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

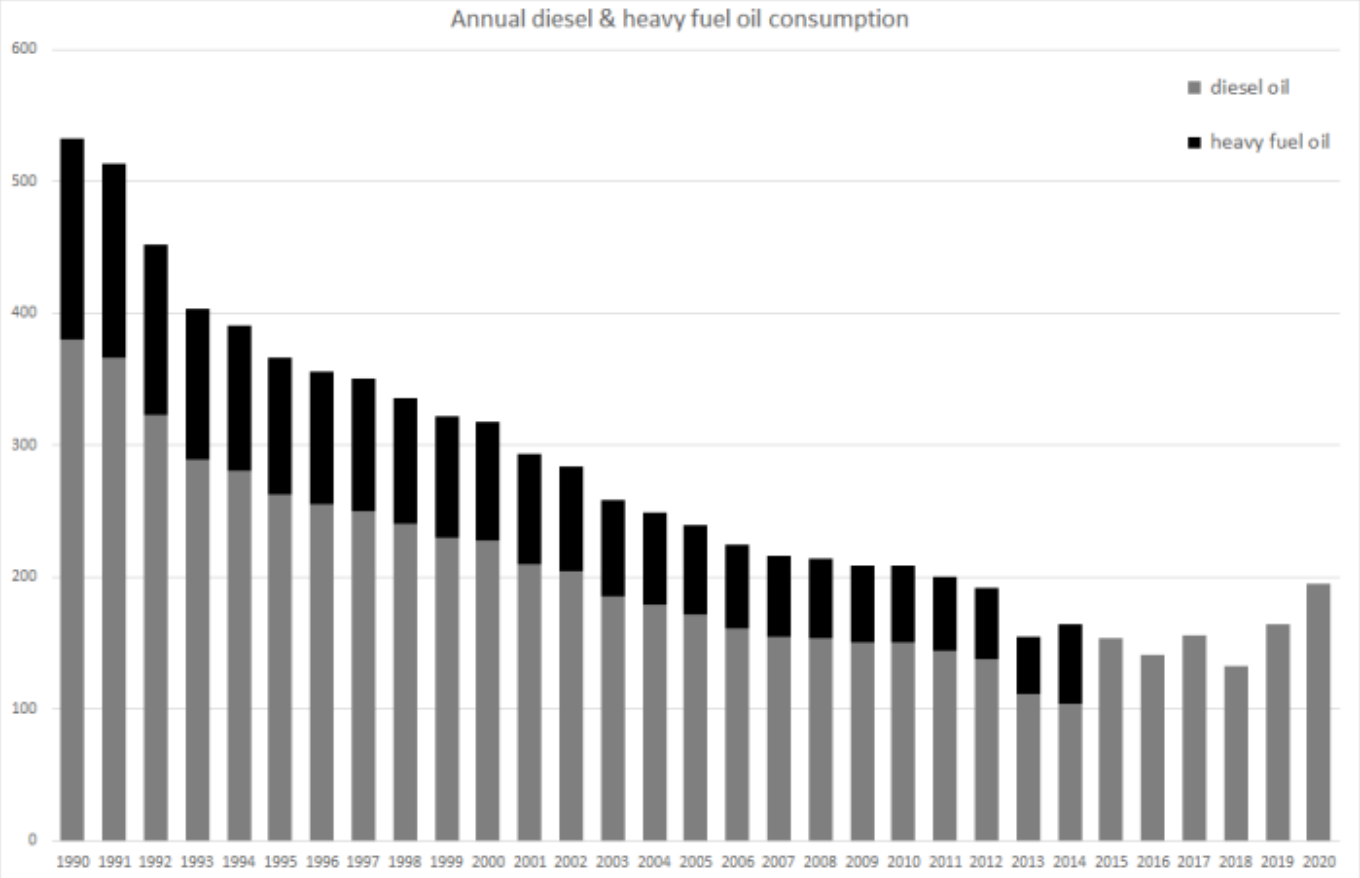
Primary fuel data for national military waterborne activities is included in NEB lines 6 ('International Deep-Sea Bunkers') and 64 ('Coastal and Inland Navigation') for IMO and non-IMO ships respectively.

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
Diesel Oil	983	665	563	410	383	366	360	349	347	330	313	302	332	273	359	489	436	558
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Heavy Fuel Oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Σ 1.A.5.b iii	**983**	**665**	**563**	**419**	**394**	**382**	**378**	**373**	**369**	**351**	**334**	**319**	**351**	**286**	**370**	**500**	**434**	**558**

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
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	0,32	0,33	0,33	0,33	0,33
NMVOC	41,4	41,4	41,4	41,4	41,4	41,4	41,4	41,4	41,4	41,4	41,4	41,6	41,1	47,7	37,4	38,0	39,1	38,2
NO_x	1.106	1.106	1.106	1.106	1.106	1.106	1.106	1.106	1.106	1.106	1.106	1.105	1.098	1.011	1.119	1.124	1.117	1.134
SO_x	466	419	233	186	186	186	140	69,8	69,8	65,2	59,4	55,9	53,4	40,0	38,7	38,8	39,3	39,2
BC	109	98,3	54,6	43,7	43,7	43,7	32,8	16,4	16,4	15,3	15,3	15,3	16,1	19,6	16,3	15,2	15,8	14,8
$PM_{2.5}$	352	317	176	141	141	141	106	52,9	52,9	49,3	49,3	49,3	51,9	63,2	52,6	49,0	51,0	47,9
PM_{10}	377	339	189	151	151	151	113	56,6	56,6	52,8	52,8	52,7	55,5	67,7	56,3	52,4	54,6	51,2
TSP	377	339	189	151	151	151	113	56,6	56,6	52,8	52,8	52,7	55,5	67,7	56,3	52,4	54,6	51,2
CO	136	136	136	136	136	136	136	136	136	136	136	136	142	158	148	139	142	137

[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.