HELCOM Recommendation 42-43/6

Supersedes HELCOM Recommendation 31E/1

Adopted 28 February 2025,
having regard to Article 20, Paragraph 1 b)
of the Helsinki Convention

LISTS OF PRIORITY SUBSTANCES, SOURCES OF RELEASE, AND UNCERTAINTIES TO ADDRESS

THE COMMISSION,

RECALLING Article 5 of the Convention on the Protection of the Marine Environment of the Baltic Sea Area 1992 (Helsinki Convention), in which the Contracting Parties undertake to prevent and eliminate pollution of the marine environment of the Baltic Sea Area caused by harmful substances from all sources;

HAVING REGARD to the procedure for identifying and evaluating harmful substances as laid down in Annex I of the Helsinki Convention;

RECOGNIZING that levels of hazardous substances in the Baltic Sea are still elevated or unknown and a cause for concern as well as that hazardous substances originate from a wide range of human activities on land and at sea;

RECALLING ALSO the goal in the updated Baltic Sea Action Plan (BSAP) adopted in the Ministerial Meeting 2021 of a Baltic Sea unaffected by hazardous substances, accordingly the management objective to minimize input and impact of hazardous substances from human activities as well as the ecological objectives including concentrations of hazardous substances close to natural levels;

RECALLING FURTHER the agreement in the BSAP to establish a mechanism for managing the HELCOM list of priority substances starting from 2025 and respond to screening and assessment results pointing out regional challenges for the Baltic Sea environment and contaminants of emerging concern;

RECALLING FURTHERMORE the agreement in the BSAP to develop a regional strategic approach for HELCOM work on hazardous substances;

RECOGNIZING ALSO the need for the regional strategic approach for HELCOM work on hazardous substances and HELCOM actions to be based on a holistic approach for assessing the current situation regarding hazardous substances, in terms of the state of the Baltic Sea, activities and pressures;

RECOGNIZING ALSO the role of HELCOM priority lists as an essential intermediate step after the current situation has been assessed and prior to adopting actions, to ensure that actions will target key hazardous substances hampering the recovery of the Baltic Sea ecosystem, as well as sources and drivers of hazardous releases, and in addition existing uncertainties which are limiting reliable assessments;

ACKNOWLEDGING that, according to the above regional strategic approach, the HELCOM priority lists have an additional aim to support a common understanding and convey a message to other stakeholders accordingly on the anticipated most impacting or threatening substances or sources and the most critical gaps in data and methodologies hindering reliable assessments;

ACKNOWLEDGING existing national and international legislation and competences and, for those Contracting Parties being EU Member States, also other relevant EU legislation and commitments, aiming at preventing further degradation of the marine and freshwater environments and at achieving a healthy sea in good environmental/ ecological/chemical status;

RECOMMENDS to the Governments of the Contracting Parties to the Helsinki Convention to:

a) strategically focus the work of HELCOM on priority substances for the Baltic Sea (HELCOM List of Priority substances as contained in Attachment 1) with the aim to develop measures preventing or minimizing their releases to the marine environment, as well as, where possible, remediating existent pollution or reducing its impacts;
b) gather further evidence of the risk that other substances of concern (HELCOM List of Substances of Concern in Attachment 1) can pose to the Baltic marine environment and if actions should be taken to prevent or minimize their releases and integrate them, where relevant, to the list of priority substances in the next update of the list;
c) target relevant sources of hazardous releases (Attachment 2) to minimize impacts of released substances aiming for actions with potential for horizontal benefits through effects on multiple substances or groups;
d) reduce uncertainties related to hazardous substances, focusing the efforts in particular on the gaps as contained in Attachment 3, with the aim to support a further improved knowledge-base and technical capacity at the time when an update of the assessment and this Recommendation will be performed;
e) convey the information contained in the three priority lists (Attachments 1 to 3) to all relevant national stakeholders, and European and global processes of relevance, with the aim to promote achievement of the Recommendation and BSAP vision, especially for those elements beyond the direct jurisdiction of national governments.

RECOMMENDS FURTHER that the Contracting Parties review and, if necessary, update this Recommendation in 2030.

Attachment 1

HELCOM LIST OF PRIORITY SUBSTANCES AND SUBSTANCES OF CONCERN

I DEFINITION

In accordance with the regional strategic approach [link], the HELCOM list of priority substances contain substances and groups of substances with the highest anticipated risk for the Baltic Sea, based on a data-driven approach, either at this moment or in the near future.

HELCOM list of substances of concern is defined in the same way as HELCOM list of priority substances but the included substances have a higher uncertainty about the actual risk they pose.

II LIST

The substances have been prioritized based on an assessment following the scheme described in the regional strategic approach. Summary background information about the prioritization process and the concerns for each substance are provided in Annex I. More detailed information is provided in separate fact sheets per substance or substance group.

HELCOM list of priority substances[1] *(in alphabetical order)*

Entry number	Substance or substance group[2]	CAS number (not exhaustive list)[3]
1	17b-estradiol	50-28-2
2	17α-ethinylestradiol	57-63-6
3	Alkylphenols and their ethoxylates	140-66-9, 104-40-5, 25154-52-3, 84852-15-3, 1806-26-4
4	Arsenic and its compounds	7440-38-2
5	Bisphenols	80-05-7
6	Cadmium and its compounds	7440-43-9
7	Carbamazepine	298-46-4
8	Chlorpyrifos	2921-88-2
9	Chromium and its compounds	7440-47-3
10	Clarithromycin	81103-11-9
11	Copper and its compounds	7440-50-8
12	Cypermethrin	52315-07-8
13	DDT and its degradation products	789-02-6, 50-29-3, 72-55-9, 72-54-8, 53-19-0
14	Diclofenac	15307-86-5

[1] The following substances/groups that had been listed among the priority substances in Appendix 2 of superseded HELCOM Recommendation 31E/1 are not included in the HELCOM list of priority substances and substances of concern of the current Recommendation: *Hexabromocyclododecane (HBCDD), Short-chain chlorinated paraffins (SCCP or chloroalkanes, C10-13), Medium-chain chlorinated paraffins (MCCP or chloroalkanes, C14-17), Endosulfan*.

[2] Information about the description and rationale for substance groups listed is provided in the respective fact sheets.

[3] Some of the substances listed may be linked with more than one CAS number, thus this column should be read as a non- exhaustive listing. In particular for group entries, the CAS numbers listed are rather indicative. Specifically, for entries corresponding to inorganic elements and their compounds, the CAS number indicated is only that of the elemental form. For group organic entries, the CAS numbers indicated may e.g. correspond to members of the group listed in a HELCOM indicator or in official regulatory lists such as the EU Water Framework Directive.

15	Dioxins (dioxin-like PCBs, dioxins and furans)	1746-01-6, 40321-76-4, 39227-28-6, 57653-85-7, 19408-74-3, 35822-46-9, 3268-87-9, 51207-31-9, 57117-41-6, 57117-31-4, 70648-26-9, 57117-44-9, 72918-21-9, 60851-34-5, 67562-39-4), 55673-89-7, 39001-02-0, 32598-13-3, 70362-50-4, 32598-14-4, 74472-37-0, 31508-00-6, 65510-44-3, 57465-28-8, 38380-08-4, 69782-90-7, 52663-72-6, 32774-16-6, 39635-31-9
16	Diuron	330-54-1
17	Estrone	53-16-7, 19973-76-3
18	Gabapentin	60142-96-3
19	Heptachlor and its degradation products	76-44-8, 1024-57-3
20	Hexachlorobenzene	118-74-1
21	Irgarol (Cybutryne)	28159-98-0
22	Lead and its compounds	7439-92-1
23	Lindane (gamma-Hexachlorocyclohexane)	58-89-9
24	Mercury and its compounds	7439-97-6
25	Nickel and its compounds	7440-02-0
26	Nicosulfuron	111991-09-4
27	Octinoxate	5466-77-3
28	Organotins	36643-28-4
29	PAHs (Polycyclic Aromatic Hydrobarbons)	50-32-8, 206-44-0, 120-12-7, 5315-79-7
30	PBDEs (Polybrominated diphenyl ethers)	41318-75-6, 5436-43-1, 60348-60-9, 189084-64-8, 68631-49-2, 207122-15-4
31	PFAS (Per- and polyfluoroalkyl substances)	335-67-1, 1763-23-1, 355-46-4, 375-95-1, 375-73-5, 307-24-4, 375-22-4, 2706-90-3, 2706-91-4, 335-76-2, 307-55-1, 2058-94-8, 375-85-9, 72629-94-8, 375-92-8, 335-77-3, 376-06-7, 67905-19-5, 16517-11-6, 62037-80-3, 958445-44-8, 647-42-7, 678-39-7, 1190931-41-9
32	Phthalates	117-81-7
33	Zinc and its compounds	7440-66-6

HELCOM list of substances of concern

Entry number	Substance or substance group	CAS number (not exhaustive list)[2]
1	1-Dodecanamine, N-dodecyl-N-methyl-	2915-90-4
2	2,4,6-Tribromophenol (TBP)	118-79-6
3	2-Ethylhexyl diphenyl phosphate (EHDPP)	1241-94-7
4	2-Propen-1-yl 2-(cyclohexyloxy)acetate	68901-15-5
5	Bemotrizinol	187393-00-6
6	Bis(2-chloro-1-methylethyl) 2-chloropropyl phosphate	76025-08-6
7	Butyl acrylate	141-32-2
8	Cetylpyridinium (hexadecylpyridinium chloride)	123-03-5
9	Chlorhexidine	55-56-1
10	Cobalt and its compounds	7440-48-4
11	Das2 (C.I. Fluorescent Brighterner 220)	16470-24-9
12	Dechlorane Plus (anti-DDC-CO)	13560-89-9
13	DSBP (distyrylbiphenylsulfonate)	27344-41-8

14	Kinoprene	42588-37-4
15	Metsulfuron-methyl	74223-64-6
16	N-Methyl-2-pyrrolidone (NMP)	872-50-4
17	Nonanedioic acid (azelaic acid)	123-99-9
18	Octadecanamide	124-26-5
19	Pentabromobenzyl acrylate (PBB-Acr)	59447-55-1
20	Prometon	1610-18-0
21	Tris(2-ethylhexyl) phosphate (TEHP)	78-42-2
22	Uranium and its compounds	7440-61-1

Attachment 2

HELCOM LIST OF RELEVANT SOURCES OF HAZARDOUS RELEASES

I DEFINITION

In accordance with the regional strategic approach, the HELCOM list of relevant sources of hazardous releases contains:

- *sectors of human activity or specific activities*
- *pathways to the Baltic Sea*

anticipated to have significant contribution to overall inputs of hazardous substances to the Baltic Sea, either at this moment or in the near future.

II LIST

The sectors and pathways have been derived based on information collected in accordance with the regional strategic approach. Information has primarily been gathered from the categories *'inputs to the Baltic Sea'* and certain *'analogous concerns'*, i.e. those relating to likely significant inputs in the near future. Information from the *'presence in the Baltic Sea'* assessment was used to a lesser extent, as some of the critical/significant levels are associated with persistent residues of legacy uses or earlier inputs of respective activities.

With the available information, it was not possible to estimate the relative significance of different sources. Hence it was not possible to determine which of the listed entries are expected to have the highest overall inputs of hazardous substances.

Entry number	Source/Pathway	Type	Concern
1	Industrial sectors (including where relevant whole life cycle of products), including among many sectors: mining, production/smelting of non-ferrous metals, thermal power stations and other combustion installations, production of pig iron or steel, polymers/resins, batteries, paints/coatings/inks, adhesives, production of pulp/paper/ board/wood products, electronics, medical devices, landfills (various hazardous substances, including also nanomaterials from high-tech industries)	Source	Likely significant inputs to Baltic Sea / possible significant inputs in the near future (emerging sectors in the Baltic Sea and catchment, time-delayed emissions)
2	Agriculture (use of pesticides, veterinary products and micronutrients, emissions of hormones)	source	
3	Dredged material deposition and seabed disturbance activities	source	
4	Wastewater treatment plants (e.g. pharmaceuticals and personal care products, disinfection byproducts)	source, pathway	
5	Stormwater (e.g. metals, PAHs, biocides, disinfection byproducts)	pathway	
6	Shipping (antifouling, scrubber emissions, oil spills, flame retardants, bilge or ballast water, grey water and sewage)	source	

7	Dumped munitions (explosives and chemical warfare agents) and wrecks in the Baltic Sea (munitions and their toxic degradation products include amongst others α chloroacetophenone, sulfur mustard, clark-type munitions, TNT, HMX, RDX, etc.)	source	
8	Atmospheric deposition to Baltic Sea and its catchment	pathway	
9	Off-shore wind farms, floating terminals of Liquefied Natural Gas, and other renewable energy sectors including hydrogen production (antifouling / disinfection agents (sodium hypoclorite) and by-products, corrosion protection, oil spills etc.)	source	
10	Submarine sediment banks or landslides of / runoff from contaminated soil of industrial origin – in particular relating to abandoned plants	source, pathway	
11	Aquaculture (pharmaceuticals, disinfection agents and byproducts, biocides, food additives)	source	

Attachment 3

HELCOM LIST OF HORIZONTAL UNCERTAINTIES TO ADDRESS

I DEFINITION

In accordance with the regional strategic approach, the HELCOM list of horizontal uncertainties to address contains:

key horizontal gaps in data or methodologies hindering:

- *assessment of level of priority of substances / substance groups*
- *assessment of predominant sources of inputs*
- *identification of assessment units of poor status*
- *identification of most appropriate actions.*

II LIST

The key horizontal uncertainties are listed below, categorized according to their type.

It is noted that remaining uncertainties associated with priority substances or substances of concern have been reflected in the corresponding fact sheets. The list in this attachment reflects issues encountered during the current run of the approach, which relate to substances other than the ones on the lists of priority or concern (with the exception of sections 5-7, which relate to substances in Attachment 1 and partly to substances relevant for sources in Attachment 2). Such issues relate to data not readily available or that could not be retrieved during the exercise, data that were available but were not processed within the limited time of the exercise, needed methodologies that were lacking, or investigation needs triggered by analysis of existing data.

Main examples of substances the horizontal gaps relate to are provided, where relevant, as additional information per entry.

1. KEY GAPS IN ASSESSING PRIORITY: PRESENCE IN THE BALTIC SEA

Entry number	horizontal gap	main examples of substances it applies to	rationale
1	Identity confirmation in screening samples (PreEMPT)	Beyond the indicated in their fact sheets 11 substances of concern also e.g.: • *Jasmonic acid* • *Tolazoline* • *Iloprost* • *Pirbuterol* • *Penicillic acid* • *3a,4,5,6,7,7a-Hexahydro-4,7-methano-1H-inden-5-yl propionate* • *Camphor* • *Ethyl 3-(N-butylacetamido)propionate* • *Hexa-2,4-dienoic acid* • *4,4-Dimethyl oxazolidine* • *4-tert-Butylbenzoic acid* • *1-Butanol, 3-methoxy-3-methyl-, acetate* • *Octanedioic acid*	➢ conclude on HELCOM priority

		• *3-Pyridinol* • *3-Methylbenzoic acid* • *2-Butenedioic acid (2Z)-, monobutyl ester* • *3,5-Di-tert-butyl-4-hydroxybenzaldehyde* • *1-Propanone, 1-(4-dodecylphenyl)-2-hydroxy-2-methyl-* • *(3S-trans)-hexahydro-3-isobutylpyrrolo[1,2-a]pyrazine-1,4-dione* • *N-(2,4-Dimethylphenyl)formamide* • *12-Oxooctadecanoic acid* • *2-Naphthylamine* • *Benzoic acid, 4-(1,1-dimethylethyl)-, 1-methylethyl* • *Methylparaben* • *Musk* • *Dacarbazine* • *Misoprostol* • *Pilocarpine* • *Vernakalant*	
2	Further spatial coverage of marine data	Beyond the indicated 2 priority substances in their respective fact sheets, also e.g.: • *Diethylamino hydroxybenzoyl hexyl benzoate* • *Risperidone* • *Cyanides* • *Emamectin* • *Phenol* • *Norfloxacin* • *Dioctyldiphenylamine* • *Triphenylene* • *Diphenylsulfone* • *m-Terphenyl* • *Diethylamino hydroxybenzoylhexylbenzoate* • *2-Ethylhexyl diphenyl phosphate (EHDP)* • *Formaldehyde* • *N,N-dimethyltetradecylamine*	➢ conclude on HELCOM priority
3	Application/development of more sensitive analytical methods (lower Limit Of Detection)	E.g. for substances with very low toxicity thresholds such as many pesticides, biocides, pharmaceutical substances, and others (all matrices). Or for substances for which there is analytical data only from screening campaigns. Furthermore, for screening campaigns, for interpreting non-detections, it would be beneficial to report, if justified, a more reasonable value for the LOD than reported currently (lowest concentration measured among the samples).	➢ conclude on HELCOM priority
4	Past trends of marine levels in the Baltic Sea	All substances in the Master table compiled during the primary run of the framework, which had monitoring data and time series, including substances in Attachment 1.	➢ conclude on HELCOM priority
5	First data about marine levels in the Baltic Sea (or first data in the relevant matrix or relevant form)	Beyond the indicated in their fact sheets priority substances, also e.g.: • *Thifensulfuron-methyl (expected relevant matrix)* • *Sulfamethizole (expected relevant matrix)* • *4,5-Dichloro-2-octyl-isothiazolone (DCOIT) (expected relevant matrix)* • *2-(2h-benzotriazol-2-yl)-4,6-bis(1-methyl-1-phenylethyl)phenol (expected relevant matrix)* • *venlafaxine and its transformation product (O-desmethylvenlafaxine) (water)* • *further substances identified as of likely significant inputs during the pirmary run of the*	➢ conclude on HELCOM priority

		framework – including where available presence data did not correspond to the expected relevant matrix based on their physicochemical properties; • *candidate substances of concern that may be identified on the basis of market data and PBT properties (see entry #12)*	
6	First data about marine levels of transformation products in the Baltic Sea	Transformation products of substances with high market volume and known transformation products with potential PBT/vPvB properties (relevant substances can be identified via databases, e.g. relating to REACH registration information and accordingly for other sectors – including also chlorinated and brominated disinfection byproducts)	➢ identify new HELCOM priority substances
7	Confirmation of whether detection may have been due to contamination during sampling or analysis (PreEMPT)	• *Methylparaben* • *Musk*	➢ conclude on HELCOM priority
8	Distinguishment between marine levels in polluted vs. reference sites	Applies in general to all hazardous substances	➢ improve priority assessment
9	Marine levels of hazardous substances of natural origin (see also entry #15 about establishment of background levels)	E.g.: • *Halogenated naturally produced compounds (produced by filamentous macroalgae due to eutrophication), such as brominated dioxins*	➢ identify new HELCOM priority substances

2. KEY GAPS IN ASSESSING PRIORITY: INPUTS TO THE BALTIC SEA

Entry number	horizontal gap	main examples of substances it applies to	rationale
10	Past trends of inputs to the Baltic Sea	Beyond the indicated, in their fact sheets, priority substances, also e.g.: • *Cyanides* • *Thifensulfuron-methyl* • *Sulfamethizole* • *4,5-Dichloro-2-octyl-isothiazolone (DCOIT)* • *2-(2h-benzotriazol-2-yl)-4,6-bis(1-methyl-1-phenylethyl)phenol* • *venlafaxine and its transformation product (O-desmethylvenlafaxine)*	➢ conclude on HELCOM priority
11	First data about measured or estimated inputs, from specific pathways to the Baltic Sea expected to contribute significantly to overall inputs of substances (such as atmospheric deposition and direct releases from certain off-	Atmospheric deposition: substances where this pathway may be relevant may be identified on the basis of their physicochemical properties, as well as magnitude of global market. Marine aquaculture: substances authorized for such use in Contracting Parties. E.g.: • *Florfenicol* • *Flumequine* • *Oxolinic acid* • *Sulfadiazine/ trimethoprim* • *Benzocaine* • *Emamectin benzoate*	➢ conclude on HELCOM priority ➢ identify new HELCOM priority substances ➢ (predominant sources of inputs and appropriate measures)

	shore sources, including aquaculture)	Renewable energy sectors. E.g. substances identified in relevant literature or relevant projects outputs, such as: • *Sodium hypochlorite and chlorinated disinfection byproducts* • *Indium* • *Naphthenic acids* Further emerging sectors. E.g. *carbon nanotubes* (batteries, 'high-tech' industries)	
12	Regional market data – and identification of candidate substances of concern on that basis along with PBT properties	Substances in sectors beyond pharmaceuticals (for which sales data was made available via a data call) and beyond data in the SPIN database. Candidate substances of concern on the basis of market information (REACH registrations and SPIN database) and PBT (/suspected PBT) properties, but for which no presence/inputs information was available for the Baltic Sea, include e.g.: • *Terphenyl, hydrogenated* • *Cyclomethicones/Hydrocarbylsiloxanes* • *Fluorescent Brightener CF-351* • *Di-tert-butyl 3,3,5-trimethylcyclohexylidene diperoxide* • *Bis(2,4-dichlorobenzoyl) peroxide*	➢ conclude on HELCOM priority ➢ identify new HELCOM priority substances
13	Information about the actual chemicals in spills	Information about substances in the spills beyond the information recorded during aerial surveillance activities, e.g. information gathered during response operations including any sampling of the spill. Applicable in particular for substances other than petroleum hydrocarbons.	➢ identify new HELCOM priority substances
14	Conversion of estimated inputs to Predicted Environmental Concentrations (PECs) in Baltic Sea matrices	All substances for which data on inputs was compiled during the primary run or for which inputs data (measured or estimated, including based on market data) may become available for future runs.	➢ conclude on HELCOM priority ➢ identify new HELCOM priority substances

3. KEY GAPS IN ASSESSING PRIORITY: HAZARDOUS PROPERTIES AND TOXICITY THRESHOLDS

Entry number	horizontal gap	main examples of substances it applies to	rationale
15	More reliable data about marine quality standards (water, sediment, biota), including establishment of background levels for naturally occurring substances in the sea	Beyond the indicated, in their fact sheets, priority substances, also e.g.: • *5'-Methylthioadenosine (bacground levels)* • *Terbumeton (threshold for sediment)* • *Thifensulfuron-methyl (threshold in expected relevant matrix)* • *Sulfamethizole (threshold in expected relevant matrix)* • *Diethylamino hydroxybenzoyl hexyl benzoate (threshold in water)* • *4,5-Dichloro-2-octyl-isothiazolone (DCOIT) (threshold in expected relevant matrix)* • *Cyanides (threshold in water)* • *Selenium (threshold in sediment, biota)* • *2-(2h-benzotriazol-2-yl)-4,6-bis(1-methyl-1-phenylethyl)phenol (threshold in expected relevant matrix)*	➢ conclude on HELCOM priority

		• *Pilocarpine (background levels, if relevant)* • *substances for which identity in screening samples will be confirmed from horizontal gap #1 (threshold in matices where exceedances of NORMAN lowest PNECs were observed)*	
16	First data about marine quality standards (water, sediment, biota)	Frequently detected substances in Baltic Sea for which no toxicity threshold was available to compare with, for any of the matrices for which there was analyzed samples, e.g.: • substances detected in all samples: • *naturally occurring substances:* - *chemical elements / metals (e.g. Zirconium, Cerium, Tungsten, Neodymium, Niobium, Gallium, etc.)* • *biologically produced substances:* - *Nodularin and Microcystin-LR (toxins), p-Terphenyl, α-Tocopherol acetate* • *anthropogenic substances:* - *Parlar 50, Dechlorane 602, AES-C12 (some members), Mesazaline* • substances detected in the vast majority of samples: • *naturally occurring substances:* - *chemical elements / metals (e.g. Bismuth, Strontium, etc.)* • *anthropogenic substances:* - *Parlar 26, Parlar 62, Dechlorane 603, Aliphatic hydrocarbons >C16-C35, N-dodecyl-4-methoxybenzamide, Tris(2-isopropylphenyl) phosphate, Tetracycline/Doxycycline, Methylhexahydrophthalic anhydride (MHHPA), AES-C12 (some members), etc.*	➢ conclude on HELCOM priority
17	First data about marine quality standards (biota) referring to biota taxa for which there is available monitoring information (e.g. marine predators and marine plants), and being of equivalent level of protection to critical marine biota standards available	E.g. for organics detected in sea mammals or apex predators in screening campaigns such as in project LifeAPEX. Or, to the extent relevant, for metals and EU WFD priority organics for which there is monitoring data by CPs in sea mammals or sea plants/flora.	➢ conclude on HELCOM priority
18	More conclusive/extensive compilation of available data about modes of hazardous action to aquatic biota and humans – or about their absence, for substances	Applies in general to all hazardous substances	➢ conclude on HELCOM priority
19	More reliable or first data about Persistence and Bioaccumulativity	Substances with possibly significant inputs for which P or B data was unavailable, e.g.: • *Thifensulfuron-methyl (B)* • *Sulfamethizole (B)* • *4,5-Dichloro-2-octyl-isothiazolone (DCOIT) (P,B)* • *2-(2h-benzotriazol-2-yl)-4,6-bis(1-methyl-1-phenylethyl)phenol (P,B)*	➢ conclude on HELCOM priority

		• *Diisononylphthalate (DNP) (P,B)* • *Thiacloprit (P,B)* • *1,2-Bis(2,4,6-tribromophenoxy) ethane (BTBPE) (P,B)* • *tricresyl phosphate, tritolyl phosphate (m-TMPP) (P,B)* • *Mecoprop (P,B)* Also for any substances for which there is official P/B assessments (e.g. substances in the REACH Candidate list of SVHCs / assessed by ECHA's PBT expert group), but the respective information may not have been taken forward in the primary run, ensuring that such information is utilized in the priority assessment.	

4. KEY GAPS IN ASSESSING PRIORITY: BIOLOGICAL EFFECTS AND THEIR TRIGGERS

Entry number	horizontal gap	main examples of substances it applies to	Rationale
20	Comprehensive list of substances (/ their mixtures) that triggered observed biological effects	Monitored Biological Effects which exceeded relevant thresholds in the Baltic Sea: • *Reproductive toxicity* • *Neurotoxicity* • *Oxidative stress* • *Membrane toxicity* Location for assessment: in particular, but not only, in Assessment Units where these were observed Examples of substances known to specifically elicit the mentioned biological effects, though this does not exclude the possibility that it is other unknown substances in the same locations that may produce similar effects: • Reproductive toxicants, substances inducing oxidative stress and substances inducing membrane toxicity, such as: *polychlorinated dibenzofurans, dioxins, dioxin-like polychlorinated biphenyls, PAHs, and metals* • Neurotoxicants such as: *organophosphates and carbamates or similar* From another angle, substances with relevant modes of action have been detected or have frequently exceeded toxicity thresholds in assessment units where biological effects have also been observed. While a direct cause-effect relationship cannot yet be established, these substances may represent potential candidate triggers, warranting further investigation. Examples of such preliminary candidate triggers are among others: • Neurotoxicity as a mode of action: *Misoprostol, Bis(2-chloro-1-methylethyl) 2-chloropropyl phosphate, Pentaethylene glycol monododecyl ether, Methacrylamide, Triphenyltin and triphenyltin compounds, cis-Heptachlorepoxide, 4-Acetaminoantipyrine, etc.* • Reproductive toxicity as a mode of action: *Octylphenol diethoxylates, Cetylpyridinium, Bis(2-chloro-1-methylethyl) 2-chloropropyl phosphate, Iron, Uranium, Tetrabutyltin (TeBT),*	➢ conclude on HELCOM priority ➢ identify new HELCOM priority substances

		Pentchlorobenzene, Piperonal, Benzoic acid, 4-(1,1-dimethylethyl)-, 1-methylethyl ester, etc.	
21	Underutilization / Limited spatial coverage on biological effects in Baltic Sea (linked with exposure to hazardous substances)	NA	➢ further conclude about the modes of action which are relevant in the Baltic Sea
22	Underrepresentation of biological effects for some taxonomical groups (e.g. algae)	NA	➢ wider panel of effect-based methods → identify new modes of action which are relevant in the Baltic Sea
23	Specific thresholds values for the Baltic Sea for biological effects	NA	➢ generation of further specific threshold values for the Baltic Sea → use of some of the available BE tools for some species → further conclude about the modes of action which are relevant in the Baltic Sea
24	Interactive effects with 'non-hazardous' substances in mixtures	E.g. *caffeine / sweeteners*	➢ identify new HELCOM priority substances ➢ conclude on HELCOM priority

5. KEY GAPS IN ASSESSING PREDOMINANT SOURCES OF INPUTS AND APPROPRIATE MEASURES

Entry number	horizontal gap	main examples of substances it applies to	Rationale
25	More comprehensive apportionment of activities / releases / inputs	Substances in the HELCOM list of priority substances or associated with sources/pathways in the HELCOM list of relevant sources of release. Potentially also substances in the HELCOM list of substances of concern.	➢ predominant sources of inputs → appropriate measures
26	'Secondary' sources of 'legacy' substances	Substances in the HELCOM list of priority substances and substance of concern with mostly 'legacy status' (i.e. for which no authorised activity has been identified in most/any of the Contracting Parties), but with non-negligible measured inputs based on riverine/WWTP monitoring or atmospheric deposition data (unless analysis of past trends in the period 2015-2022 where data in the primary run refers to indicates negligible inputs in the most recent years). E.g.: • *DDX* • *Heptachlor and its degradation products* • *Lindane*	➢ predominant sources of inputs → appropriate measures

		• *Chlorpyrifos* • *Prometon* • *Kinoprene*	
27	Methodologies to assist in a more effective and efficient assessment of predominant sources of release / input per substance or group of substances	Applicable to all hazardous substances	➢ predominant sources of inputs → appropriate measures

6. KEY GAPS IN ASSESSING EFFECTIVENESS OF MEASURES

Entry number	horizontal gap	main examples of substances it applies to	rationale
28	Future trends of inputs to or presence in the Baltic Sea	Substances in the HELCOM list of priority substances or associated with sources/pathways in the HELCOM list of relevant sources of release. Potentially also substances in the HELCOM list of substances of concern.	➢ likely level of implementation and/or effectiveness of adopted measures → appropriate measures
29	Appropriateness of and gaps in existing measures, in terms of the targeted element (in accordance with DAPSIM framework), targeted actor, or mode of policy action (relevant aspects to be considered: effectiveness / resource efficiency / secondary impacts / fairness)	Substances and issues in the three HELCOM priority lists, for which no progress will be identified by the subsequent run of the regional strategic approach	➢ gaps in management → appropriate measures
30	Methodologies to assess or predict the effectiveness of individual past/future measures	Applicable to all hazardous substances	➢ appropriate measures

7. KEY GAPS IN ASSESSING PRIORITY: DRIVERS OF PRESENCE IN / INPUTS TO BALTIC SEA

Entry number	horizontal gap	main examples of substances it applies to	rationale
31	Ongoing and future influence of climate change on the overall hazardous substances landscape (marine levels, marine quality standards, etc.)	Applicable to all hazardous substances	➢ identify new drivers of HELCOM priority
32	Key drivers on the overall hazardous substances landscape	Applicable to all hazardous substances	➢ identify new drivers of HELCOM priority

Annex I

BACKGROUND INFORMATION

Summary of the prioritization process

The process on which prioritization was based followed the scheme described in the regional strategic approach.

At first, three parallel, independent from each other, assessments were performed:

- *'presence in the Baltic Sea' assessment*: available monitoring and screening measurement data in the Baltic Sea (2015-2024) versus toxicity threshold values (also where available)
- *'inputs to the Baltic Sea' assessment:* available quantitative data from input pathways to the Baltic Sea (2015-2024) in combination with persistence, bioaccumulativity, and toxicity properties of substances (also where available)
- *'analogous concerns' assessment:* available information in relation to some of the defined as 'analogous concerns' to presence and inputs, such as biological effects, presence in 'analogous' sea, likely inputs in the near future, and potential for trophic biomagnification

The above assessments covered approximately 1,500 individual substances or substance groups. It led to the identification of approximately 350 substances/groups that fulfilled the criteria established for at least one of the three respective concerns: critical/significant presence[4], likely significant inputs[5], analogous concern[6] (for details, see the regional strategic approach).

The 350 substances/groups were ranked, by scoring the extent to which they fulfilled the presence and inputs criteria (analogous concerns used as a qualitative flag to support expert judgement) and taking into account also the criticality of their mode of toxicity. The scoring included also a technical uncertainty/sensitivity analysis, based on alternative scenarios for that part of data which was of low reliability, e.g. unreliable toxicity thresholds, concentrations coming from screening, or insufficiently representative data (e.g. small number of data points or of data-rich assessment units). Overall-scoring intended to be a rough evaluation of the likely magnitude of impact or threat of a substance for the Baltic Sea and its ecosystem services.

135 top-ranked substances/groups/clusters were selected as of priority and were investigated further. These included entries both from the total combined ranking and from individual rankings. The reason was to ensure that e.g. substances with likely significant inputs but which may not have yet reached critical levels at the Baltic Sea – or such information is not available – are also considered as candidates for prioritization, as preventive measures may well be needed. Further investigation included grouping considerations, consideration of additional collected information for example on market, and expert judgement including via a dedicated workshop, before deriving the HELCOM list of priority substances via the standard HELCOM procedure involving the relevant HELCOM Groups.

[4] The criterion for 'critical/significant presence' related to at least 2 assessment units (including 2 Contracting Parties or 1 off-shore unit) with at least 10% samples (and at least 2 samples) exceeding the acquired toxicity threshold or equivalent, to account for the diversity in available data.

[5] The 'likely significant inputs' criterion corresponded to a 'borderline'-PBT substance (roughly according to the REACH Regulation's criteria) with estimated inputs to the Baltic Sea of 1 tonne/year or equivalent (e.g. fulfilment of the T criteria to greater extent, i.e. threshold value for water much lower than 10µg/l, allowed also inputs below 1 tonne/year meeting the criteria, etc.)

[6] The criteria depended on the specific analogous concern. For example, 'possibly significant inputs in the near future' related to emerging sectors. Whereas potential for trophic biomagnification was associated with a reported trophic magnification factor (predator / prey) above 30.

Summary of the main concern per substance

Entries in the HELCOM list of priority substances *(listed in alphabetical order)*

Entry number	substance or substance group	main concern	additional concerns
1	17b-estradiol	likely significant inputs to the Baltic Sea	critical mode of action
2	17α-ethinylestradiol	critical/significant presence in the Baltic Sea	
3	Alkylphenols and their ethoxylates	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, critical mode of action
4	Arsenic and its compounds	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, critical mode of action
5	Bisphenols	likely critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, critical mode of action
6	Cadmium and its compounds	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, critical mode of action, analogous concern (possible significant inputs in the near future)
7	Carbamazepine	critical/significant presence in the Baltic Sea	possible significant inputs to Baltic Sea
8	Chlorpyrifos	likely critical/significant presence in the Baltic Sea, likely significant inputs to the Baltic Sea	critical mode of action
9	Chromium and its compounds	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, analogous concern (possible significant inputs in the near future)
10	Clarithromycin	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea
11	Copper and its compounds	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, analogous concern (possible significant inputs in the near future)
12	Cypermethrin	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea
13	DDT and its degradation products	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, evidence of high trophic magnification potential, critical mode of action
14	Diclofenac	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea
15	Dioxins (dioxin-like PCBs)	critical/significant presence in the Baltic Sea	
16	Diuron	critical/significant presence in the Baltic Sea	possible significant inputs to Baltic Sea, toxicity driver in

			North-East Atlantic, critical mode of action
17	Estrone	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea
18	Gabapentin	critical/significant presence in the Baltic Sea	critical mode of action
19	Heptachlor and its degradation products	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea
20	Hexachlorobenzene	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, critical mode of action
21	Irgarol (Cybutryne)	critical/significant presence in the Baltic Sea	possible significant inputs to Baltic Sea, toxicity driver in North-East Atlantic
22	Lead and its compounds	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, analogous concern (likely significant inputs in the near future)
23	Lindane (gamma-Hexachlorocyclohexane)	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, critical mode of action
24	Mercury and its compounds	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, critical mode of action, analogous concern (likely significant inputs in the near future)
25	Nickel and its compounds	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, analogous concern (likely significant inputs in the near future)
26	Nicosulfuron	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea
27	Octinoxate	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea
28	Organotins	critical/significant presence in the Baltic Sea	analogous concern (biological effects observed in Baltic Sea), likely significant inputs to Baltic Sea
29	PAHs (Polycyclic Aromatic Hydrobarbons)	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, very critical/significant presence in North-East Atlantic, critical mode of action
30	PBDEs (Polybrominated diphenyl ethers)	critical/significant presence in the Baltic Sea	
31	PFAS (Per- and polyfluoroalkyl substances)	critical/significant presence in the Baltic Sea	evidence of high trophic magnification potential, critical mode of action
32	Phthalates	critical/significant presence in the Baltic Sea	possible significant inputs to Baltic Sea, critical mode of action
33	Zinc and its compounds	critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea

Entries in the HELCOM list of substances of concern *(listed in alphabetical order)*

Entry number	substance or substance group	main concern	additional concerns
1	1-Dodecanamine, N-dodecyl-N-methyl-	likely critical/significant presence in the Baltic Sea	
2	2,4,6-Tribromophenol (TBP)	likely significant inputs to the Baltic Sea	
3	2-Ethylhexyl diphenyl phosphate (EHDPP)	likely significant inputs to the Baltic Sea	critical mode of action
4	2-Propen-1-yl 2-(cyclohexyloxy)acetate	likely critical/significant presence in the Baltic Sea	
5	Bemotrizinol	likely significant inputs to the Baltic Sea	
6	Bis(2-chloro-1-methylethyl) 2-chloropropyl phosphate	likely critical/significant presence in the Baltic Sea	
7	Butyl acrylate	likely critical/significant presence in the Baltic Sea	
8	Cetylpyridinium (hexadecylpyridinium chloride)	likely critical/significant presence in the Baltic Sea	possible significant inputs to Baltic Sea
9	Chlorhexidine	likely significant inputs to the Baltic Sea	
10	Cobalt and its compounds	likely significant inputs to the Baltic Sea	critical mode of action, analogous concern (possible significant inputs in the near future)
11	Das2	likely significant inputs to the Baltic Sea	
12	Dechlorane Plus (anti-DDC-CO)	likely significant inputs to the Baltic Sea	
13	DSBP (distyrylbiphenylsulfonate)	likely significant inputs to the Baltic Sea	
14	Kinoprene	likely critical/significant presence in the Baltic Sea	critical mode of action
15	Metsulfuronmethyl	likely significant inputs to the Baltic Sea	
16	N-Methyl-2-pyrrolidone	likely critical/significant presence in the Baltic Sea	critical mode of action, analogous concern (possible significant inputs in the near future)
17	Nonanedioic acid	likely critical/significant presence in the Baltic Sea	
18	Octadecanamide	likely critical/significant presence in the Baltic Sea	
19	Pentabromobenzyl acrylate (PBB-Acr)	likely significant inputs to the Baltic Sea	
20	Prometon	likely critical/significant presence in the Baltic Sea	critical mode of action
21	Tris(2-ethylhexyl) phosphate	likely critical/significant presence in the Baltic Sea	likely significant inputs to Baltic Sea, critical mode of action

22	Uranium and its compounds	likely significant inputs to the Baltic Sea	likely critical/significant presence in Baltic Sea, analogous concern (possible significant inputs in the near future)