Fact sheets for substances in the HELCOM list of priority substances and substances of concern

Introduction

This document lists fact sheets for the substances in the HELCOM list of priority substances and substances of concern.

Per substance or substance group, a first section summarizes the evidence based on which HELCOM has prioritized it or listed it as of concern. Including what risk (impact or threat) is posing for the Baltic Sea. For substance groups, the definition of the individual substances intended to be covered and justification for the grouping are explained under the subsection ‘overall assessment’.

A second section reflects aspects relevant for management considerations – mainly apportionment of releases/pathways/inputs and main substance-specific existing measures. So, in other words, what we know about the causes/origins of the situation. And what is currently done by other policies in this respect (HELCOM actions are not listed therin). A subsection marked with a questionmark, where relevant, indicates aspects that could be investigated and could further improve the evaluation of the magnitude of risk.

The HELCOM DAPSIM causal framework (according to which societal management is depicted as repeating cycles of Drivers – Activities – Pressures – State – Impact - Measures) has been used to indicate which part of the causal chain each piece of information relates to.

The most common references are listed at the end of the document. In the current version (March 2025), detailed specific references for each substance or substance group are not listed. They are to be added in an upcoming updated version of the document.

HELCOM list of priority substances

17b-estradiol

(CAS numbers: e.g. 50-28-2, EC number: 200-023-8 / Entry number in HELCOM list of priority substances: 1)

General sectors: Hormone, pharmaceutical, industry

DRIVERS ACTIVITIES PRESSURES STATE IMPACTS

Why a HELCOM priority?

Main evidence

P Approximately **26-61 kg of 17b-estradiol** are estimated to enter the Baltic Sea every year, mainly via rivers and Wastewater Treatment Plants (WATERBASE[1]; Undeman et al, 2022[2]). Given that the substance is **persistent** and **extremely toxic**[3], current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. The data used for the riverine part of the estimation (WATERBASE) concerns only measurements in the proximity of river mouths, and the period 2015-2022. The 13 subcatchment areas for which there was such riverine data reflected 14 % of the total riverine flow to the Baltic Sea, to which inputs have been extrapolated. The data in WATERBASE included approximately 6 countries and 92 samples.

I Current inputs to the Baltic Sea indicate potential negative impacts at least on pelagic biota.

Supporting evidence

I 17b-estradiol is considered to have an **especially concerning mode of toxicity**. For example, it is an endocrine disruptor[4] and toxic for reproduction[5]. Endocrine disruptors mimic or interfere with hormones and can cause developmental abnormalities, reproductive dysfunction, and population effects.

Overall assessment

When assessing current levels in the Baltic Sea (no relevant measurement data due to difficult chemical analysis), current inputs, and the severity of the relevant toxicity mechanism, 17b-estradiol scores **44-95/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A 17b-estradiol is a natural estrogen, which is excreted by humans as well as animals. It is also sold as a pharmaceutical. Furthermore, it is used in the EU in industrial settings as an intermediate in synthesis.

P Based on available estimations[1,2], riverine and direct inputs to the Baltic Sea are of similar order of magnitude. The contribution of direct releases was calculated as a percentage of the total WWTP discharges estimated by Undeman et al. study.

Relevant policies (existing or planned measures)

M (on A/P)

- Listed in the first and second **EQSD Watch Lists**. And also as priority substance in the EC proposed Directive amending WFD and EQSD.

References:

1. 2. 3. 4. 5. [Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

17α-ethinylestradiol

(CAS numbers: e.g. 57-63-6, EC number: 200-342-2 / Entry number in HELCOM list of priority substances: 2)

General sectors: Pharmaceutical

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of 17α-ethinylestradiol exceed the applied threshold value in all the **4** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**3**/3 assessed off-shore areas). In these 4 areas, **100%**[*] of the assessible samples in **water** exceed the threshold value. This is based on monitoring data for the 17α-ethinylestradiol period 2015-2023 as reported by Contracting Parties (CPs) as response to a data call organized by HELCOM. A total number of 24 data points were possible to evaluate for 17α-ethinylestradiol.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, 17α-ethinylestradiol scores **9.0/10** (confidence range: **8.2 – 9.1**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for 17α-ethinylestradiol, for water, was acquired from the EC proposed Directive amending WFD and EQSD[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota.

Supporting evidence

P Approximately **2-23 kg of 17α-ethinylestradiol** are estimated to enter the Baltic Sea every year, via Wastewater Treatment Plants (WWTPs) / rivers (WATERBASE[1]; Undeman et al, 2022[2]). Given that the substance is **persistent** and **extremely toxic**[3], current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also historical inputs.

A With sales in CPs of ≥1.1 - 1.4 kg/y (2015-2022[4]), the predicted (conservative) river concentration at the proximity of WWTP effluents by using the guidelines of Phase I ERA is about 1.5 times the threshold value for freshwater.

I 17α-ethinylestradiol is considered to have an **especially concerning mode of toxicity**. It is an endocrine disruptor[5] and carcinogen[6]. Endocrine disruptors mimic or interfere with hormones and can cause developmental abnormalities, reproductive dysfunction, and population effects.

Overall assessment

When assessing current levels in the Baltic Sea (no relevant measurement data), current inputs, and the severity of the relevant toxicity mechanism, 17α-ethinylestradiol scores **86-91/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A 17α-ethinylestradiol is a synthetic estrogen[7]. The amount of sales has a somewhat decreasing trend.

Relevant policies (existing or planned measures)

P 17α-ethinylestradiol is expected to enter the Baltic Sea via wastewater effluents.

M (on A/P) • Listed in the first and second **EQSD Watch Lists**. And also as priority substance in the **EU WFD** update proposal.

References:

1. 2. 3. 4. 5. 6.7.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering that there were also inconclusive non-detections (in terms of exceedance, due to a relatively high limit of detection), it is possible that the actual average frequency of exceedance in these areas is somewhat lower, but in any case >40%.

Alkylphenols and their ethoxylates

(CAS numbers: e.g. 140-66-9, 104-40-5, 25154-52-3, 84852-15-3, 1806-26-4, EC numbers: e.g. 205-426-2, 203-199-4, 246-672-0, 284-325-5, 217-302-5 / Entry number in HELCOM list of priority substances: 3)

General sectors: Industry and commercial products, off-shore (shipping)

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of 4-tert-Octylphenol exceed the applied threshold value in **6** of the 21 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**2**/7 assessed off-shore areas). In these 6 areas, on average **43%** of the assessible samples in **water** and/or **sediment** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1] and scientific articles/reports[2], as well as target screening data from the project PreEMPT[3]. A total number of 502 data points were possible to evaluate for 4-tert-Octylphenol.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, 4-tert-Octylphenol scores **6.6/10** (confidence range: **6.5 – 7.2**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

Concentrations of nonylphenols and octylphenol ethoxylates also frequently exceed their respective threshold value, with the ethoxylates exceeding the threshold value for **biota**. The threshold values for the three substances mentioned, were acquired from the EQS Directive[4] for water, and from the ecotoxicology database of NORMAN Network for sediment and biota[5].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota, sediment dwelling biota, and top predators such as seals.

Supporting evidence

P Approximately **4 – 70 tonnes of alkylphenols and their ethoxylates** are estimated to enter the Baltic Sea every year, mainly via rivers, and secondly from direct releases from land-based activities or WWTPs (WATERBASE[6], Undeman et al[7]). The range is large, as there is contradicting data on measured inputs and the group itself is broad. Additional inputs may be expected from off-shore activities (see under Activities below) and from atmospheric deposition. Given that the substances in this group are **very persistent and very toxic**[8], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the likely higher historical inputs.

S According to Swedish monitoring data, levels of alkylphenols are decreasing in Sweden's off-shore sediments, although they are still above the limit of quantification**.**

I Alkylphenols are considered have an **especially concerning mode of toxicity,** as many of them are endocrine disruptors[9]. Endocrine disruptors mimic or interfere with hormones and can cause developmental abnormalities, reproductive dysfunction, and population effects.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, for example 4-tert-Octylphenol scores **68-74/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment. Besides 4-tert-Octylphenol, for several other alkylphenols (i.e. hydrocarbylphenols that have aliphatic saturated hydrocarbyl substituents on the phenol), in particular those with branched or linear alkyl chains with 3 to 15 carbons, there is evidence of hazardous (endocrine disrupting) properties and concerning environmental fate and/or occurrence profiles[15]. Furthermore, ethoxylated alkyphenols have been shown to degrade to alkylphenols in the environment or wastewater treatment plants, with some also having endocrine disrupting properties as such[16]. This substance group entry aims to reflect all such relevant individual substances.

Facts relevant for management considerations

Causal chain and pathways

A The REACH registered volume (manufacture/import in the EU) for substances in the group is >20,000 tonnes/year[10]. However, part of it is registration of alkylphenols as monomer in imported polymers. Thus, the minimum estimate is likely lower for the overall group.

According to ECHA Assessments for Regulaotry Needs [11] / REACH registered uses, octylphenol is used in adhesives, coatings, paints, inks, thinners, paint removers, flocculants, tyres and rubber products, polymer preparations and compounds, and as an intermediate. An evaluation of the information in ECHA's prioritisation assessment for inclusion of SVCHs ot the Authorization list[12] reflected that all registered tonnage either refers to intermediate uses (e.g. monomer for polymerisation) or import of polymers containing it. Similar is the situation for nonylphenols, which, apart from intermediate uses (e.g. manufacture of epoxy resins) or import of polymers containing it, it has also been registered for uses in fuels; water treatment; oil fields; adhesives/sealants; coatings, paints, paint removers; inks and toners; fillers/putties/plasters/modelling clay. According to ECHA's prioritisation assessment[12], it is unclear if uses e.g. as adhesives indeed take place and if they are uses of the substance (note: perhaps could be uses of polymers/resins containing the substance as monomer?).

For octylphenol ethocxylates, the REACH authorised volume is >150 tonnes/year (volume for some authorised uses is confidential)[13]. In 2014, before inclusion to the authorisation regime, the volume on the market was 1,000 -10,000 t/y[12]. REACH sectors of authorised uses for octylphenol ethocxylates are in **pharma/medical/diagnostic products** as such and also their manufacture and their **packaging**. As well as in **aerospace and defence**[13].

Shipping emissions relate to bilge water or ballast water[14].

P Estimated inputs are available for several individual substances and large sub-groups, both for riverine inputs and for WWTP effluents (which emit either upstream in rivers or directly to the coast). In general, WWTPs do not appear to be the main contributor of overall riverine inputs. Among various sources of riverine emissions may also be release from biosolids used in agriculture. No quantified information is available for shipping emissions or atmospheric deposition. Alkylphenols are in general released not only due to their uses as such, but also due to degradation of their ethoxylates (to be confirmed if they can also be released in relevant rates also from polymers containing it).

Relevant policies (existing or planned measures)

M (on A/P)

• **Several alkylphenols and ethoxylates are listed as SVHC** (Substances of Very High Concern) **under EU REACH** (mainly on the basis of their endocrine disrupting properties for the environment, but some also due to their PBT properties). Octlyphenol ethoxylates have further been included in the **REACH Authorization list**. ECHA (and perhaps some EU Member States, to be confirmed) has also developed **Assessments of Regulatory needs (ARN) for various alkylphenols – whereas for some others ARNs are under preparation**.

• Nonylphenols and Octylphenols are listed as priority hazardous substances or priority substances under the **EU WFD**. And as priority substances in its update proposal.

• There are provisions in **EU Best Available Techniques** Reference documents for these substances.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.13.14.15.16.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Arsenic and its compounds

(CAS numbers: e.g. 7440-38-2, EC numbers: e.g. 231-148-6 / Entry number in HELCOM list of priority substances: 4)

General sectors: Industry and commercial products, off-shore (shipping, dumped chemical warfare agents)

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Arsenic exceed the applied threshold value in **25** of the 33 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**10**/12 assessed off-shore areas). In these 25 areas, on average **97%** of the assessible samples in **water and/or sediment** (and/or biota, which are exceeded more rarely) exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1], as well as in scientific articles/reports[2]. A total number of 1741 data points were possible to evaluate for Arsenic.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Arsenic scores **8.6/10** (confidence range: **8.0 – 8.8**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Arsenic were acquired from the ecotoxicology database of the NORMAN Network[3] (water – Arsenic has also a CLP harmonized classification as Aquatic Acute 1 and Aquatic Chronic 1) and national EU MSFD assessments[4] (sediment, biota).

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling biota, pelagic biota, top predators such as mammals and birds, and humans via consumption of seafood.

Supporting evidence

P Approximately **210 – 230 tonnes of Arsenic and its compounds** are estimated to enter the Baltic Sea every year, mainly via rivers (WATERBASE[5]) and secondly deposition of dredged material[5]. Given that the substance is **very persistent (metals do not degrade) and toxic**[6], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also historical inputs.

S According to expert information provided, according to an EQS value that has been developed by **Denmark all areas where measured appear to be subGES** (not good environmental status). Furthermore, **arsenic in sediments of the Skagerrak show an increasing trend over time.**

I Arsenic is considered to have an especially **concerning mode of toxicity**: for example it is carcinogenic[7] (beyond its aquatic toxicity), thus posing high long-term risk to populations (at least for human health via consumption of seafood).

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Arsenic scores **85-88/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The substance is manufactured/imported in the EU in quantities >300 t/y (not complete calculation of EU REACH registered volume[8], as there are several substances containing Arsenic). Main sectors which officially reported releases to the Baltic Sea catchment in the context of E-PRTR[9] and the respective shares for the reported emissions are as following (a broader overview including REACH-registered uses with potential emissions has not been compiled here):

Releases to water/soil (average reported releases 10 t/y, 2018-2022): **Opencast mining and quarrying** (52%), **Underground mining and related operations** (24%), Chemical installations for the production on an industrial scale of phosphorous, nitrogen or potassium based fertilisers (5%). Releases to air (average reported releases 8 t/y, 2018-2022): **Power stations and other combustion installations** (57%), **Installations for the production and/or smelting of non-ferrous metals** (27%), Production of non-ferrous crude metals by metallurgical, chemical or electrolytic processes (6%).

Shipping emissions have been estimated as 1.4 t/y (scrubber wash water, bilge water, grey water, sewage) (EMERGE[10]). Furthermore, certain chemical warfare agents contain Arsenic, and can be released from **dumped munitions**.

P Based on available estimations, Arsenic appears to enter the Baltic Sea mainly via **rivers** (~200 t/y, WATERBASE) and secondly via direct off-shore emissions (12-33 t/y:11-31 t/y via **deposition of dredged material**, HELCOM BSEFS[11]; plus 1.4 t/y via shipping, EMERGE). The contribution of Wastewater Treatment Plants appears relatively low (estimated to account for approximately 4t/y out of the 200t/y of riverine inputs plus 1 t/y of direct emissions) (Undemann, 2022[12]). Direct emissions from E-PRTR reporting land-based sectors were in the order of 1 t/y. Inputs via atmospHeric deposition seem to be negligible (10-40 kg/y, EMERGE).

S **?** *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is a review of the toxicity threshold (including whether background levels taken into account; furthermore, it is relevant to assess compatibility in terms of form (soluble/total – specifically for water, chemical speciation e.g. organic vs inorganic) between measured levels and the threshold; as well as potentially the influence of salinity on ecotoxicity).*

Relevant policies (existing or planned measures)

M (on A/P/I) • **Some activities are restricted under EU REACH** (antifouling, wood preservation, treatment of industrial waters). **Some Arsenic substances are listed as SVHC** (Substances of Very High Concern) **under EU REACH** (on the basis of CMR properties): Arsenic acid, Diarsenic pentaoxide, Diarsenic trioxide, Calcium arsenate, Trilead diarsenate, Triethyl arsenate – the three first have further been included in the **REACH Authorization list**. ECHA has also developed an **Assessment of Regulatory needs (ARN) for complex inorganic substances**

originating from metallurgical processes excluding slags, including heavy metal alloys with arsenic and other elements resulting from smelting / arsenic oxides (ECHA[13]).

• Arsenic and its compounds is **listed under the 'indicative list of the main pollutants' of EU WFD (Annex VIII).** Germany has many projects on dumped munitions. Germany and Denmark are exploring EQS development, on sediments and biota (mussels – likely everywhere exceeded) respectively.

• There are provisions in **EU Best Available Techniques** Reference documents for arsenic

• **EU is developing an EQS for inorganic As in food.** Relevant HELCOM and national mesures to be listed.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.13.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Bisphenols

(CAS numbers: e.g. 80-05-7, EC numbers: e.g. 201-245-8 / Entry number in HELCOM list of priority substances: 5)

General sectors: Industry and commercial products

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Bisphenol A exceed the applied threshold value in all the **7** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**1**/1 off-shore area). In these 7 areas, all the samples in **water** that was possible to evaluate exceed the threshold value, noting also several inconclusive, in terms of exceedance, non-detections (due to a relatively high limit of detection)[*]. This is based on monitoring data for the period 2015-2024 available in national and international databases[1] and scientific articles/reports[2]. A total number of 39 data points were possible to evaluate for Bisphenol A.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Bisphenol A scores **9.1/10** (confidence range: **8.5 – 9.2**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Bisphenol A in water was acquired from the EC proposed Directive amending WFD and EQSD[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota.

P For Bisphenol A and Tetrabromo-bisphenol A (TBBPA), the amounts estimated to enter the Baltic Sea every year via rivers/WWTPs are **1-3 (data on WWTPs) and 4-17 (riverine data) tonnes per year, respectively** (WATERBASE[3], Undeman et al, 2022[4], Gustavsson et al, 2018[5]). Given that they are **very toxic**[6] (Bisphenol) and **toxic and suspect as very persistent**[7] (TBBPA), current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. Other bisphenols, such as Bisphenol AF and Bisphenol m, have measured inputs in the orders of up to hundreds of kg, which are considered as possibly significant, given that they have similarly high toxicity / persistence properties. Additional inputs might be expected, including from atmospheric deposition, although Bisphenols degrade relatively fast in the atmosphere[8]. As mentioned above, for the bisphenol for which there is marine data (Bisphenol A), levels in Baltic Sea have already exceeded thresholds, due not only to current but also the historical inputs.

Supporting evidence

I Bisphenol are considered of **especially concerning mode of toxicity.** For example, Bisphenol A is an endocrine disruptor and toxic for reproduction[9]. Endocrine disruptors mimic or interfere with hormones and can cause developmental abnormalities, reproductive dysfunction, and population effects.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, for example Bisphenol A scores **91-94/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment. Besides Bisphenol A, several other Bisphenols (which are substances with two hydroxyphenyl functional groups linked by a bridge, with the phenolic hydroxyl groups on the para position to the bridge – and which may also include possible substituents at the phenyl rings or have the phenolic hydroxyls derivatised) have been shown to or suspected to have hazardous properties and to exhibit concerning environmental fate/occurrence profiles[14]. In fact, monitoring data from WWTP as well as human biomonitoring indicate that measures targeted at Bisphenol A has resulted in an increased use of other Bisphenols. This substance group entry aims to reflect all such relevant individual substances.

Facts relevant for management considerations

Causal chain and pathways

A The REACH registered volume (manufacture/import in the EU) for Bisphenol A is >1,000,000 tonnes/year[10]. According to ECHA's prioritisation assessment for SVCHs[11], although a significant part of the total volume is used as an intermediate, 1,000 - 10,000 t/y is used as epoxy-resins hardener; lubricants, greases, hydraulic and break fluids; paints, lacquers, varnishes; binding agents; stabilisers; surface treatment; food-contact materials. Applications regard diverse sectors, such as building and construction, crop and animal production, hunting, extraction of crude petroleum and natural gas, metals and metal products, manufacture of chemicals and chemical products, computer, electronic and optical products, electrical equipment, vehicles, non-metallic mineral products, transport equipment, paper and paper products, wood and wood products, printing and reproduction of recorded media, retail trade, warehousing, and wholesale trade.

For TBBPA, the REACH authorised volume is >10,000 tonnes/year[10]. According to ECHA's prioritisation assessment for SVCHs, from this amount 1,000 - 10,000 t/y is not used as intermediate, but rather as flame retardant[12]. Another example of bisphenol, Bisphenol AF is used as intermediate and in rubber products, as a crosslinking agent for fluoroelastomers and specialty polymers (e.g., high-temperature composites and electronic materials)[13].

S **?** *In order to further improve the evaluation of the magnitude of risk, one aspect that could be relevant in the future is gathering of marine data for further bisphenols than only Bisphenol A.*

Relevant policies (existing or planned measures)

M (on A/P) • **Four bisphenols are listed as SVHC** (Substances of Very High Concern) **under EU REACH** (depending on the case, on the basis of endocrine disrupting properties / toxicity for reproduction / carcinogenicity). ECHA has developed an **Assessment of Regulatory needs (ARN) for the group of Bisphenols** (dozens of individual substances).

• Bisphenol A is listed as a priority hazardous substances under the **EU WFD/EQSD** update proposal.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.13.14.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering the inconclusive non-detections, it is possible that the actual average frequency of exceedance in these areas is somewhat lower, but in any case >45%.

Cadmium and its compounds

(CAS numbers: e.g. 7440-43-9, EC numbers: e.g. 231-152-8 / Entry number in HELCOM list of priority substances: 6)

General sectors: Industry and commercial products, off-shore (shipping, dredged material deposition)

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Cadmium exceed the applied threshold value in **36** of the 41 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**16**/16 assessed off-shore areas). In these 36 areas, on average **75%** of the assessible samples in **sediment and/or biota** exceed the threshold value. This is based on regular monitoring data gathered by HELCOM Contracting Parties and reported to the HELCOM COMBINE database for the period 2016-2021, in the context of the Cadmium indicator[1].

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Cadmium scores **8.0/10** (confidence range: **8.0 – 8.0**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Cadmium were as agreed for the HELCOM indicator for HOLAS 3.

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling biota, top predators such as mammals and birds, and humans via consumption of seafood.

Supporting evidence

P Approximately **24 – 60 tonnes of Cadmium and its compounds** are estimated to enter the Baltic Sea every year, mainly via rivers and secondly depositing of dredged material and atmospheric deposition[3]. Given that the substance is **very persistent (metals do not degrade) and toxic**[4] (according to the EU WFD and its update proposal, it also tends to accumulate in sediment and/or biota[5]), current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also historical inputs. Increased inputs in the near future are possible, due to its use and occurence in emerging sectors, such as mining and metal processing industry .

I Cadmium is considered to have an **especially concerning mode of toxicity**: it is carcinogenic[6] (beyond its aquatic toxicity), thus posing high long-term risk to populations (at least for human health via consumption of seafood), and has also a relationship to brittle skeletons.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Cadmium scores **80-82/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Cadmium and its compounds are manufactured (processed) / imported in the EU in quantities >5,330 – 53,370 tonne/year (not including registered substances only used as intermediates, for which registered volume is confidential)[7]. The **REACH registered uses** include mainly batteries, but also brazing, coatings, and some other sectors[8]. Main sectors which officially reported releases to the Baltic Sea catchment in the context of E-PRTR[9] and the respective shares for the reported emissions are as following:

Releases to water/soil (reported releases 1-12 t/y, in the period 2018-2022): **Mining and related operations** (70%), Pulp production (9%), Thermal power / combustion (5%). Releases to air (reported releases 1-4 t/y, in the period 2018-2022): mainly **Thermal power / combustion** (64%). Further E-PRTR-reporting sectors, with smaller contributions, include for example metal processing industry and landfills.

Emissions from P-Cd fertilizers, as well as from biosolids from WWTPs are also expected.

P Based on available estimations, Cadmium appears to enter the Baltic Sea mainly via **rivers** (17-49 t/y, PLC[3]) and secondly via depositing of dredged material (3-6t/y, HELCOM BSEFS[10]) and atmospheric deposition (3-4 t/y, PLC). Direct emissions from land-based activities are lower (0.4-0.6 t/y, PLC). Shipping emissions seem to be negligible (<1 kg/y, EMERGE[11]).

Relevant policies (existing or planned measures)

M (on A/P/I) • **Some activities are restricted under EU REACH** (use in paints, plastics, cadmium-plated metallic articles in certain applications (e.g. furniture, agriculture, food production, household goods, certain equipment and machinery, etc.), brazing fillers, metla componenes for jewellery making, hair accessories) and some under EU RoHS (electrical and electronic devices). **Some Cadmium substances are listed as SVHC** (Substances of Very High Concern) **under EU REACH** (e.g. on the basis of CMR properties). ECHA has also developed an **Assessment of Regulatory needs (ARN) for complex inorganic substances**, including several substances containing cadmium (ECHA[12]). Further relevant ARNs for Cadmium substances may exist (to be confirmed).

• Cadmium and its compounds are listed as a priority hazardous substances under the **EU WFD** and its update proposal. Cadmium is also a **HELCOM indicator**.

• **Cadmium is listed among contaminants with maximum levels in EU Regulation 2023/915, including seafood**.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Carbamazepine

General sectors: Pharmaceutical

(CAS numbers: e.g. 298-46-4, EC number: 206-062-7 / Entry number in HELCOM list of priority substances: 7)

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM priority?

Main evidence

P Approximately **2-10 tonnes of Carbamazepine** are estimated to enter the Baltic Sea every year, mainly via Wastewater Treatment Plants (WWTP) / rivers (Undeman et al, 2022[1]; WATERBASE[2]; Langas-MORPHEUS, 2019[3]). Given that the substance is **toxic**[4], current inputs are possibly significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already occasionally exceeded thresholds. As WATERBASE data covered only ~1% of the Baltic Sea catchment, for the inputs range estimation above were used the Undeman's study on WWTP discharges (2010-2019) and a value derived from the few samples of WATERBASE and of the MORPHEUS study, both focusing on mouth rivers.

S Concentrations of Carbamazepine exceed the applied threshold value in **1** of the 21 examined areas (assessment units) of the Baltic Sea. This is a coastal area. In this area, **100%** of the assessible samples in **water and/or sediment** exceed the threshold value. This is based on monitoring data for the period 2015-2024 from scientific articles/reports[1]. A total number of 422 data points were possible to evaluate for Carbamazepine.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Carbamazepine scores **6.0/10** (confidence range: **6.0 – 6.0**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Carbamazepine, for water and sediment, were acquired respectively from the EC proposed Directive amending WFD and EQSD[5] and the ecotoxicology database of the NORMAN Network[6].

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling biota and pelagic biota.

Supporting evidence

P According to literature, carbamazepine has been reported as being frequently found in landfill leachate[7], and is commonly found in wastewaters[8].

A With sales in CPs of ≥9 –15 t/y (2015-2022[9]), the predicted (conservative) river concentration at the proximity of WWTP effluents by using the guidelines of Phase I ERA is 0.2 – 0.4 times the threshold value for freshwater (0.2 when using the sales figure from 2022).

I Carbamazepine is considered to have a concerning **mode of toxicity**, as it is neuroactive[10]. Neuroactive substances cause sublethal neurological impacts like disorientation or altered behaviour that can affect feeding success, predator avoidance, and overall survival.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Carbamazepine scores **53-60/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Carbamazepine is an antiepileptic[11]. Based on combined information from countries that contributed to the HELCOM data call on pharmaceutical sales[9], there is a decreasing trend. According to further expert judgement, in Finland sales have decreased ca. 50% over the last 20 years. In Germany, in general sales of antiepileptic drugs are increasing.

P As mentioned above, the substance appears to enter the Baltic Sea via WWTP effluents (released either to rivers or to coastal waters). With landfill leachates also contributing to the overall releases.

S **?** *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is possible toxic transformation products, such as 10,11-dihydro-10-hydroxycarbamazepine, which also has been detected in marine water in potentially critical/significant levels.*

Relevant policies (existing or planned measures)

M (on A/P)
- Listed as priority substance in the **EU WFD** update proposal.
- It is one of the 'Category 1' substances (substances that can be very easily treated) in the updated Directive on urban wastewater treatment.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.11.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Chlorpyrifos

(CAS numbers: e.g. 2921-88-2, EC number: 220-864-4 / Entry number in HELCOM list of priority substances: 8)

General sectors: Industry and commercial products?, legacy pesticide

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Chlorpyrifos exceed the applied threshold value in **1** of the 5 examined areas (assessment units) of the Baltic Sea. This is an off-shore area. In this 1 area, all samples in **water** that was possible to evaluate exceed the threshold value, noting also several inconclusive, in terms of exceedance, non-detections (due to a relatively high limit of detection)[*]. This is based on monitoring data for the period 2015-2024 available in national and international databases[1]. A total number of 41 data points were possible to evaluate for Chlorpyrifos.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Chlorpyrifos scores **7.5/10** (confidence range: **3.7 – 7.8**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for Chlorpyrifos, for water, was acquired from the EC proposed Directive amending WFD and EQSD[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota.

P Approximately **9-36 kg of Chlorpyrifos** are estimated to enter the Baltic Sea every year, mainly via rivers (WATERBASE[3]). Further riverine emissions (and any atmospheric deposition) are possible. Historical inputs have been higher. Given that the substance is **suspect as very persistent and is extremely toxic**[4](according to the EU WFD/EQSD update proposal, it also tends to accumulate in sediment and/or biota[5]), even current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. The riverine data used for the estimation concerns only measurements in the proximity of river mouths, and the period 2015-2022. The 25 subcatchment areas for which there was such riverine data reflected 20 % of the total riverine flow to the Baltic Sea . The data in WATERBASE included approximately 7 countries and 2103 samples.

Supporting evidence

I Chlorpyrifos is considered to have an especially **concerning mode of toxicity**, as it affects an essential physiological process: nervous system signaling. It is an Acetylcholinesterase (AChE) inhibitor, that can affect the enzyme involved in nerve transmission causing paralysis and death in marine organisms[6].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Chlorpyrifos scores **60-79/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A No significant activities expected at least in the EU, as it neither authorized as an active substance as Plant Protection Product. Nor is with a valid EU REACH registration: The substance was REACH-registered earlier, however since 2020 the registration is no longer valid[7]. On the other hand, there are about 250 Classification & Labelling notifications under the EU CLP Regulation[8]. Therefore manufacture/import (accordingly use) in unknown amounts of less than a tonne/year per manufacturer/importer is likely the case.

P The riverine emissions mentioned above refer to the period 2015-2022. Therefore, they may be linked with earlier REACH-registered uses, until 2020. According to expert information provided, in Latvia and Germany the substance is monitored but not detected above the Limit Of Quantification in rivers.

Relevant policies (existing or planned measures)

M (on A/P)

- Listed as a priority substance under the **EU WFD.** And as a priority hazardous substance in its update proposal. The EQSD update proposal also includes an EQS for total of active substances in pesticides, including their relevant metabolites, degradation and reaction products. Respective national **Progammes of Measures for this** are relevant.
- As mentioned above, under the EU Regulation 1107/2009 concerning the placing of **plant protection products on the market it is not authorized as active substance** (withdrawal of authorizations in 2020).

References:

1. 2. 3. 4. 5. 6. 7. 8.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering the inconclusive non-detections, it is possible that the actual frequency of exceedance in this area is considerably lower.

Chromium and its compounds

(CAS numbers: e.g. 7440-47-3, EC numbers: e.g. 231-157-5 / Entry number in HELCOM list of priority substances: 9)

General sectors: Industry and commercial products, off-shore (shipping, dredged material deposition), personal care product

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Chromium exceed the applied threshold value in **22** of the 32 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**9**/12 assessed off-shore areas). In these 22 areas, on average **80%** of the assessible samples in **water and/or sediment and/or biota** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1] and scientific articles/reports[2]. A total number of 1158 data points were possible to evaluate for Chromium.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Chromium scores **8.0/10** (confidence range: **7.4 – 8.3**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Chromium were acquired from the ecotoxicology database of the NORMAN Network[3] (water), national EU MSFD assessments[4] (sediment), and national EU WFD assessments[5] (biota).

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota, sediment dwelling biota, and potentially for top predators such as mammals and birds and humans via consumption of seafood, maybe depending on chemical speciation (e.g. Cr(III) vs Cr(VI)[6]).

Supporting evidence

P Approximately **200 – 400 tonnes of Chromium and its compounds** are estimated to enter the Baltic Sea every year, mainly via rivers (PLC[7]) and depositing of dredged material (HELCOM BSEFS[8]). Given that the substance is **very persistent (metals do not degrade) and suspect as toxic**[9], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also historical inputs. Likely increased inputs in the near future are possible, due to it use in emerging sectors, such as in batteries.

I Chromium is considered to have a concerning **mode of toxicity**, as for example it affects the metabolic system[10]. Contaminants that disrupt energy production or utilization (energy metabolism dysfunction) can affect growth, reproduction, and overall fitness of marine organisms.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Chromium scores **70-84/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Chromium and its compounds are manufactured/imported in the EU in quantities 1,000,000 – 10,000,000 tonnes/year[11]. The **REACH registered uses** include base metals ans alloys, surface treatment products, pigments, welding and soldering products, and other sectors. Main sectors which officially reported releases to the Baltic Sea catchment in the context of E-PRTR[12] and the respective shares for the reported emissions are as following:

Releases to water/soil (average reported releases 16 t/y, in the period 2018-2022): **Industrial plants for the production of pulp from timber or similar fibrous materials** (70%), Installations for the production of pig iron or steel including continuous casting (9%), Underground mining and related operations (5%). Releases to air (average reported releases 24 t/y, in the period 2018-2022): mainly **Thermal power / combustion** (64%), **Metal ore (including sulphide ore) roasting or sintering installations** (9%), Installations for the production and/or smelting of non-ferrous metals (7%), Installations for the production of pig iron or steel including continuous casting (6%). Further E-PRTR-reporting sectors, with smaller contributions, include for example metal processind and landfills.

Emissions from shipping relate to scrubber wash water, bilge water, grey water, and sewage[13]. Furthermore, chromium is used as micronutrient.

P Based on available estimations, Chromium appears to enter the Baltic Sea mainly via **rivers** (104-167t/y, PLC) and **depositing of dredged material** (81-95t/y, HELCOM BSEFS). And to lower extent via direct inputs from land activities (15 t/y, Undeman et al, 2022[14], E-PRTR[15]) and atmospheric deposition (12-18 t/y, EMERGE[16]). Shipping emissions have been estimated to contribute to a lower degree, with about 2 t/y (EMERGE[13]). Chromium(VI) is not detectable in proximity of river mouths (WATERBASE[17]), with measurement data however being representative only for 1 Contracting Party.

S **?** *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is a review of the toxicity threshold (including whether background levels taken into account; furthermore, it is relevant to assess compatibility in terms of form (soluble/total – specifically for water, chemical speciation e.g. Cr(0) vs Cr(III) vs Cr(VI)) between measured levels and the threshold; as well as potentially the influence of salinity on ecotoxicity).*

Relevant policies (existing or planned measures)

M (on A/P) • **For Chromium(VI), some activities are restricted under EU REACH** (cement and cement-containing mixtures, leather articles coming in contact with skin) and some under EU RoHS (electrical and electronic devices). **Several Chromium(VI) substances are listed as SVHC** (Substances of Very High Concern) **under EU REACH** (e.g. on the basis of CMR properties) and further under **REACH Auhtorizaiton list**. For suh substances, ECHA has more recently submitted an intention to submit a restriction proposal, taking stock of the granted authorisations as well as processed and pending applications for authorisations for Chromium (VI) substances (ECHA[18]). ECHA has recently developed an **Assessment of Regulatory needs (ARN) for the group of substances including chromium metal and simple trivalent chromium compounds** (covering 38 individual substances, ECHA[19]).

• There are provisions in **EU Best Available Techniques** Reference documents for this substance.

References: 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.13.14.15.16.17.18.19

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Clarithromycin

General sectors: Pharmaceutical

(CAS numbers: e.g. 81103-11-9, EC number: 617-200-4 / Entry number in HELCOM list of priority substances: 10)

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Clarithromycin exceed the applied threshold value in **7** of the 21 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**1**/2 assessed off-shore areas). In these 7 areas, on average **62%** of the assessible samples in **water and/or sediment** exceed the threshold value. This is based on monitoring data for the period 2015-2023 as reported by Contracting Parties (CPs) as response to a data call organized by HELCOM, as well as in scientific articles/reports[1]. A total number of 480 data points were possible to evaluate for Clarithromycin.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Clarithromycin scores **7.1/10** (confidence range: **7.1 – 7.6**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Clarithromycin, for water and sediment, were acquired respectively from the EC proposed Directive amending WFD and EQSD[2] and the ecotoxicology database of the NORMAN Network[3].

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling biota and pelagic biota.

Supporting evidence

P Approximately **1-2 tonnes of Clarithromycin** are estimated to enter the Baltic Sea every year via WWTPs/rivers (WATERBASE[4]; Undemann et al, 2022[5]). Given that the substance is **suspect as very persistent and is very toxic**[6] (according to the EU WFD/EQSD update proposal, it also tends to accumulate in sediment and/or biota[6]), current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the historical inputs.

A With sales in CPs of ≥1.5 – 2.7 t/y (2015-2022[7]), the predicted (conservative) river concentration at the proximity of WWTP effluents by using the guidelines of Phase I ERA is around the threshold value for freshwater (0.6 – 1.2 , or 0.6 when using the sales figure from 2022).

I Clarithromycin has an elevated potential for the selection of antimicrobial resistance compared to other antibiotics[8].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Clarithromycin scores **57-74/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A It is a macrolide antibiotic[9], authorised only for human use[10]. While reserved for human use, there are examples that it has been used in veterinary applications, e.g., for companion animals (dogs and cats) and for foals[10]. It is, in combination with other antibiotics, the first choice antibiotic for severe community-acquired pneumonia in hospital settings[8]. The amount of sales was mentioned above and has a decreasing trend. Specifically for Finland, according to expert information provided sales have decreased drastically (80%) over the last 20 years.

P Based on available estimations[4,5], WWTPs likely contributes equally to riverine and direct inputs to the Baltic Sea.

Relevant policies (existing or planned measures)

M (on A/P)
- Listed in the first and second **EQSD Watch Lists**. And also as priority substance in the **EU WFD** update proposal.
- It is one of the 'Category 1' substances (substances that can be very easily treated) in the updated Directive on urban wastewater treatment.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Copper and its compounds

(CAS numbers: e.g. 7440-50-8, EC numbers: e.g. 231-159-6 / Entry number in HELCOM list of priority substances: 11)

General sectors: Industry and commercial products, off-shore (shipping, dredged material deposition, OWF), biocide

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Copper exceed the applied threshold value in **all the 15** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**11**/11 assessed off-shore areas). In these 15 areas, on average **88%** of the assessible samples in **sediment** exceed the threshold value. This is based on regular monitoring data gathered by HELCOM Contracting Parties and reported to the HELCOM COMBINE database for the period 2016-2021, in the context of the Copper indicator[1].

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Copper scores **8.2/10** (confidence range: **8.2 – 8.2**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for Copper, for sediment, was as agreed for the HELCOM indicator for HOLAS 3.

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling biota.

Supporting evidence

P Approximately **1,100 – 2,000 tonnes of Copper and its compounds** are estimated to enter the Baltic Sea every year, mainly via rivers and shipping, and secondly via atmospheric deposition and deposition of dredged material (PLC[2], EMERGE[3], HELCOM BSEFS[4]). Given that the substance is **very persistent (metals do not degrade) and toxic**[5], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also historical inputs. Likely increased inputs in the near future are possible, due to it use in emerging setors, such as in batteries, shipping, and Offshore Wind Farms (OWF).

I Copper is considered to have a concerning **mode of toxicity**, as for example it is a photosynthesis inhibitor[6]. Photosynthesis inhibitors disrupt energy production or utilization and can affect growth and overall fitness of primary producing marine organisms.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Copper scores **75-84/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Copper and its compounds are manufactured/imported in the EU in quantities 1,000,000 - 10,000,000 tonnes/year[7]. The **REACH registered uses** cover many sectors including among others batteries, tyres, etc. Main sectors which officially reported releases to the Baltic Sea catchment in the context of E-PRTR[8] and the respective shares for the reported emissions are as following:

Releases to air (reported releases 30-35 t/y, in the period 2018-2022): mainly **Underground mining** (31%), **Production/smelting of non-ferrous metals** (20%), **Metal ore roasting or sintering** (19%). Releases to water/soil (avreage reported releases >21 t/y, in the period 2018-2022): **production of pulp, paper, board, wood products** (42%), **disposal or incineration of non-hazardous waste** (20%), production of fertilisers (8%).

Shipping and lesure boating is responsible for emissions from **antifouling paints**. Shipping contributes also via emissions from scrubber wash water, bilge water, grey water, and sewage, but to a much lower degree[9]. Several copper substances are used in Contracting Parties as biocides (function: disinfectants, wood preservatives, antifouling)[10]. Copper is also released from agriculture (pig farming – antibiotics' alternatve; fertilisers; biosolids). It is also released from natural sources (e.g. leaching from forest and other land areas), as well as from roofs and pipes.

P Based on available estimations, Copper appears to enter the Baltic Sea mainly via **rivers** (434-1,120 t/y, PLC), off-shore emissions (**shipping**: 518 t/y + **deposition of dredged material**: 53-148t/y, EMERGE, HELCOM BSEFS), and **atmospheric deposition** (83-149 t/y, EMERGE, PLC). Direct emissions from land-based activities appear to be relatively lower (estimation: 14-20 t/y, PLC, Undeman et al, 2002[11], E-PRTR).

Relevant policies (existing or planned measures)

M (on A/P) • ECHA has developed an **Assessment of Regulatory needs (ARN) for complex inorganic substances**, including several substances containing Copper (ECHA[12]). Further relevant ARNs for Copper substances may exist (to be confirmed).

• There are provisions in **EU Best Available Techniques** Reference documents for this substance.

• Copper is a **HELCOM indicator**

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Cypermethrin

(CAS number: e.g. 52315-07-8, EC number: 257-842-9 / Entry number in HELCOM list of priority substances: 12)

General sectors: Pesticide, pharmaceutical, biocide, off-shore (aquaculture?)

Drivers	Activities	Pressures	State	Impacts

Why a HELCOM priority?

Main evidence

S Concentrations of Cypermethrin exceed the applied threshold value in **2** of the 8 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**1**/3 assessed off-shore areas). In these 2 areas, on average **13%** of the assessible samples in **water** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1]. A total number of 173 data points were possible to evaluate for Cypermethrin.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Cypermethrin scores **6.3/10** (confidence range: **6.1 – 6.8**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for Cypermethrin, for water, was acquired from the EC proposed Directive amending WFD and EQSD[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota.

Supporting evidence

P Approximately **2-9 kg of Cypermethrin** are estimated to enter the Baltic Sea every year, mainly rivers (WATERBASE[3]). Additional inputs may be expected from direct runoff from land. Given that the substance is **persistent and extremely toxic**[4] (according to the EU WFD/EQSD update proposal, it also tends to accumulate in sediment and/or biota[5]), this amount of inputs even though in absolute terms low is likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the historical inputs.

I Cypermethrin is considered to have a concerning **mode of toxicity**, as it is neuroactive[6]. Neuroactive substances cause sublethal neurological impacts like disorientation or altered behaviour that can affect feeding success, predator avoidance, and overall survival.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Cypermethrin scores **59-69/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The substance is authorized as pesticide in five from the Contracting Parties (CPs) which are members of the EU[6]. According to literature, it is used as insecticide in large-scale commercial agricultural applications[7]. Furthermore, the substance is authorized for use in biocide products in seven from the CPs which are members of the EU (expert information about Sweden: authorized for local use). Biocide-approved applications are as insecticide, acaricide, and disinfectant[8]. According to literature, there are biocide applications in consumer products for domestic purposes[9], to be confirmed with the EU BPR data. In addition, it is relevant as veterinary pharmaceutical. For instance, depending on the country it is allowed for applications such as pour-on solution for sheep and/or cattle, external use on horses, dogs, and cats, or as an ear tag for cattle[10]. Use in aquaculture is plausible, however it is not authorized for such use at least in Denmark, Finland, Germany, Latvia, Lithuania, or Poland[11].

P Based on available estimations[3,7], rivers are the main (quantified) source of the total estimated inputs of 2-9 kg/y, with WWTPs contributing to a small extent only (in the order of 1 kg/y, both direct inputs and via rivers). As mentioned above, emissions due to direct runoff to the sea from agricultural use, and any use in mariculture, are possible as well.

Relevant policies (existing or planned measures)

M (on A/P) • Listed as a priority substance under the **EU WFD** (and its update proposal) – including respective national **Progammes of Measures for this**. The EQSD update proposal also includes an EQS for total of active substances in pesticides, including their relevant metabolites, degradation and reaction products.

• Under the EU Regulation 1107/2009 concerning the placing of **plant protection products on the market, it is candidate for substitution**, on the basis of non-active isomers. Under the EU Sustainable Use of Pesticides Directive (2009/128/EC), Member States of the EU shall adopt **National Action Plans** to set up their quantitative objectives, targets, measures and timetables to reduce risks and impacts of pesticide use and to encourage the development and introduction of integrated pest management and of alternative approaches or techniques in order to reduce dependency on the use of pesticides. Under the EU BPR Regulation, it appears that for the product types relevant for the CPs it is not candidate for substitution (instead it is under assessment towards possible status candidate for substitution for a different product type: wood preservative).

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

DDT and its degradation products

(CAS numbers: e.g. 789-02-6, 50-29-3, 72-55-9, 3424-82-6, 72-54-8, 53-19-0, 32-03-1, EC numbers: e.g. 212-332-5, 200-024-3, 200-784-6, 222-318-0, 200-166-6 / Entry number in HELCOM list of priority substances: 13)

General sectors: Legacy pesticide

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of 2,4-DDT exceed the applied threshold value in **13** of the 20 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**7**/7 assessed off-shore areas). In these 13 areas, on average **95%*** of the assessible samples in **sediment** and/or **biota** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1] as well as target screening data from the project PreEMPT[2]. A total number of 781 data points were possible to evaluate for 2,4-DDT.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, 2,4-DDT scores **8.2/10** (confidence range: **7.9 – 8.4**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

Concentrations of 4,4-DDE, DDD (p,p'), 2,4-DDE, 2,4-DDD, and DDT (p,p') also frequently exceed their respective threshold value. The threshold values for all substances in the group, for sediment and biota, were acquired from the NORMAN Network ecotoxicology database[3]. It is noted that **high trophic magnification** has been reported, for instance a TMF value of 29 for p,p'-DDE[4].

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling biota, pelagic biota, top predators such as mammals and birds, and humans via consumption of seafood.

Supporting evidence

P Approximately **0.2 – 1.5 tonnes of DDT and its degradation products** are estimated to enter the Baltic Sea every year, mainly via rivers (WATERBASE[5]). Historical inputs have been considerably higher. Given that the substance is **very persistent, very bioaccumulative, and very toxic**[6], even current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the historical inputs.

I DDT and its degradation products are considered of **especially concerning mode of toxicity**: for example 2,4-DDE is an endocrine disruptor[7]. Endocrine disruptors mimic or interfere with hormones and can cause developmental abnormalities, reproductive dysfunction, and population effects.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, DDT and its degradation products score **75-80/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment. Several isomers and degradation products of DDT have hazardous properties and exhibit concerning environmental occurrence profiles. This substance group entry aims to reflect all such relevant individual substances.

Facts relevant for management considerations

Causal chain and pathways

A No known on-going activities causing emissions.

P Its high persistence (as much as 50% can remain in the soil 10-15 years after application) and earlier widespread use have meant that DDT and its degradation products residues can be found everywhere[8]. That likely explains the measured riverine inputs. Beyond that, it is expected that sediment disturbing activities may release historical residues of DDT and its degradation products. However, deposition of dredged material appears to be a negligible source of inputs (only up to 2kg/y).

S **?** *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is a review of the available toxicity thresholds for sediment and biota.*

Relevant policies (existing or planned measures)

M (on A/P) • Listed under **Stockholm Convention** on POPs (signed by all HELCOM Contracting Parties) – Annex B (restriction for the production and use in light of any applicable acceptable purposes and/or specific exemptions) – accordingly **EU POPs Regulation. No acceptable purposes or exemptions reported** by any HELCOM Contracting Party. Therefore considered as banned.

• Listed as a priority hazardous substance under the **EU WFD** update proposal. It appears that although under the current EU EQSD an EQS was provided, the group as such was not identified as a priority substance or priority hazardous substance. The EQSD update proposal also includes an EQS for total of active substances in pesticides, including their relevant metabolites, degradation and reaction products.

References:

1. 2. 3. 4. 5. 6. 7. 8.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering that there were also inconclusive non-detections (in terms of exceedance, due to a relatively high limit of detection), it is possible that the actual average frequency of exceedance in these areas is somewhat lower, but in any case >60%.

Diclofenac

(CAS numbers: e.g. 15307-86-5, EC number: 239-348-5 / Entry number in HELCOM list of priority substances: 14)

General sectors: Pharmaceutical, industrial

DRIVERS ACTIVITIES PRESSURES STATE IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Diclofenac exceed the applied threshold value in **13** of the 27 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**2**/8 assessed off-shore areas). In these 13 areas, on average **57%** of the assessible samples in **water** (and/or sediment, which is exceeded more rarely) exceed the threshold value. This is based on regular monitoring data gathered by HELCOM Contracting Parties and reported for the period 2016-2021, in the context of the Diclofenac pre-core indicator[1], as wel as scientific articles/reports[2].

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Diclofenac scores **7.3/10** (confidence range: **7.3 – 7.3**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Diclofenac, for water and sediment, were acquired respectively from the EC proposed Directive amending WFD and EQSD[3] and the value agreed for the HELCOM indicator for HOLAS 3[1].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic and sediment dwelling biota.

Supporting evidence

P Approximately **6-9 tonnes of Diclofenac** are estimated to enter the Baltic Sea every year via WWTPs/rivers (WATERBASE[4]; Undemann et al, 2022[5]). Given that the substance is **persistent and very toxic**[6] (according to the EU WFD/EQSD update proposal, it also tends to accumulate in sediment and/or biota[7]), current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the historical inputs.

A With sales in CPs of 48 – 65 t/y (2015-2022[8]), the predicted (conservative) river concentration at the proximity of WWTP effluents by using the guidelines of Phase I ERA is about 50 times the threshold value for freshwater.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Diclofenac scores **61-76/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A It is a NSAID (nonsteroidal anti-inflammatory drug), authorised for human use[9]. It can be applied to the skin, which contributes notably to the total mass of wastewater loadings[10]. It could be suspected that diclofenac, in its topical form, can be present in grey waters currently allowed to be discharged into the Baltic Sea[11], such as from the water in automatic clothes washers and from bathtubs and showers[13]. Furthermore, topically applied diclofenac may also have a contribution through bathers at coastal locations, where the bathers enter the water without prior removal of the topical pharmaceutical. Beyond its use as pharmaceutical, it is used in the EU in industrial settings as an intermediate in synthesis.

P The substance appears to enter the Baltic Sea via WWTP effluents (released either to rivers or to coastal waters).

Relevant policies (existing or planned measures)

M (on A/P)

• Listed in the first **EQSD Watch List**. And also as priority substance in the **EU WFD** update proposal. It is a HELCOM pre-core indicator.

• It is one of the 'Category 1' substances (substances that can be very easily treated) in the updated Directive on urban wastewater treatment.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.11.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Dioxins (dioxin-like-PCBs, dioxins and furans)

General sectors: Process byproduct, off-shore (shipping)

(CAS numbers: e.g. 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, EC numbers: e.g. 217-122-7, 694-814-9, 694-767-4, 694-811-2, 694-835-3, 694-829-0, 694-762-7, 694-762-7, 694-761-1, 694-812-8, 694-837-4, 694-765-3, 694-831-1, 694-815-4, 694-836-9, 694-806-5, 634-804-3, 690-324-4, 690-324-4, 634-808-5, 690-296-3, 621-375-2, 690-284-8, 682-346-8, 620-601-7, 690-279-0, 690-199-6, 682-345-2, 690-157-7
/ Entry number in HELCOM list of priority substances: 15)

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Dioxins exceed the applied threshold value in **all the 29** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**9**/9 assessed off-shore areas). In these 29 areas, **100%** of the assessible samples in **biota** exceed the threshold value. This is based on regular monitoring data gathered by HELCOM Contracting Parties and reported to the HELCOM COMBINE database for the period 2016-2021, as part of the broader, 'PCBs, dioxins and furans' indicator[1].

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Dioxins scores **9.5/10** (confidence range: **9.5 – 9.5**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for Dioxins, for biota, was acquired from the EC proposed Directive amending WFD and EQSD[2].

I Current levels in the Baltic Sea indicate potential negative impacts on top predators such as mammals and birds and humans via consumption of seafood.

Supporting evidence

S Some **increasing trends have been observed in monitoring in Sweden**.

I Dioxins are considered of **especially concerning mode of toxicity**, as for example they are carcinogenic[3] (beyond their aquatic toxicity), thus posing high long-term risk to populations (e.g. for human health via consumption of seafood).

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Dioxins scores **84-96/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment. This substance group includes polychlorinated dibenzo-p-dioxin (PCDD), dibenzofuran (PCDF) compounds, as well as dioxin-like PCBs (PCBs with a co-planar structure very similar to that of dioxins and dioxin-like effects, i.e. CB-77, CB-81, CB-126, CB-169, CB-105, CB-118, CB-156, CB-157, CB-167, CB-114, CB-123, CB-189).

Facts relevant for management considerations

Causal chain and pathways

A Dioxins are byproducts of combustion processes, forest fires, impurities of chlorinated products[4]. Main sectors which officially reported releases to the Baltic Sea catchment in the context of E-PRTR[5] and the respective shares for the reported emissions are as following:

Releases to air (reported releases >0.0002 TEQ dioxins/furans per year, in the period 2018-2022): mainly **Thermal power / combustion** (69%), **Manufacture of basic organic chemicals** (11%), **Production of pig iron or steel** 8%). Releases to water/soil (reported releases >0.000033 TEQ dioxins/furans per year, in the period 2018-2022): Thermal power / combustion (92%), Landfills (excluding landfills of inert waste or which were closed before 2002) (5%).

P Based on available estimations, Dioxins appears to enter the Baltic Sea via **rivers** (>0,0005 t/y, sum of 30 dioxins/furans, WATERBASE6[8]), **atmospheric deposition** (0.0001 TEQ dioxins/furans, PLC[7]), and **direct emissions from land-based activities** (>>0,00001 t/y, 2 individual dioxins/furans, Undeman et al, 2002[8]).

Relevant policies (existing or planned measures)

M (on A/P/I)
- Listed under **Stockholm Convention** on POPs (signed by all HELCOM Contracting Parties) – Annex C (minimize unintentional releases) – accordingly **EU POPs Regulation –** including respective **national Action Plans for these.**
- Listed as a priority hazardous substance under the **EU WFD** (and its update proposal) – including respective national **Progammes of Measures for this**.
- There are provisions in **EU Best Available Techniques** Reference documents for dioxins
- 'PCBs, dioxins and furans' is a broader **HELCOM indicator**.
- **Dioxins are listed among contaminants with maximum levels in EU Regulation 2023/915, including seafood**, with some derogations applicable e.g. for Finland and Sweden.

References:

1. 2. 3. 4. 5. 6. 7. 8.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Diuron

(CAS number: e.g. 330-54-1, EC number: 206-354-4 / Entry number in HELCOM list of priority substances: 16)

General sectors: Biocide, industry and commercial products, off-shore (shipping, OWF, aquaculture?), legacy pesticide

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Diuron exceed the applied threshold value in **4** of the 22 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in coastal and potentially also at one off-shore area (**1**/4 assessed off-shore areas), but at which in addition to exceedances there are also several inconclusive, in terms of exceedance, non-detections (due to a relatively high limit of detection). In these 4 areas, on average **88%*** of the assessible samples in **water** and/or **sediment** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1]. As well as in target screening data from the project PreEMPT[2]. A total number of 117 data points were possible to evaluate for Diuron.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Diuron scores **6.8/10** (confidence range: **6.0 – 6.0**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk.

The threshold values for Diuron, for water and sediment, were acquired from the EC proposed Directive amending WFD and EQSD[3].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic and sediment dwelling biota.

Supporting evidence

P Approximately **90-150 kg of Diuron** are estimated to enter the Baltic Sea every year, mainly via WWTPs/rivers (WATERBASE[4]; Undemann, 2022[5]). Additional inputs may be expected from off-shore activities (see under Activities below). Given that the substance is **suspect as persistent and is very toxic**[6], current inputs are considered as possibly significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the historical inputs.

I Diuron is considered to have a concerning **mode of toxicity**, as for example it is a possible carcinogen[7] as well as photosynthesis inhibitor[7]. Photosynthesis inhibitors disrupt energy production or utilization and can affect growth and overall fitness of primary producing marine organisms. Furthermore, an Effect-Directed-Analysis study in the North-East Atlantic has revealed this substance as one of the **drivers of inhibition of photosystem efficiency in marine microalgae**[8]. In addition, a REACH Substance Evaluation report has pointed out that **four metabolites of Diuron are considered as possibly relevant in terms of endocrine disruption properties**[9].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Diuron scores **60-68/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern and 100 extreme risk.

Facts relevant for management considerations

Causal chain and pathways

A The substance is manufactured/imported in the EU in quantities 100 - 1,000 t/y according to EU REACH registrations[10]. The **REACH registered uses** indicate applications in polymers and rubber products, with releases expected from industrial use, as well as from outdoors use of long-life materials such as tyres, construction, and building materials due to weathering[9,10]. At least in the past it is reported to have been widely used as a tin-free, copper-free booster biocide for antifouling paints, as well as in aquaculture, and a relevant substance for Off-shore Wind Farms (OWFs)[11]. In the EU it is not an approved active substance for use in antifouling. However, releases from surfaces where it has been previously applied or applied outside the EU are possible. There is also a possible future use as biocide (preservative for films and construction materials), as an initial application for approval is in progress by Denmark under the EU Biocidal Products Regulation (there is an ongoing assessment by Denmark whether diuron is an endocrine disruptor)[12].

P Based on available estimations[5,6], effluents of Wastewater Treatment Plants appear the main (quantified) source of inputs, with approximate estimations indicating orders of magnitude such as 70-80 kg/y of riverine and 20-70 kg/y of direct inputs. As mentioned above, emissions due to off-shore activities may add to this.

Relevant policies (existing or planned measures)

M (on A/P) • Listed as a priority substance under the **EU WFD** (and its update proposal) – including respective national **Progammes of Measures for this**. The EQSD update proposal also includes an EQS for total of active substances in pesticides, including their relevant metabolites, degradation and reaction products.

• REACH: Substance Evaluation was concluded by Finland in 2024[11]. For addressing risks from wide-dispersive uses, the respective report proposed identification as SVHC, which though it will be possible only after endocrine disrupting / PBT / or PMT properties are confirmed. The report also proposes to consider the possibility for restriction.

• Further measures are relevant, such as the updated EU Urban Waste Water Treatment Directive (no specific listing of the substance as such).

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering the inconclusive non-detections (in terms of exceedance, due to a relatively high limit of detection), it is possible that the actual average frequency of exceedance in these areas is somewhat lower, but in any case >50%.

Estrone

(CAS numbers: e.g. 53-16-7, 19973-76-3, EC number: 200-164-5 / Entry number in HELCOM list of priority substances: 17)

General sectors: Hormone, pharmaceutical, industry

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of estrone exceed the applied threshold value in all the **4** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**3**/3 assessed off-shore areas). In these 4 areas, **100%*** of the assessible samples in **water** exceed the threshold value. Th This is based on monitoring data for the period 2015-2024 available in national and international databases[1]. A total number of 37 data points were possible to evaluate for estrone.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, estrone scores **9.3/10** (confidence range: **8.7 – 9.4**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for estone, for water, was acquired from the EC proposed Directive amending WFD and EQSD[2].

I Current inputs to the Baltic Sea indicate potential negative impacts at least on pelagic biota.

Supporting evidence

P Approximately **50-92 kg of estrone** are estimated to enter the Baltic Sea every year, via Wastewater Treatment Plants (WWTPs) / rivers (WATERBASE[3]; Undeman et al, 2022[4]). Given that the substance is **suspect as persistent** and is **extremely toxic**[5], current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also historical inputs.

I Estrone is considered to have an especially **concerning mode of toxicity**. For example, it is an endocrine disruptor[6]. Endocrine disruptors mimic or interfere with hormones and can cause developmental abnormalities, reproductive dysfunction, and population effects.

Overall assessment

When assessing current levels in the Baltic Sea (no relevant measurement data), current inputs, and the severity of the relevant toxicity mechanism, estronescores **90-93/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Estrone is a natural estrogen, which is excreted by humans as well as animals. It is the most common livestock-derived estrogen contaminant in the environment[7]. It is also sold as pharmaceutical. Furthermore, it is used in the EU in industrial settings as an intermediate in synthesis[8].

P Based on available rough estimations[3,4], riverine inputs to the Baltic Sea are at least as high and likely higher (perhaps 1-4 times higher) than direct inputs via coastal WWTPs.

S **?** *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is whether background levels have been taken into account in the toxicity threshod in the EC proposed Directive amending WFD and EQSD.*

Relevant policies (existing or planned measures)

M (on A/P) • Listed in the first and second **EQSD Watch Lists**. And also as priority substance in the **EU WFD** update proposal.

References:

1. 2. 3. 4. 5. 6. 7. 8.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering that there were also inconclusive non-detections (in terms of exceedance, due to a relatively high limit of detection), it is possible that the actual average frequency of exceedance in these areas is somewhat lower, but in any case >75%.

Gabapentin

General sectors: Pharmaceutical

(CAS numbers: e.g. 60142-96-3, EC number: 262-076-3 / Entry number in HELCOM list of priority substances: 18)

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Gabapentin exceed the applied threshold value in **7** of the 10 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**1**/3 assessed off-shore areas). In these 7 areas, on average **68%** of the assessible samples in **water** exceed the threshold value. This is based on monitoring data for the period 2015-2023 as reported by Contracting Parties (CPs) as response to a data call organized by HELCOM, as well as in scientific articles/reports[1] and target screening data from the project LifeAPEX[3]. A total number of 234 data points were possible to evaluate for Gabapentin.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Gabapentin scores **7.2/10** (confidence range: **6.9 – 7.8**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for Gabapentin, for water, was acquired from Posthuma et al, 2019[4].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota.

Supporting evidence

I Gabapentin is considered to have an especially **concerning mode of toxicity**. For example, it is toxic for reproduction[5].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Gabapentin scores **62-78/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Gabapentin is an analgesic used as a human pharmaceutical. Its sales in CPs were ≥35 – 77 tonnes/year in the period 2015-2022[6], with an increasing trend. It has been described as a concern due to suspected non-medical use within Europe (European Monitoring Centre for Drugs and Drug Addiction, 2021[7]).

P It is expected to enter the Baltic Sea via WWTP effluents (both direct and via rivers).

S ? *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is a review of the toxicity threshold (water).*

Relevant policies (existing or planned measures)

M -

References:

1. 2. 3. 4. 5. 6. 7.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Heptachlor and its degradation products

General sectors: Legacy pesticide

(CAS numbers: e.g. 76-44-8, 1024-57-3, 28044-83-9, 1024-57-3, EC numbers: e.g. 200-962-3, 213-831-0, 634-785-1, 213-831-0
/ Entry number in HELCOM list of priority substances: 19

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Heptachlor exceed the applied threshold value in **5** of the 6 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**2**/2 assessed off-shore areas). In these 5 areas, on average **46%*** of the assessible samples in **biota** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1]. A total number of 73 data points were possible to evaluate for Heptachlor.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Heptachlor scores **7.6/10** (confidence range: **7.3 – 7.9**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

Concentrations of cis-heptachlorepoxide and trans-heptachlorepoxide also frequently exceed their respective threshold value. And water is another matrix, beyond biota, where exceedances have been observed. The threshold values for all substances in the group, for biota, were acquired from the EC proposed Directive amending WFD and EQSD[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota, top predators such as mammals and birds, and humans via consumption of seafood.

Supporting evidence

P Approximately **15 – 210 kg of Heptachlor and its degradation products** are estimated to enter the Baltic Sea every year, mainly via rivers (WATERBASE[3]). Historical inputs have been considerably higher. Given that the substance is **very persistent, very bioaccumulative, and extremely toxic**[4], even current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the historical inputs.

I Heptachlor and its degradation products are considered of **concerning mode of toxicity**: for example Heptachlor is a possible carcinogen[5], as well as neuroactive[6]. Neuroactive substances cause sublethal neurological impacts like disorientation or altered behaviour that can affect feeding success, predator avoidance, and overall survival.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Heptachlor and its degradation products score **69-81/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment. Both Heptachlor and its degradation product heptachlor epoxide have hazardous properties and exhibit concerning environmental occurrence profiles, and they have been grouped in one entry.

Facts relevant for management considerations

Current causes, pathways

A No known on-going activities causing emissions.

P Its high persistence, and earlier widespread use have meant that residues of this group are widespread[7]. That likely explains the measured riverine inputs.

Relevant policies (existing or planned measures)

M (on A/P) • Listed under **Stockholm Convention** on POPs (signed by all HELCOM Contracting Parties) – Annex A (elimination of manufacture and use, with specific exemptions possible) – accordingly **EU POPs Regulation. No acceptable purposes or exemptions reported** by any HELCOM Contracting Party. Therefore considered as banned.

- Listed as a priority hazardous substance under the **EU WFD** and its update proposal. The EQSD update proposal also includes an EQS for total of active substances in pesticides, including their relevant metabolites, degradation and reaction products.

References:

1. 2. 3. 4. 5. 6. 7.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering that there were also inconclusive non-detections (in terms of exceedance, due to a relatively high limit of detection), it is possible that the actual average frequency of exceedance in these areas is somewhat lower, but in any case >15%.

Hexachlorobenzene

(CAS number: e.g. 118-74-1, EC number: 204-273-9 / Entry number in HELCOM list of priority substances: 20)

General sectors: Process byproduct, off-shore (dredged material deposition), legacy pesticide

Drivers	Activities	Pressures	State	Impacts

Why a HELCOM priority?

Main evidence

S Concentrations of Hexachlorobenzene exceed the applied threshold value in **22** of the 42 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**12**/14 assessed off-shore areas). In these 22 areas, on average **72%** of the assessible samples in **sediment and/or biota** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national/international databases[1] and scientific articles/reports[2], as well as in target screening data from the project LifeAPEX[3]. A total number of 1583 data points were possible to evaluate for Hexachlorobenzene.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Hexachlorobenzene scores **7.5/10** (confidence range: **7.3 – 7.6**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for this substance, for sediment and biota, were acquired respectively from the national EU MSFD assessments[4] and the EC proposed Directive amending WFD and EQSD[5].

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling biota, pelagic biota, top predators such as mammals and birds, and humans via consumption of seafood.

Supporting evidence

P Approximately **380 kg of Hexachlorobenzene** are estimated to enter the Baltic Sea every year, mainly via atmospheric deposition, which has been modelled by EMEP[6] (2019) using officially reported emission data. Historical inputs have been higher. Given that the substance is **very persistent, bioaccumulative, and very toxic**[7], even current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the historical inputs.

S According to expert information provided, there are **increasing trends in monitoring in two Swedish stations** (likely related to e.g. foodwebs and not increased releases from sediments).

I Hexachlorobenzene is considered to have an especially **concerning mode of toxicity**, as for example it is carcinogenic[8] (beyond its aquatic toxicity), thus posing high long-term risk to populations (at least for human health via consumption of seafood).

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Hexachlorobenzene scores **77-79/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Although manufacture and use has been eliminated for signees of the Stockholm Convention (all HELCOM Contracting Parties), it is generated as a byproduct during the manufacture of certain industrial chemicals and also exists as an impurity in several pesticide formulations. The main sector with officially reported releases to the Baltic Sea catchment is **chemical installations for the production on an industrial scale of basic inorganic chemicals** (18 kg/y to air reported to E-PRTR[9], 2018-2022). On country basis and based on the inventories of unintended emissions reported to Stockholm Convention[10] (also quite incomplete), further relevant sectors in HELCOM Contracting Parties include **ferrous and non-ferrous metal production** (>8kg/y), **heat and power generation** (>5kg/y), and other sectors (>3kg/y) including transportation, open burning processes, and waste incineration. Reported emissions to water/soil mainly from production of basic plant health products and of biocides, and to lesser degree from landfills are in the order of 2kg/y (E-PRTR).

P Based on available estimations, **atmospheric deposition** seems by far the predominant route of direct inputs to Baltic Sea (370 kg/y), followed by riverine inputs (1-15 kg/y based on river mouth data from WATERBASE[11]) and negligible inputs from deposition of dredged material[12] (~150g/y). Further emissions e.g. from sediment disturbing activities are possible.

Relevant policies (existing or planned measures)

M (on A/P) • Listed under **Stockholm Convention** on POPs (signed by all HELCOM Contracting Parties) – Annexes A (elimination of manufacture and use), C (minimize unintentional releases) – accordingly **EU POPs Regulation –** including respective **national Action Plans for these.**

- Listed as a priority hazardous substance under the **EU WFD** (and its update proposal) – including respective national **Progammes of Measures for this**. The EQSD update proposal also includes an EQS for total of active substances in pesticides, including their relevant metabolites, degradation and reaction products.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Irgarol (cybutryne)

(CAS number: e.g. 28159-98-0, EC number: 248-872-3 / Entry number in HELCOM list of priority substances: 21)

General sectors: Off-shore (shipping, OWF, aquaculture?), legacy biocide, legacy pesticide

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Irgarol exceed the applied threshold value in **10** of the 23 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**1**/6 assessed off-shore areas). In these 10 areas, on average **77%*** of the assessible samples in **sediment** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1]. As well as scientific articles/reports[2], and target screening data from the project PreEMPT[3]. A total number of 639 data points were possible to evaluate for Irgarol.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Irgarol scores **7.2/10** (confidence range: **6.6 – 7.2**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk.

The threshold value for Irgarol, for sediment, was acquired from the NORMAN Network ecotoxicology database[4].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic and/or sediment dwelling biota.

Supporting evidence

P Approximately **35-140 kg of Irgarol** are estimated to enter the Baltic Sea every year, mainly via rivers (WATERBASE[5]). Additional inputs may be expected from off-shore activities (see under Activities below). Given that the substance is **very persistent and very toxic**[6], current inputs are considered as possibly significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the higher historical inputs.

I Irgarol is considered to have a concerning **mode of toxicity**, as for example it is a photosynthesis inhibitor[7]. Photosynthesis inhibitors disrupt energy production or utilization and can affect growth and overall fitness of primary producing marine organisms. Furthermore, an Effect-Directed-Analysis study in the North-East Atlantic has revealed this substance as one of the **drivers of inhibition of photosystem efficiency in marine microalgae**[8].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Irgarol scores **62-72/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern and 100 extreme risk.

Facts relevant for management considerations

Causal chain and pathways

A At least in the past it is reported to have been widely used as a tin-free, copper-free booster biocide for antifouling paints, as well as in aquaculture, and a relevant substance for Off-shore Wind Farms (OWFs)[9]. In the EU it is not an approved active substance for use in antifouling or in general as biocide or pesticide. However, releases from surfaces where it has been previously applied or applied outside the EU are possible. In this context, it might also be used on structures, equipment and recreational craft in cases not already subject to the International Convention on antifouling. Regarding aquaculture, although use is plausible, it is not authorized for such use at least in Denmark, Finland, Germany, Latvia, Lithuania, or Poland[10].

P Quantified data is available only for the riverine pathway ot the Baltic Sea, as mentioned above. Even though emissions off-shore are expected. The source of the measured levels in rivers (in fact river mouths) is unknown. It is not clear if Its high persistence, and earlier widespread use, can explain this.

S **?** *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is a review of the toxicity threshold (sediment). Another aspect could be confirming whether active use in some off-shore sectors could be the case.*

Relevant policies (existing or planned measures)

M (on A/P)
- Irgarol is **subject to the International Convention on the Control of Harmful Anti-fouling Systems on Ships**[11].
- Listed as a priority substance under the **EU WFD** (and its update proposal) – including respective national **Progammes of Measures for this**. The EQSD update proposal also includes an EQS for total of active substances in pesticides, including their relevant metabolites, degradation and reaction products.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering that there were also inconclusive non-detections (in terms of exceedance, due to a relatively high limit of detection), it is possible that the actual average frequency of exceedance in these areas is somewhat lower, but in any case >50%.

Lead and its compounds

(CAS numbers: e.g. 7439-92-1, EC numbers: e.g. 231-100-4 / Entry number in HELCOM list of priority substances: 22)

General sectors: Industry and commercial products, off-shore (shipping, dredged material deposition, OWF?)

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Lead exceed the applied threshold value in **36** of the 41 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**16**/16 assessed off-shore areas). In these 36 areas, on average **92%** of the assessible samples in **sediment and/or biota** exceed the threshold value. This is based on regular monitoring data gathered by HELCOM Contracting Parties and reported to the HELCOM COMBINE database for the period 2016-2021, in the context of the Lead indicator[1].

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Lead scores **8.9/10** (confidence range: **8.9 – 8.9**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Lead were as agreed for the HELCOM indicator for HOLAS 3.

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling biota, top predators such as mammals and birds, and humans via consumption of seafood.

Supporting evidence

P Approximately **180 – 400 tonnes of Lead and its compounds** are estimated to enter the Baltic Sea every year, mainly via rivers, depositing of dredged material, and atmospheric deposition (PLC[2], HELCOM BSEFS[3]). Given that the substance is **very persistent (metals do not degrade) and toxic**[4] (according to the EU WFD and its update proposal, it also tends to accumulate in sediment and/or biota[5]), current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also historical inputs. Likely increased inputs in the near future are possible, due to it use in emerging setors, such as in batteries and perhaps Off-shore Wind Farms (latter to be confirmed).

I Lead is considered to have an especially **concerning mode of toxicity**: for example it is toxic for reproduction[6].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Lead scores **87-90/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Lead and its compounds are manufactured/imported in the EU in quantities 1,000,000 – 10,000,000 tonnes/year[7]. Sectors of the **REACH registered uses** include batteries, pigments/coatings/inks, plastics, rubber, lead articles or alloys, solder, galvanisation, heat transfer fluids or lubricants, aviation fuels, adsorbents, explosives, plating, construction materials etc. With article service life and emissions from waste being relevant. According to ECHA[8], the apportionment of use of lead and its compounds in the EU is as follows: Automotive batteries (57%), Industrial batteries (32%), Rolled and extruded products (4%), Shot and ammunition (4%), Lead compounds (1%), Cable sheathing (1%), Alloys (including solders) (0.5 %).
Main sectors which officially reported releases to the Baltic Sea catchment in the context of E-PRTR[9] and the respective shares for the reported emissions are as following:
Releases to air (reported releases 17-75 t/y, in the period 2018-2022): mainly **Thermal power / combustion** (35%), **Production/smelting of non-ferrous metals** (22%), **Metal ore roasting or sintering** (18%), **Production of pig iron or steel** (16%). Releases to water/soil (reported releases 4-25 t/y, in the period 2018-2022): **Underground mining and related operations** (69%), Pulp production (7%). Sectors reporting to E-PRTR with relatively lower emissions include for example landfills, glass manufacture, and disposal of non-hazardous waste.
Shipping emissions to the Baltic Sea have been estimated at 2 t/y and they correspond to scrubber wash water, bilge water, grey water, and sewage. Emissions from biosolids, from WWTPs,applied on land may also be expected.

P Based on available estimations, Lead appears to enter the Baltic Sea via **rivers** (78-153 t/y, PLC[3]), direct off-shore emissions (**depositing of dredged material** (41-143t/y, HELCOM BSEFS[10]) plus shipping (2 t/y, EMERGE)), **atmospheric deposition** (49-93 t/y, PLC, EMERGE), and direct emissions from land-based activities (1.5-5 t/y, PLC, Undeman et al, 2022, E-PRTR).

Relevant policies (existing or planned measures)

M (on A/P/I) • **Many activities are restricted under EU REACH for lead compounds in general, as well as specifically for lead carbonates and lead sulphates – restrictions exist also for electrical and electronic devices (under EU RoHS). 33 Lead substances are listed as SVHC** (Substances of Very High Concern) **under EU REACH** (on the basis of CMR properties), a small number of which has further been included in **REACH Authorization list**. ECHA has recently developed an **Assessment of Regulatory needs (ARN) for slag substances (residues from processing of primary and secondary metal sources)**, including substances containing lead (ECHA[12]). Further relevant ARNs for Lead substances may exist (to be confirmed).

• Lead and its compoounds are listed as a priority substances under the **EU WFD** and as priority hazardous substances under its update proposal. Lead is is also a **HELCOM indicator**.

• **Lead is listed among contaminants with maximum levels in EU Regulation 2023/915, including seafood**.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Lindane (gamma Hexachlorocyclohexane)

(CAS numbers: e.g. 58-89-9, EC number: 200-401-2 / Entry number in HELCOM list of priority substances: 23)

General sectors: Legacy pesticide, legacy pharmaceutical

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Lindane exceed the applied threshold value in **8** of the 30 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**4**/12 assessed off-shore areas). In these 8 areas, on average **59%** of the assessible samples in **sediment** and/or **biota** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1], as well as scientific articles/reports[2]. A total number of 1526 data points were possible to evaluate for Lindane.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Lindane scores **6.9/10** (confidence range: **6.6 – 7.5**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Lindane, for sediment and biota, were acquired from the ecotoxicology database of the NORMAN Network[3].

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling biota and pelagic biota, possibly including top predators, such as mammals and birds, and humans via consumption of seafood.

Supporting evidence

P Approximately **30-100 kg of Lindane** are estimated to enter the Baltic Sea every year via WWTP effluents (Undeman et al, 2022[4]). Further riverine emissions (and any atmospheric deposition) are possible. Historical inputs have been higher. Given that the substance is **very persistent and very toxic**[5], even current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the historical inputs. For a different isomer, alpha Hexachlorocyclohexane, a smaller, still **possible significant, inputs have been estimated to enter the Baltic Sea (2-9 kg/year)**.

I Lindane is considered to have a concerning **mode of toxicity**, as it is neuroactive[6]. Neuroactive substances cause sublethal neurological impacts like disorientation or altered behaviour that can affect feeding success, predator avoidance, and overall survival.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Lindane scores **69-74/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A No known on-going activities causing emissions.

P The reported load of Lindane in WWTP effluents is not easily justified considering that no active use is expected in Contracting Parties. Beyond such inputs, atmospheric deposition can in general be a relevant pathway for Lindane, however its legacy status may mean that such inputs are expected to be low or even negligible.

S **?** *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is a review of the toxicity threshold (sediment, biota).*

Relevant policies (existing or planned measures)

M (on A/P) • Listed under **Stockholm Convention** on POPs (signed by all HELCOM Contracting Parties) – Annex A (elimination of manufacture and use, with specific exemptions possible) – accordingly **EU POPs Regulation. No acceptable purposes or exemptions reported** by any HELCOM Contracting Party. Therefore considered as banned.

- Listed as a priority hazardous substance under the **EU WFD** and its update proposal. The EQSD update proposal also includes an EQS for total of active substances in pesticides, including their relevant metabolites, degradation and reaction products.
- There are provisions in **EU Best Available Techniques** Reference Documents for lead

References:

1. 2. 3. 4. 5. 6.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Mercury and its compounds

(CAS numbers: e.g. 7439-92-1, EC numbers: e.g. 231-100-4 / Entry number in HELCOM list of priority substances: 24)

General sectors: Industry and commercial products, off-shore (shipping, dredged material deposition, OWF)

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of mercury exceed the applied threshold value in **all 41** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**15**/15 assessed off-shore areas). In these 41 areas, on average **91%** of the assessible samples in **biota** exceed the threshold value. This is based on regular monitoring data gathered by HELCOM Contracting Parties and reported to the HELCOM COMBINE database for the period 2016-2021, in the context of the Mercury indicator[1].

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, mercury scores **8.8/10** (confidence range: **8.8 – 8.8**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for mercury, for water, was acquired from the EC proposed Directive amending WFD and EQSD[2].

I Current levels in the Baltic Sea indicate potential negative impacts on top predators such as mammals and birds, and humans via consumption of seafood.

Supporting evidence

P Approximately **4 – 6 tonnes of mercury** are estimated to enter the Baltic Sea every year, mainly via atmopsheric deposition and rivers, and secondly via depositing of dredged material (PLC[3], HELCOM BSEFS[4], EMERGE[5]). Given that the substance is **very persistent (metals do not degrade) and toxic**[6] (according to the EU WFD and its update proposal, it also tends to accumulate in sediment and/or biota[7]), current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also historical inputs. Likely increased inputs in the near future are possible, due to it use in emerging setors, such as in batteries.

I Mercury is considered to have an especially **concerning mode of toxicity**: for example it is toxic for reproduction[8].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Mercury scores **87-89/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Mercury and its compounds are manufactured/imported in the EU in quantities >100 – 1,000 tonnes/year[9] (to be confirmed if this corresponds to all mercury-containing registered substances). Sectors of use include in general metallurgy, offshore mining, construction materials, batteries and accumulators, machinery and mechanical appliances (to be confirmed that these cover also the REACH registered sectors). Main sectors which officially reported releases to the Baltic Sea catchment in the context of E-PRTR[10] and the respective shares for the reported emissions are as following:

Releases to air (reported releases 3-5 t/y, in the period 2018-2022): mainly **Thermal power / combustion** (70%), **Production/smelting of non-ferrous metals** (7%), **Production of cement clinker or lime in rotary kilns or other furnaces** (7%), **Production of pig iron or steel** (6%). Releases to water/soil (average reported releases 0.3 t/y, in the period 2018-2022): **Underground mining and related operations** (31%), Opencast mining and quarrying (15%), Production of pulp, paper, board, wood products (11%).

Shipping emissions to the Baltic Sea have been estimated at only 20 kg/y and they correspond to scrubber wash water, bilge water, grey water, and sewage (EMERGE). Mercury is also emitted form natural sources (e.g. volcanoes, geothermal springs, geologic deposits).

P Based on available estimations, mercury appears to enter the Baltic Sea via **atmospheric deposition** (1.4-3.1 t/y, PLC, EMERGE), **rivers** (1.6-2.2 t/y, PLC[3]), direct off-shore emissions (**depositing of dredged material** (0.2-0.6 t/y, HELCOM BSEFS[10]) plus shipping (0.02 t/y, EMERGE)), and direct emissions from land-based activities (0.06-0.18 t/y, PLC, Undeman et al, 2022[11], E-PRTR).

Relevant policies (existing or planned measures)

M (on A/P/I) • Addressed by the **Minamata Convention** (signed by all HELCOM Contracting Parties but Russia) – this includes the phase-out and phase-down of mercury use in a number of products and processes, ban / phase-out of mercury mines, control measures on emissions to air and on releases to land and water, and the regulation of the informal sector of artisanal and small-scale gold mining.

• **Several activities are restricted under EU REACH for mercury compounds** (antifouling, wood preservation, heavy-duty industrial textiles and yarn, treatment of industrial waters, certain measuring devices, mixtures and articles contianing phenylmercury) and an electrical and electronic devices restriction there is under EU RoHS. In the context of REACH, Denmark and Sweden had in the past prepared **Assessments of Regulatory needs (ARN) / Risk Management Options Aanalyses (RMOA) regarding dental amalgams, lamps, and waste collection rates**[12] – also linked with implementation of the Minamanta Convention.

• There are provisions in **EU Best Available Techniques** Reference Documents for mercury

• Mercury and its compounds are listed as a priority hazardous substances under **EU WFD** and its update proposal. It is is also a **HELCOM indicator**.

• **Mercury is listed among contaminants with maximum levels in EU Regulation 2023/915, including seafood**.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Nickel and its compounds

(CAS numbers: e.g. 7440-02-0, EC numbers: e.g. 231-111-4 / Entry number in HELCOM list of priority substances: 25)

General sectors: Industry and commercial products, off-shore (shipping, dredged material deposition)

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Nickel exceed the applied threshold value in **21** of the 37 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**11**/15 assessed off-shore areas). In these 22 areas, on average **83%** of the assessible samples in **water and/or sediment and/or biota** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1] and scientific articles/reports[2]. A total number of 2139 data points were possible to evaluate for Nickel.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Nickel scores **7.9/10** (confidence range: **7.9 – 7.9**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Nickel were acquired from the EC proposed Directive amending WFD and EQSD[3].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota, sediment dwelling biota, and top predators such as mammals and birds.

Supporting evidence

P Approximately **450 – 920 tonnes of Nickel and its compounds** are estimated to enter the Baltic Sea every year, mainly via rivers (PLC[4]) and secondly via deposition of dredged material (HELCOM BSEFS[5]). Additional inputs are expected from Off-shore Wind Farms. Given that the substance is **very persistent (metals do not degrade) and toxic**[6], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also historical inputs. Likely increased inputs in the near future are possible, due to it use in emerging sectors, such as in batteries.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Nickel scores **63-81/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Nickel and its compounds are manufactured/imported in the EU in quantities : ≥ 100,000 tonnes/year[7] (not complete calculation of EU REACH registered volume, as there are several substances containing Arsenic). Main sectors which officially reported releases to the Baltic Sea catchment in the context of E-PRTR[8] and the respective shares for the reported emissions are as following (a broader overview including REACH-registered uses with potential emissions has not been compiled here):
Releases to water/soil (average reported releases 12 t/y, in the period 2018-2022): **Industrial plants for the production of pulp from timber or similar fibrous materials** (21%), Installation for the production of non-ferrous crude metals from ore chemical or electrolytic processes (13%), Installations for the production of pig iron or steel including continuous casting (9%). Releases to air (average reported releases 20t/y, in the period 2018-2022): mainly **Thermal power / combustion** (52%), **Mineral oil and gas refineries** (14%), Installation for the production of non-ferrous crude metals by metallurgical, chemical or electrolytic processes (9%), Installations for the production of pig iron or steel including continuous casting (8%). Emissions from shipping (about 10 t/y, EMERGE) relate to scrubber wash water, bilge water, grey water, and sewage[9].

P Based on available estimations, Nickel appears to enter the Baltic Sea via **rivers** (362-757t/y, PLC), direct off-shore emissions (**depositing of dredged material** (44-115 t/y, HELCOM BSEFS) plus shipping (10 t/y, EMERGE) plus inputs are expected from Off-shore Wind Farms (unquantified)), atmospheric deposition (23-27 t/y, EMERGE), and direct inputs from land activities (9-13 t/y, PLC).

S **?** *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is a review of the water toxicity threshold in the EC proposed Directive amending WFD and EQSD (compatibility in terms of form (soluble/total) between measured levels and the threshold).*

Relevant policies (existing or planned measures)

M (on A/P) • **For Nickel, some activities are restricted under EU REACH** (use in piering assembly and articles intended to come into direct and prolonged contact with the skin, such as earrings, necklaces, bracelets and chains, etc.). There are **several Assessments for Regulatory Needs or Risk Management Options Analyses for individual nickel substances and some sub-groups**, prepared in the context of ECHA's Integrated Regulatory Strategy[10]**.**

• Nickel and its compounds are listed as a priority substances under the **EU WFD** and its update proposal.

• There are provisions in **EU Best Available Techniques** Reference Documents for nickel

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Nicosulfuron

General sectors: Pesticide

(CAS numbers: e.g. 111991-09-4, EC numbers: 601-148-4, 686-897-5, 691-662-5 / Entry number in HELCOM list of priority substances: 26)

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Nicosulfuron exceed the applied threshold value in **4** of the 7 examined areas (assessment units) of the Baltic Sea, noting also, for some of these areas, several inconclusive, in terms of exceedance, non-detections (due to a relatively high limit of detection). The threshold is exceeded in both coastal and off-shore areas (**1**/3 assessed off-shore areas). In these 4 areas, on average **90%**[*] of the assessible samples in **water and/or sediment** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1]. A total number of 38 data points were possible to evaluate for Nicosulfuron.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Nicosulfuron scores **7.6/10** (confidence range: **3.9 – 7.9**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Nicosulfuron, for water and sediment, were acquired respectively from the EC proposed Directive amending WFD and EQSD[2] and the ecotoxicology database of the NORMAN Network[3].

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling biota and pelagic biota.

P Approximately **3-40 kg of Nicosulfuron** are estimated to enter the Baltic Sea every year, mainly via rivers (WATERBASE[4]). Additional inputs may be expected from direct runoff from land. Given that the substance is **very persistent and toxic**[5], current inputs are possibly significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the historical inputs. The riverine data used for the estimation concerns only measurements in the proximity of river mouths, and the period 2015-2022. The 12 subcatchment areas for which there was such riverine data reflected 3 % of the total riverine flow to the Baltic Sea, to which inputs have been extrapolated. The data in WATERBASE included approximately 3 countries and 198 samples.

Supporting evidence

I Nicosulfuron is considered to have a concerning **mode of toxicity**, as it is inhibits protein biosynthesis[6].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Nicosulfuron scores **52-80/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Current causes, pathways

A The substance is authorized as pesticide in five from the Contracting Parties (CPs) which are members of the EU[7]: Germany, Estonia, Lithuania, Latvia (300 kg/y), and Poland. According to the literature, it is used as herbicide against weeds and grass weeds[8].

Relevant policies (existing or planned measures)

M (on A/P) • Listed as a priority substance under the **EU WFD update proposal**. The EQSD update proposal also includes an EQS for total of active substances in pesticides, including their relevant metabolites, degradation and reaction products. Programmes of Measures (PoMs) may exist for CPs which have included it as additional contaminant in MSFD assessments / River-Basin-Specific Pollutant in WFD assessments.

• Under the EU Regulation 1107/2009 concerning the placing of **plant protection products on the market, it is candidate for substitution**, on the basis of the two PBT criteria. Under the EU Sustainable Use of Pesticides Directive (2009/128/EC), Member States of the EU shall adopt **National Action Plans** to set up their quantitative objectives, targets, measures and timetables to reduce risks and impacts of pesticide use and to encourage the development and introduction of integrated pest management and of alternative approaches or techniques in order to reduce dependency on the use of pesticides.

References:

1. 2. 3. 4. 5. 6.7.8.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering that there were also inconclusive non-detections (in terms of exceedance, due to a relatively high limit of detection), it is possible that the actual average frequency of exceedance in these areas is lower, but in any case >15%.

Octinoxate

(CAS number: e.g. 5466-77-3, EC number: 226-775-7 / Entry number in HELCOM list of priority substances: 27)

General sectors: Personal care product

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Octionoxate exceed the applied threshold value in **16** of the 22 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**3**/4 assessed off-shore areas). In these 16 areas, on average **83%** of the assessible samples in **water and/or sediment and/or biota** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1]. As well as in suspect screening data from the project PreEMPT[2]. A total number of 94 data points were possible to evaluate for Octionoxate.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Octionoxate scores **8.1/10** (confidence range: **4.8 – 8.6**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk.

The threshold values for Octionoxate were acquired from the NORMAN Network ecotoxicology database[3].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic and/or sediment dwelling biota, and/or top predators such as mammals and birds.

Supporting evidence

P Approximately **46-540 kg of Octionoxate** are estimated to enter the Baltic Sea every year, via WWTPs/rivers (WATERBASE[4]). Additional inputs might be expected from atmospheric deposition, although the substane degrades fast in air. As well as from direct emissions from bathing. Given that the substance is **suspect as very toxic**[3], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Octinoxate scores **50-68/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern and 100 extreme risk.

Facts relevant for management considerations

Causal chain and pathways

A Although the substance is not EU REACH-registered[5] (thus there are no manufacturers or importers of this substance in amounts above 1 tonne/year per company), classification & labelling notifications have been received by ECHA by about 2,000 companies[6]. Therefore, the total amount in the EU market may still be significant. According to the SPIN database, for the period 2017-2021, in Denmark and Sweden the substance was reported in total amounts up to tonnage bands of 1.5 – 150 t/y and 8.8 – 880 t/y respectively[7]. Octinoxate is a UV filter and light stabilizer in cosmetics (e.g. sunscreen products). It is also reported to have been used as UV filter in pharmaceuticals, intermediates and fine chemicals.

P Quantified estimations are available for the riverine pathway to the Baltic Sea (30 - 480 kg, WATERBASE), as well as the direct coastal emissions via WWTPs (16-64 kg, Undeman et al, 2022[8]). As mentioned above, beyond these, potentially atmospheric deposition and direct emissions from bathing might be expected.

S ? *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is a review of the toxicity thresholds (water, sediment, biota).*

Relevant policies (existing or planned measures)

M (on A/P)

- Octionoxate is **listed in the EU Cosmetics Regulation (EC) 1223/2009 (regulated as a UV-filter in sunscreen products in a concentration up to 10 %)**.
- Listed in the first **EQSD Watch List**.

References:

1. 2. 3. 4. 5. 6. 7. 8.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Organotins

(CAS numbers: e.g. 36643-28-4
/ Entry number in HELCOM list of priority substances: 28)

General sectors: Industry and commercial products, off-shore (shipping, dredged material deposition)

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of TBT (Tributyltin compounds) exceed the applied threshold value in **21** of the 25 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**10**/12 assessed off-shore areas). In these 21 areas, on average **98%** of the assessible samples in **sediment and/or biota** exceed the threshold value. This is based on regular monitoring data gathered by HELCOM Contracting Parties and reported to the HELCOM COMBINE database for the period 2016-2021, in the context of the indicator 'TBT and imposex'[1].

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, TBT scores **8.6/10** (confidence range: **8.6 – 8.6**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

Concentrations of MBT (Monobutyltin compounds), DBT (Dibutyltin compounds), TeBT (Tetrabutyltin compounds), and Triphenyltin compounds also frequently exceed their respective threshold value.

The threshold values for TBT, for sediment and biota, were acquired from the EC proposed Directive amending WFD and EQSD[2] and MSFD national assessments[3], respectivey. For the further organotins mentioned above, threshold values for sediment and biota were mainly acquired from MSFD national assessments, but also from the NORMAN Network ecotoxicology database[4].

I A biological effect linked to ecposure to organotins, imposex, has been observed to exceed the respective applied threshold value in 13 of the 17 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (1/3 assessed off-shore areas). This is based on regular monitoring data gathered by HELCOM Contracting Parties for the period 2016-2021, in the context of the indicator 'TBT and imposex'.

Supporting evidence

P The quantified input estimations indicate **at least 20 – 90 kg of TBT** to enter the Baltic Sea every year, mainly via deposition of dredged material (HELCOM BSEFS[5]). In addition to this, direct emissions from shipping and leisure boating are expected (unquantified). Given that the substance is **very persistent, bioaccumulative, and very toxic**[6], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also the higher historical inputs. Similar evidence exist for other organotins, such as MBT (at least 20-90 kg/y mainly via WWTPs plus unquantified inputs via shipping) and DBT (at least 10-35 kg/y mainly via WWTPs plus unquantified inputs via shipping) (Undeman et al, 2022[7], WATERBASE[8]).

I Several organotins are considered of **especially concerning mode of toxicity**: for example TBT is an endocrine disruptor[9]. Endocrine disruptors mimic or interfere with hormones and can cause developmental abnormalities, reproductive dysfunction, and population effects.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, for example TBT scores **86-88/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment. Besides TBT, several other organotins (mono-, di-, tri-, and/or tetra-substituted organotins), also called organostannic compounds, have hazardous properties and concerning environmental fate and/or occurrence profiles – or may degrade to such in the environment[14]. This substance group entry aims to reflect all such relevant individual substances.

Facts relevant for management considerations

Causal chain and pathways

A Organotins are manufactured/imported in the EU in the following quantities[10]: DBT ≥330-3,300 tonnes/year (at least 6 substances, including e.g. Dibutyltin dilaurate, Dibutyltin oxide, and Dibutylbis(pentane-2,4-dionato-O,O')tin), TBT and TeBT confidential (only uses as intermediate)[7], Dioctyltins ≥1,000 – 10,000 tonnes/year, Dimethyltins ≥1,000 – 10,000 tonnes/year. And potentially further organotins. **REACH registered uses**[11] for Dibutyltin dilaurate include e.g.: industrial uses (as a catalyst / process regulator, additive to prevent reaction of polymer with reactive diluent, electrical wire enamelling and coating); as catalyst in professional and consumer uses of adhesives/sealants/fillers (building and construction work); and article service life e.g. in vehicles, machinery / electircal appliances, batteries and accumulators, rubber articles, wood articles, construction articles and building materials. Registered uses for Dibutyltin oxide include e.g.: industrial uses such as cataphoretic coating, catalyst/process regulator including use in production of polymers, intermediate; professional and consumer use of products such as fabrics, textiles and apparel, leather articles; and article service life similar to Dibutyltin dilaurate. Some of the above uses are also relevant for Dibutylbis(pentane-2,4-dionato-O,O')tin), plus applications such as coatings/paints/thinners/paint removers. And paper and board treatment products. Registered uses of dioctyltins and dimethyltins have not been compiled here.

Leisure craft and ships still have organotin compounds on their hulls. Whereas secondary releases during maintenance work is also expected.

Relevant policies (existing or planned measures)

M (on A/P)

• Organotins are **subject to the International Convention on the Control of Harmful Anti-fouling Systems on Ships**[12].

• Accordingly, organotins are **restricted under EU REACH** for uses as biocides/antidouling. Furthermore, tri-substituted organotins, dibutyltin (DBT) compounds, and dioctyltin (DOT) compounds are restricted as concerns their inclusion in many types of articles above 0.1% tin. Five organotin substances are **listed as REACH SVHC** (two DBT and two dioctyltin substances due to their toxicity for reproduction properties; and one TBT substances due to its PBT properties). One of the dioctyltin substances has further been included in **REACH Authorization list**. **Assessments of Regulatory Needs / Risk Management Options Analyses** have been prepared in the context of ECHA's Integrated Regulatory Strategy at least for certain individual dioctyltins and dimethyltin substances[13].

• TBT is listed as a priority hazardous substance under **WFD** and its update proposal HELCOM indicator. It is also part of a **HELCOM indicator**.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13.14.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

PAHs (Polycyclic Aromatic Hydrobarbons) and metabolites

(CAS numbers: e.g. 50-32-8, 206-44-0, 120-12-7, 5315-79-7, EC numbers: 200-028-5, 205-912-4, 204-371-1, 624-224-9 / Entry number in HELCOM list of priority substances: 29)

General sectors: Process byproduct, industry and commercial products, off-shore (shipping)

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of anthracene exceed the applied threshold value in **6** of the 15 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**2**/10 assessed off-shore areas). In these 6 areas, on average **69%** of the **sediment and/or biota** samples exceed the threshold value. This is based on regular monitoring data gathered by HELCOM Contracting Parties and reported to the HELCOM COMBINE database for the period 2016-2021, as part of the broader, 'PAHs and metabolites' indicator[1].

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, anthracene scores **7.3/10** (confidence range: **7.3 – 7.3**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for anthracene, for sediment and biota, were respectively as agreed for the HELCOM indicator for HOLAS 3 and as listed in the EC proposed Directive amending WFD and EQSD[2].

Concentrations of benzo(a)pyrene and likely further PAHs, as well as metabolites, such as 1-hydroxypyrene, also frequently exceed their respective threshold values.

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling organisms, top predators such as mammals and birds and humans via consumption of seafood.

Supporting evidence

P At least **12 tonnes of PAHs** are estimated to enter the Baltic Sea every year, with atmopsheric deposition and direct off-shore inputs appearing to likely dominate among pathways (WATERBASE[3], HELCOM BSEFS[4], EMERGE[5], Undeman et al, 2022[6], E-PRTR[7]). Given that PAHs are **very persistent, very bioaccumulative, and very toxic**[8], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also historical inputs.

I PAHs are considered of **especially concerning mode of toxicity**, as for example they are carcinogenic, toxic for reproduction, and endocrine disruptors[9].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, for example anthracene scores **72-73/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment. Besides anthracene, several other Polycyclic Aromatic Hydrobarbons, in particular those with 2-6 benzene rings, have hazardous properties and concerning environmental fate and/or occurrence profiles[11]. Certain degradation products including metabolites, e.g. hydroxylated PAHs, also have such properties and profiles[12]. This substance group entry aims to reflect all such relevant individual substances.

Facts relevant for management considerations

Causal chain and pathways

A In terms of emissions to air, main sectors which officially reported releases to the Baltic Sea catchment in the context of E-PRTR (total reported releases 5-25 tonnes/year, in the period 2018-2022) and the respective shares are as following: **Production of fertilisers** (28%), **Production of cement clinker or lime in rotary kilns or other furnaces** (21%), **Thermal power / combustion** (20%), **Surface treatment of metal/plastic materials by electrolytic or chemical process** (14%). There are also other pyrogenic sources[10] (anthropogenic - various sectors burning coal, oil and gas or wood, forest fires - and natural, e.g. volcanic) (no quantitative info on releases).

In terms of releases to water/soil, the main sector which officially reported releases to the Baltic Sea catchment in the context of E-PRTR[5] is **independently operated industrial WWTPs** (average total reported releases 0.5 tonnes/year, in the period 2018-2022). There are also anthropogenic petrogenic sources to water (**depositing of dredged material** (>2 t/y, HELCOM BSEFS)**, fraction of oil spills from shipping/accidents, riverine oil discharges**), as well as **shipping emissions to water mainly from scrubber waters and bilge water** (perhaps around 1 t/y, EMERGE).

P Based on available estimations for sums of individual PAHs, they appear to enter the Baltic Sea via the four pathways at least at the following amounts: **atmospheric deposition** (>7 t/y), **direct off-shore releases** (>3 t/y), **rivers** (>2 t/y), and direct emissions from land-based activities (>0.02 t/y). There is available information also about estimated inputs of further individual PAHs.

Relevant policies (existing or planned measures)

M (on A/P/I)

- Listed under the **EU POPs Regulation –** ANNEX III (PART B): list of substances subject to release reduction provisions.
- Listed as a priority hazardous substance under the **EU WFD** (and its update proposal) – including respective national **Progammes of Measures for this**. 'PAHs and metabolites' is a **HELCOM indicator**.
- **For PAHs, some activities are restricted under EU REACH.** Furthermore, some PAHs are listed as **REACH SVHCs.**
- There are provisions in **EU Best Available Techniques** Reference Documents for PAHs

• **PAHs are listed among contaminants with maximum levels in EU Regulation 2023/915, including seafood**, however due to contamination in smoked fish.

References: 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.11.12.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

PBDEs (Polybrominated diphenyl ethers)

(CAS numbers: e.g. 41318-75-6, 5436-43-1, 60348-60-9, 189084-64-8, 68631-49-2, 207122-15-4, EC numbers: e.g. 868-402-6, 690-137-8, 690-282-7, 690-350-6, 690-275-9 / Entry number in HELCOM list of priority substances: 30)

General sectors: Industry and commercial products

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM priority?

Main evidence

S The sum of concentrations of six representative PBDEs (PBDE28 + PBDE47 + PBDE99 + PBDE100 + PBDE153 + PBDE154) exceed the applied threshold value in all the **37** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**13**/13 assessed off-shore areas). In these 37 areas, **100%** of the **biota** samples exceed the threshold value. This is based on regular monitoring data gathered by HELCOM Contracting Parties and reported to the HELCOM COMBINE database for the period 2016-2021, in the context of the PBDEs indicator[1].

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, anthracene scores **9.6/10** (confidence range: **9.6 – 9.6**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for PBDEs, for biota, was acquired from the EC proposed Directive amending WFD and EQSD[2].

I Current levels in the Baltic Sea indicate potential negative impacts on top predators such as mammals and birds and humans via consumption of seafood.

Supporting evidence

I PBDEs are considered of **especially concerning mode of toxicity.** For example, they are endocrine disruptors[3]. Endocrine disruptors mimic or interfere with hormones and can cause developmental abnormalities, reproductive dysfunction, and population effects.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, PBDEs score **84-97/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment. In general, beyond the representative PBDEs listed above, several PBDEs have hazardous properties and concerning environmental fate and/or occurrence profiles – or may degrade to such in the environment[9]. This substance group entry aims to reflect all such relevant individual substances.

Facts relevant for management considerations

Causal chain and pathways

A PBDE emissions originate from the production and use of flame-protected materials, recycling of articles containing PBDEs, and respective waste stage (e.g. landfills and waste sorting sites)[4].

P Based on available estimations, PBDEs appear to enter the Baltic Sea at least at the following amounts: **rivers** (>0.15 t/y, WATERBASE[5], Undeman et al, 2022[6], Gustavsson et al, 2018[7]), direct emissions from land-based activities (>0.03 t/y, Undeman et al, 2022), atmospheric deposition (>0.0003 t/y, PLC[8]). **WWTPs** appears to be the main source of eventual inputs. There is available information also about estimated inputs of individual PBDEs.

Relevant policies (existing or planned measures)

M (on A/P) • Some PBDEs are listed under **Stockholm Convention** on POPs (signed by all HELCOM Contracting Parties) – Annex A (elimination) – accordingly **EU POPs Regulation –** including respective **national Action Plans for these.** There are specific exemptions registered by CPs.

• **Some PBDEs are restricted under RoHS ((electrical and electronic devices)).** Furthermore, DecaBDE is listed as **REACH SVHC.**

• Listed as a priority hazardous substance under the **EU WFD** (and its update proposal) – including respective national **Progammes of Measures for this**. PBDEs are also a **HELCOM indicator**.

• There are provisions in **EU Best Available Techniques** Reference Documents for these substances

References:

1. 2. 3. 4. 5. 6. 7. 8. 9.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

PFAS (Per- and polyfluoroalkyl substances)

General sectors: Industry and commercial products

(CAS numbers: e.g. 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, EC numbers: e.g. 206-397-9, 217-179-8, 206-587-1, 206-801-3, 206-793-1, 206-196-6, 206-786-3, 220-300-7, 220-301-2, 206-400-3, 206-203-2, 218-165-4, 206-798-9, 276-745-2, 206-800-8, 206-401-9, 206-803-4, 267-638-1, 240-582-5, 700-242-3, 211-477-1, 211-648-0, 682-239-6 / Entry number in HELCOM list of priority substances: 31)

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of PFOS exceed the applied threshold value in **37** of the 39 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**13**/13 assessed off-shore areas). In these 37 areas, **100%** of the assessible samples in **biota** (and/or water, for which the thresholds are exceeded more rarely) exceed the threshold value. This is based on regular monitoring data gathered by HELCOM Contracting Parties and reported to the HELCOM COMBINE database for the period 2016-2021, as part of the more limited, PFOS indicator[1].

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, PFAS scores **9.3/10** (confidence range: **9.3 – 9.3**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for PFOS, for biota and water, were acquired from the EC proposed Directive amending WFD and EQSD[2] (not yet in effect as of February 2025).

Concentrations of PFNA, PFDA, PFUnDA, PFTrDA, PFDoDA, PFDS, FOSA, and other PFAS substances also frequently exceed their respective threshold values in biota, while TFA, 6:2 FTS, PFOA, PFHxS and N-EtFOSA (and other PFAS) are in addition to previous often detected in water at high concentrations. This is based on monitoring data for the period 2015-2023 as reported by Contracting Parties (CPs) as response to a data call organized by HELCOM for PFAS.

It is noted that **high trophic magnification** has been reported, for PFAS[3].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota, top predators such as mammals and birds and humans via consumption of seafood.

Supporting evidence

I PFAS are considered of **especially concerning mode of toxicity**: for example some of them are toxic for reproduction and/or endocrine disruptors[4].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, PFOS alone scores **94-94/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment. Besides PFOS, thousands of other Per- and polyfluoroalkyl substances have been to shown to have hazardous properties and to exhibit concerning environmental fate/occurrence profiles[12]. This substance group entry reflects any chemical containing at least one saturated CF2 or CF3 moiety[13].

Facts relevant for management considerations

Causal chain and pathways

A Although PFOS is restricted under Annex B of the Stockholm Convention, there are specific exemptions, such as in metal plating, fire-fighting foams for liquid fuel vapour suppression and liquid fuel fires, and insect baits. It is not registered for EU REACH[5], thus likely on EU market in low tonnage as it has been notified by about 30 companies wihtout specific use information[6]. There are expected releases e.g. from legacy firefighting foams and life of products containing it.

Release estimates for the broader PFAS (non-polymeric) group: textile, upholstery, leather, apparel and carpets (80%), food contact materials and packaging (7%), electronics and semiconductors (7%)[7]. Certain cookware and paints may as well contain PFAS[8].

P Based on available estimations, PFOS appear to enter the Baltic Sea at the following amounts: **rivers** (0.2 t/y, WATERBASE[9]), atmospheric deposition (0.06 t/y), direct emissions from land-based activities (0.02 t/y, Undeman et al, 2022[10]). **WWTPs** is roughly estimated to contribute with 0.07 t/y. There is available information also about estimated inputs of further individual PFAS.

Relevant policies (existing or planned measures)

M (on A/P) • Some sub-groups of PFAS are listed under **Stockholm Convention** on POPs (signed by all HELCOM Contracting Parties) – Annexes A (elimination) / B (restriction) – accordingly **EU POPs Regulation –** including respective **national Action Plans.**

• **Some PFAS are listed as REACH SVHC** (basis: toxicity for reproduction / PBT / endocrine disruption, depending on the case). In 2023, authorities from Denmark, Germany, the Netherlands, Norway and Sweden submitted a **REACH restriction proposal**[11].
• PFOS is listed as a priority hazardous substance under the **EU WFD** (instead, PFAS is listed as priority hazardous substance under its update proposal) – including respective national **Progammes of Measures for this**.
• PFOS is a more limited **HELCOM indicator**.
• There are provisions in EU Best Available Reference Documents for these substances

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11.12. 13.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Phthalates

(CAS numbers: e.g. 117-81-7, EC numbers: e.g. 204-211-0 / Entry number in HELCOM list of priority substances: 32)

General sectors: Industry and commercial products, off-shore (shipping)

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of a substance tentatively identified as isobutyl hydrogen phthalate exceed the applied threshold value in **14** of the 21 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**1**/2 assessed off-shore areas). In these 14 areas, on average **74%** of the assessible samples in **biota** exceed the threshold value. This is based on suspect screening data from the project PreEMPT[1]. A total number of 100 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, isobutyl hydrogen phthalate scores **7.7/10** (confidence range: **6.7 – 8.3**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds. The fact that the chromatographic peaks have not yet been confirmed via a commercial standard adds to the relative uncertainty.

Based on monitoring data (national and international databases[2] - in some cases also complemented by suspect screening data), concentrations of DEHP (Di-(2-Ethylhexyl)-phthalate), Diisobutyl phthalate, and Di-n-octyl phthalate also frequently or occasionally, depending on the substance, exceed their respective threshold values, for matrices such as **water, sediment, and/or biota**. The threshold value, e.g. for DEHP (water matrix - the matrix exceeded for this subtance), was acquired from the EQS Directive[3]. The threshold value for isobutyl hydrogen phthalate, for biota, was acquired from the NORMAN Network ecotoxicology database[4].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or sediment dwelling biota and/or top predators such as mammals and birds and/or humans via consumption of seafood.

Supporting evidence

P Approximately **50 – 210 tonnes of DEHP** are estimated to enter the Baltic Sea every year, essentially via rivers (WATERBASE[5]), with very small contribution from direct emissions from land-based activities (Undeman et al, 2022[6], E-PRTR[7]). Additional inputs to this estimate may be expected from shipping and from atmospheric deposition (unquantified). Given that it is **toxic**[8] (according to the EU WFD/EQSD update proposal, it also tends to accumulate in sediment and/or biota[8]), current inputs are considered as possibly significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea for DEHP have occasionally exceeded thresholds.

I Phthalates are considered of **especially concerning mode of toxicity:** for example DEHP is toxic for reproduction and an endocrine disruptor[9]. Endocrine disruptors mimic or interfere with hormones and can cause developmental abnormalities, reproductive dysfunction, and population effects.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, for example DEHP scores **56-60/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment. Besides DEHP, several other phthalates (ortho-phthalates, isophthalates, terephthalates, trimellitates) have or are suspected to have hazardous properties and concerning environmental fate and/or occurrence profiles[14]. And they also show a similar use pattern and could replace each other in some of their uses[14]. This substance group entry aims to reflect all such relevant individual substances.

Facts relevant for management considerations

Causal chain and pathways

A Several phthalates are EU REACH registered. For DEHP (which is in REACH Authorization list), authorised sectors concern **PVC products** (review of authorisation is ongoing)[10]. The REACH registered volume for DEHP is 100 - 1,000 t/y[11]. Main sectors which officially reported releases of DEHP to the Baltic Sea catchment in the context of E-PRTR[11] and the respective shares for the reported emissions are as following (a broader overview including REACH-registered uses with potential emissions has not been compiled here):
Releases to water/soil (average reported releases 43 kg/y, in the period 2018-2022): Coke ovens (73%), Independently operated industrial waste-water treatment plants (14%), Chemical installations for the production on an industrial scale of basic organic chemicals (7%). Releases to air (average reported releases 160 kg/y, in the period 2018-2022): Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces (100%).
Shipping emissions of DEHP relate to bilge water or ballast water[12].

S **?** *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is a review of the toxicity thresholds for some phthalates (relevant matrix/ces depending on the individual substance).*

Relevant policies (existing or planned measures)

M (on A/P) • **Several activities are restricted under EU REACH** and some under **EU RoHS** (electrical and electronic devices). **18 phthalates are listed as SVHC** (Substances of Very High Concern) **under EU REACH** (mainly on the basis of their toxicity for reproduction properties, but some also due to their endocrine disrupting properties). DEHP has been further included in the **REACH Authorization list**. ECHA (and perhaps some EU Member States, to be confirmed) has also developed **Assessments of Regulatory needs (ARN) for sub-groups of phthalates (e.g. ortho phthalates)**[13].

• DEHP is listed as a priority hazardous substances under the **EU WFD** and its update proposal.

References: 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Zinc and its compounds

(CAS numbers: e.g. 7440-66-6, EC numbers: e.g. 231-175-3 / Entry number in HELCOM list of priority substances: 33)

General sectors: Industry and commercial products, off-shore (shipping, dredged material deposition, OWF), biocide

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of Zinc exceed the applied threshold value in **25** of the 39 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**4**/15 assessed off-shore areas). In these 25 areas, on average **60%** of the assessible samples in **water and/or sediment** (and/or biota, for which the threshold is exceeded more rarely) exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1]. A total number of 2331 data points were possible to evaluate for Zinc.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Zinc scores **7.5/10** (confidence range: **6.7 – 8.0**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Zinc were acquired from national WFD assessments[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota, sediment dwelling biota, and top predators such as mammals and birds.

Supporting evidence

P Approximately **3,800 – 7,800 tonnes of Zinc and its compounds** are estimated to enter the Baltic Sea every year, mainly via rivers (PLC[3]); secondly from Off-shore Wind Farms (OWFs)[4], atmospheric deposition[5] and depositing of dredged material[6]; and thirdly via direct coastal emissions mainly from WWTPs[7] and by direct off-shore emissions from shipping[8]. Given that the substance is **very persistent (metals do not degrade) and very toxic**[9], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds, due not only to current but also historical inputs. Likely increased inputs in the near future are possible, due to it use in emerging sectors, such as in OWFs.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Zinc scores **59-80/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Zinc and its compounds are manufactured/imported in the EU in quantities : ≥ 1,100,000 tonnes/year[10] (not complete calculation of EU REACH registered volume, as there are several substances containing Zinc). For the highest volume substance, i.e. elemental Zinc, REACH registered uses include e.g. metals, welding & soldering products, coating products, inks and toners, finger paints and metal surface treatment products, etc.[11]

Off-shore releases to the Baltic Sea are estimated to take place as follows: OWF: 198 - 1123 t/y, depositing of dredged material: 176-566 t/y, shipping (scrubber wash water, bilge water, grey water, sewage, antifouling paint) and leisure boating (antifouling paint): 117 t/y.

12 substances of zinc are approved biocidal active substances under EU BPR Regulation, for several product types, including also antifouling[13].

Main sectors which officially reported releases to the Baltic Sea catchment in the context of E-PRTR[14] and the respective shares for the reported emissions are as following:
Releases to water/soil (average reported releases 246 t/y, in the period 2018-2022): **Underground mining and related operations** (43%), **Industrial plants for the production of pulp from timber or similar fibrous materials** (30%), **Industrial plants for the production of paper and board and other primary wood products** (7%). Releases to air (average reported releases 130t/y, in the period 2018-2022): mainly **Thermal power / combustion** (40%), **Installations for the production of pig iron or steel including continuous casting** (16%), **Metal ore (including sulphide ore) roasting or sintering installations** (13%), Installation for the production of non-ferrous crude metals from ore by metallurgical, chemical or electrolytic processes (10%).

It is also used in pig farming, at least in Denmark (Zn used as antibiotic alternatve).

P Based on available estimations, Zinc appears to enter the Baltic Sea via **rivers** (2,810-5,243t/y, PLC), **direct off-shore** emissions (491 – 1,806 t/y), **atmospheric deposition** (410-610 t/y, EMERGE), and direct inputs from land activities (70-170 t/y, PLC, Undeman et al, 2022, E-PRTR).

S **?** *In order to further improve the evaluation of the magnitude of risk, one aspect that could be investigated in the future is a review of the water toxicity threshold (compatibility in terms of form (soluble/total) between measured levels and the threshold). As well as the possibility that in the future it may replace other biocides such as copper-containing ones, which may also lead to increased emissions.*

Relevant policies (existing or planned measures)

M (on A/P) • **ECHA recently prepared an Assessment for Regulatory Needs for Zinc and its simple inorganic compounds**[15]. Further relevant ARNs may exists (to be confirmed).

• There are provisions in **EU Best Available Techniques** Reference Documents for zinc

• Germany has research projects on meatls in sediments near OWFs (mainly in North Sea, but some new in Baltic may also be taking place).

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

HELCOM list of substances of concern

1-Dodecanamine, N-dodecyl-N-methyl-

(CAS numbers: e.g. 2915-90-4, EC number: 220-838-2 / Entry number in HELCOM list of substances of concern: 1)

General sectors: Industry and commercial products

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

S Concentrations of a substance tentatively identified as 1-Dodecanamine, N-dodecyl-N-methyl- exceed the applied threshold value in all the **5** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**1**/1 assessed off-shore areas). In these 5 areas, **100%** of the assessible samples in **sediment and/or biota** exceed the threshold value. This is based on suspect screening data from the project PreEMPT[1]. A total number of 7 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, 1-Dodecanamine, N-dodecyl-N-methyl- scores **8.2/10** (confidence range: **4.1 – 8.5**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for 1-Dodecanamine, N-dodecyl-N-methyl- in sediment and biota were acquired from the NORMAN Network ecotoxicology database[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or sediment dwelling biota and/or top predators such as mammals and birds and/or humans via consumption of seafood.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, 1-Dodecanamine, N-dodecyl-N-methyl- scores **43-85/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The substance is not registered under EU REACH Regulation. 6 companies manufacture it or import it in the EU in unknown amounts of less than a tonne/year/company and have accordingly submitted Classification & Labelling notifications under the EU CLP Regulation[3]. According to the SPIN database, for the period 2017-2021, in Sweden the substance was reported in total amounts up to the tonnage band of 15 kg/y – 1.5 t/y, up to the year 2019[4]. There is no information about what it is used for.

S **?** *In order to further improve the evaluation of the risk, the first aspect to consider is identity confirmation (PreEMPT samples). If identity is confirmed, then furhter relevant aspects to consider are a review of the toxicity thresholds (sediment, biota) and further marine information plus information about its market in the Contracting Parties (tonnage, uses).*

Relevant policies (existing or planned measures)

M -

References:

1. 2. 3. 4.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

2,4,6-Tribromophenol (TBP)

(CAS numbers: e.g. 118-79-6, EC number: 204-278-6 / Entry number in HELCOM list of substances of concern: 2)

General sectors: Industry and commercial products

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

P Approximately **0.3-6 tonnes of TBP** are estimated to enter the Baltic Sea every year via rivers (Gustavsson et al, 2018[1]). Additional inputs may be expected from direct releases from WWTPs to coasts. Given that the substance is **suspect as persistent** and is **very toxic**[2], current inputs are possibly/likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. The data used for the riverine inputs estimation concerns only measurements in the proximity of river mouths. They originate from one-grab samples from the 23 rivers covering the whole latitudinal range of Sweden. And they have been extrapolated to the total riverine flow to Baltic Sea.

I Current inputs to the Baltic Sea indicate potential negative impacts at least on pelagic biota.

Overall assessment

When assessing current levels in the Baltic Sea (no relevant measurement data), current inputs, and the severity of the relevant toxicity mechanism, TBP scores **26-89/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The REACH registered volume for TBP (manufacture+import in the EU) is 100 – 1,000 t/y plus confidential use as intermediate[3]. However, all registrations state to correspond to a chain ending agent in a polymer imported to the EU – i.e. not to a manufatured or imported substance or mixture in the EU. ECHA's ARN[4] states that there is a potential for exposure to TBP from widespread uses in polymer preparations as a flame retardant or chain ending agent.

At the same time, according to literature[5], TBP is an alternative flame retardant that has recently replaced legacy flame retardants such as PBDEs. It is not clear whether use as flame retardant may correspond to the amount manufactured or imported in the EU as such (in amounts <1t per year per company) by some of the 174 companies which have submitted Classification & Labelling notifications under the EU CLP Regulation[6] – or to uses of the polymers containing it. In the SPIN database TBP was reported until 2010 by Denmark. According to the literature[5], TBP is the most widely produced brominated phenol, it is used as intermediate during the synthesis of brominated flame retardants and it similarly represents a degradation product of these substances (including new flame retardants in the market). Moreover, it is also known to be a naturally occurring molecule in some marine organisms, which produce it as a defense against predators and biofouling[7]. The volume manufactured in the EU appears to have decreased dramatically over the last years (it used to be 10,000–100,000 t/y in 2012 and 1-10 t/y in 2016)[5].

S **?** *In order to further improve the evaluation of the risk, relevant aspects to consider are information on marine levels and a review of the toxicity thresholds (expected relevant matrices – paying attention also on background levels). Information on the actual market, in the Contracting Parties, for uses of the substance as such and substances that may degrade to TBP would also be relevant. As well as a rough estimation of the likely fraction of anthropogenic inputs to the marine environment (vs natural ones).*

Relevant policies (existing or planned measures)

M (on A/P) • TBP is covered by **two Assessments for Regulatory Needs prepared by ECHA** recently ('Regulatory strategy for flame retardants', 'brominated flame retardants: Brominated cycloalkanes, alcohols, phosphates, triazine triones, diphenyl ethers and diphenyl alkyls')[4].

• It is **under assessment for PBT properties** under the REACH Regulation (originally, the assessment had been postponed due to cease of manufacture in the EU, but it was reinitiated in 2024, under Substance Evaluation and after ECHA's ARN). In the same contet, it is also **under assessment for Endocrine Disruption and for PMT/vPvM properties**. According to REACH Substance Evaluation report[8], TBP is also a **likely toxic for reproduction** substance.

References:

1. 2. 3. 4. 5. 6. 7. 8.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

2-Ethylhexyl diphenyl phosphate (EHDPP)

(CAS numbers: e.g. 1241-94-7, EC number: 214-987-2 / Entry number in HELCOM list of substances of concern: 3)

General sectors: Industry and commercial products

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

P Approximately **0.3-5 tonnes of EHDPP** are estimated to enter the Baltic Sea every year mainly via rivers, and to a lower extent directly via WWTP emissions (Gustavsson et al, 2018[1], Undeman et al, 2022[2]). Given that the substance is **suspect as toxic**[3], current inputs are possibly significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. The data used for the riverine inputs estimation concerns only measurements in the proximity of river mouths. They originate from one-grab samples from the 23 rivers covering the whole latitudinal range of Sweden. And they have been extrapolated to the total riverine flow to Baltic Sea. The contribution of direct releases was calculated as a percentage of the total WWTP discharges estimated by Undeman et al. study (2010-2019).

S Concentrations of EHDPP exceed the applied threshold value in **2** of the 3 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**2**/2 assessed off-shore areas). In these 2 areas, **100%** of the assessible samples in **sediment** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[4]. A total number of 5 data points were possible to evaluate for EHDPP.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, EHDPP scores **3.6/10** (confidence range: **2.4 – 6.8**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for EHDPP, for sediment, was acquired from the NORMAN Network ecotoxicology database[5].

I Current levels in the Baltic Sea indicate potential negative impacts on sediment dwelling biota and/or pelagic biota.

Supporting evidence

I EHDPP is considered to have an especially **concerning mode of toxicity**. For example, it is an endocrine disruptor[6]. Endocrine disruptors mimic or interfere with hormones and can cause developmental abnormalities, reproductive dysfunction, and population effects.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, EHDPP scores **32-53/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for EHDPP is >10,000 t/y[7]. Registered uses are as flame retardant and potentially further technical functions in professional uses (adhesives, sealants, fillers, putties, plasters, polymer, leather tanning, dyes, finishes, functional fluids, PUR), industrial uses (formulation, same as professional plus use of pellets, powder coatings, granules coating material, etc.), as well as service life of respective products[8].

S **?** *In order to further improve the evaluation of the risk, relevant aspects to consider are a review of the toxicity threshold (sediment) and further marine monitoring or modelling for predicted environmental concentrations based on estimated inputs.*

Relevant policies (existing or planned measures)

M (on A/P) • EHDPP is covered by **two Assessments for Regulatory Needs prepared by ECHA** recently ('Regulatory strategy for flame retardants', 'Alkyl aryl and cyclic diaryl esters of phosphoric acid')[9].

• A PBT-assessment[10] by the ECHA PBT group concluded that **it does not fulfil REACH PBT/vPvB criteria**, in 2013.

• There is ongoing toxicity data generation, under REACH Dossier Evaluation, for some endpoints.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

2-Propen-1-yl 2-(cyclohexyloxy)acetate

(CAS numbers: e.g. 68901-15-5, EC number: 272-657-3 / Entry number in HELCOM list of substances of concern: 4)

General sectors: Industry and commercial products, personal care product

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

S Concentrations of a substance tentatively identified as 2-Propen-1-yl 2-(cyclohexyloxy)acetate exceed the applied threshold value in all the **29** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**5**/5 assessed off-shore areas). In these 29 areas, on average **95%** of the assessible samples in **biota** exceed the threshold value. This is based on suspect screening data from the project PreEMPT[1]. A total number of 100 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, 2-Propen-1-yl 2-(cyclohexyloxy)acetate scores **8.9/10** (confidence range: **7.7 – 9.0**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for 2-Propen-1-yl 2-(cyclohexyloxy)acetate in biota was acquired from the NORMAN Network ecotoxicology database[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or top predators such as mammals and birds.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, 2-Propen-1-yl 2-(cyclohexyloxy)acetate scores **58-91/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for 2-Propen-1-yl 2-(cyclohexyloxy)acetate is 10 - 100 t/y[3]. Registered uses include consumer uses (washing and cleaning products, air care products, biocides, polishes and wax blends, cosmetics; professional uses (washing and cleaning products, polishes and wax blends); and industrial uses (formulation)[4]. Classification & labelling notifications have been received by ECHA by about 1,800 manufacturers/importers[5]. Therefore, the total amount in the EU market may be higher than the registration band. According to the SPIN database, for the period 2017-2021, in Sweden and Denmark the substance was reported in total amounts up to tonnage bands of 15 kg/y – 1.5 t/y and 0 – 88 kg/y respectively[6]. The substance is authorised in the EU for use in cosmetic products (as perfuming agent).

S **?** *In order to further improve the evaluation of the risk, the first aspect to consider is identity confirmation (PreEMPT samples). If identity is confirmed, then a furhter aspect to consider is a review of the relevant toxicity threshold (biota).*

Relevant policies (existing or planned measures)

M (on A/P) • 2-Propen-1-yl 2-(cyclohexyloxy)acetate is **listed in the EU Cosmetics Regulation (EC) 1223/2009 (regulated as a perfuming agent for which the level of free allyl alcohol in the ester shall be less than 0,1 %)**.

References:

1. 2. 3. 4. 5. 6.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Bemotrizinol

(CAS numbers: e.g. 187393-00-6, EC numbers: 606-111-6, 425-950-7 / Entry number in HELCOM list of substances of concern: 5)

General sectors: Industry and commercial products, personal care product

DRIVERS ACTIVITIES PRESSURES STATE IMPACTS

Why a HELCOM concern?

Main evidence

P Approximately **0.7-3 tonnes of Bemotrizinol** are estimated to enter the Baltic Sea every year via Wastewater Treatment Plants (WWTPs) emissions. Given that the substance is **suspect as very toxic**[1], current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. The data on WWTP discharges (2010-2019) originates from the study of Undeman et al. (2022)[2].

I Current inputs to the Baltic Sea indicate potential negative impacts at least on pelagic biota.

Overall assessment

When assessing current levels in the Baltic Sea (no relevant measurement data), current inputs, and the severity of the relevant toxicity mechanism, Bemotrizinol scores **30-100/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for Bemotrizinol is 1,000 – 10,000 t/y[3]. Registered uses consumer uses (personal care products, including sunscreen/ daily cream application, fragrances), professional uses (application in a solarium or cancer treatment), and industrial uses (formulation)[4]. According to the SPIN database, for the period 2017-2021, in Sweden and Denmark the substance was reported in total amounts up to tonnage bands of 1.5 t/y – 150 t/y and 0 – 88 kg/y respectively[4]. The substance is authorised in the EU for use in cosmetic products (relevant functions: hair conditioning, light stabilizer, UV absorber, UV filter)[5].

S **?** *In order to further improve the evaluation of the risk, relevant aspects to consider are a review of the relevant toxicity thresholds (expected relevant matrices) and further marine monitoring or modelling for predicted environmental concentrations based on estimated inputs. Derivation of time-trends, based on the available inputs information, would also be of use.*

Relevant policies (existing or planned measures)

M (on A/P) • Bemotrizinol is **listed in the EU Cosmetics Regulation (EC) 1223/2009 (regulated as a UV filter in cosmetic products in a concentration up to 10 %)**.

References:

1. 2. 3. 4. 5.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Bis(2-chloro-1-methylethyl) 2-chloropropyl phosphate

(CAS numbers: e.g. 76025-08-6, EC number: 616-283-4 / Entry number in HELCOM list of substances of concern: 6)

General sectors: Industry and commercial products

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

S Concentrations of a substance tentatively identified as Bis(2-chloro-1-methylethyl) 2-chloropropyl phosphate exceed the applied threshold value in all the **17** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**3**/3 assessed off-shore areas). In these 17 areas, **100%*** of the assessible samples in **sediment and/or biota** exceed the threshold value. This is based on suspect screening data from the project PreEMPT[1]. A total number of 29 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Bis(2-chloro-1-methylethyl) 2-chloropropyl phosphate scores **8.8/10** (confidence range: **8.5 – 9.0**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Bis(2-chloro-1-methylethyl) 2-chloropropyl phosphate, in sediment and biota, were acquired from the NORMAN Network ecotoxicology database[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or sediment-dwelling biota and/or top predators such as mammals and birds.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Bis(2-chloro-1-methylethyl) 2-chloropropyl phosphate scores **61-90/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for Bis(2-chloro-1-methylethyl) 2-chloropropyl phosphate is >1,000 t/y[3]. Registered uses, according to ECHA's ARN[4] are as flame retardant in polyurethane foams and coatings, with presence in, e.g., plastic and textile articles in vehicles and furniture. According to the same source, it is additionally used in adhesives and sealants. Whereas article types include among others childcare articles.

S **?** *In order to further improve the evaluation of the risk, the first aspect to consider is identity confirmation (PreEMPT samples). If identity is confirmed, then a furhter relevant aspect to consider is a review of the relevant toxicity thresholds (sediment, biota).*

Relevant policies (existing or planned measures)

M (on A/P) • Bis(2-chloro-1-methylethyl) 2-chloropropyl phosphate is covered by an **Assessment for Regulatory Needs prepared by ECHA** (on a group of chlorinated trialkyl phosphate flame retardants)[9]. Although the substance with the specific CAS number appears as not REACH-registered, according to ECHA's ARN it appears that registration has been adapted to a different description of substance identity. According to the same report, there is a known or potential hazard for reproductive toxicity, carcinogenicity and endocrine disruption and possible inclusion to the REACH SVHC list can be considered perhaps after ongoing toxiciological assessment's (in the US – to be confirmed) results.

References:

1. 2. 3. 4.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering that there were also inconclusive non-detections (in terms of exceedance, due to a relatively high limit of detection), it is possible that the actual average frequency of exceedance in these areas is somewhat lower, but in any case >65%.

Butyl acrylate

(CAS numbers: e.g. 141-32-2, EC number: 205-480-7 / Entry number in HELCOM list of substances of concern: 7)

General sectors: Industry and commercial products, off-shore (shipping), personal care product

Drivers	Activities	Pressures	State	Impacts

Why a HELCOM concern?

Main evidence

S Concentrations of a substance tentatively identified as Butyl acrylate exceed the applied threshold value in all the **23** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**3**/3 assessed off-shore areas). In these 23 areas, **100%** of the assessible samples in **biota** exceed the threshold value. This is based on suspect screening data from the project PreEMPT[1]. A total number of 62 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Butyl acrylate scores **9.2/10** (confidence range: **8.5 – 9.2**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for Butyl acrylate, in biota, was acquired from the NORMAN Network ecotoxicology database[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or top predators such as mammals and birds.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Butyl acrylate scores **62-93/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for Butyl acrylate is 100,000 - 1,000,000 t/y[3]. Registered uses include consumer uses in inks, toners, adhesives, sealants (although some of the registrants advise against these); professsional uses of coatings and adhesives (some registrants advise against); and several industrial uses in polymerization, as adhesive, etc. According to project reports[4], Butyl acrylate is also an important pollutant emitted from ships (potentially as a transformation product of emulsifiers, and linked with bilge water or ballast water, to be confirmed). Furthermore, it is authorised in the EU for use in personal care products as a binding agent.

S **?** *In order to further improve the evaluation of the risk, the first aspect to consider is identity confirmation (PreEMPT samples). If identity is confirmed, then a furhter aspect to consider is a review of the relevant toxicity threshold (biota).*

Relevant policies (existing or planned measures)

M (on A/P) • Butyl acrylate is covered by a recent **Assessment for Regulatory Needs prepared by ECHA** (on a group of acrylates and methacrylates with linear or branched aliphatic alcohols, simple acids and salts)[5]. Also noted that a minority of the REACH registrants (0.6% of registrations) indicate that they consider this substance as a PBT[6].

References:

1. 2. 3. 4. 5. 6.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Cetylpyridinium (hexadecylpyridinium chloride)

(CAS numbers: e.g. 123-03-5, EC number: 204-593-9 / Entry number in HELCOM list of substances of concern: 8)

General sectors: Industry and commercial products, personal care product, legacy biocide

DRIVERS	**A**CTIVITIES	**P**RESSURES	**S**TATE	**I**MPACTS

Why a HELCOM concern?

Main evidence

S Concentrations of a substance tentatively identified as Cetylpyridinium exceed the applied threshold value in **12** of the 16 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**1**/1 assessed off-shore areas). In these 12 areas, on average **92%** of the assessible samples in **sediment and/or biota** exceed the threshold value. This is based on suspect screening data from the project PreEMPT[1]. A total number of 67 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Cetylpyridinium scores **7.8/10** (confidence range: **4.5 – 8.3**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for Cetylpyridinium, in biota, was acquired from the NORMAN Network ecotoxicology database[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or top predators such as mammals and birds.

Supporting evidence

P Approximately **7 – 30 kg of Cetylpyridinium** are estimated to enter the Baltic Sea every year via Wastewater Treatment Plants (Undeman et al, 2022[3]). Additional inputs may be expected from riverine inputs beyond the contributing WWTP effluents. Given that the substance is **bioaccumulative and very toxic**[4], current inputs are considered as possibly significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Cetylpyridinium scores **49-79/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for Cetylpyridinium is 100 - 1,000 t/y[5]. Registered uses include as co-formulant in agrochemical products and in powder and liquid application by consumers ('down-the-drain cosmetic products')[6]. The substance is also authorised in the EU for use in personal care products, such as antimicrobial, antistatic, deodorant, hair conditioning, oral care, surfactant-cleansing, and surfactant-emulsifying.

S **?** *In order to further improve the evaluation of the risk, the first aspect to consider is identity confirmation (PreEMPT samples). If identity is confirmed, then a furhter aspect to consider is a review of the relevant toxicity thresholds (sediment, biota).*

Relevant policies (existing or planned measures)

M -

References:

1. 2. 3. 4. 5. 6.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Chlorhexidine

(CAS numbers: e.g. 55-56-1, EC number: 200-238-7 / Entry number in HELCOM list of substances of concern: 9)

General sectors: Personal care product, pharmaceutical, industry and commercial products

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

P Approximately **30 - 120 kg of Chlorhexidine** are estimated to enter the Baltic Sea every year via Wastewater Treatment Plants (WWTPs) emissions. Given that the substance is **suspect as very persistent** and is **very toxic**[1], current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. The data on WWTP discharges (2010-2019) originates from the study of Undeman et al. (2022)[2].

I Current inputs to the Baltic Sea indicate potential negative impacts at least on pelagic biota.

Supporting evidence

A With sales as pharmaceutical in CPs of ≥7.8 – 8.9 t/y (2015-2022[3]), the predicted (conservative) river concentration at the proximity of WWTP effluents due to this use, by using the guidelines of Phase I ERA, is about 60 times the threshold value for freshwater.

I Chlorhexidine is considered to have a concerning **mode of toxicity**, as for example it disrupts cell membrane[4].

Overall assessment

When assessing current levels in the Baltic Sea (no relevant measurement data), current inputs, and the severity of the relevant toxicity mechanism, Chlorhexidine scores **31-99/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for Chlorhexidine is 1,000 – 10,000 t/y[5]. REACH-registered uses are only as intemediate in reactions[6]. There are also 90 Classification & Labelling notifications received by ECHA by manufacturers/improters under the EU CLP Regulation[7]. Therefore manufacture/import (accordingly use) in unknown amounts for potential further uses than as intermediate, and of less than a tonne/year per manufacturer/importer, is possible. In fact, Chlorhexidine is indeed authorised in the EU for use in cosmetic products, with the following indicated functions: antistatic, emulsion stabilising, hair conditioning, skin conditioning - emollient, viscosity controlling, antimicrobial, oral care, preservative[8]. Furthermore, Chlorhexidine is also used as pharmaceutical in antiinfectives and antiseptics for local oral treatment or for dermal use (creams and ointments), in amounts as reflected above[9].

S **?** *In order to further improve the evaluation of the risk, relevant aspects to consider are a review of the relevant toxicity thresholds (expected relevant matrices) and marine monitoring or modelling for predicted environmental concentrations based on estimated inputs.*

Relevant policies (existing or planned measures)

M (on A/P)

• Chlorhexidine is **listed in the EU Cosmetics Regulation (EC) 1223/2009 (allowed as a preservative in cosmetic products up to 0,3 %)**.

• Chlorhexidine is covered by an **Assessment for Regulatory Needs prepared by ECHA** (on a group of guanidylureas, cyanoguanidines and biguanides)[10]. According to this report, there is a potential for endocrine disrupting effects in the environment, whereas the substance has also potentially vPvM and PMT properties.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Cobalt and its compounds

(CAS numbers: e.g. 7440-48-4, EC numbers: e.g. 231-158-0 / Entry number in HELCOM list of priority substances: 10)

General sectors: Industry and commercial products, food and feeding, off-shore (aquaculture)?

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

P The amount of Cobalt estimated to enter the Baltic Sea every year via rivers is approximately **96 tonnes** (WATERBASE[1]). Additional inputs may be expected from direct emissions from land-based sources and potentially atmospheric deposition. Given that Cobalt is **very persistent (metals do not degrade) and toxic**[2], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned below, levels in Baltic Sea have already occasionally exceeded thresholds. The riverine data used for the estimation concerns only measurements in the proximity of river mouths, and the period 2015-2022. The 65 subcatchment areas for which there was such riverine data reflected 48 % of the total riverine flow to the Baltic Sea, to which inputs have been extrapolated. The data in WATERBASE included approximately 5 countries and 5033 samples. Likely increased inputs in the near future are possible, due to Cobalt's use in emerging setors, such as in batteries.

S Concentrations of Cobalt exceed the applied threshold value in **1** of the 12 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in coastal areas (**0**/4 assessed off-shore areas). In this 1 area, **67%** of the assessible samples in **water** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[3]. A total number of 476 data points were possible to evaluate for Cobalt.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Cobalt scores **2.3/10** (confidence range: **2.3 – 5.7**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for Cobalt in water was acquired from the NORMAN Network ecotoxicology database[4]. Cobalt has also a CLP harmonized classification as Aquatic Chronic 4.

I Current inputs and levels in the Baltic Sea indicate potential negative impacts on pelagic biota.

Further evidence

I Cobalt is considered to have an especially **concerning mode of toxicity**, as for example it is toxic for reproduction[5].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Cobalt scores **29-47/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A According to REACH registration data, Cobalt and its compounds are manufactured/imported in the EU in quantities : 1,000 - 10,000 tonnes/year[6]. According to the literature, sectors of use include metal surface treatment products, batteries, semiconductors, electronic equipment, optical equipment, and as micronutrient. Cobalt is also used in feeds in agriculture and likely also in aquaculture. An overview of REACH-registered uses with potential emissions has not been compiled here.

S **?** *In order to further improve the evaluation of risk, one aspect that could be investigated in the future is a review of the water toxicity threshold (including whether background levels taken into account; furthermore, it is relevant to assess compatibility in terms of form (soluble/total – specifically for water) between measured levels and the threshold).*

Relevant policies (existing or planned measures)

M (on A/P) • **Five cobalt salts are listed as SVHC** (Substances of Very High Concern) **under EU REACH** (due to their toxicity for reproduction and carcinogenicity properties). ECHA has developed an **Risk Management Options Analysis for the group of soluble cobalt salts**. Furthermore, Member States of the EU have developed **Risk Managemeent Options Analyses for certain individual cobalt substances**. Substances containing Cobalt are also included among the substances covered by a recent **Assessment of Regulatory Needs prepared by ECHA on groups such as Complex inorganics from non-metallurgy[7].**

• There are provisions in **EU Best Available Techniques** Reference Documents for cobalt**.**

References:

1. 2. 3. 4. 5. 6. 7.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Das2 (C.I. Flurescent Brighterner 220)

(CAS numbers: e.g. 16470-24-9, EC number: 240-521-2 / Entry number in HELCOM list of substances of concern: 11)

General sectors: Industry and commercial products

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

P Approximately **5 - 19 tonnes of Das2** are estimated to enter the Baltic Sea every year via WWTP emissions. Additional riverine inputs beyond the WWTP contributions are possible. Given that the substance is **suspect as very toxic**[1], current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. The data on WWTP discharges (2010-2019) originates from the study of Undeman et al. (2022)[2].

I Current inputs to the Baltic Sea indicate potential negative impacts at least on pelagic biota.

Overall assessment

When assessing current levels in the Baltic Sea (no relevant measurement data), current inputs, and the severity of the relevant toxicity mechanism, Das2 scores **33-100/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for Das2 is 10,000 – 100,000 t/y[3]. According to ECHA's ARN[4], registered uses are as an optical brightener e.g. in washing and cleaning products, textiles, and other types of products.

S **?** *In order to further improve the evaluation of the risk, relevant aspects to consider are a review of the relevant toxicity thresholds (expected relevant matrices) and marine monitoring or modelling for predicted environmental concentrations based on estimated inputs.*

Relevant policies (existing or planned measures)

M (on A/P) • Das2 is covered by a recent **Assessment for Regulatory Needs prepared by ECHA** on the group of Ditriazine stilbenesulfonic acid dyes[5]. In this report, it is stated, that Das2 is unlikely to have an environmental hazard. However, this seems to be in contradiction with the tentative threshold value for water indicated in the NORMAN Network ecotoxicology database[1].

References:

1. 2. 3. 4. 5.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Dechlorane Plus (anti-DDC-CO)

(CAS numbers: e.g. 13560-89-9, EC number: 236-948-9 / Entry number in HELCOM list of substances of concern: 12)

General sectors: Industry and commercial products

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM concern?

Main evidence

P Approximately **20 - 300 kg of Dechlorane Plus** are estimated to enter the Baltic Sea every year via rivers (Gustavsson et al, 2018[1]). Additional inputs are expected via the atmospheric deposition route[2]. Given that the substance is **very persistent, very bioaccumulative, and very toxic**[3], current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. The data used for the riverine inputs estimation concerns only measurements in the proximity of river mouths. They originate from one-grab samples from the 23 rivers covering the whole latitudinal range of Sweden. And they have been extrapolated to the total riverine flow to Baltic Sea.

I Current inputs to the Baltic Sea indicate potential negative impacts at least on pelagic biota.

Overall assessment

When assessing current levels in the Baltic Sea (no relevant measurement data), current inputs, and the severity of the relevant toxicity mechanism, Dechlorane Plus scores **32-96/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A EU REACH registrant(s) ceased manufacture of this substance in 2020[4]. Before that, the registered volume was 100 - 1,000 t/y and regarded uses at industrial sites as a flame retardant in adhesives, sealants, polymer preparations, and semiconductors. With >10 t/y ending up in articles such as computers, electronics, electrical batteries and accumulators, vehicle textiles, textiles and apparel, automobiles, aerospace, and defence engines[5]. About 300 manufacturers/importers have submitted Classiciation & Labelling notifications to ECHA for this substance under the EU CLP Regulation (it is possible that some of them have also ceased manufacture/import, however have not inactivated their notifications). Dechlorane Plus is is a potential substitute for DecaBDE (a PBDE), which is restricted under the Stockholm Convention[6].

S **?** *In order to further improve the evaluation of the risk, relevant aspects to consider are an estimation of inputs via atmospheric deposition and its trends following inclusion under the Stockholm Convention, a review of the relevant toxicity thresholds (expected relevant matrices) and marine monitoring. As well as the likely relevance of the syn-DDC-CO isomer, in addition to the anti isomer.*

Relevant policies (existing or planned measures)

M (on A/P) • Listed under **Stockholm Convention** on POPs (signed by all HELCOM Contracting Parties) in 2023 (listing not entered yet into force) – Annex A (elimination of manufacture and use, with specific exemptions possible) – with specific exemptions: aerospace, space and defence applications, medical imaging and radiotherapy devices and installations, replacement parts for, and repair of, articles in applications where Dechlorane Plus was originally used in the manufacture of those articles and may be available, limited to the following applications, until the end of the service life of the articles or 2041/2044 (such as the above plus certain types of vehicles, equipent, and machinery).

• Dechlorane Plus is **listed as SVHC (Substances of Very High Concern) under EU REACH** (due to its vPvB properties). It has also been recommended by ECHA for inclusion to the REACH Authorizaiton list, in 2019. However with the actual inclusion been expected, back then, to be impacted by its anticipated potential iclusion also in the Stockholm Convention.

References:

1. 2. 3. 4. 5. 6.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

DSBP (distyrylbiphenylsulfonate)

(CAS numbers: e.g. 27344-41-8, EC number: 248-421-0 / Entry number in HELCOM list of substances of concern: 13)

General sectors: Industry and commercial products, personal care product

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

P Approximately **100 - 400 kg of DSBP** are estimated to enter the Baltic Sea every year via WWTP emissions. Additional riverine inputs beyond the WWTP contributions are possible. Given that the substance is **suspect as persistent, bioaccumulative, and very toxic**[1], current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. The data on WWTP discharges (2010-2019) originates from the study of Undeman et al. (2022)[2].

I Current inputs to the Baltic Sea indicate potential negative impacts at least on pelagic biota.

Overall assessment

When assessing current levels in the Baltic Sea (no relevant measurement data), current inputs, and the severity of the relevant toxicity mechanism, DSBP scores **30-91/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for DSBP is 10,000 – 100,000 t/y[3]. Registered uses include consumer and professional uses (cleaning and maintenance products), as well as industrial uses (pulp, paper and paper products, textile finishing, etc.). It is also authorised in the EU for use in personal care products, with the following functions: hair conditioning, surfactant - cleansing, UV absorber, viscosity controlling[4].

S **?** *In order to further improve the evaluation of the risk, relevant aspects to consider are a review of the relevant toxicity thresholds (expected relevant matrices) and marine monitoring or modelling for predicted environmental concentrations based on estimated inputs.*

Relevant policies (existing or planned measures)

M (on A/P) • According to information by ECHA, **a PBT assessment for DSBP is under development**[5]. However, the latest update about the intention for this assessment by the respective Member State is from 2015.

References:

1. 2. 3. 4. 5.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Kinoprene

(CAS numbers: e.g. 42588-37-4, EC number: 255-898-9 / Entry number in HELCOM list of substances of concern: 14)

General sectors: (Legacy?) pesticide

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

S Concentrations of a substance tentatively identified as Kinoprene exceed the applied threshold value in **6** of the 15 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**2**/3 assessed off-shore areas). In these 6 areas, **100%** of the assessible samples in **biota** exceed the threshold value. This is based on suspect screening data from the project PreEMPT[1]. A total number of 41 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Kinoprene scores **7.9/10** (confidence range: **7.7 – 8.5**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Kinoprene, in sediment and biota, were acquired from the NORMAN Network ecotoxicology database[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or top predators such as mammals and birds.

Supporting evidence

I Kinoprene is considered to have an especially **concerning mode of toxicity**: for example it is toxic for reproduction[3].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Kinoprene scores **69-84/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Kinoprene is not approved in the EU as an active ingredient in plant protection products since 2002[4]. No information has been retrieved about the current status of approval/use in Russia. Function-wise, it is a ‘biochemical’ pesticide (insect juvenile hormone mimic) mainly applicable to non-food crops. 39 companies have submitted Classification & Labelling notifications to ECHA for kinoprene in the context of the EU CLP Regulation[5], but it is not clear if this could relate mainly to minimal amounts in the Scientific Research and Development market or other potential industrial uses below 1 tonne per year and company.

S **?** *In order to further improve the evaluation of the risk, the first aspect to consider is identity confirmation (PreEMPT samples). If identity is confirmed, then a furhter relevant aspect to consider is a review of the relevant toxicity threshold (biota), as well as the market status in Russia, potential uses beyond plant protection in the EU, and potential for long-range transport in partiular as Kinoprene was until recently (if not being still) in use in other parts of the world[6].*

Relevant policies (existing or planned measures)

M -

References:

1. 2. 3. 4. 5. 6.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Metsulfuron-methyl

General sectors: Pesticide

(CAS numbers: e.g. 74223-64-6, EC number: 616-063-8 / Entry number in HELCOM list of substances of concern: 15)

DRIVERS	**A**CTIVITIES	**P**RESSURES	**S**TATE	**I**MPACTS

Why a HELCOM concern?

Main evidence

P Approximately **7-112 kg of Metsulfuronmethyl** are estimated to enter the Baltic Sea every year via rivers (WATERBASE[1]). Additional inputs are expected via direct coastal run-off. Given that the substance is **suspect as persistent** and is **very toxic**[2], current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. The data used for the riverine part of the estimation (WATERBASE) concerns only measurements in the proximity of river mouths, and the period 2015-2022. The 8 subcatchment areas for which there was such riverine data reflected 6% of the total riverine flow to the Baltic, to which inputs have been extrapolated. The data in WATERBASE included approximately 2 countries and 185 samples.

Supporting evidence

I Metsulfuron-methyl is considered to have a concerning **mode of toxicity**, as it is inhibits protein biosynthesis[3].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Metsulfuron-methyl scores **28-97/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Metsulfuron-methyl is approved as an active ingredient in plant protection products in all 8 Contracting Parties which are members of the EU[4]. Based on expert information provided, the sales volume in Latvia currently is 150 kg/y. According to the literature[5], it is used as a herbicide against weeds and some annual grasses.

P No significant contributions are expected from WateWater Treatmeant Plant effluents. Indeed, the substyance is not detected in WWTP effluents (Undeman et al, 2022[6]). As mentioend above, the main pathway to the Baltic Sea is riverine emissions and potentially also direct coastal run-off.

S ? *In order to further improve the evaluation of the risk, relevant aspects to consider are a review of the expected relevant toxicity thresholds and either marine monitoring or modelling for predicted environmental concentrations based on estimated inputs.*

Relevant policies (existing or planned measures)

M -

References:

1. 2. 3. 4. 5. 6.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

N-Methyl-2-pyrrolidone (NMP)

(CAS numbers: e.g. 872-50-4, EC number: 212-828-1 / Entry number in HELCOM list of substances of concern: 16)

General sectors: Industry and commercial products

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM concern?

Main evidence

S Concentrations of a substance tentatively identified as NMP exceed the applied threshold value in **22** of the 23 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**2**/2 assessed off-shore areas). In these 22 areas, on average **86%** of the assessible samples in **biota** exceed the threshold value. This is based on suspect screening data from the project PreEMPT[1]. A total number of 100 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, NMP scores **8.2/10** (confidence range: **5.0 – 8.4**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for NMP, in biota, was acquired from the NORMAN Network ecotoxicology database[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or top predators such as mammals and birds and/or humans via consumption of seafood.

Supporting evidence

I NMP is considered to have an especially **concerning mode of toxicity**. For example, it is toxic for reproduction[3].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, NMP scores **58-85/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for NMP is 10,000 - 100,000 t/y plus confidential volume registered as intermediate[4]. Registered uses include applications at industrial sites (e.g. in chemical processes, formulation and repacking, in coatings such as inks, cleaning agents, oil field drilling and production operations, as binders and release agents, as functional fluids, polymer processing, water treatment), and by professional workers (e.g. in coatings, as functional fluids, etc.)[5]. According to the European Commission's Risk Management Options Analysis document of 2018, NMP is used as solvent for the manufacture of other chemicals (pharmaceuticals, agrochemicals, etc); in the production of man-made fibers, textiles and artificial leather; coatings; paint strippers and cleaners and in electronic[6].

S **?** *In order to further improve the evaluation of the risk, the first aspect to consider is identity confirmation (PreEMPT samples). If identity is confirmed, then a furhter aspect to consider is a review of the relevant toxicity threshold (biota).*

Relevant policies (existing or planned measures)

M (on A/P) • There is a restriction under EU REACH, requiring appropriate operational conditions at use-sites, to ensure that exposure of workers to NMP is below a defined, in the restriction, level.

• NMP is **listed as SVHC (Substances of Very High Concern) under EU REACH** (due to its reprotoxic properties). It has also been recommended by ECHA for inclusion to the REACH Authorizaiton list, in 2018.

• It is covered by a **Risk Management Options Analysis prepared by the European Commission for three aprotic solvents** (NMP, DMAC, DMF), in 2018[6].

References:

1. 2. 3. 4. 5. 6.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Nonanedioic acid (azelaic acid)

(CAS numbers: e.g. 123-99-9, EC number: 204-669-1 / Entry number in HELCOM list of substances of concern: 17)

General sectors: Industry and commercial products, personal care product

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM concern?

Main evidence

S Concentrations of a substance tentatively identified as Nonanedioic acid exceed the applied threshold value in **13** of the 23 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**2**/4 assessed off-shore areas). In these 22 areas, on average **68%** of the assessible samples in **biota** exceed the threshold value. This is based on suspect screening data from the project PreEMPT[1]. A total number of 100 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Nonanedioic acid scores **5.5/10** (confidence range: **4.8 – 8.1**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for Nonanedioic acid, in biota, was acquired from the NORMAN Network ecotoxicology database[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or top predators such as mammals and birds.

Supporting evidence

I Nonanedioic acid is considered to have a concerning **mode of toxicity**, as it is inhibits protein biosynthesis[3].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Nonanedioic acid scores **48-81/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for Nonanedioic acid is 1,000 - 10,000 t/y[4]. Registered uses include professional uses (medical device, component of cleaning and maintenance products) and industrial uses (of facade / surface cleaning products, application of coatings or inks, construction chemicals (outdoor), laundry products, metal treatment products, vehicle cleaning products, leather finishing, as intermediate, etc.)[5]. According to the SPIN database, for the period 2017-2021, in Sweden and Denmark the substance was reported in total amounts up to tonnage bands of 150 – 15,000 t/y and 0 88 kg/y respectively[6]. Furthermore, it is authorised in the EU for use in personal care products with the following functions: buffering, fragrance[7].

S **?** *In order to further improve the evaluation of the risk, the first aspect to consider is identity confirmation (PreEMPT samples). If identity is confirmed, then a furhter aspect to consider is a review of the relevant toxicity threshold (biota).*

Relevant policies (existing or planned measures)

M (on A/P) • It is covered by an **Assessment of Regulatory Needs, prepared by the ECHA, on linear aliphatic dicarboxylic acids (C≥8) and their salts**[8].

References:

1. 2. 3. 4. 5. 6. 7. 8.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Octadecanamide

(CAS numbers: e.g. 124-26-5, EC number: 204-693-2 / Entry number in HELCOM list of substances of concern: 18)

General sectors: Industry and commercial products

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

S Concentrations of a substance tentatively identified as Octadecanamide exceed the applied threshold value in all the **10** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**2**/2 assessed off-shore areas). In these 10 areas, **100%**[*] of the assessible samples of **sediment and/or biota** exceed the threshold value. This is based on suspect screening data from the project PreEMPT[1]. A total number of 21 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Octadecanamide scores **8.3/10** (confidence range: **4.1 – 8.5**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Octadecanamide, in sediment and biota, were acquired from the NORMAN Network ecotoxicology database[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or sediment-dwelling organisms and/or top predators such as mammals and birds.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Octadecanamide scores **43-86/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for Octadecanamide is 1,000 - 10,000 t/y[3]. Registered uses include industrial, professional, and consumer uses in adhesives, coatings or inks, production and use of plastics and rubber products, etc[4].

S **?** *In order to further improve the evaluation of the risk, the first aspect to consider is identity confirmation (PreEMPT samples). If identity is confirmed, then a furhter aspect to consider is a review of the relevant toxicity thresholds (sediment, biota).*

Relevant policies (existing or planned measures)

M (on A/P) • It is covered by an **Assessment of Regulatory Needs, prepared by the ECHA, on aliphatic primary amides**[5]. According to this document, Octadecanamide is considered as inconclusive for aquatic toxicity (hazard potential needs to be clarified) and wide dispersive uses are noted.

References:

1. 2. 3. 4. 5.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering that there were also inconclusive non-detections (in terms of exceedance, due to a relatively high limit of detection), it is possible that the actual average frequency of exceedance in these areas is somewhat lower, but in any case >70%.

Pentabromobenzyl acrylate (PBB-Acr)

(CAS numbers: e.g. 59447-55-1, EC number: 261-767-7 / Entry number in HELCOM list of substances of concern: 19)

General sectors: Industry and commercial products

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

P Approximately **41 - 660 kg of PBB-Acr** are estimated to enter the Baltic Sea every year via rivers (Gustavsson et al, 2018[1]). Additional inputs may be expected via the atmospheric deposition route[2]. Given that the substance is **suspect as very persistent and very toxic**[3], current inputs are likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. The data used for the riverine inputs estimation concerns only measurements in the proximity of river mouths. They originate from one-grab samples from the 23 rivers covering the whole latitudinal range of Sweden. And they have been extrapolated to the total riverine flow to Baltic Sea.

I Current inputs to the Baltic Sea indicate potential negative impacts at least on pelagic biota.

Overall assessment

When assessing current levels in the Baltic Sea (no relevant measurement data), current inputs, and the severity of the relevant toxicity mechanism, PBB-Acr scores **30-94/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH-registered volume is 100 - 1,000 t/y, however it appears to relate with registration corresponding to imported polymer[4]. According to the literature, PBB-Acr is an alternative flame retardant that has recently replaced legacy ones (such as PBDEs)[5].

S **?** *In order to further improve the evaluation of the risk, relevant aspects to consider are a review of the relevant toxicity thresholds (expected relevant matrices) and marine monitoring or modelling for predicted environmental concentrations based on estimated inputs. Furthermore, it would be useful to assess possible inputs via atmospheric deposition. As well as clarify the situation on the market / form of substance in the imported polymers / accordingly potential for release from them.*

Relevant policies (existing or planned measures)

M -

References:

1. 2. 3. 4. 5.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Prometon

(CAS numbers: e.g. 1610-18-0, EC number: 216-548-0 / Entry number in HELCOM list of substances of concern: 20)

General sectors: (Legacy?) pesticide

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

S Concentrations of a substance tentatively identified as Prometon exceed the applied threshold value in **all the 9** examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**2**/2 assessed off-shore areas). In these 9 areas, **100%*** of the samples of **sediment** exceed the threshold value. This is based on suspect screening data from the project PreEMPT[1]. A total number of 16 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Prometon scores **8.9/10** (confidence range: **7.9 – 9.0**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Prometon, in sediment, was acquired from the NORMAN Network ecotoxicology database[2].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or sediment-dwelling organisms.

Supporting evidence

I Prometon is considered to have a **concerning mode of toxicity**, as it is a photosynthesis inhibitor[3]. Photosynthesis inhibitors disrupt energy production or utilization and can affect growth and overall fitness of primary producing marine organisms.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Prometon scores **66-91/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Prometon has not been applied for authorisation in the EU as an active ingredient in plant protection products[4]. No information has been retrieved about the current status of approval/use in Russia. It is a triazine substance. Function-wise, it is a herbicide against weeds to aid in brush and grass control mainly in non-cropping situations[5]. 42 companies have submitted Classification & Labelling notifications to ECHA for Prometon in the context of the EU CLP Regulation[6], but it is not clear if this could relate mainly to minimal amounts in the Scientific Research and Development market or other potential industrial uses below 1 tonne per year and company.

S **?** *In order to further improve the evaluation of the risk, the first aspect to consider is identity confirmation (PreEMPT samples). If identity is confirmed, then a furhter relevant aspect to consider is a review of the relevant toxicity threshold (sediment), as well as the market status in Russia and potential uses beyond plant protection in the EU.*

Relevant policies (existing or planned measures)

M -

References:

1. 2. 3. 4. 5. 6.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering that there were also inconclusive non-detections (in terms of exceedance, due to a relatively high limit of detection), it is possible that the actual average frequency of exceedance in these areas is somewhat lower, but in any case >80%.

Tris(2-ethylhexyl) phosphate (TEHP)

(CAS numbers: e.g. 78-42-2, EC number: 201-116-6 / Entry number in HELCOM list of substances of concern: 21)

General sectors: Industry and commercial products

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM concern?

Main evidence

S Concentrations of Tris(2-ethylhexyl) phosphate exceed the applied threshold value in **15** of the 17 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**1**/2 assessed off-shore areas). In these 15 areas, on average **93%*** of the assessible samples of **biota** (and/or sediment, where thresholds are exceeded more rarely) exceed the threshold value. This is based on a combination of monitoring data from the project LifeAPEX[1] and suspect screening data (thus corresponding to tentative identification) from the project PreEMPT[2]. A total number of 57 data points were possible to evaluate for this substance.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Tris(2-ethylhexyl) phosphate scores **8.0/10** (confidence range: **6.9 – 8.4**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for Tris(2-ethylhexyl) phosphate, in biota and sediment, were acquired from the NORMAN Network ecotoxicology database[3].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota and/or top predators such as mammals and birds and/or sediment-dwelling organisms.

Supporting evidence

P Approximately **220-900 kg of Tris(2-ethylhexyl) phosphate** are estimated to enter the Baltic Sea every year via WWTPs (Undeman et al, 2022[4]). Additional inputs may be expected from riverine inputs beyond the contributing WWTP effluents. Given that the substance is **very toxic**[5], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds.

I Tris(2-ethylhexyl) phosphate is considered to have an **especially concerning mode of toxicity**. For example, it is an endocrine disruptor[6]. Endocrine disruptors mimic or interfere with hormones and can cause developmental abnormalities, reproductive dysfunction, and population effects.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Tris(2-ethylhexyl) phosphate scores **73-80/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A The EU REACH registered volume for Tris(2-ethylhexyl) phosphate is 1,000 - 10,000 t/y[7]. Registered uses include consumer (photopaper, lubricants and greases in vehicles or machinery), professional (PUR, PPP products, lubricants and greases in vehicles or machinery including for use in open systems), and industrial uses (as a solvent in photochemicals, metal working fluids, in synthesis of hydrogen hyperoxide, lubricants and greases)[8]. According to ECHA's ARN[9], the main technical function identified is as flame retardant and lubricating agent in a wide range of applications.

S **?** *In order to further improve the evaluation of the risk, one possible aspect to consider is identity confirmation in PreEMPT samples – although it appears that its identity has been confirmed at least in LifeAPEX marine biota samples. A further aspect to consider is a review of the relevant toxicity thresholds (biota and secondary sediment).*

Relevant policies (existing or planned measures)

M (on A/P) • Tris(2-ethylhexyl) phosphate is covered by two recent **Assessments for Regulatory Needs prepared by ECHA** (one on a group of chlorinated trialkyl phosphate flame retardants[10] – and one on regulatory strategy for flame retardants[9]). According to these reports, the substance is of known or potential hazard for endocrine disruption (both in terms of environment and human health), unlikely for PBT/vPvB, and eventual possible inclusion to SVHC list can be considered. Data generation for endocrine disrupting properties in the context of the REACH Regulation is ongoing.

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

* considering that there were also inconclusive non-detections (in terms of exceedance, due to a relatively high limit of detection), it is possible that the actual average frequency of exceedance in these areas is somewhat lower, but in any case >60%.

Uranium and its compounds

(CAS numbers: e.g. 7440-61-1, EC numbers: e.g. 231-170-6 / Entry number in HELCOM list of priority substances: 22)

General sectors: Nuclear, munitions

DRIVERS	ACTIVITIES	PRESSURES	STATE	IMPACTS

Why a HELCOM concern?

Main evidence

S Concentrations of Uranium exceed the applied threshold value in **5** of the 6 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**4**/4 assessed off-shore areas). In these 5 areas, on average **89%** of the assessible samples in **water** exceed the threshold value. This is based on monitoring data for the period 2015-2024 available in national and international databases[1]. A total number of 43 data points were possible to evaluate for Uranium.

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, Uranium scores **8.1/10** (confidence range: **4.7 – 8.5**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold value for Uranium, in water, was acquired from national EU WFD assessments[2]. **Uncertainties exist regarding large variation in toxicity across different Uranium chemical forms** (see section about uncertainties below). Uranium also has a CLP harmonized classification as Aquatic Chronic 4.

P The amount of Uranium estimated to enter the Baltic Sea every year via rivers is approximately **249 tonnes** (WATERBASE[3]). Additional inputs are expected from atmospheric deposition and potentially direct emissions from land-based sources. Given that Uranium is **persistent and toxic**[4], current inputs are considered as likely significant, in terms of risk they pose for the Baltic Sea and its ecosystem services. As mentioned above, levels in Baltic Sea have already exceeded thresholds. The riverine data used for the estimation concerns only measurements in the proximity of river mouths, and the period 2015-2022. The 36 subcatchment areas for which there was such riverine data reflected 37 % of the total riverine flow to the Baltic Sea, to which inputs have been extrapolated. The data in WATERBASE included approximately 2 countries and 2918 samples. Increased inputs in the near future are also possible with increases in mining and stone extraction.

I Current inputs and levels in the Baltic Sea indicate potential negative impacts on pelagic biota.

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, Uranium scores **54-85/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment.

Facts relevant for management considerations

Causal chain and pathways

A Uranuim is a likely naturally ocurring element, whereas there are historic sources from past mining and the Chernobyl event[5]. A possible new source is depleted munitions[6].

S **?** *In order to further improve the evaluation of risk, one aspect that could be investigated in the future is a review of the water toxicity threshold (including whether background levels taken into account; and speciation, as athere is a large variation across different Uranium chemical forms). Furthermore, it is relevant to assess the relative relevance of anthropogenic emissions, taking into account possible future emissions from depleted munitions.*

Relevant policies (existing or planned measures)

M

References:

1. 2. 3. 4. 5. 6.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]

Common references

Note: Detailed references are not yet provided in the individual fact sheets and will be added in a later version of the document. Here is a first concise listing of a selection of some of the most frequently occurring references along the different substanes.

State

- HELCOM MADS
- National and international databases
  - ICES DOME
  - Swedish national data host (SGU)
  - German MUDAB database
  - German UPB database
- PreEMPT project
- LifeAPEX project
- HELCOM data calls
- Scientific articles and reports
- Threshold values
  - EC proposed Directive amending WFD and EQSD
  - MSFD national assessments (2018)
  - WFD national assessments (2nd RBMP)
  - Ecotoxicology database of the NORMAN Network (retrieved in December 2023)
  - Posthuma et al, 2019
- HELCOM's regional strategic approach

Pressures

- HELCOM BSEFS
- HELCOM PLC-8 BSEP
- WATERBASE
- Undeman et al, 2022
- E-PRTR
- EMERGE project
- Gustavsson et al, 2018
- Further scientific articles and reports
- RIVM PBT and PMT screening tool
- EU REACH: Candidate List of Substances of Very High Concern
- Assessments for Regulatory Needs (ARNs), Risk Management Options Analyses (published under ECHA PACT)

Impacts

- EU CLP Regulation
- ECHA's Classification & Labelling Inventory including self-classifications (in accordance to the EU CLP Regulation)
- Kramer et al, 2024 (curated database of modes of action)
- HELCOM MADS (imposex)
- Kanwischer et al, 2022 (EDA review article)
- Booij et al, 2015 (EDA study)

Activities Measures

- Stockholm Convention on Persistent Organic Pollutants (POPs)
- EU Persistent Organic Pollutants Regulation
- EU Water Framework Directive
- EU REACH: Restrictions list
- Assessments for Regulatory Needs (ARNs), Risk Management Options Analyses (published under ECHA PACT)
- EU REACH: Total registered volumes
- EU REACH: Registered uses (ECHA CHEM)
- EU REACH: Candidate List of Substances of Very High Concern
- EU REACH: ECHA's Annex XIV prioritization assessments
- EU REACH: Authorisation List
- EU REACH: Authorized uses for substances in REACH Authorization list
- EU REACH: Downstream uses covered by granted authorisations
- HELCOM indicator reports
- SPIN database
- Pharmaceuticals sales: HELCOM's data call

- Guideline on the environmental risk assessment of medicinal products for human use (including Phase I ERA guidance)
- EU BPR: Approved active substances
- EU BPR: Authoried products
- Active substances approved for use in plant protection products in accordance with EU Regulation 1107/2009
- EU Urban WasteWater Treatment Directive
- EU RoHS Directive
- Scientific articles and reports
- EU Regulation 2023/915 on maximum levels for certain contaminants in food

Overall assessment

- HELCOM's regional strategic approach
- Grouping rationales / descriptions