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. (2019)), 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	423	
Biodiesel	0	0	0	9	11	16	18	24	22	21	20	18	19	14	11	11	11	
Heavy Fuel Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Σ 1.A.5.b iii	**983**	**665**	**563**	**419**	**394**	**382**	**378**	**373**	**369**	**351**	**334**	**319**	**351**	**286**	**370**	**500**	**434**	

source: Deichnik, K. (2019): BSH model [1)]

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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, K. (2019)) [2)] which mainly relate on values from the EMEP/EEA guidebook 2019 [3)]. 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	
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	
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	
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	
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	
$PM_{2.5}$	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	
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	
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	
CO	136	136	136	136	136	136	136	136	136	136	136	136	142	158	148	139	142	

[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 [4)] [3] estimated from a BC-fraction of 0.31 as provided in [5)], 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.footnote 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. [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].

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Discussion of emission trends

> This sub-category is **not considered separately in the key category analysis**.

Due to the application of very several tier1 emission factors, most emission trends reported for this sub-category only reflect the trend in fuel deliveries. Therefore, the fuel-consumption dependend trends in emission estimates are only influenced by the annual fuel mix.

++ Selected main pollutants: NO,,x,,

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++ Sulphur dioxide and particulate matter

As fuel sulphur content underlies strict legislation, the trends of these directly related emissions

reflect the outcome of ever lower fuel sulphur contents.

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Recalculations

The small changes in the **activity data** applied result solely from a revised biofuel share for biodiesel in 2017:

Table 4: Revised fuel consumption data 2017, in terajoules

	= **TOTAL**	= **Diesel Oil**	= **Biodiesel**
~ Submission 2020	> 500.2	> 489.3	> 10.9
~ Submission 2019	> 500.6	> 489.3	> 11.3
~ absolute change	> -0.40	> 0.00	> -0.40
~ relative change	> -0.08%	> 0.00%	> -3.57%

In contrast, all (annual) country-specific **emission factors** remain unaltered.

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.

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bibliography

: 1 : Deichnik (2019): 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, 2019. : 2 : EMEP/EEA, 2019: EMEP/EEA air pollutant emission inventory guidebook 2019, Copenhagen, 2019. : 3 : Rentz et al., 2008: Nationaler Durchführungsplan unter dem Stockholmer Abkommen zu persistenten organischen

Schadstoffen (POPs), im Auftrag des Umweltbundesamtes, FKZ 205 67 444, UBA Texte | 01/2008, January 2008 - URL: http://www.umweltbundesamt.de/en/publikationen/nationaler-durchfuehrungsplan-unter-stockholmer
bibliography

[1)] (bibcite 1)
[2)] (bibcite 1)
[3)] (bibcite 2)
[4)] (bibcite 2)
[5)] (bibcite 2)
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.