 (cruise)
CO	1989-2010	15.897	3.472	18.753	0.406
	2011	15.987	3.433	19.116	2.2
	2012	15.644	3.379	18.983	2.243
	2013	15.331	3.217	19.412	2.626
	2014	15.188	3.162	19.839	2.528
	2015	14.979	3.155	19.659	2.57
	2016	15.014	3.196	19.432	2.717
	2017	14.29	3.062	19.149	2.691
	2018	13.729	2.948	19.154	2.552
	2019	13.582	2.95	18.504	2.465
	2020	16.01	3.765	18.789	2.409
	TSP, PM10, PM2.5	1989-2010	0.113	0.15	0	0
2011		0.117	0.15	0	0
2012		0.12	0.152	0	0
2013		0.122	0.155	0	0
2014		0.123	0.155	0	0
2015		0.126	0.16	0	0
2016		0.122	0.155	0	0
2017		0.125	0.158	0	0
2018		0.122	0.158	0	0
2019		0.123	0.161	0	0
2020		0.139	0.154	0	0

Source: Statistics Norway

Road traffic - CH₄, N₂O, NO_x, NMVOC, CO, NH₃, particles and PAH

Table 9. General emission factors for road traffic

Source	Fuel	CH ₄ kg/tonne	N ₂ O kg/tonne	NO _x kg/tonne	NMVOC kg/tonne	CO kg/tonne	NH ₃ kg/tonne	TSP, PM ₁₀ kg/tonne	PM _{2.5} kg/tonne	Dioxins µg I- TEQ/tonne
M.1A3B.1 Passenger car	V11 Motor gasoline	0.258	0.017	2.624	4.828	30.397	0.561	0.024	0.024	0.1
	V15 Auto diesel	0.111	0.134	15.856	0.317	2.801	0.042	0.176	0.167	0.1
	V23 Bio ethanol	0.258	0.017	2.624	4.828	30.397	0.561	0.024	0.024	0.1
	V24 Bio diesel	0.111	0.134	15.856	0.317	2.801	0.042	0.176	0.167	0.1
	V25 Bio diesel	0.111	0.134	15.856	0.317	2.801	0.042	0.176	0.167	0.1
	V32 LPG	1.134	0.04	1.49	0.296	13.327	0.406	0.024	0.024	0.06
	M.1A3B.2 Other light duty cars	V11 Motor gasoline	0.595	0.056	6.645	10.646	115.354	0.555	0.084	0.084	0.1
V15 Auto diesel		0.096	0.115	13.093	0.159	2.483	0.047	0.311	0.296	0.1
V23 Bio ethanol		0.595	0.056	6.645	10.646	115.354	0.555	0.084	0.084	0.1
V24 Bio diesel		0.096	0.115	13.093	0.159	2.483	0.047	0.311	0.296	0.1
V25 Bio diesel		0.096	0.115	13.093	0.159	2.483	0.047	0.311	0.296	0.1
M.1A3B.3 Heavy duty vehicles		V11 Motor gasoline	0.791	0.036	32.336	22.875	27.441	0.01	0	0	0.1
	V15 Auto diesel	0.005	0.113	7.965	0.209	3.489	0.033	0.151	0.143	0.1
	V23 Bio ethanol	0.791	0.036	32.336	22.875	27.441	0.01	0	0	0.1
	V24 Bio diesel	0.005	0.113	7.965	0.209	3.489	0.033	0.151	0.143	0.1
	V25 Bio diesel	0.005	0.113	7.965	0.209	3.489	0.033	0.151	0.143	0.1
	V31/V37 Natural gas/Biogas	14.463	0.189	7.255	0.042	1.257	0	0.11	0.11	0.05
	M.1A3B.4 1 Moped	V11 Motor gasoline	22.926	0.051	3.036	103.686	177.995	0.051	10.127	10.127	0.1
V23 Bio ethanol		22.926	0.051	3.036	103.686	177.995	0.051	10.127	10.127	0.1
M.1A3B.4 2 Motorcycle	V11 Motor gasoline	2.418	0.051	4.714	29.214	218.792	0.051	0.181	0.181	0.1
	V23 Bio ethanol	2.418	0.051	4.714	29.214	218.792	0.051	0.181	0.181	0.1

Bold numbers are different for different years, but only the 2019 data are shown here, except for CH₄ (table 10) and N₂O (table 11).
Source: Results from Statistics Norway's use of HBEFA 4.1(INFRAS), Finstad *et al.* (2001). PAH-profile: Aarhus University (2016)

Table 9 (cont.). General emission factors for road traffic

Source	Fuel	benzo(a)pyrene g/tonne	benzo(b)fluoranthene g/tonne	benzo(k)fluoranthene g/tonne	indeno(1,2,3_cd)pyrene g/tonne
M.1A3B.1	V11 Motor gasoline	0.030	0.034	0.024	0.037
Passenger car	V15 Auto diesel	0.114	0.127	0.100	0.106
	V23 Bio ethanol	0.03	0.03	0.02	0.04
	V24 Bio diesel	0.11	0.13	0.1	0.11
	V25 Bio diesel	0.11	0.13	0.1	0.11
	V31 Natural gas	0	0	0	0
	V32 LPG	0.026	0.030	0.021	0.033
M.1A3B.2	V11 Motor gasoline	0.029	0.035	0.024	0.038
Other light duty cars	V15 Auto diesel	0.114	0.127	0.100	0.106
	V23 Bio ethanol	0.03	0.03	0.02	0.04
	V24 Bio diesel	0.11	0.13	0.1	0.11
	V25 Bio diesel	0.11	0.13	0.1	0.11
M.1A3B.3	V11 Motor gasoline	0.014	0.083	0.092	0.021
Heavy duty vehicles	V15 Auto diesel	0.028	0.169	0.189	0.043
	V23 Bio ethanol	0.01	0.08	0.09	0.02
	V24 Bio diesel	0.03	0.17	0.19	0.04
	V25 Bio diesel	0.03	0.17	0.19	0.04
	V31/V37 Natural gas/Biogas	0	0	0	0
	M.1A3B.41	V11 Motor gasoline	0.040	0.040	NE
Moped	V23 Bio ethanol	0.040	0.040	NE	NE
M.1A3B.42	V11 Motor gasoline	0.040	0.040	NE	NE
Motorcycle	V23 Bio ethanol	0.040	0.040	NE	NE

Bold numbers are different for different years, but only the 2019 data are shown here, except for CH₄ (table 10) and N₂O (table 11).
Source: Results from Statistics Norway's use of HBEFA 4.1 (INFRAS), Finstad *et al.* (2001). PAH-profile: Aarhus University (2016)

Table 10. Average CH₄ emission factors for road traffic including cold start emissions and evaporation, g CH₄/ kg fuel

	V11 Motor gasoline					V15 Auto diesel		
	Passenger car	Other light duty cars	Heavy duty vehicles	Moped	Motorcycle	Passenger car	Other light duty cars	Heavy duty vehicles
1990	1.7	1.676	0.735	11.752	2.669	0.158	0.085	0.133
1991	1.652	1.693	0.74	11.835	2.518	0.152	0.084	0.132
1992	1.599	1.679	0.743	11.875	2.38	0.142	0.082	0.128
1993	1.565	1.655	0.754	12.058	2.247	0.117	0.072	0.118
1994	1.515	1.617	0.766	12.237	2.145	0.119	0.078	0.12
1995	1.454	1.557	0.778	12.431	2.069	0.113	0.074	0.112
1996	1.275	1.412	0.751	12	1.881	0.105	0.068	0.1
1997	1.217	1.39	0.776	12.408	1.99	0.107	0.069	0.097
1998	1.097	1.29	0.767	12.261	1.984	0.099	0.06	0.078
1999	1.008	1.226	0.767	13.772	2.04	0.083	0.05	0.061
2000	0.96	1.181	0.803	17.238	2.29	0.08	0.048	0.058
2001	0.854	1.06	0.77	19.489	2.323	0.071	0.043	0.049
2002	0.785	0.997	0.769	22.706	2.436	0.067	0.04	0.046
2003	0.714	0.944	0.761	24.552	2.507	0.063	0.039	0.043
2004	0.642	0.888	0.751	25.232	2.549	0.06	0.036	0.04
2005	0.614	0.887	0.785	26.415	2.663	0.059	0.036	0.039
2006	0.569	0.851	0.794	26.385	2.685	0.055	0.033	0.036
2007	0.547	0.829	0.814	26.597	2.746	0.053	0.032	0.033
2008	0.519	0.786	0.812	26.08	2.708	0.05	0.029	0.03
2009	0.493	0.746	0.804	25.451	2.738	0.049	0.027	0.025
2010	0.46	0.694	0.809	25.384	3.501	0.049	0.024	0.02
2011	0.449	0.694	0.82	25.558	3.551	0.056	0.025	0.017
2012	0.427	0.673	0.813	25.227	3.449	0.063	0.029	0.015
2013	0.402	0.655	0.805	24.868	3.302	0.067	0.034	0.013
2014	0.371	0.631	0.783	24.111	3.098	0.07	0.037	0.011
2015	0.352	0.63	0.786	24.122	2.985	0.076	0.042	0.009
2016	0.326	0.612	0.77	23.549	2.802	0.082	0.046	0.008
2017	0.303	0.593	0.772	23.695	2.694	0.094	0.056	0.007
2018	0.284	0.591	0.781	23.566	2.603	0.104	0.067	0.006
2019	0.277	0.601	0.801	23.693	2.554	0.108	0.08	0.005
2020	0.258	0.595	0.791	22.926	2.418	0.111	0.096	0.005

Source: Results from Statistics Norway's use of HBEFA 4.1 (INFRAS)

Table 10 (cont.) Average CH₄ emission factors for road traffic including cold start emissions and evaporation, g CH₄/kg fuel

	V23 Bio ethanol					V24 Bio diesel/V25 Fossil part of FAME		
	Passenger car	Other light duty cars	Heavy duty vehicles	Moped	Motorcycle	Passenger car	Other light duty cars	Heavy duty vehicles
1990	1.7	1.676	0.735	11.752	2.669	0.158	0.085	0.133
1991	1.652	1.693	0.74	11.835	2.518	0.152	0.084	0.132
1992	1.599	1.679	0.743	11.875	2.38	0.142	0.082	0.128
1993	1.565	1.655	0.754	12.058	2.247	0.117	0.072	0.118
1994	1.515	1.617	0.766	12.237	2.145	0.119	0.078	0.12
1995	1.454	1.557	0.778	12.431	2.069	0.113	0.074	0.112
1996	1.275	1.412	0.751	12	1.881	0.105	0.068	0.1
1997	1.217	1.39	0.776	12.408	1.99	0.107	0.069	0.097
1998	1.097	1.29	0.767	12.261	1.984	0.099	0.06	0.078
1999	1.008	1.226	0.767	13.772	2.04	0.083	0.05	0.061
2000	0.96	1.181	0.803	17.238	2.29	0.08	0.048	0.058
2001	0.854	1.06	0.77	19.489	2.323	0.071	0.043	0.049
2002	0.785	0.997	0.769	22.706	2.436	0.067	0.04	0.046
2003	0.714	0.944	0.761	24.552	2.507	0.063	0.039	0.043
2004	0.642	0.888	0.751	25.232	2.549	0.06	0.036	0.04
2005	0.614	0.887	0.785	26.415	2.663	0.059	0.036	0.039
2006	0.569	0.851	0.794	26.385	2.685	0.055	0.033	0.036
2007	0.547	0.829	0.814	26.597	2.746	0.053	0.032	0.033
2008	0.519	0.786	0.812	26.08	2.708	0.05	0.029	0.03
2009	0.493	0.746	0.804	25.451	2.738	0.049	0.027	0.025
2010	0.46	0.694	0.809	25.384	3.501	0.049	0.024	0.02
2011	0.449	0.694	0.82	25.558	3.551	0.056	0.025	0.017
2012	0.427	0.673	0.813	25.227	3.449	0.063	0.029	0.015
2013	0.402	0.655	0.805	24.868	3.302	0.067	0.034	0.013
2014	0.371	0.631	0.783	24.111	3.098	0.07	0.037	0.011
2015	0.352	0.63	0.786	24.122	2.985	0.076	0.042	0.009
2016	0.326	0.612	0.77	23.549	2.802	0.082	0.046	0.008
2017	0.303	0.593	0.772	23.695	2.694	0.094	0.056	0.007
2018	0.284	0.591	0.781	23.566	2.603	0.104	0.067	0.006
2019	0.277	0.601	0.801	23.693	2.554	0.108	0.08	0.005
2020	0.258	0.595	0.791	22.926	2.418	0.111	0.096	0.005

Source: Results from Statistics Norway's use of HBEFA 4.1 (INFRAS)

Table 11. Average N₂O emission factors for road traffic including cold start emissions and evaporation, g N₂O/ kg fuel

	V11 Motor gasoline					V15 Auto diesel		
	Passenger car	Other light duty cars	Heavy duty vehicles	Moped	Motorcycle	Passenger car	Other light duty cars	Heavy duty vehicles
1990	0.102	0.092	0.034	0.047	0.045	0	0	0.038
1991	0.109	0.093	0.034	0.047	0.045	0	0	0.038
1992	0.115	0.095	0.034	0.048	0.044	0	0	0.038
1993	0.123	0.102	0.035	0.048	0.045	0	0	0.034
1994	0.133	0.11	0.035	0.049	0.045	0	0	0.037
1995	0.144	0.121	0.036	0.05	0.045	0.004	0.005	0.036
1996	0.152	0.127	0.034	0.048	0.043	0.013	0.015	0.036
1997	0.16	0.143	0.036	0.05	0.045	0.026	0.024	0.038
1998	0.156	0.148	0.035	0.049	0.044	0.038	0.031	0.038
1999	0.155	0.156	0.035	0.049	0.044	0.043	0.035	0.033
2000	0.159	0.167	0.037	0.052	0.046	0.053	0.042	0.033
2001	0.155	0.177	0.035	0.049	0.044	0.057	0.044	0.03
2002	0.155	0.194	0.035	0.049	0.045	0.063	0.047	0.029
2003	0.15	0.172	0.035	0.049	0.044	0.068	0.051	0.028
2004	0.145	0.174	0.035	0.048	0.044	0.071	0.054	0.026
2005	0.086	0.165	0.036	0.051	0.046	0.078	0.059	0.026
2006	0.082	0.163	0.036	0.051	0.047	0.081	0.062	0.025
2007	0.081	0.164	0.037	0.052	0.048	0.088	0.067	0.027
2008	0.078	0.155	0.037	0.052	0.048	0.091	0.068	0.031
2009	0.073	0.146	0.037	0.052	0.048	0.091	0.067	0.037
2010	0.067	0.128	0.037	0.052	0.051	0.092	0.064	0.046
2011	0.063	0.125	0.038	0.053	0.051	0.099	0.066	0.062
2012	0.056	0.116	0.037	0.052	0.051	0.106	0.069	0.073
2013	0.049	0.106	0.037	0.052	0.05	0.109	0.071	0.078
2014	0.041	0.095	0.036	0.05	0.049	0.109	0.071	0.088
2015	0.035	0.089	0.036	0.05	0.049	0.111	0.073	0.094
2016	0.03	0.079	0.035	0.049	0.048	0.112	0.075	0.097
2017	0.026	0.071	0.035	0.049	0.048	0.121	0.085	0.104
2018	0.022	0.065	0.036	0.05	0.049	0.127	0.096	0.11
2019	0.02	0.062	0.037	0.051	0.051	0.131	0.106	0.113
2020	0.017	0.056	0.036	0.051	0.051	0.134	0.115	0.113

Table 11 (cont.) Average N₂O emission factors for road traffic including cold start emissions and evaporation, g N₂O/kg fuel

	V23 Bio ethanol					V24 Bio diesel/V25 Fossil part of FAME		
	Passenger car	Other light duty cars	Heavy duty vehicles	Moped	Motorcycle	Passenger car	Other light duty cars	Heavy duty vehicles
1990	0.102	0.092	0.034	0.047	0.045	0	0	0.038
1991	0.109	0.093	0.034	0.047	0.045	0	0	0.038
1992	0.115	0.095	0.034	0.048	0.044	0	0	0.038
1993	0.123	0.102	0.035	0.048	0.045	0	0	0.034
1994	0.133	0.11	0.035	0.049	0.045	0	0	0.037
1995	0.144	0.121	0.036	0.05	0.045	0.004	0.005	0.036
1996	0.152	0.127	0.034	0.048	0.043	0.013	0.015	0.036
1997	0.16	0.143	0.036	0.05	0.045	0.026	0.024	0.038
1998	0.156	0.148	0.035	0.049	0.044	0.038	0.031	0.038
1999	0.155	0.156	0.035	0.049	0.044	0.043	0.035	0.033
2000	0.159	0.167	0.037	0.052	0.046	0.053	0.042	0.033
2001	0.155	0.177	0.035	0.049	0.044	0.057	0.044	0.03
2002	0.155	0.194	0.035	0.049	0.045	0.063	0.047	0.029
2003	0.15	0.172	0.035	0.049	0.044	0.068	0.051	0.028
2004	0.145	0.174	0.035	0.048	0.044	0.071	0.054	0.026
2005	0.086	0.165	0.036	0.051	0.046	0.078	0.059	0.026
2006	0.082	0.163	0.036	0.051	0.047	0.081	0.062	0.025
2007	0.081	0.164	0.037	0.052	0.048	0.088	0.067	0.027
2008	0.078	0.155	0.037	0.052	0.048	0.091	0.068	0.031
2009	0.073	0.146	0.037	0.052	0.048	0.091	0.067	0.037
2010	0.067	0.128	0.037	0.052	0.051	0.092	0.064	0.046
2011	0.063	0.125	0.038	0.053	0.051	0.099	0.066	0.062
2012	0.056	0.116	0.037	0.052	0.051	0.106	0.069	0.073
2013	0.049	0.106	0.037	0.052	0.05	0.109	0.071	0.078
2014	0.041	0.095	0.036	0.05	0.049	0.109	0.071	0.088
2015	0.035	0.089	0.036	0.05	0.049	0.111	0.073	0.094
2016	0.03	0.079	0.035	0.049	0.048	0.112	0.075	0.097
2017	0.026	0.071	0.035	0.049	0.048	0.121	0.085	0.104
2018	0.022	0.065	0.036	0.05	0.049	0.127	0.096	0.11
2019	0.02	0.062	0.037	0.051	0.051	0.131	0.106	0.113
2020	0.017	0.056	0.036	0.051	0.051	0.134	0.115	0.113

Source: Results from Statistics Norway's use of HBEFA 4.1 (INFRAS)

Navigation - CH₄, N₂O, NO_x, NMVOC, CO, particles and POPs

Table 12. General emission factors for navigation

	CH ₄ kg/ tonne	N ₂ O kg/ tonne	NO _x kg/ tonne	NMVOC kg/tonne	CO kg/ tonne	NH ₃ kg/ tonne	TSP, PM ₁₀ kg/ tonne	PM _{2.5} kg/ tonne	Dioxins µg I- TEQ/ tonne
V17 Marine gas oil/diesel, V18 Light fuel oils	0.23	0.08	33.11	2.4	2.9	0	1.6	1.5	4
V19 Heavy distillate, V20 Heavy fuel oil	0.23	0.08	33.11	2.4	2.9	0	5.4	5.1	4
V31 Natural gas (1000 Sm ³)	32.49	0.07	4.88	0.81	2.14	0	0.03	0.03	0.05

Table 12 (cont.). General emission factors for navigation

	benzo(a)pyrene g/tonne	benzo(b)fluoranthene g/tonne	benzo(k)fluoranthene g/tonne	indeno(1,2,3-cd)pyrene g/tonne
V17 Marine gas oil/diesel	0.006	0.028	0.013	0.051
V19 Heavy distillate	0.003	0.009	0.004	0.009
V20 Heavy fuel oil	0.003	0.008	0.004	0.008
V31 Natural gas (1000 Sm ³)	0.000025	0.000102	0.000039	0.000038

Numbers in italics have exceptions for some sectors, see table 13, and bold numbers are different for different years, see tables 14-16.

Source: Flugsrud and Rypdal (1996), Tornsjø (2001), Finstad *et al.* (2001), Finstad *et al.* (2002b), Finstad *et al.* (2003), Bremnes Nielsen and Stenersen (2010). PAHs: Aarhus University (2016) and EEA (2013).

Table 13. Exceptions from the general factors for navigation

Component	Emission factor (kg/tonne)	Fuel	Sector
CH ₄	0.8 V17	Marine gas oil/diesel	230600.1 -230600.3, 230910
CH ₄	1.9 V20	Heavy fuel oil	230600.1 -230600.3, 230910
N ₂ O	0.02 V17	Marine gas oil/diesel	230600.1 -230600.3, 230910
NO _x	28.60 V17, 19, 20	Marine gas oil/diesel, light fuel oils, heavy distillate, heavy fuel oil	230310.N
NO _x	54 V17	Marine gas oil/diesel, light fuel oils, heavy distillate, Heavy fuel oil	230600.1 -230600.3, 230910
NO _x	46.58 V17, 19, 20	Marine gas oil/diesel, light fuel oils, heavy distillate, heavy fuel oil	248422
NMVOC	1.4 V17, 18, 19, 20	Marine gas oil/diesel, light fuel oils, heavy distillate, heavy fuel oil	230310.N
NMVOC	2.3 V17, 19, 20	Marine gas oil/diesel, light fuel oils, heavy distillate, heavy fuel oil	248422
NMVOC	5 V17	Marine gas oil/diesel, light fuel oils	230600.1 -230600.3, 230910
NMVOC	5 V19, 20	Heavy distillate, heavy fuel oil	230600.1 -230600.3, 230910
CO	7.9 V17, 18, 19, 20	Marine gas oil/diesel, light fuel oils, heavy distillate, heavy fuel oil	230310.N
CO	7 V17, 19, 20	Marine gas oil/diesel, light fuel oils, heavy distillate, heavy fuel oil	230600.1 -230600.3, 230910
CO	2.3 V17, 19, 20	Marine gas oil/diesel, light fuel oils, heavy distillate, heavy fuel oil	248422

Table 14. Time series for variable emission factors for navigation. NO_x

Sector	General	230310.N	248422
Fuel	V17-20	V17, 19, 20	V17, 19, 20
1990	56.85	52.11	50.17
1991	56.8	52.11	50.17
1992	56.89	52.11	50.17
1993	56.77	52.11	50.17
1994	56.82	52.11	50.17
1995	56.68	52.11	50.17
1996	57.23	52.11	50.17
1997	57.47	52.11	50.17
1998	57.41	52.11	50.17
1999	56.82	52.11	50.17
2000	57.82	52.12	49.82
2006	57.96	52.01	49.6
2007	57.18	51.9	49.39
2008	56.8	51.8	49.17
2009	56.51	51.69	48.95
2010	55.9	51.58	48.74
2011	55.55	51.48	48.52
2012	54.61	50.93	48.31
2013	53.35	49.9	48.09
2014	52.1	47.41	47.88
2015	50.84	45.17	47.66
2016	49.58	43.64	47.44
2017	48.33	43.36	47.23
2018	47.07	40.94	47.01
2019	45.81	37.97	46.8
2020	44.56	36.6	46.58

Source: (Flugsrud *et al.* 2010 and Vandenbussche 2019)

Table 15. Time series for variable emission factors for navigation, general, natural gas, CH₄

2000	2001-2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015-
31.43	31.35	51.67	54.39	54.55	54.43	36.81	38.83	41.65	42.73	40.67	36.69	34.59	32.83	32.49

Table 16. Time series for variable emission factors for navigation. NMVOC and CO

Sector	Fuel	NMVOC						CO				
		1980-1990	1980-1997	1980-1998	1991-	1998-	1999-	1980-1997	1998-			
General	V17-20										3.1	2.9
230310.N	V17-20			1.5						1.4		
230600.1	V17-20										2	7
230600.1- 230600.3, 230910	V19,20	6.4				5						
248422	V17-20		2.2					2.3				

Other mobile sources including railways - CH₄, N₂O, NO_x, NMVOC, CO, NH₃, particles and POPs

Table 17. General emission factors for other mobile sources

		CH ₄ kg/ tonne	N ₂ O kg/ tonne	NO _x kg/ tonne	NMVOC kg/ tonne	CO kg/ tonne	NH ₃ kg/ Tonne	TSP, PM ₁₀ kg/ tonne	PM _{2.5} kg/ tonne	Dioxins µg I- TEQ/ tonne
M.1A3C Railway	V01 Coal	0.28	0.04	3	1.1	3	0	1.6/1.14	0.82	1.6
	V15 Auto diesel	0.18	1.2	47	4	11	0.007	3.8	3.61	0.1
M.1A3E.21 Small boats 2 stroke	V11 Motor gasoline	5.1	0.02	7.73	92.77	415	0	8	8	0.1
	V23 Bio ethanol	5.1	0.02	7.73	92.77	415	0	8	8	0.1
M.1A3E.22 Small boats 4 stroke	V11 Motor gasoline	1.7	0.08	36.3	46.65	1 000	0	1	1	0.1
	V15 Auto diesel	0.18	0.03	38.93	7.22	25	0	4	4	0.1
	V23 Bio ethanol	1.7	0.08	36.3	46.65	1 000	0	1	1	0.1
M.1A3E.31 Motorized equipment 2 stroke	V11 Motor gasoline	6	0.02	2 ¹	500	700	0	8	8	0.1
	V23 Bio ethanol	1.7	0.08	12	40	1 000	0	1	1	0.1
M.1A3E.32 Motorized equipment 4t	V11 Motor gasoline	2.2	0.07	10	110	1 200	0	1	1	0.1
	V15 Auto diesel	0.17	0.14	12.23	0.84	6.07	0.008	0.09	0.09	0.1
	V18 Light fuel oils	0.17	1.3	50	6	15	0.005	7.1	6.75	0.1
	V23 Bio ethanol	2.2	0.07	10	110	1 200	0	1	1	0.1

Table 17 (cont.). General emission factors for other mobile sources

		benzo(a)pyrene g/tonne	benzo(b)fluoranthene g/tonne	benzo(k)fluoranthene g/tonne	indeno(1,2,3_cd)pyrene g/tonne
M.1A3C Railway	V01 Coal	0.007	0.01	0.004	0.003
	V15 Auto diesel	0.030	0.050	0	0
M.1A3E.21 Small boats 2 stroke	V11 Motor gasoline	0.040	0.040	0	0
	V23 Bio ethanol	0.040	0.040	0	0
M.1A3E.22 Small boats 4 stroke	V11 Motor gasoline	0.040	0.040	0	0
	V15 Auto diesel	0.030	0.050	0	0
	V23 Bio ethanol	0.040	0.040	0	0
M.1A3E.31 Motorized equipment 2 stroke	V11 Motor gasoline	0.040	0.040	0	0
	V23 Bio ethanol	0.040	0.040	0	0
M.1A3E.32 Motorized equipment 4t	V11 Motor gasoline	0.040	0.040	0	0
	V15 Auto diesel	0.030	0.050	0	0
	V18 Light fuel oils	0.030	0.050	0	0
	V23 Bio ethanol	0.040	0.040	0	0

M.1A3E.1 Snow scooter has the same emission factors as M.1A3B.41 Moped, see table 9.

Bold numbers are different for different years, but only 2019 figures are presented here.

¹Before 1995 the emission factor was 1.3.

Numbers in italics have exceptions for some sectors, see tables 18–19.

Sources: Bang (1993), Bang *et al.* (1999), Finstad *et al.* (2001), Finstad *et al.* (2002b), Finstad *et al.* (2003), Winther and Nielsen (2006), EEA (2013).

Table 18. Exceptions from the general factors for greenhouse gases and precursors for other mobile sources

Component	Emission factor (kg/tonne)		Fuel	Source	Sectors
CH ₄	6.2	V11	Motor gasoline	M.1A3E.31 Motorized equipment 2 stroke	230100
CH ₄	3.7	V11	Motor gasoline	M.1A3E.32 Motorized equipment 4 stroke	230100
CH ₄	7.7	V11	Motor gasoline	M.1A3E.31 Motorized equipment 2 stroke	230210
CH ₄	8.1	V11	Motor gasoline	M.1A3E.31 Motorized equipment 2 stroke	330000
CH ₄	5.5	V11	Motor gasoline	M.1A3E.32 Motorized equipment 4 stroke	330000
CH ₄	0.18	V15	Auto diesel	M.1A3E.32 Motorized equipment 4 stroke	330000
CH ₄	6.2	V23	Bio ethanol	M.1A3E.31 Motorized equipment 2 stroke	230100
CH ₄	3.7	V23	Bio ethanol	M.1A3E.32 Motorized equipment 4 stroke	230100
CH ₄	7.7	V23	Bio ethanol	M.1A3E.31 Motorized equipment 2 stroke	230210
CH ₄	8.1	V23	Bio ethanol	M.1A3E.31 Motorized equipment 2 stroke	330000
CH ₄	5.5	V23	Bio ethanol	M.1A3E.32 Motorized equipment 4 stroke	330000
N ₂ O	0.08	V11	Motor gasoline	M.1A3E.32 Motorized equipment 4 stroke	230500-233320
N ₂ O	0.132	V15	Auto diesel	M.1A3E.32 Motorized equipment 4 stroke	230100-230210
N ₂ O	0,08	V23	Bio ethanol	M.1A3E.32 Motorized equipment 4 stroke	230500-233320
NO _x	11.81	V15	Auto diesel	M.1A3E.32 Motorized equipment 4 stroke	230100-230210
NO _x	54	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	230100
NO _x	52	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	230210
NO _x	47	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	230710-230892, 234910
NO _x	48	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	232360, 248422
NO _x	46	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	234110-234120
NM VOC	1.48	V15	Auto diesel	M.1A3E.32 Motorized equipment 4 stroke	230100-230200
NM VOC	7.2	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	230100
NM VOC	5.7	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	230210
NM VOC	4	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	230710- 230892,234910
NM VOC	4.8	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	232360, 248422
NM VOC	3.8	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	234110-234120
CO	8.46	V15	Auto diesel	M.1A3E.32 Motorized equipment 4 stroke	230100-230210
CO	25	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	230100
CO	20	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	230210
CO	11	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	230710-230892, 234910
CO	17	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	234110-234120
CO	18	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	248422

Bold numbers are different for different years, time series for NO_x are presented in table 20.

Table 19. Exceptions from the general factors for other pollutants for other mobile sources

Component	Emission factor (kg/tonne)	Fuel	Source	Sectors	
TSP, PM ₁₀	1.28	V15	Auto diesel	M.1A3E.32 Motorized equipment 4 stroke	230100-230210
TSP, PM ₁₀	3.8	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	230710-230892, 234910
TSP, PM ₁₀	4.2	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	232360
TSP, PM ₁₀	5.3	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	234110-234120
TSP, PM ₁₀	5.4	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	248422
PM _{2.5}	1.21	V15	Auto diesel	M.1A3E.32 Motorized equipment 4 stroke	230100-230210
PM _{2.5}	3.61	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	230710-230892, 234910
PM _{2.5}	3.99	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	232360
PM _{2.5}	5.04	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	234110-234120
PM _{2.5}	5.13	V18	Light fuel oils	M.1A3E.32 Motorized equipment 4 stroke	248422

Bold numbers are different for different years, but only 2019 figures are presented here.

Table 20. Time series for NO_x emission factors for use of auto diesel in motorized equipment 4t

Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
General	46.3	46.4	46.4	46.4	46.5	46.6	46.7	46.8	46.0	43.9	41.9	40.2	37.8	35.0	31.8
230100-230210	27.1	27.0	26.7	26.5	26.4	26.4	26.5	26.6	26.6	26.5	26.4	26.2	25.8	25.4	24.9

Sector	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
General	28.6	24.8	21.6	19.8	18.5	17.1	16.1	15.3	14.5	13.5	13.0	12.78	12.56	12.42	12.27	12.23
230100-230210	24.1	23.3	22.3	21.3	20.3	19.3	18.3	17.5	16.8	15.9	15.1	14.37	13.61	12.95	12.39	11.81

Source: Winther and Nielsen (2006). Data for 2005 and later are extrapolations.

Table 21. Time series for variable emission factors for other mobile sources

Fuel	Component	1980-1990	1991	1992	1993	1994	1995	1996	1997-
V11 Gasoline	Dioxins	1.32	1.11	0.95	0.69	0.25	0.23	0.11	0.1

Fuel Wood - CH₄, N₂O, NO_x, NMVOC, CO, NH₃, particles and PAH

Table 22. Emission factors Fuel Wood V41, kg/tonne

Component	S.05 Small stoves (produced before 1998)	S.06 Small stoves (produced after 1998)	S.07 Fireplace
CH ₄	16.1445	3.883	5.3
N ₂ O	0.032	0.032	0.032
NO _x	0.97	0.97	1.3
NMVOC	22.284	15.218	7
CO	102.025	85.73	126.3
NH ₃	0.066	0.066	0.066
TSP	24.145	8.44	17.3
PM ₁₀	23.13	8.3	17
PM _{2.5}	20.855	7.85	16.4

Source: Seljeskog *et al.* (2017).

Table 23. Emission factors Fuel Wood V41, g/tonne

Component	S.05 Small stoves (produced before 1998)	S.06 Small stoves (produced after 1998)	S.07 Fireplace
benzo(a)pyrene	0.737	0.006	0.819
benzo(b)fluoranthene	1.160	0.010	1.289
benzo(k)fluoranthene	0.271	0.003	0.301
indeno(1,2,3-cd)pyrene	0.531	0.005	0.590

Source: Finstad *et al.* (2001). PAH-profile: EEA (2013)

Table 24. Emission factors Fuel Wood V41, ug/tonne

Component	S.05 Small stoves (produced before 1998)	S.06 Small stoves (produced after 1998)	S.07 Fireplace
Dioxins	9.9375	3.758	5.9

Source: Seljeskog *et al.* (2017).

CH₄ - Stationary combustion

Table 25. General emission factors, kg CH₄/tonne fuel

Source	V01 Coal	V02 Coke	V03 Petrol coke	V41 Fuel wood	V42 Wood waste	V43 Black liquor	V44 Wood pellets	V45 Wood briquettes	V04 Charcoal	V31 Natural gas (1 000 Sm ³)	V33 Refinery gas
S.01 Direct- fired furnaces ..	0.0281	0.285	0.105	.	.	.	.	.	5.9	0.1775	0.0486
S.02 Gas turbines ..	.	.	.	.	.	.	.	.	.	0.91	.
S.03 Boilers	8.43	8.55	0.35	.	0.1788	0.0216	0.1901	0.1703	.	0.1775	0.0486
S.04 Small stoves	8.43	8.55	.	.	.	.	5.184	.	6.0	.	.
S.1B2C Flares ....	.	.	.	.	.	.	.	.	.	0.24	0.28

	V34 CO gas	V36 Landfill gas	V35 Fuel gas	V32 LPG	V13 Kerosene (heating)	V17 Marine gas oil/ diesel	V18 Light fuel oils	V19 Heavy distillate	V20 Heavy fuel oil	V51 Municipal waste	V52 Special waste
S.01 Direct- fired furnaces	0.0067	.	0.05	.	.	0.431	.	0.431	0.406	.	1.218
S.02 Gas turbines	.	0.251	.	.	.	.	.	.	.	.	.
S.03 Boilers	0.0067	0.251	0.05	0.2305	0.431	0.431	0.431	0.431	0.406	0.345	1.218
S.04 Small stoves	.	.	.	0.2305	0.431	.	0.431	0.431	.	.	.
S.1B2C Flares	.	0.37	0.054.	.	.	.	.	.	.	.	.

Numbers in italics have exceptions for some sectors, see table 23.

Source: IPCC (2006), Sandgren *et al.* (1996), Karlsvik (1995) and The Norwegian oil industry association (1994).

Table 26. Exceptions from the general factors for CH₄, stationary combustion (kg CH₄/tonne fuel)

Emission factor	Fuel	Source	Sectors
0.1293	V13, V17, V18, V19 Kerosene (heating), marine diesel; light fuel oil, heavy distillate	S.01 Direct fired furnaces, S.03 Boilers	230500-233530
0.1218	V20 Heavy fuel oil	S.01 Direct fired furnaces, S.03 Boilers	230500-233530
0.0461	V32 LPG	S.03 Boilers	230500-233530
0.0403	V31 Natural gas (1000 Sm ³)	S.01 Direct fired furnaces. S.03 Boilers	230600.1- 230600.3, 230910, 234950
0.0355	V31 Natural gas (1000 Sm ³)	S.01 Direct fired furnaces. S.03 Boilers	230500-233530
0	V34 CO gas	S.03 Boilers	231922
0.0502	V36 Landfill gas	S.02 Gas turbines, S.03 Boilers	230500-233530
0.4875	V42 Wood waste	S.03 Boilers	230500-233530
4.644	V45 Wood briquettes	S.03 Boilers	330000

N₂O - Stationary combustion

Table 27. General emission factors. kg N₂O/tonne fuel

Source	V01 Coal	V02 Coke	V03 Petrol coke	V41 Fuel wood	V42 Wood waste	V43 Black liquor	V44 Wood pellets	V45 Wood briquettes	V04 Char- coal	V31 Natural gas (1000 Sm ³)	V33 Refinery gas
S.01 Direct- fired furnaces ..	0.0422	0.0428	0.021	.	.	.	.	.	0.12	0.0036	0.0049
S.02 Gas turbines ..	.	.	.	.	.	.	.	.	.	0.0036	.
S.03 Boilers	0.0422	0.0428	0.021	.	0.065	0.0144	0.0691	0.0619	.	0.0036	0.0049
S.04 Small stoves	0.0422	0.0428	.	.	.	.	0.0691	.	0.03	.	.
S.1B2C Flares ....	.	.	.	.	.	.	.	.	.	0.02	0.024
	V34 Blast furnace gas	V36 Landfill gas	V35 Fuel gas	V32 LPG	V13 Kero- sene (heating)	V17 Marine gas oil/ diesel	V18 Light fuel oils	V19 Heavy distillate	V20 Heavy fuel oil	V51 Municipal waste	V52 Special waste
S.01 Direct- fired furnaces	0.0007	0.005	0.005	.	.	0.0259	.	0.0259	0.0244	.	0.1624
S.02 Gas turbines	.	0.005	.	.	.	0.0259	.	.	.	.	.
S.03 Boilers	0.0007	0.005	0.005	0.0046	0.0259	0.0259	0.0259	0.0259	0.0244	0.046	0.1624
S.04 Small stoves	.	.	.	0.0046	0.0259	.	0.0259	0.0259	.	.	.
S.1B2C Flares	.	0.0015	0.024	.	.	.	.	.	.	.	.

Numbers in italics have exceptions for some sectors, see table 25.

Source: IPCC (2006), Sandgren *et al.* (1996) and The Norwegian oil industry association (1994).

Table 28. Exceptions from the general factors for N₂O. Stationary combustion (kg N₂O/1000 Sm³ natural gas)

Emission factor	Fuel	Source	Sectors
0.0040	V31 Natural gas	S.01 Direct-fired furnaces, S.02 Gas turbines, S.03 Boilers	230600.1-230600.3, 230910,234950

NO_x - Stationary combustion

Table 29. General emission factors. kg NO_x/tonne fuel

Source	V01 Coal	V02 Coke	V03 Petrol coke	V41 Fuel wood	V42 Wood waste	V43 Black liquor	V44 Wood pellets	V45 Wood bri- quettes	V04 Char- coal gas (1000 Sm ³)	V31 Natural gas (1000 Sm ³)	V33 Refinery gas
S.01 Direct- fired furnaces ..	16	20	20	.	.	.	.	.	2.68	5.95	5.4
S.02 Gas turbines ...	.	.	.	.	.	.	.	.	.	6.27	.
S.03 Boilers	3	3	3.4	.	0.9	0.9	1.3	1.3	.	2.55	3
S.04 Small stoves	3	3	.	.	.	.	1.1	.	1.4	.	.
S.1B2C Flares .....	.	.	.	.	.	.	.	.	.	12	7

	V34 Blast furnace gas	V36 Landfill gas	V35 Fuel gas	V32 LPG	V13 Kerosene (heating)	V17 Marine gas oil/ diesel	V18 Light fuel oils	V19 Heavy distillate	V20 Heavy fuel oil	V51 Municipal waste	V52 Special waste
S.01 Direct- fired furnaces	5.4	.	5.4	.	.	54	.	5	5	.	5
S.02 Gas turbines	.	.	.	.	.	16	.	.	.	.	.
S.03 Boilers	3	0.01	3	2.3	3	2.5	2.5	2.5	4.2	1.365	4.2
S.04 Small stoves	.	.	.	2.3	2.5	.	2.5	2.5	.	.	.
S.1B2C Flares	.	0.17	.	.	.	.	.	.	.	.	.

Numbers in italics have exceptions for some sectors, see table 27, and bold numbers are different for different years, see table 28.

Source: Rosland (1987). Fuel wood factor based on data from annual surveys on use of fuel wood in households.

Table 30. Exceptions from the general factors for NO_x. Stationary combustion. kg NO_x /tonne fuel

Emission factor	Fuel	Source	Sectors
24	V19, 20, 52	Heavy distillate, heavy fuel oil, special waste	S.01 Direct-fired furnaces 231910.2, 232350
6.13	V31	Natural gas (1000 Sm ³)	S.01 Direct-fired furnaces 232014
9.5	V19, 20	Heavy distillate, heavy fuel oil	S.01 Direct-fired furnaces 232360
8.681	V31	Natural gas (1000 Sm ³)	S.02 Gas turbines 230600.1
1,4	V31	Natural gas (1000 Sm ³)	S.1B2C Flares 230600.1
3	V17, 18, 19	Fuel oils	S.03 Boilers 230500-233320
4.5	V01	Coal	S.03 Boilers 230500-233320
3.4	V02	Coke	S.03 Boilers 230500-233320
5	V20, 52	Heavy fuel oil, special waste	S.03 Boilers 230500-233320
2.9	V35	Fuel gas	S.03 Boilers 232011-232050, 232411-232442
0.01	V34	CO gas	S.03 Boilers 233510-233530
6.27	V33	Refinery gas	S.02 Gas turbines 231922, 233511
1.4	V01, 02	Coal, coke	S.04 Small stoves 330000

Table 31. Time series for variable emission factors for NO_x. Stationary combustion. kg NO_x /tonne fuel

Sector	Source	Fuel	1980-										
			1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000-
230600.1	S.02	V31	8.223	8.172	8.234	8.444	8.617	8.874	9.128	9.185	9.528	9.087	8.681

NMVOC - Stationary combustion**Table 32. General emission factors. kg NMVOC/tonne fuel**

Source	V01 Coal	V02 Coke	V03 Petrol coke	V41 Fuel wood	V42 Wood waste	V43 Black liquor	V44 Wood pellets	V45 Wood bri- quettes	V04 Char coal	V31 Natural gas (1000 Sm ³)	V33 Re finery gas
S.01 Direct-fired furnaces	0	0	0	.	.	.	.	.	8.85	0	0.1
S.02 Gas turbines .....	.	.	.	.	.	.	.	.	.	0.24	.
S.03 Boilers	1.1	0.6	0.6	1.30	.	.	1.3	1.3	.	0.085	0.1
S.04 Small stoves	1.1	0.6	.	.	.	.	6.501	.	10	.	.
S.1B2C Flares	.	.	.	.	.	.	.	.	.	0.06	13.5
	V34 CO gas	V36 Landfill gas	V35 Fuel gas	V32 LPG	V13 Kero sene (heating)	V17 Marine gas oil/ diesel	V18 Light fuel oils	V19 Heavy distillate	V20 Heavy fuel oil	V51 Municipal waste	V52 Special waste
S.01 Direct-fired furnaces	0	.	0	.	.	5	.	0.3	0.3	.	0.3
S.02 Gas turbines	.	.	.	.	.	0.03	.	.	.	.	.
S.03 Boilers	0.1	0	0.1	0.1	0.4	0.4	0.4	0.4	0.3	0.7	0.3
S.04 Small stoves	.	.	.	0.1	0.4	.	0.4	0.4	.	.	.
S.1B2C Flares	.	0	.	.	.	.	.	.	.	.	.

Numbers in italics have exceptions for some sectors, see table 30.

Source: Rosland (1987) and Sandgren *et al.* (1996).

Table 33. Exceptions from the general factors for NMVOC. Stationary combustion. kg NMVOC/tonne fuel

Emission factor	Fuel		Source	Sectors
0	V 19, 20, 52	Heavy distillate, heavy fuel oil, special waste	S.01 Direct-fired furnaces	231910.2, 232350
0.1	V34	CO gas	S.01 Direct-fired furnaces	231910.2
0.085034	V31	Natural gas (1000 Sm ³)	S.01 Direct-fired furnaces	232014
0.9	V19, 20	Heavy distillate, heavy fuel oil	S.01 Direct-fired furnaces	232360
0.8	V01	Coal	S.03 Boilers	230500-233320
0	V32, 34, 35, 42	LPG, CO gas, fuel gas, wood waste	S.03 Boilers	230500-233320, 231711, 232011-232050, 233510-233530
0.6	V17, 18, 19	Fuel oils	S.03 Boilers	330000
10	V01	Coal	S.04 Small stoves	330000
0.6	V13	Kerosene (heating)	S.04 Small stoves	330000

CO - Stationary combustion

Table 34. General emission factors. kg CO/tonne fuel

Source	V01 Coal	V02 Coke	V03 Petrol coke	V41 Fuel wood	V42 Wood waste	V43 Black liquor	V44 Wood pellets	V45 Wood briquettes	V04 Char coal	V31 Natural gas (1000 Sm ³)	V33 Re finery gas
S.01 Direct- fired furnaces .	0	26.16	0	.	.	.	.	.	16.82.	0	0
S.02 Gas turbines ..	.	.	.	.	.	.	.	.	.	1.7	.
S.03 Boilers	3	26.16	3	.	15	0	15	15	.	0	0
S.04 Small stoves	3	26.16	.	.	.	.	2.6	.	100	.	.
S.1B2C Flares ....	.	.	.	.	.	.	.	.	.	1.5	0
	V34 CO gas	V36 Landfill gas	V35 Fuel gas	V32 LPG	V13 Kero sene (heating)	V17 Marine gas oil/ diesel	V18 Light fuel oils	V19 Heavy distillate	V20 Heavy fuel oil	V51 Municipal waste	V52 Special waste
S.01 Direct- fired furnaces .	0	.	0	.	.	5	.	0.2	0.2	.	0.2
S.02 Gas turbines ..	.	.	.	.	.	0.7	.	.	.	.	.
S.03 Boilers	0	0	0	0.5	2	2	2	2	0.4	2.8	0.4
S.04 Small stoves	.	.	.	0.5	2	.	2	2	.	.	.
S.1B2C Flares	.	0.04	.	.	.	.	.	.	.	.	.

Numbers in italics have exceptions for some sectors, see table 32, and bold numbers are different for different years, see table 33.

Table 35. Exceptions from the general factors for CO. Stationary combustion. kg CO/tonne fuel

Emission factor	Fuel	Source	Sectors
0	V 19, 20, 52	Heavy distillate, heavy fuel oil, special waste	S.01 Direct-fired furnaces 231910.2, 232350, 232360
0.01	V34	CO gas	S.01 Direct-fired furnaces 231910.2
7	V17	Marine gas oil/diesel	S.01 Direct-fired furnaces 230910, 230600.2
0.2	V20, 52	Heavy fuel oil, special waste	S.03 Boilers 230500-233320
0	V32, 42	LPG, wood waste	S.03 Boilers 230500-233320, 231711
6.5	V17, 18, 19	Fuel oils	S.03 Boilers 330000
100	V01, 02	Coal, coke	S.04 Small stoves 330000
6.5	V13	Kerosene (heating)	S.04 Small stoves 330000
1.7	V31	Natural gas (1000 Sm ³)	S.1B2C Flares 231922

NH₃ - Stationary combustion

Table 36. General emission factors. kg NH₃/tonne fuel

Source	V01 Coal	V02 Coke	V03 Petrol coke	V41 Fuel wood	V42 Wood waste	V43 Black liquor	V44 Wood pellets	V45 Wood bri- quettes	V04 Char- coal	V31 Natural gas (1000 Sm ³)	V33 Re- finery gas	V34 CO gas	V36 Land- fill gas	V35 Fuel gas	V32 LPG	V13 Kero- sene (heating)	V17 Marine gas oil/ diesel	V18 Light fuel oils	V19 Heavy dis- tillate	V20 Heavy fuel oil	V51 Munici- pal waste	V52 Special waste
S.04 Small stoves	.	.	.0066	.	.0066	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
All other sources	0	0	0	.	0	0	0	0	1.09	0	0	0	0	0	0	0	0	0	0	0	0	0

Particulate matter - Stationary combustion

Table 37. General emission factors. kg particle component/tonne fuel

Com- ponent	Source	V01 Coal	V02 Coke	V03 Petrol coke	V41 Fuel wood	V42 Wood waste	V43 Black liquor	V44 Wood pellets	V45 Wood briquettes	V04 Char coal	V31 Natural gas (1000 Sm ³)	V33 Refinery gas
TSP	...S.01 Direct-fired furnaces	1.6	1.6	1.6	.	.	.	.	.	4.43.	0.122	0.144
TSP	...S.02 Gas turbines	.	.	.	.	.	.	.	.	.	0.122	.
TSP	...S.03 Boilers	1.6	1.6	1.6	.	2.69	0	2.69	2.69	.	0.122	0.144
TSP	...S.04 Small stoves	4.2	2.85	3.5	.	.	.	1.1	.	2.4	.	.
TSP	...S.1B2C Flares	.	.	.	.	.	.	.	.	.	0.002	0.144
PM ₁₀	...S.01 Direct-fired furnaces	1.14	1.14	1.14	.	.	.	.	.	4.22	0.122	0.144
PM ₁₀	...S.02 Gas turbines	.	.	.	.	.	.	.	.	.	0.122	.
PM ₁₀	...S.03 Boilers	1.14	1.14	1.14	.	2.52	0	2.52	2.52	.	0.122	0.144
PM ₁₀	...S.04 Small stoves	2.8	1.71	2.1	.	.	.	1.1	.	2.4	.	.
PM ₁₀	...S.1B2C Flares	.	.	.	.	.	.	.	.	.	0.002	0.144
PM _{2.5}	...S.01 Direct-fired furnaces	0.82	0.82	0.82	.	.	.	.	.	4.13	0.122	0.144
PM _{2.5}	...S.02 Gas turbines	.	.	.	.	.	.	.	.	.	0.122	.
PM _{2.5}	...S.03 Boilers	0.82	0.82	0.82	.	2.52	0	2.52	2.52	.	0.122	0.144
PM _{2.5}	...S.04 Small stoves	0.86	0.86	1.5	.	.	.	1.1	.	2.4	.	.
PM _{2.5}	...S.1B2C Flares	.	.	.	.	.	.	.	.	.	0.002	0.144

Table 37 (cont.) General emission factors. kg particle component/tonne fuel

	V34 CO gas	V36 Landfill gas	V35 Fuel gas	V32 LPG	V13 Kerosene (heating)	V17 Marine gas oil/ diesel	V18 Light fuel oils	V19 Heavy distillate	V20 Heavy fuel oil	V51 Municipal waste	V52 Special waste
TSP ...S.01 Direct-fired furnaces	0.144	.	0.144	.	.	0.286	.	*	*	.	5.68
TSP ...S.02 Gas turbines	.	.	.	.	.	0.286	.	.	.	.	.
TSP ...S.03 Boilers	0.144	0.144	0.144	0.136	0.296	0.286	0.286	*	*	0.05	5.68
TSP ...S.04 Small stoves	.	.	.	0.136	0.3	.	0.3	.	.	.	.
TSP ...S.1B2C Flares	.	0.144	.	.	.	.	.	.	.	.	.
PM ₁₀ ...S.01 Direct-fired furnaces	0.144	.	0.144	.	.	0.143	.	*	*	.	4.87
PM ₁₀ ...S.02 Gas turbines	.	.	.	.	.	0.143	.	.	.	.	.
PM ₁₀ ...S.03 Boilers	0.144	0.144	0.144	0.136	0.148	0.143	0.15	*	*	0.05	4.87
PM ₁₀ ...S.04 Small stoves	.	.	.	0.136	0.16	.	0.155	.	.	.	.
PM ₁₀ ...S.1B2C Flares	.	0.144	.	.	.	.	.	.	.	.	.
PM _{2.5} ...S.01 Direct-fired furnaces	0.144	.	0.144	.	.	0.036	.	*	*	.	3.2
PM _{2.5} ...S.02 Gas turbines	.	.	.	.	.	0.036	.	.	.	.	.
PM _{2.5} ...S.03 Boilers	0.144	0.144	0.144	0.136	0.037	0.12	0.12	*	*	0.05	3.2
PM _{2.5} ...S.04 Small stoves	.	.	.	0.136	0.12	.	0.119	.	.	.	.
PM _{2.5} ...S.1B2C Flares	.	0.144	.	.	.	.	.	.	.	.	.

Numbers in italics have exceptions for some sectors, see table 37, and bold numbers are different for different years, see table 38.

* General emission factors for all sources for heavy distillate and heavy fuel oil are given in table 36 for all years.

Source: Finstad *et al.* (2003). Fuel wood factor based on data from annual surveys on use of fuel wood in households

Table 38. General particle emission factors for heavy distillate and heavy fuel oil for all sources. Factors dependent on sulphur content. kg particle component /tonne fuel

Fuel	Com-ponent	1990	1991	1992	1993	1994	1995	1996-1997	1998	1999	2000-
V19	TSP	0.803	0.714	0.701	0.701	0.688	0.714	0.663	0.688	0.701	0.714
	PM ₁₀	0.690	0.614	0.603	0.603	0.592	0.614	0.570	0.592	0.603	0.614
	PM _{2.5}	0.450	0.400	0.393	0.393	0.385	0.400	0.371	0.385	0.393	0.400
V20	TSP	1.350	1.339	1.316	1.304	1.190	1.053	1.098	1.087	1.110	1.201
	PM ₁₀	1.161	1.151	1.131	1.121	1.023	0.905	0.944	0.934	0.954	1.033
	PM _{2.5}	0.761	0.754	0.741	0.735	0.671	0.593	0.619	0.613	0.625	0.677

Source: Finstad *et al.* (2003).

Table 39. Exceptions from the general factors for particles. Stationary combustion

Emission factor (kg TSP/tonne)	Emission factor (kg PM ₁₀ /tonne)	Emission factor (kg PM _{2.5} /tonne)	Fuel	Source	Sectors
4.06	2.4	1.4	V52	Special waste	S.01 Direct-fired furnaces 230500-233320
5.45	3.54	1.45	V01	Coal	S.01 Direct-fired furnaces 233530
4.2	2.8	0.86	V01	Coal	S.03 Boilers 230100
.	0.143 (V18)	0.036 (V17, 18)	V17, 18	Light fuel oils	S.03 Boilers 230500-233320
4.06	2.4	1.4	V52	Special waste	S.03 Boilers 230500-233320
5.45	3.54	1.45	V01	Coal	S.03 Boilers 233530
0.5	0.5	0.5	V51	Municipal waste	S.03 Boilers 253800
0.3	0.155	0.119	V13	Kerosene (heating)	S.04 Small stoves 330000

POPs (Persistent Organic Pollutants) - Stationary combustion

Table 40. General emission factors for PAH

Component	Source	V01	V02	V03	V41	V42	V43	V44	V45	V04	V31	V33
		Coal	Coke	Petrol coke	Fuel wood	Wood waste	Black liquor	Wood pellets	Wood briquettes	Charcoal	Natural gas (1000 Sm ³)	Refinery gas
benzo(a) pyrene	S.01 Direct-fired furnaces	0.00002	0.00002	0.00002	.	.	.	.	.	0.007	0.00002	0.00003
benzo(a) pyrene	S.02 Gas turbines	.	.	.	.	.	.	.	.	.	0.00002	.
benzo(a) pyrene	S.03 Boilers	0.007	0.007	0.007	.	0.0001	0.0001	0.0001	0.0001	.	0.00002	0.00003
benzo(a) pyrene	S.04 Small stoves	2.81	2.85	3.5	.	.	.	2.091	2.091	3.5695	.	.
benzo(b) fluoranthene	S.01 Direct-fired furnaces	0.001	0.001	0.001	.	.	.	.	.	0.010	0.00003	0.00004
benzo(b) fluoranthene	S.02 Gas turbines	.	.	.	.	.	.	.	.	.	0.00003	.
benzo(b) fluoranthene	S.03 Boilers	0.010	0.010	0.010	.	0.0075	0.0075	0.0075	0.0075	.	0.00003	0.00004
benzo(b) fluoranthene	S.04 Small stoves	4.777	4.845	5.95	.	.	.	1.918	1.918	3.2745	.	.
benzo(k) fluoranthene	S.01 Direct-fired furnaces	0.0008	0.0008	0.001	.	.	.	.	.	0.004	0.00003	0.00004
benzo(k) fluoranthene	S.02 Gas turbines	.	.	.	.	.	.	.	.	.	0.00003	.
benzo(k) fluoranthene	S.03 Boilers	0.004	0.004	0.004	.	0.0075	0.0075	0.0075	0.0075	.	0.00003	0.00004
benzo(k) fluoranthene	S.04 Small stoves	3.653	2.85	3.5	.	.	.	0.726	0.726	1.239	.	.
indeno(1,2,3_cd) pyrene	S.01 Direct-fired furnaces	0.00003	0.00003	0.00004	.	.	.	.	.	0.003	0.00003	0.00004
indeno(1,2,3_cd) pyrene	S.02 Gas turbines	.	.	.	.	.	.	.	.	.	0.00003	.
indeno(1,2,3_cd) pyrene	S.03 Boilers	0.003	0.003	0.003	.	0.0002	0.0002	0.0002	0.0002	.	0.00003	0.00004
indeno(1,2,3_cd) pyrene	S.04 Small stoves	2.248	2.28	2.8	.	.	.	1.227	1.227	2.0945	.	.

Table 40 (cont.). General emission factors for PAH

Component	Source	V34 Blast furnace gas	V36 Landfill gas	V35 Fuel gas	V32 LPG	V13 Kero- sene (heating)	V17 Marine gas oil/ diesel	V18 Light fuel oils	V19 Heavy distillate	V20 Heavy fuel oil	V51 Municipal waste ¹	V52 Special waste
benzo(a)pyrene	S.01 Direct-fired furnaces	0.00001	.	0.00004	.	.	NE	.	NE	NE	.	0.077
benzo(a)pyrene	S.02 Gas turbines	.	0.00003	.	.	.	NE	.	.	.	.	.
benzo(a)pyrene	S.03 Boilers	0.00001	0.00003	0.00004	2.5816E-08	0.00002	NE	0.00002	NE	NE	0.00001	0.077
benzo(a)pyrene	S.04 Small stoves	.	.	.	2.5816E-08	0.003	.	0.003	.	.	.	.
benzo(b)fluoranthene	S.01 Direct-fired furnaces	0.00003	.	0.00015	.	.	0.00019	.	0.00019	0.00018	.	0.609
benzo(b)fluoranthene	S.02 Gas turbines	.	0.00004	.	.	.	0.00019	.	.	.	.	.
benzo(b)fluoranthene	S.03 Boilers	0.00001	0.00004	0.00015	3.8724E-08	0.00001	0.00003	0.00001	0.00019	0.00018	0.00002	0.609
benzo(b)fluoranthene	S.04 Small stoves	.	.	.	3.8724E-08	0.002	.	0.002	.	.	.	.
benzo(k)fluoranthene	S.01 Direct-fired furnaces	0.00001	.	0.00006	.	.	0.00019	.	0.00019	0.00018	.	0.069
benzo(k)fluoranthene	S.02 Gas turbines	.	0.00004	.	.	.	0.00019	.	.	.	.	.
benzo(k)fluoranthene	S.03 Boilers	0.00001	0.00004	0.00006	3.8724E-08	0.00002	0.00003	0.00002	0.00019	0.00018	0.00001	0.069
benzo(k)fluoranthene	S.04 Small stoves	.	.	.	3.8724E-08	0.003	.	0.003	.	.	.	.
indeno(1,2,3-cd)pyrene	S.01 Direct-fired furnaces	0.00001	.	0.00005	.	.	0.0003	.	0.00030	0.00028	.	0.061
indeno(1,2,3-cd)pyrene	S.02 Gas turbines	.	0.00004	.	.	.	0.0003	.	.	.	.	.
indeno(1,2,3-cd)pyrene	S.03 Boilers	0.00001	0.00004	0.00005	3.8724E-08	0.00005	0.00004	0.00005	0.00030	0.00028	0.00001	0.061
indeno(1,2,3-cd)pyrene	S.04 Small stoves	.	.	.	3.8724E-08	0.007	.	0.007	.	.	.	.

Bold numbers are different for different years, see table 40. NE = Not estimated. ¹Emission factor used for the years after 1995. Emission factors for the years 1990 to 1994 can be given on request.

Source: Finstad *et al.* (2001). Fuel wood factor based on data from annual surveys on use of fuel wood in households. EEA (2013), EEA (2016), . Allerup *et. al* (2015)

POPs (Persistent Organic Pollutants) - Stationary combustion

Table 41. General emission factors for dioxins

Com- ponent	Source	V01 Coal	V02 Coke	V03 Petrol coke	V41 Fuel wood	V42 Wood waste	V43 Black liquor	V44 Wood pellets	V45 Wood bri- quettes	V04 Char- coal	V31 Natural gas (1000 Sm ³)	V33 Refinery gas
Dioxins µg I- TEQ/ton ne	S.01 Direct- fired furnaces	1.6	1.6	1.6	.	.	.	.	.	2.95.	0.05	0
Dioxins µg I-TEQ /tonne	S.02 Gas turbines	.	.	.	.	.	.	.	.	.	0.05	.
Dioxins µg I-TEQ /tonne	S.03 Boilers	1.6	1.6	1.6	.	1	1	1	1	.	0.05	0
Dioxins µg I-TEQ /tonne	S.04 Small stoves	10	10	10	.	.	.	5.9	.	10	.	.
Dioxins µg I-TEQ /tonne	S.1B2C Flares	.	.	.	.	.	.	.	.	.	0.05	0
		V34 CO gas	V36 Landfill gas	V35 Fuel gas	V32 LPG	V13 Kero- sene (heating)	V17 Marine gas oil/ diesel	V18 Light fuel oils	V19 Heavy distillate	V20 Heavy fuel oil	V51 Municipal waste	V52 Special waste
Dioxins µg I-TEQ /tonne	S.01 Direct- fired furnaces	0	.	0	.	.	4	.	0.1	0.1	.	4
Dioxins µg I-TEQ /tonne	S.02 Gas turbines	.	.	.	.	.	4	.	.	.	.	.
Dioxins µg I-TEQ /tonne	S.03 Boilers	0	0	1	0.06	0.1	0.1	0.1	0.1	0.1	0.02	4
Dioxins µg I-TEQ /tonne	S.04 Small stoves	.	.	.	0.06	0.06	.	0.2	.	.	.	.
Dioxins µg I-TEQ /tonne	S.1B2C Flares	.	0	.	.	.	.	.	.	.	.	.

Numbers in italics have exceptions for some sectors, see table 42.

Source: Finstad *et al.* (2002).

Table 42. Exceptions from the general factors for POPs. Stationary combustion

Emission factor (ug dioxin/tonne)	Fuel	Source	Sectors
0.2	V18, 19 Heavy distillate, heavy fuel oil	S.03 Boilers	330000

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