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EVALUATION AND HARMONIZATION OF RULES AND GUIDANCE ON THE DISCHARGE OF DISCHARGE WATER FROM EGCS INTO THE AQUATIC ENVIRONMENT, INCLUDING CONDITIONS AND AREAS

Data to be used for the calculation of representative emission factors of discharge water from exhaust gas cleaning systems (EGCS)

Submitted by Norway

SUMMARY

Executive summary:	This document contains data to be used for the development of representative emission factors of discharge water from exhaust gas cleaning systems (EGCS) and provides relevant information regarding the sampling and analysis of the water.
Strategic direction, if applicable:	1
Output:	1.23
Action to be taken:	Paragraph 17
Related documents:	Resolution MEPC.340(77); MEPC.1/Circ.899; MEPC 78/93; MEPC 79/5/1; MEPC 82/5/1, MEPC 82/INF.22; PPR 11/7/5; PPR 12/7/2 and PPR 12/INF.11

Background

1 The Marine Environment Protection Committee (MEPC), at its seventy-eighth session, approved the *2022 Guidelines for risk and impact assessments of the discharge water from EGCS* (MEPC.1/Circ.899), agreeing that the Guidelines would be kept under review in light of experience gained. The purpose of the Guidelines is to provide a unified approach containing procedures that would support Member States to judge whether the introduction of restrictions/conditions of discharge water from EGCS would be needed and justifiable or not.

2 At PPR 11, the Sub-Committee considered emission factors for use in the environmental risk assessment of the discharge water from EGCS with a view to including representative emission factors in a revised version of MEPC.1/Circ.899, so that a consistent environmental load from the use of EGCS would be used in the risk and impact assessments.

3 During the consideration of the proposed representative emission factors provided in documents MEPC 78/9/3 (Germany) and PPR 11/7/5 (ICS and CLIA), discussions were held on the differences in the methodology used for the establishment of emission factors, especially whether the emission factors should be based upon the amount of each substance generated solely by the scrubbing process or if background concentrations (pollutants detected in the inlet water) also should be part of a representative emission factor.

4 The Sub-Committee was not in a position to conclude on these discussions, but invited interested Member States and international organizations to:

.1 submit relevant data to a future session;

.2 submit proposals for terms of reference for the re-establishment of the GESAMP Task Team on EGCS to conduct further work on this matter to MEPC 82; and

.3 consider providing financial contributions to enable the re-establishment of the GESAMP Task Team on EGCS.

5 At MEPC 82, the Working Group on Air Pollution and Energy Efficiency (APEE) considered a proposal of draft terms of reference for the re-establishment of the GESAMP Task Team on EGCS as set out in the annex to document MEPC 82/5/3 (ICS and CLIA). In the ensuing discussions, different suggestions were made, such as to amend the proposed terms of reference to include the determination of emission factors, to consider any other relevant chemical substances in EGCS discharge water in addition to the proposed list of priority hazardous substances, remove the reference to the use of 50% of laboratory detection limits as assigned values for non-detects, and align key terminology and evaluation criteria with the 2022 Guidelines for risk and impact assessments of the discharge water from EGCS.

6 Due to time constraints, the Committee referred the draft terms of reference for the GESAMP Task Team on EGCS to PPR 12 for further consideration, with a view to finalization and providing advice to the Committee accordingly.

7 This document contains data to be used for the development of representative emission factors of discharge water from EGCS and provides relevant information regarding the sampling and analysis of the discharge water that might also be relevant to the work of the GESAMP Task Team on EGCS, together with the considerations provided in documents PPR 12/7/2 (Norway) and PPR 12/INF.11 (Norway).

Discharge water samples

8 Solvang ASA is a Norwegian shipping company specialized in the transport of LPG and petrochemicals. The company has a fleet of 23 ships where 15 of the ships are equipped with EGCS. The standard EGCS configuration consists of one EGCS for the main engine and one for the auxiliary engines and boiler.

9 The discharge water samples presented in this document come from five very large gas carriers (VLGC), three large gas carriers (LGC) and four ethylene carriers. Water samples are taken annually for each ship with an EGCS, including one set in port with two auxiliary engines in parallel and a minimum 75% power (four samples), and one set in transit with main engine at approximately 75% power and two auxiliary engines at 75% power (five samples). In total, 99 samples are presented from inlet water (52 in harbour and 47 in transit) and 146 samples after the scrubber (52 after auxiliary engines in harbour, 47 after auxiliary engine and 47 after main engine in transit). All ships have been using marine residual fuels category RMG-380, in accordance with ISO 8217-2024.

10 All samples have been analysed by ALS, an ISO 17025 accredited laboratory, which also supplied the sampling bottles. The procedure for sampling, preparations and analysis have been carried out consistent with appendix III of the *2021 Guidelines for Exhaust Gas Cleaning Systems* (resolution MEPC.340(77)), including the use of the recommended methods for sample analysis set out in section 2.4 of the Guidelines.

11 The data presented in this document includes inlet seawater (for background) sampled from the seawater strainer ("1" in figure 1) and discharge water after scrubber(s) ("2"in figure 1). After the scrubber, the discharge water goes to a cleaning system which consists of a residence tank and hydrocyclones where soot and other particles, heavier than water, are removed from the discharge water and deposited in the sludge tank, and from there into filter bags which are delivered ashore. Soot and oily particles with a density lower than water (floating on the top), are skimmed off from the top of the residence tank regularly and delivered ashore. Depending on local regulations, for example the United States Vessel General Permit (VGP), the overboard pH can be increased to greater than (>) six in port and in transit.

12 Samples of discharge water after treatment and possible dilution (referred to in section 2.1.2.3 in the 2021 Guidelines) are not presented in this document as such data is not representative to be used as a basis for emission factors, since not all EGCS have such after treatment and the wash water may be diluted at this point.

13 The data set presented in this document includes two samples in "harbour mode" and three samples in "transit mode". The EGCS and the principle set up for sampling is illustrated in figure 1 below.

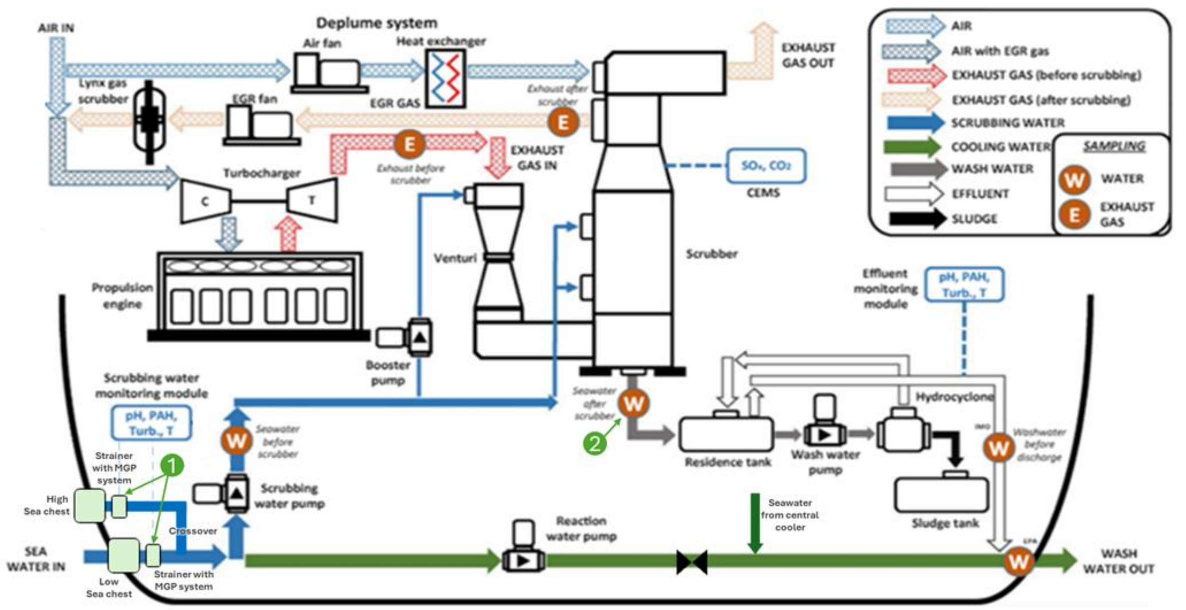

Figure 1: EGCS System and sampling points. The sampling point for the intake seawater is marked "1" and the sampling point after the scrubber but before cleaning of the water is marked "2".

14 To ensure a representative sample, the engine load and water flow should be stable for several hours prior to sampling. It is also important to collect a representative water sample, and since the water flow after the scrubber is not uniform and 100% mixed, a special sampling lance with the length of the diameter of the pipe had been used to collect the water sample. The pipes from seawater pump are galvanized steel pipes, the scrubber itself is made of

corrosion resistant steel, and all pipes and equipment after the scrubber are made of Glass Reinforced Epoxy (GRE), stainless steel or steel coated with special paint, as copper pipes or brass valves will contaminate the water sample. The water temperature across the EGCS increases by approximately 5°C.

15 The data set and emission factors presented in this document have undergone a Quality Assurance (QA) by SINTEF Ocean and a memo regarding the QA is provided in document PPR 12/INF.11. Considerations regarding the origin of the different substances detected in the samples from discharge water are provided in document PPR 12/7/2.

16 An overview of the data set is presented in table 1 below. The data has been split into samples collected at harbour and during transit, and average concentrations (µg/l) are presented for both inlet water and for discharge water after the EGCS. Emission factors (measured in mg/MWh) representing the net contribution from the scrubbing process are presented for harbour and transit separately. The complete data set with relevant information regarding the ships, calculations and raw data, etc., can be downloaded using this link: https://solvangship.no/environment/scrubber-data

Table 1: An overview of the data set presented in this document. For non-detects, a value of 50% of the detection limit has been used. Barium harbour emission factor was set to Barium transit emission factor due to extreme large variations in ambient seawater in port

Overview				Harbour					Transit							
ELEMENT	LOD	Emission factor Harbour average actual waterflow AE (97.2 m^3/MWH) [m^3/MWH]	Emission factor Transit average actual waterflow 80% ME (56.4 m^3/MWH) 20% AE (95.5 m^3/MWH) [m^3/MWh]	Average seawater inlet harbour [µg/L] ± 2σ (95%)	N_{tot} ($N_{<LOD}$)	Average after AE harbour [µg/L] ± 2σ (95%)	N_{tot} ($N_{<LOD}$)	Average delta AE Harbour based on each sample pair, basis for EF [µg/L]	Average seawater inlet transit [µg/L] ± 2σ (95%)	N_{tot} ($N_{<LOD}$)	Average after ME [µg/L] ± 2σ (95%)	N_{tot} ($N_{<LOD}$)	Average delta ME Transit based on each sample pair, basis for EF [µg/L]	Average after AE transit [µg/L] ± 2σ (95%)	N_{tot} ($N_{<LOD}$)	Average delta AE Transit based on each sample pair, basis for EF [µg/L]
Arsenic	0.50	0	0	3.37 ± 5.19	52 (0)	3.19 ± 4.89	52 (0)	-0.18	3.10 ± 3.96	47 (0)	3.18 ± 4.53	47 (0)	0.08	2.91 ± 3.45	47 (0)	-0.19
Barium	1.00	9*	9	19.1 ± 43.6	47 (0)	22.0 ± 50.0	47 (0)	2.95	9.93 ± 19.3	42 (0)	10.1 ± 22.7	42 (0)	0.17	10.0 ± 23.3	42 (0)	0.08
Cadmium	0.05	0	0	0.04 ± 0.05	52 (32)	0.03 ± 0.04	52 (37)	-0.01	0.03 ± 0.04	47 (34)	0.03 ± 0.00	47 (36)	0.00	0.03 ± 0.00	47 (40)	-0.01
Chromium	0.90	105	225	2.54 ± 6.12	52 (23)	3.71 ± 7.67	52 (11)	1.08	0.81 ± 1.42	47 (27)	4.67 ± 7.30	47 (5)	3.49	5.02 ± 9.19	47 (7)	3.63
Cobalt	0.20	33	26	0.19 ± 0.29	52 (33)	0.51 ± 0.97	52 (12)	0.34	0.10 ± 0.00	47 (38)	0.57 ± 0.94	47 (9)	0.42	0.54 ± 0.95	47 (11)	0.38
Copper	1.00	0	18	9.15 ± 13.5	52 (1)	9.19 ± 10.7	52 (0)	-0.76	6.53 ± 9.28	47 (1)	7.38 ± 8.83	47 (0)	0.41	6.93 ± 7.44	47 (0)	-0.05
Lead	0.50	0	0	0.62 ± 1.28	52 (29)	0.34 ± 0.38	52 (36)	-0.26	0.55 ± 1.17	47 (28)	0.25 ± 0.00	47 (37)	-0.30	0.25 ± 0.00	47 (41)	-0.32
Mercury	0.02	0	0	0.01 ± 0.00	47 (47)	0.01 ± 0.01	47 (45)	0.00	0.01 ± 0.00	43 (43)	0.01 ± 0.00	43 (43)	0.00	0.01 ± 0.00	43 (43)	0.00
Molybdenum	0.50	121	118	10.5 ± 5.73	52 (0)	11.8 ± 6.26	52 (0)	1.25	11.1 ± 4.02	47 (0)	13.0 ± 5.58	47 (0)	1.75	13.5 ± 5.33	47 (0)	2.12
Nickel	0.60	2732	2814	3.56 ± 7.51	52 (10)	34.2 ± 36.4	52 (0)	28.1	2.92 ± 7.40	47 (9)	49.3 ± 44.2	47 (0)	46.1	42.4 ± 42.4	47 (0)	39.3
Vanadium	0.20	11234	9492	2.61 ± 3.08	52 (0)	117 ± 129	52 (0)	116	2.19 ± 1.49	47 (0)	148 ± 133	47 (0)	150	141 ± 149	47 (0)	147
Zinc	4.00	0	0	10.1 ± 21.5	52 (17)	10.0 ± 15.0	52 (9)	-0.93	10.4 ± 27.5	47 (18)	10.7 ± 19.4	47 (9)	-0.89	8.79 ± 12.6	47 (9)	-1.14
Naphthalene	0.03	132	105	0.015 ± 0.00	52 (52)	1.374 ± 3.35	52 (7)	1.36	0.016 ± 0.01	47 (46)	1.723 ± 3.37	47 (1)	1.71	1.498 ± 5.42	47 (5)	1.48
Acenaphthylene	0.01	2	1	0.005 ± 0.00	52 (52)	0.021 ± 0.15	52 (45)	0.02	0.005 ± 0.00	47 (47)	0.017 ± 0.10	47 (37)	0.01	0.006 ± 0.01	47 (43)	0.00
Acenaphthene	0.01	4	9	0.005 ± 0.00	52 (52)	0.045 ± 0.09	52 (21)	0.04	0.005 ± 0.00	47 (46)	0.189 ± 0.57	47 (10)	0.18	0.058 ± 0.14	47 (16)	0.05
Fluorene	0.01	17	29	0.005 ± 0.00	52 (51)	0.178 ± 0.28	52 (8)	0.17	0.006 ± 0.01	47 (46)	0.539 ± 0.98	47 (1)	0.53	0.243 ± 0.55	47 (4)	0.24
Phenanthrene	0.02	55	96	0.010 ± 0.00	52 (52)	0.572 ± 0.87	52 (8)	0.56	0.011 ± 0.01	47 (46)	1.810 ± 3.41	47 (1)	1.80	0.776 ± 1.53	47 (4)	0.77
Anthracene	0.01	0	0	0.005 ± 0.00	52 (52)	0.005 ± 0.01	52 (50)	0.00	0.005 ± 0.00	47 (47)	0.014 ± 0.07	47 (40)	0.01	0.007 ± 0.02	47 (42)	0.00
Fluoranthene	0.01	4	4	0.005 ± 0.00	52 (50)	0.043 ± 0.11	52 (10)	0.04	0.005 ± 0.00	47 (46)	0.072 ± 0.14	47 (3)	0.07	0.066 ± 0.33	47 (6)	0.06
Pyrene	0.01	4	7	0.006 ± 0.01	52 (49)	0.042 ± 0.14	52 (16)	0.04	0.005 ± 0.00	47 (47)	0.145 ± 0.50	47 (7)	0.14	0.048 ± 0.15	47 (14)	0.04
Benz(a)anthracene	0.01	0	1	0.005 ± 0.00	52 (52)	0.008 ± 0.01	52 (42)	0.00	0.005 ± 0.00	47 (47)	0.027 ± 0.12	47 (25)	0.02	0.009 ± 0.02	47 (38)	0.00
Chrysene	0.01	1	4	0.005 ± 0.00	52 (51)	0.016 ± 0.04	52 (30)	0.01	0.005 ± 0.00	47 (47)	0.082 ± 0.32	47 (13)	0.08	0.025 ± 0.11	47 (28)	0.02
Sum of Benzo(b+j)fluoranthene	0.01	0	1	0.005 ± 0.01	49 (48)	0.008 ± 0.02	49 (41)	0.00	0.005 ± 0.00	44 (44)	0.020 ± 0.06	44 (22)	0.01	0.010 ± 0.03	44 (36)	0.01
Benzo(k)fluoranthene	0.01	0	0	0.005 ± 0.00	52 (52)	0.005 ± 0.00	52 (51)	0.00	0.005 ± 0.00	47 (47)	0.006 ± 0.01	47 (43)	0.00	0.005 ± 0.01	47 (46)	0.00
Benzo(a)pyrene	0.01	0	0	0.005 ± 0.00	52 (52)	0.005 ± 0.00	52 (52)	0.00	0.005 ± 0.00	47 (47)	0.009 ± 0.03	47 (42)	0.00	0.006 ± 0.01	47 (45)	0.00
Dibenz(a.h)anthracene	0.01	0	0	0.005 ± 0.00	52 (52)	0.005 ± 0.00	52 (52)	0.00	0.005 ± 0.00	47 (47)	0.007 ± 0.01	47 (44)	0.00	0.005 ± 0.00	47 (46)	0.00
Benzo(g.h.i)perylene	0.01	0	0	0.005 ± 0.00	52 (52)	0.007 ± 0.01	52 (44)	0.00	0.005 ± 0.00	47 (47)	0.013 ± 0.04	47 (35)	0.01	0.008 ± 0.02	47 (39)	0.00
Indeno(1.2.3.cd)pyrene	0.01	0	0	0.005 ± 0.00	52 (52)	0.005 ± 0.00	52 (52)	0.00	0.005 ± 0.00	47 (47)	0.006 ± 0.01	47 (45)	0.00	0.006 ± 0.01	47 (46)	0.00
Sum of 16 PAH (M1)	0.10	218	258	0.046 ± 0.01	52 (50)	2.290 ± 4.57	52 (5)	2.24	0.049 ± 0.03	47 (45)	4.638 ± 8.61	47 (1)	4.59	2.731 ± 7.74	47 (2)	2.68
Sum of carcinogenic PAH (M1)	0.04	1	6	0.018 ± 0.00	52 (52)	0.031 ± 0.07	52 (30)	0.01	0.018 ± 0.00	47 (47)	0.135 ± 0.56	47 (8)	0.12	0.045 ± 0.17	47 (26)	0.03
pH Value	1.00			7.99 ± 0.51	52 (0)	3.49 ± 2.61	52 (3)	-4.50	8.10 ± 0.25	47 (0)	2.95 ± 1.23	46 (2)	-5.15	3.40 ± 2.20	47 (2)	-4.71

Action requested of the Sub-Committee

17 The Sub-Committee is invited to consider the information contained in this document and take action as appropriate.

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