UPDATED SUGGESTED DETECTION LIMITS FOR RELEVANT CHEMICALS IN BALLAST WATER

Most recent revision: GESAMP-BWWG 42 (July 2022)

Introduction

1 At its 42nd meeting, the GESAMP-BWWG noted that MEPC 78 had approved guidelines for re-evaluations in cases where modifications have been made to a ballast water management system and had instructed the Secretariat to issue the revised Methodology incorporating the aforementioned guidelines as a new chapter 12, by means of BWM.2/Circ.13/Rev.5.

2 The Group recalled that appendix 7 to the annex to BWM.2/Circ.13/Rev.4 contained appropriate detection limits for different chemicals associated with treated ballast water – Active Substance (AS), Relevant Chemicals (RCs), and some Other Chemicals (OCs) (neutralizers), as established at its Seventh Stock-taking Workshop (STW 7).

3 The Group also recalled that in the course of its work following STW 7, some of the predicted no effect concentrations (PNEC), derived no-effect levels (DNEL) and derived minimal effect levels (DMEL) had been revised and incorporated into the GESAMP-BWWG Database of chemicals most commonly associated with treated ballast water (https://gisis.imo.org/).

4 The detection limits in appendix 7 are related to critical values (CV_{PNEC} and $CV_{DNEL\text{-}DMEL}$) of Relevant Chemical concentrations in ballast water (RC_{BW}), that must not be exceeded in order to keep the PEC/PNEC ratio and/or the Risk Characterization Ratio (RCR) below 1 (see paragraph 7). Thus, the revision of PNEC, DNEL and/or DMEL values consequently leads to changes in detection limits. Therefore, the Group considered that the list of detection limits in appendix 7 was out of date and did not reflect the recent practices of the Group.

4 Following discussion, the Group concluded that the detection limits contained in appendix 7 of the annex to its Methodology could be kept up to date without requiring frequent revisions of the Methodology by moving this information to the IMO Biosafety Website. Thus, the Group requested the Secretariat to implement this change and replace the detection limits in the Methodology with a link to this document.

5 This document provides up-to-date detection limits and related information.

General remarks and rationale

6 Detection limits should be based on RC_{BW}, which are higher and easier to detect than environmental concentrations (actual or calculated).

7 The suggested detection limits ($DL_{suggested}$, formerly referred to as $DL_{analytical}$ in appendix 7 of the annex to BWM.2/Circ.13/Rev.4) are given in Table 1 below. They are derived from the calculated critical values (CVs) for RCs related to PNEC (CV_{PNEC}), used to assess environmental risks, as well as to DNEL and/or DMEL ($CV_{DNEL\text{-}DMEL}$), used to assess human exposure risks, as follows:

.1 The predicted environmental concentration (PEC) is calculated using MAMPEC-BW v3.1.0.3, see Methodology section 6.3.1.4, section 5.6.3 and further outlined in appendix 5, with no degradation assumed. The PEC of any given RC, as calculated by MAMPEC-BW with the GESAMP-BWWG emission scenario, must

always be lower than PNEC, so that ratio of PEC/PNEC is < 1. The critical value based on PNEC, CV_{PNEC}, is calculated by dividing PNEC by a pre-calculated value from MAMPEC-BW, that is specific to each chemical and subsequently used by the Database to calculate the PEC for all chemicals reported with each BWMS. This value is stated for each chemical in the Database under the tab MAMPEC calculations. CV_{PNEC} is the maximum value for $[RC]_{BW}$, above which the PEC/PNEC ratio would be > 1, indicating an unacceptable environmental risk; and

.2 Values of DNEL and/or DMEL are used to assess risks for human health with RCR, calculated as [exposure / (DNEL or DMEL)], which must be < 1. The exposure is understood to be the highest concentration resulting from the worst-case scenario of the human exposure scenarios, see section 7.2.3.3.3, further explained in appendix 4, section 2.1.4 (Periodic cleaning of ballast water tanks). The corresponding critical value ($CV_{DNEL-DMEL}$) is the maximum value for $[RC]_{BW}$, above which the RCR will be > 1, indicating an unacceptable human health risk in the worst-case scenario.

8 Data from the literature was surveyed to obtain up-to-date information about detection limits for the different analytical chemistry methods recommended for chemicals listed in GESAMP-BWWG Database (https://gisis.imo.org/). An effort was also made to harmonize $DL_{suggested}$ values for chemicals belonging to the same family.

9 The values of $DL_{suggested}$ in Table 1 were determined using the lowest value of CV_{PNEC} or $CV_{DNEL-DMEL}$, rather than both values (as was previously published in appendix 7 of the annex to BWM.2/Circ.13/Rev.4).

10 To minimize confusion, the Group also updated the detection limits to ensure a detection limit at least 10 times lower than the lowest value of CV_{PNEC} or $CV_{DNEL-DMEL}$, rather than relying on sensitivity factors as was done previously (see appendix 7 of the annex to BWM.2/Circ.13/Rev.4).

Revision of original detection limits

11 Following STW 7, as new or revised values for PNEC, DNEL and/or DMEL were established and used in the GESAMP-BWWG reports for certain chemicals, CV_{PNEC} and $CV_{DNEL-DMEL}$ were calculated or re-calculated by the GESAMP-BWWG. This resulted in the increase of some $DL_{suggested}$ values to reflect new or revised CV_{PNEC} and $CV_{DNEL-DMEL}$ values.

12 The Group also considered detection limit values in the dossiers submitted by applicants to GESAMP-BWWG meeting 36 and onwards, and some $DL_{suggested}$ values were increased to adjust for the actual capabilities of analytical chemistry laboratories contracted by the applicants.

13 In the case of sodium hypochlorite the Group considered to set $DL_{suggested}$ for sodium hypochlorite at 0.01 mg/L as Cl_2 (10 µg/L).

14 Revised PNEC and DNEL/DMEL values based on more recent scientific information were consistently noted in reports of the GESAMP-BWWG as they were evaluated, established and implemented, and the endpoints were subsequently updated in the Database of chemicals most commonly associated with treated ballast water (https://gisis.imo.org/) and used for all future evaluations of BWMS by the Group.

Additional information for applicants

15 If the value of $DL_{suggested}$ for a specific RC is not met by an applicant, the detection limit of the applicant will be deemed appropriate provided it is lower than the critical value (lowest of CV_{PNEC} and $CV_{DNEL-DMEL}$).

16 If the detection limit of an applicant for a given RC is higher than the critical value, this RC will be evaluated by the Group on a case-by-case basis. Alternatively, the detection limit of the applicant may be used as a worst-case scenario concentration value.

Table 1: Updated detection limits, minimum critical value (CV) and $CV/DL_{suggested}$ ratio for the Relevant Chemicals listed in the IMO database

Chemical family	Chemical name	CV (µg/L)	$DL_{suggested}$ (µg/L)	$CV/DL_{suggested}$[4] (unitless)
Aldehyde				
	Acetaldehyde	8.2E+01[1]	5.0E+00	1.6E+01
	Formaldehyde	6.4E+01[2]	5.0E+00	1.3E+01
Aldehyde hydrate				
	Chloral hydrate	3.6E+03[1]	1.0E+02	3.6E+01
Haloacetic acid				
	Bromochloroacetic acid	4.0E+01[2]	1.0E+00	4.0E+01
	Dibromoacetic acid	4.0E+01[2]	1.0E+00	4.0E+01
	Dibromochloroacetic acid	1.1E+04[1]	1.0E+01	1.1E+03
	Dichloroacetic acid	5.3E+02[2]	1.0E+01	5.3E+01
	Dichlorobromoacetic acid	2.2E+03[1]	1.0E+01	2.2E+02
	Monobromoacetic acid	5.9E+02[1]	1.0E+01	5.9E+01
	Monochloroacetic acid	2.2E+01[1]	1.0E+00	2.2E+01
	Tribromoacetic acid	2.7E+05[2]	1.0E+01	2.7E+04
	Trichloroacetic acid	1.1E+04[1]	1.0E+01	1.1E+03
Halopropionic acid				
	2,2-dichloropropionic acid (Dalapon)	4.1E+02[1]	1.0E+01	4.1E+01
Haloacetonitrile				
	Bromochloroacetonitrile	5.3E+01[1]	1.0E+00	5.3E+01
	Dibromoacetonitrile	2.1E+00[1]	1.0E-01	2.1E+01
	Dichloroacetonitrile	9.5E+02[1]	1.0E+01	9.5E+01
	Monobromoacetonitrile	8.9E+02[1]	1.0E+01	8.9E+01
	Monochloroacetonitrile	6.9E+00[1]	5.0E-01	1.4E+01
	Trichloroacetonitrile	3.6E+00[2]	1.0E-01	3.6E+01
Haloamine				
	Monochloramine	2.1E+02[1]	1.0E+01	2.1E+01
Halomethane				
	Dibromochloromethane	4.4E+02[2]	1.0E+01	4.4E+01
	Dibromomethane	1.9E+03[2]	1.0E+01	1.9E+02
	Dichlorobromomethane	1.6E+00[2]	1.0E-01	1.6E+01
	Dichloromethane	5.4E+01[2]	1.0E+00	5.4E+01
	Tetrachloromethane	2.3E+00[2]	1.0E-01	2.3E+01
	Tribromomethane	2.1E+01[2]	1.0E+00	2.1E+01
	Trichloromethane	9.4E+01[2]	1.0E+00	9.4E+01

Haloethane			
1,1-Dibromoethane	1.1E+03[2]	1.0E+01	1.1E+02
1,1-Dichloroethane	1.2E+03[1]	1.0E+01	1.2E+02
1,2-Dichloroethane	9.8E-01[2]	1.0E-01	9.8E+00
1,1,1-Trichloroethane	3.1E+02[2]	1.0E+01	3.1E+01
1,1,2-Trichloroethane	4.3E+03[2]	1.0E+01	4.3E+02
Haloethene			
Trichloroethene	3.0E-02[2]	1.0E-02[5]	3.0E+00[5]
Halopropane			
1,2-Dibromo-3-chloropropane	9.9E+00[2]	1.0E+00	9.9E+00
1,2-Dichloropropane	4.6E+02[2]	1.0E+01	4.6E+01
1,2,3-Trichloropropane	2.4E-01[2]	5.0E-02[5]	4.8E+00[5]
Halonitroalkane			
Chloropicrin	2.5E+00[1]	2.0E-01	1.3E+01
Halophenol			
2,4,6-Tribromophenol	7.4E+01[1]	1.0E+00	7.4E+01
Inorganic			
Bromate ion	3.3E+01[2]	1.0E+00	3.3E+01
Chlorate ion	3.1E+04[2]	1.0E+02	3.1E+02
Sodium hypochlorite		1.0E+01[3]	
Sodium thiosulphate	3.0E+04[1]	1.0E+03	3.0E+01
Isocyanuric acid	1.2E+04[1]	1.0E+03	1.2E+01
Sodium sulphite	9.7E+03[1]	1.0E+03	9.7E+00

1 CV_{PNEC}

2 $CV_{DNEL\text{-}DMEL}$

3 $DL_{suggested}$ is 1/10 of MADC for TRO (as Cl_2)

4 $CV/DL_{suggested}$ (rounded to the nearest unity) must be ≥ 10

5 $CV/DL_{suggested}$ < 10, but most, if not all applicants, cannot reach the previous values of 0.001 µg/L and 0.01 µg/L for trichloroethene and 1,2,3-trichloropropane, respectively