1.A.5.b iii - Military Navigation

Short description

In sub-category *1.A.5.b iii - Other, Mobile (including Military)* emissions from military navigation are reported.

Method	AD	EF	Key Category Analysis
T1, T2	NS, M	D, M, CS, T1, T3	see superordinate chapter

Methodology

Activity Data

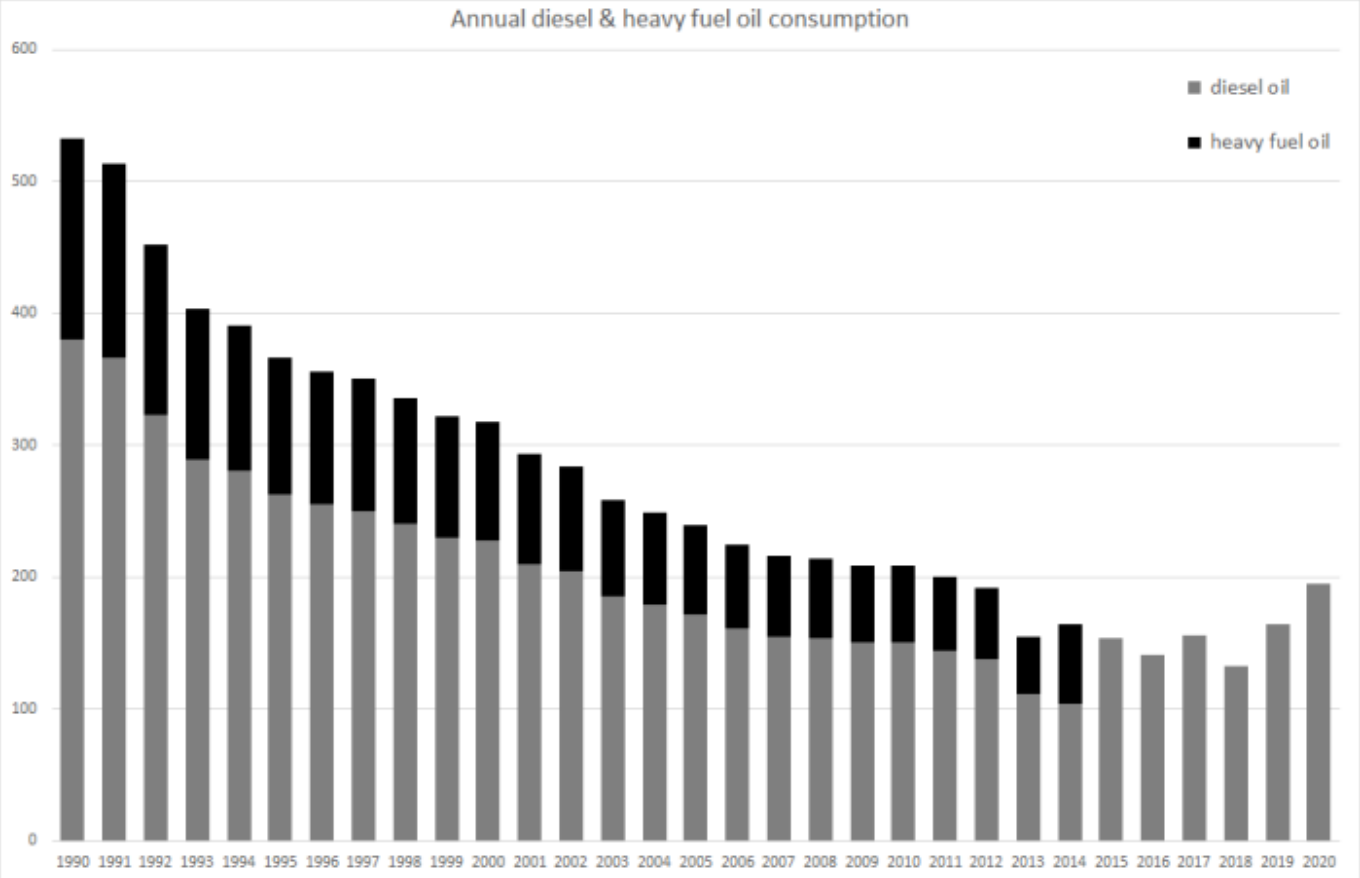
Primary fuel data for national military waterborne activities is included in NEB lines 6 ('International Deep-Sea Bunkers') and 64 ('Coastal and Inland Navigation') for IMO and non-IMO ships respectively.

The annual shares used within NFR 1.A.5.b iii are therefore calculated within (Deichnik, K. (2020)) [1)], where ship movement data (AIS signal) allows for a bottom-up approach providing the needed differentiation.

Table 1: Annual fuel consumption, in terajoules

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Diesel Oil	380	263	228	171	161	155	154	150	150	144	138	111	104	154	141	156	133	164	195
Heavy Fuel Oil	152	104	90	67	63	61	61	59	59	56	54	44	61	0	0	0	0	0	0
Σ 1.A.5.b iii	**532**	**366**	**318**	**239**	**225**	**216**	**214**	**209**	**209**	**200**	**192**	**155**	**165**	**154**	**141**	**156**	**133**	**164**	**195**

source: Deichnik, K. (2020): BSH model [2)]



Emission factors

The emission factors applied here, are derived from different sources and therefore are of very different quality.

For the main pollutants, country-specific implied values are used, that are based on tier3 EF included in (Deichnik (2020)) [3)] which mainly relate on values from the EMEP/EEA guidebook 2019 [4)]. These modelled IEFs take into account the ship specific information derived from AIS data as well as the mix of fuel-qualities applied depending on the type of ship and the current state of activity.

Table 2: Annual country-specific implied emission factors[1] for diesel fuels, in kg/TJ

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
DIESEL OIL																			
NH_3	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
NMVOC	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	40.0	39.4	34.2	34.1	34.1	36.2	35.5	35.5
NO_x	1,228	1,228	1,228	1,228	1,228	1,228	1,228	1,228	1,228	1,228	1,228	1,221	1,227	1,286	1,294	1,298	1,252	1,265	1,265
SO_x	466	419	233	186	186	186	140	69.8	69.8	65.2	60.3	56.7	53.7	37.2	37.2	37.2	37.2	37.2	37.2
BC	111	99.8	55.4	44.3	44.3	44.3	33.3	16.6	16.6	15.5	15.5	15.5	15.8	15.9	15.2	14.8	16.1	15.3	15.3
$PM_{2.5}$	358	322	179	143	143	143	107	53.6	53.6	50.1	50.1	50.1	51.0	51.2	49.1	47.8	51.9	49.3	49.3
PM_{10}	383	344	191	153	153	153	115	57.4	57.4	53.6	53.6	53.6	54.6	54.8	52.5	51.1	55.5	52.7	52.7
TSP	383	344	191	153	153	153	115	57.4	57.4	53.6	53.6	53.6	54.6	54.8	52.5	51.1	55.5	52.7	52.7
CO	140	140	140	140	140	140	140	140	140	140	140	139	142	148	144	141	148	142	142
HEAVY FUEL OIL																			
NH_3	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.35	0	0	0	0	0	0
NMVOC	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	27.0	28.6	0	0	0	0	0	0
NO_x	1,468	1,468	1,468	1,468	1,468	1,468	1,468	1,468	1,468	1,468	1,468	1,488	1,496	0	0	0	0	0	0
SO_x	1,319	1,332	1,323	1,336	744	742	742	744	496	496	496	495	506	0	0	0	0	0	0
BC	42,3	42,7	42,4	42,9	23,9	23,8	23,8	23,8	15,9	15,9	15,9	14,9	16,3	0	0	0	0	0	0
$PM_{2.5}$	353	356,0	354	357	199	198	198	199	132	133	133	124	136	0	0	0	0	0	0

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PM_{10}	388	392	389	393	219	218	218	219	146	146	146	137	150	0	0	0	0	0	0
TSP	388	392	389	393	219	218	218	219	146	146	146	137	150	0	0	0	0	0	0
CO	154	154	154	154	154	154	154	154	154	154	154	148	157	0	0	0	0	0	0

[1] due to lack of better information: similar EF are applied for fossil and biodiesel
[2] ratio $PM_{2.5}$: PM_{10} : TSP derived from the tier1 default EF as provided in [5)]
[3] estimated from a BC-fraction of 0.31 as provided in [6)], chapter: 1.A.3.d.i, 1.A.3.d.ii, 1.A.4.c.iii Navigation, Table 3-2

With respect to the emission factors applied for particulate matter, given the circumstances during test-bench measurements, condensables are most likely included at least partly. [1)]

For information on the **emission factors for heavy-metal and POP exhaust emissions**, please refer to Appendix 2.3 - Heavy Metal (HM) exhaust emissions from mobile sources and Appendix 2.4 - Persistent Organic Pollutant (POP) exhaust emissions from mobile sources.

Discussion of emission trends

As only NFR 1.A.5.b as a whole is taken into account within the key category analysis, this country-specific sub-sector is not considered separately.

Recalculations

With both **activity data** and **emission factors** remaining unrevised, no recalculations took place with this submission.

For pollutant-specific information on recalculated emission estimates for Base Year and 2018, please see the pollutant specific recalculation tables following chapter 8.1 - Recalculations.

Uncertainties

See superordinate chapter on NFR 1.A.5.b.

Planned improvements

A **routine revision** of the underlying model is planned for the next annual submission.

[1), 2), 3)] Deichnik (2020): Deichnik, K.: Aktualisierung und Revision des Modells zur Berechnung der spezifischen Verbräuche und Emissionen des von Deutschland ausgehenden Seeverkehrs. from Bundesamts für Seeschifffahrt und Hydrographie (BSH); Hamburg, 2020.
[4), 5), 6)] EMEP/EEA, 2019: EMEP/EEA air pollutant emission inventory guidebook 2019, Copenhagen, 2019.

1)

During test-bench measurements, temperatures are likely to be significantly higher than under real-world conditions, thus reducing condensation. On the contrary, smaller dillution (higher number of primary particles acting as condensation germs) together with higher pressures increase the likeliness of condensation. So over-all condensables are very likely to occur but different to real-world conditions.