

Leaflet for industry using chemicals

“Take action and avoid use of hazardous substances: advices for identification of hazardous substances in industrial chemicals”

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Nearly every industrial company uses high variety of chemicals in its production processes, no matter whether you synthesise substances, mix preparations or produce the articles, such as furniture, textile, engines etc. Despite all other things you should know whether among your used and emitted substances are the ones, which are hazardous to the water environment. It is necessary to comply with legal requirements, it is advisable to be able to avoid unnecessary fines for polluting environment, and sometimes it is needed to prove to your clients that such substances do not appear or cannot be released from your products.

Thus, what should you know about substances hazardous to the water environment?

1. What are substances hazardous to the water environment?

Hazardous substances are the substances, which present a risk to or via the aquatic environment. They can fall into one of the following categories:

- **toxic, persistent and liable to bioaccumulate (PBT)**;
- **very persistent and very bioaccumulative (vPvB)**;
- not complying with above mentioned criteria, but giving reason for an equivalent level of concern (e.g. endocrine disrupters, broadly used slowly degrading substances etc.)

Due to these properties **substances can harm ecosystems and further on also human health** when released to the environment from products and processes.

To algae, daphnia, fish, mammals, human:

- May kill
- May cause cancer
- May harm the unborn child
- May impair fertility
- May cause genetic defects
- May cause damage to the nervous system
- May damage the function of internal organs
- May cause development disorders

- May cause feminisation or masculinisation in wildlife
- May harm the human immune system

When released to the environment:

- remains there for a long time
- concentration in the environment rises over the time
- gets transported very long distances from original emission source

- Accumulates in algae and microphytes
- Accumulate from water in animal fatty tissue (e.g. to fish, mussels) and further on contaminate the food of human consumption



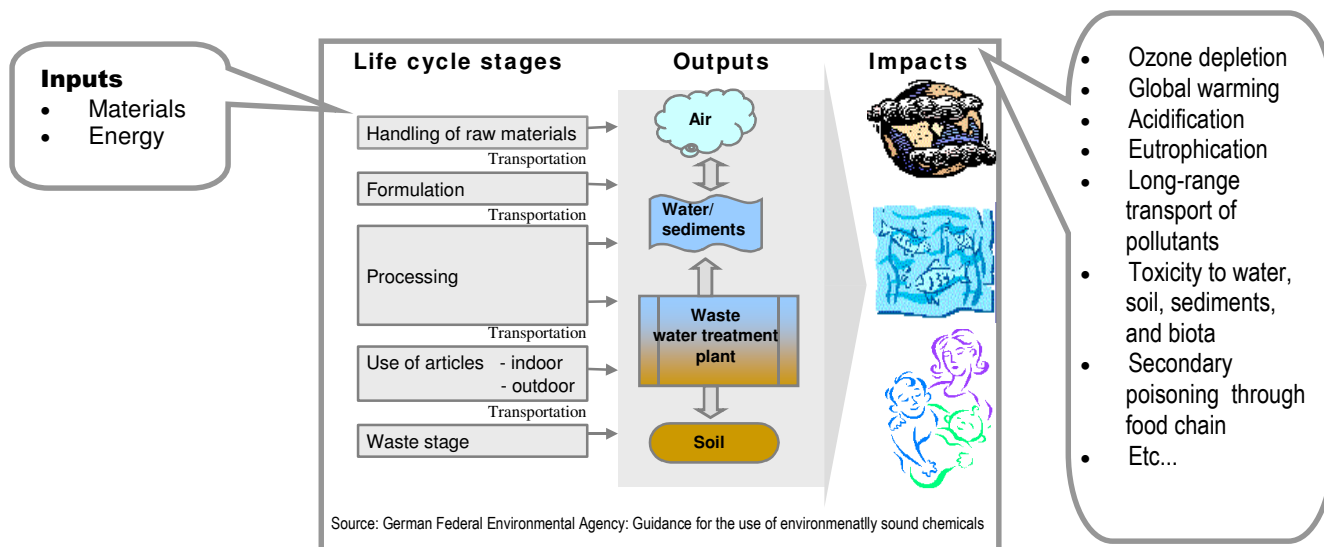
THERE IS NO SAFE CONCENTRATION FOR THESE SUBSTANCES!

2. How hazardous substances appear in the environment and how they impact it?

Hazardous substances may be emitted **from every stage of the product chain**: from the raw material (chemical products), from the production process, including the ones built up during the process (e.g. dioxins), when transported, when used as an article or handled as a waste (see Figure 1).


They reach the environment with direct discharges from your company to surface waters, discharges through municipal WWTP, emissions to air and further atmospheric deposition, old stocks, contaminated soil, leaking from landfills etc.

Figure 1. Emissions of hazardous substances during the life cycle of the product



3. How you can distinguish substances (potential) hazardous to environment?

First idea about the substances, which are hazardous to the environment you can get from the information provided on chemical package, screening your chemicals inventory or information in Safety Data Sheet (SDS) (look for classification of substance!).

→ Packaging	Label		<p>This information indicates that substance is hazardous to the environment!</p> <p>Example: Dibutyl phthalate, Repr.2; R61 Repr.3; R62 N; R50</p>
→ Classification of substance or preparation	Danger symbol	N	
	Hazard indications → Risk phrases	R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R50/R53, R51/R53, R52/R53	
→ Information in SDS	Chapter 2: Information on components	Composition, concentrations and classification of components	
	Chapter 9: Physical - chemical properties	Solubility, vapour pressure, adsorption	
	Chapter 12: Ecological information	Biodegradability, bioaccumulation, toxicity, biomagnification etc.	

However, classification not necessary suffices to prove whether substance having PBT properties. Therefore to conclude on PBT properties of the substance, you should look for the ecological and other information provided in SDS (chapters 9, 12) or other sources and compare it with the set of different criteria provided below.

Criteria for identification of PBT/vPvB substances according European Commission's Technical Guidance Document for risk assessment of substances

PBT	CRITERIA		
	Persistence	Bioaccumulation	Toxicity
PBT	Half-life > 60 d in seawater or > 40 d in freshwater or > 180 d in marine sediment or > 120 d freshwater sediment or >120 d in soil	BCF > 2000	Chronic NOEC < 0.01 mg/l or < 30 mg/kg food LC50 < 0.1 mg/l (not relevant if BCF > 5000) CMR20 → classified T; R48 or Xn; R48 or R64
vPvB	Half-life > 60 d in seawater or freshwater or > 180 d in marine or freshwater sediment >180 d in soil	BCF > 5000	Not applicable

If the substance you use does not comply with listed criteria, check for other parameters or values provided below. It will make you able to decide about **potential** concern of that substance!

Criteria	Meaning	Conclusion
Log Kow = 4.5-9	Coefficient indicating partitioning of substance between octanol and water	→ liable to bioaccumulate in fatty tissue
BCF>1300	Bioconcentration factor	→ liable to bioaccumulate in fatty tissue
BMF=3-10	Biomagnification factor	→ biomagnifies along the food chain
CMR, cat I, II = R45, R46, R48, R60, R61	Carcinogenic, mutagenic, reprotoxic	→ cause danger to veterbrates
CMR = R40, R62, R63, R68	Carcinogenic, mutagenic, reprotoxic	→ potential CMR to vertebrates
BOD5/ChOD>=0.5	Biological and chemical oxygen demand	→ substance will degrade in environment or waste water treatment plant
Koc>2700 Log Koc >3.5	The partition coefficient between water and organic carbon – indicates potential to adsorb to the soil	→ high potential of sorption of substance to soil → higher KOC values - less mobile organic chemicals → Koc <500 no or little adsorbtion
Hydrolysis, photolysis → half-life	Hydrolysis in water and photolysis in atmosphere and at surface of water and solid	→ monthes: stable → persist in the environment → hours: easily degrading

If you are not able to identify the ingredients in the chemical products you use – contact your supplier! Also be aware that preparations not classified and labelled as dangerous may nevertheless contain persistent and bioacumulative substances in relevant amounts! Therefore, contact your suppliers for additional information!

4. What are EU and international legal requirements you should know about when dealing with substances hazardous to the water environment?

EU legislation	
WFD (2000/60/EC) & DSD (76/464/EEC)	
<ul style="list-style-type: none"> → defines the lists of the hazardous and priority substances, see also chapter 5 → requires to identify the use and emissions of dangerous and priority dangerous substances; → sets the limits for the emissions to the environment → requires development of programmes of measures and reduction programmes 	
IPPC (96/61/EC) & Pollutants emissions register – EPER (2000/479)	
<ul style="list-style-type: none"> → requires to identify and list the used hazardous and priority substances when applying for environmental permit; → requires identify emissions to water from all individual facilities when applying for permit; → to report on the emissions of those substances 	
C&L&P of substances (67/548/EEC) and preparations (99/45/EC)	
<ul style="list-style-type: none"> → sets the criteria for classification, labelling and packaging of substances and preparations; → provides the harmonised classification of some substances (Annex 1) 	
Bans, Marketing and Use restrictions (76/769/EEC)	
<ul style="list-style-type: none"> → limits the application of certain substances, incl. hazardous to water environment 	
Biocides directive (98/8/EC)	
<ul style="list-style-type: none"> → requires registration/ authorisation where also purpose of use, residue limit values to be presented 	
Product related legislation – ELV, WEEE, ROHS	
<ul style="list-style-type: none"> → restricts the use of certain substances in the products; → requires to take certain actions to reduce use of those substances in the products; → requires to report on measures taken, content of substance in the products; 	

International requirements

Helsinki Convention, Recommendation 19/5¹	
<ul style="list-style-type: none"> → requires to report on emissions, losses and discharges → requires to cease listed substances by 2020 	

¹ Besides this recommendation there are quite a few other sector and product related HELCOM Recommendations, which also address hazardous substances: 24/4, 23/9, 23/7, 23/8, 23/10, 23/11, 16/7, 16/10, 17/6, 23/6, 16/8, 14/3, 25/1, 20/4, 20/2, 24/2, 23/4, 6/4, 9/4.

5. What are the hazardous substances relevant in different industry branches?

NACE	Branches*	SCCP	Chloroform	NP/ NPE	Musk xylene	DEHP	DBP	Organotin	Hexabromo biphenyl	PCB/ PCT	PAH	Brominated flame retardants	Cadmium/ compounds	Lead/ compounds	Mercury/ compounds	Selenium/ compounds
17	Textile			XX								XX				
19	Leather	XX		X								X				
21	Pulp & paper			X				X								
23	Oil refinery										XX		X	XX		
24	Chemicals														X	
24.4	Pharmaceuticals		XX													
24.5	Household chemicals and institutional cleaners			XX	X											
24.x	Cosmetics				XX	X	X									
24.x	Paints***	XX		X		X	XX	XX			XX		X			
25.2	Plastic	XX				XX		X				XX	XX	X		
25.x	Rubber	XX						X						X		
26.1	Glass-fiber													X		
27	Basic metals		X											X		X
28 - 35	Metal Products	XX		XX									XX	X		
31 - 33	Electronic industry		X												XX	
35	Ship Building and Repair	XX						XX						X		
34-35	Trains and Busses Building and Repair	XX														
28-29	Other Engineering and Machinery	XX												X		
15	Food			XX												
74.7 93.01	Public Institutions (Hospitals,		Medicine or	XX								XX				

NACE	Branches*	SCCP	Chloroform	NP/ NPE	Musk xylene	DEHP	DBP	Organotin	Hexabromo biphenyl	PCB/ PCT	PAH	Brominated flame retardants	Cadmium/ compounds	Lead/ compounds	Mercury/ compounds	Selenium/ compounds
	schools, administration), cleaning services		solvent													
45	Construction and maintenance buildings and harbors or railway infrastructure made from wood										XX	XX				
02	Forestry							X			X	X				
01	Agriculture			X				XX					X			
	Mining												XX			
40	Energy supply									XX						

* sub-sector using chemicals (mainly chemical products = preparations) for processing (processing aids) or as a component in the finished products (articles)

*** including biocidal paints

XX most relevant areas of use; X relevant areas of use (according to EU market situation in first half of 90s)

6. How you can identify hazardous substances in your company?

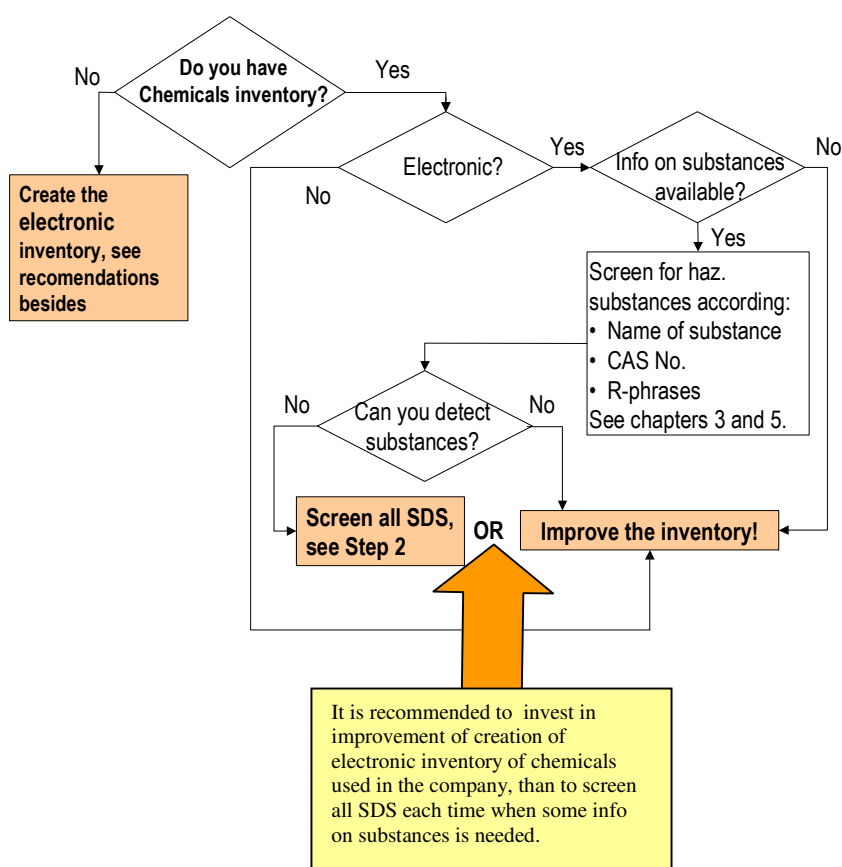
In order to identify hazardous substances relevant for your company, you can use different approaches:

→ identify hazardous substances in used chemical products and then estimate their emissions to the environment - this is less resources demanding and more targeted way!

→ analyse/ measure the hazardous substances in the emissions – costly and most probably not applicable for all substances relevant for you company.

☒ **Start with screening for hazardous substances in USED chemicals at your company!**

Step 1 – Screen available information on chemicals used in your company



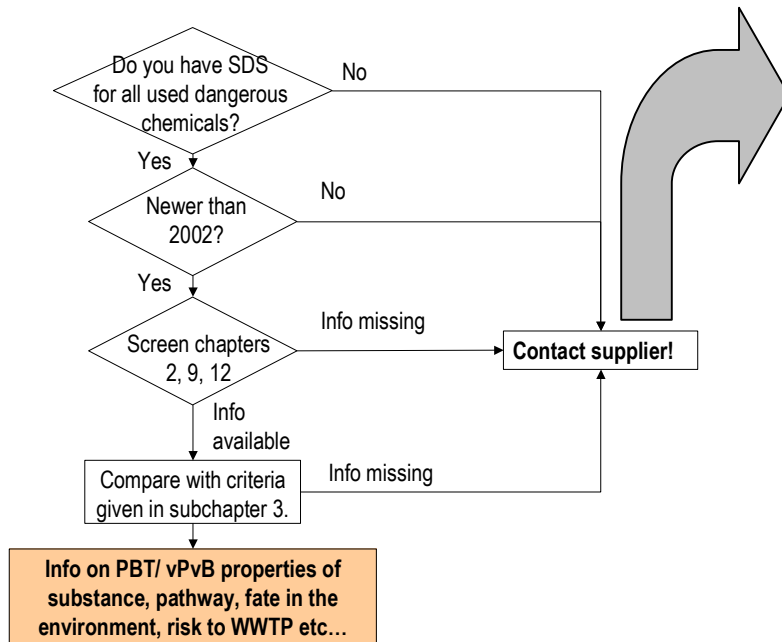
Minimum information recommended to make inventory useful:

- chemicals identity (CAS Nr.)
- information on compounds of preparation
- supplier/ producer
- classification and labelling
- place of use
- amount used per year
- technical function of chemical

Important!

- only electronic version of inventory will pay back
- start with entering info on preparations but finally end-up with information on substance level!
- first put all available information from SDS and later get the missing data
- make inventory a part of the whole system, accessible by different specialists
- renew regularly

Step 2 – Screen Safety data sheets of chemical products



Contact supplier:

- ask supplier for updated version of SDS
- ask for occurrence of specific substances (in this case hazardous substances for water environment) in the preparation
- provide concrete argument why you need such information – refer to legislation
- ask for written answer.

If supplier is not able to provide requested information - find new supplier!
If this is not possible, you have to search for this information yourself. It is very time consuming and not always reliable – nobody knows the products better as the supplier or producer!

Step 3 - Check other supporting information source

- Look what substances might be relevant to your industry branch
- Look for potential hazardous substances in emissions from certain industry branches

☒ Screen for hazardous substances in the EMISSIONS!

When identified hazardous substances in use at your company, you should estimate their emissions to the environment!

You can apply different methodologies: measure hazardous substances in emissions, calculate/ estimate emissions of hazardous substances from used amounts or combine different methodologies. No matter which methodology you use, you must prove whether hazardous substance is not emitted to environment! And, if it is emitted, then in which amounts! Document the methodology used and the results – it can be required by inspectors or used, for example, for reporting to state authorities!

7. What to do next when hazardous substances are identified?

Select the management strategy for minimising risk of hazardous substances!

You can choose the following options:

1. Decrease hazard due to intrinsic hazardous properties of substance

→ Substitution of dangerous substances/raw materials by less dangerous alternatives

Priorities for substitution must be CMR, PBT/vPvB, particularly hazardous metals (mercury, cadmium, lead and their compounds, endocrine disrupters, ozone depleting substances)



Sooner or later they must be ceased → consider now!

2. Decrease exposure of human and environment

→ change process to non-chemical solution

→ close installations → rigorous containment

→ reduce amount of used substances → recirculation/ reuse

→ engineering measures for reduction of emissions – external waste and waste water treatment with best available technique

→ provide information and good training to your employees on safe handling of hazardous substances

→ good plant management (house-keeping, maintenance, care for processing fluids)

Effect high



Effect low

3. Decrease both hazard and exposure, applying mixture of above mentioned measures

8. Information sources

EU legislation - Portal to European Union Law Eur-Lex: <http://europa.eu.int/eur-lex/en/search/index.html>

International requirements - Helsinki convention: www.helcom.fi

Lists of undesirable substances

- N-CLASS Database on Environmental Hazard Classification: http://www.kemi.se/aktuellt/nclass020314_eng.htm; <http://www.kemi.se/nclass/default.asp>
- Substances hazardous to environment and criteria set – PRIO database: http://www.kemi.se/templates/PRIOEngframes_970.aspx
- OSPAR: http://www.ospar.org/eng/doc/04-12e_2005%20amended%20LCPA.doc
- HELCOM: http://www.helcom.fi/Recommendations/en_GB/rec19_5/
- Database on harmonised classifications and labelling for substances or groups of substances included into Annex I of Directive 67/548/EEC – Classlab database: <http://ecb.jrc.it/classification-labelling/>

Databases on properties of chemicals

- **RISKLINE Database** - Information on environment and health related properties of substances: <http://www.kemi.se/riskline/index.htm>
- **TOXNET – Toxicology Data Network** <http://toxnet.nlm.nih.gov/>
 - **HSDB (Hazardous Substances Data Bank)** → extensive information on toxicity, environmental fate, human exposure, chemical safety, waste disposal, emergency handling
 - **IRIS (Integrated Risk Information System)** → carcinogenic and non-carcinogenic health risk assessment
 - **Haz-Map** → health effects of exposure to chemicals at work, jobs and hazardous tasks with occupational diseases and their symptoms
- **ECOTOX Database** – Information on single chemical toxicity information for aquatic and terrestrial life: <http://www.epa.gov/ecotox/>

Practical tools

- The Column model – An aid to risk identification and substitute assessment: <http://www.hvbg.de/e/bia/pra/spalte/spaltmod.pdf>
- Guidance for the use of environmentally sound substances: <http://www.umweltbundesamt.org/fpdf-l/2326.pdf>
- Pollution Prevention Handbook: http://www.ec.gc.ca/P2TUT/pdf/hand_all_e.pdf
- Chemical Management Guide - Improve Chemical Management to Gain Cost, Savings, Reduce Risks and Improve Safety: http://www2.gtz.de/chs/englisch/03akt_02pe.htm
- Design for the Environment (DfE) – Approaches and tools <http://www.epa.gov/opptintr/dfe/tools/>
- Chemicals risk assessment at working places – guidance/recommendations: www.vdi.lt; <http://osha.vdi.lt>

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United Nations Development Programme Global Environment Facility Small Grants Programme

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UNDP Global Environment Facility Small Grants Programme (GEF SGP) operates in 84 countries in the world. GEF SGP supports actions of communities and non-governmental organizations that conserve global biological diversity, mitigate global climate change and prevent pollution of international waters in line with the principles of sustainable development.