Environmental Protection of
International River Basins Project
Contract No. 2011/279-666

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EPIRB Project Activity 2

Pilot Testing in EPIRB Project River Basins

Guidance Document

addressing Chemical Status of Surface Water Bodies for a Pressure-Impact Analysis/Risk Assessment according to the EU WFD

4th Draft

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Abbreviations and Acronyms

AA-EQS	annual average environmental quality standard
EPIRB	Environmental Protection of International River Basins
EQS	environmental quality standard
EU	European Union
IPPC	Integrated Pollution Prevention and Control
MAC-EQS	maximum allowable concentration environmental quality standard
PAH	polyaromatic hydrocarbons
PVC	polyvinyl chloride
SME	small and medium enterprise
STP	sewage treatment plant
WFD	Water Framework Directive

1 INTRODUCTION

The project "*Environmental Protection of International River Basins*" (EPIRB), funded by the European Union (EU), encompasses a range of tasks and activities aiming at enhancing capacities of the Beneficiary Countries[1] in applying principles following the EU Water Framework Directive (WFD)[2]. Key areas addressed by the EPIRB project include:

1) Monitoring and assessment of the status of water bodies.
2) Preparation of pilot river basin management plans.

The ultimate objective of the WFD is achieving 'good status' in all water bodies. In case water bodies are (expected to be) not complying with this objective, then programmes of measures will have to be prepared and implemented in order to improve the conditions.

Assessing whether or not water bodies are of or will be of 'good status' implies an evaluation of available water quality & quantity data, often in combination with model-based approximations. Furthermore, scenarios for likely future developments may have to be developed.

However, what do you do if required data/information are or is not available? Since this question is indeed applicable to the project's Beneficiary Countries[3], the EPIRB project decided to supply further guidance. Recently, the draft document "*Guidance Document addressing hydromorphology and physico-chemistry for a Pressure-Impact Analysis/Risk Assessment according to the EU WFD*" has been issued [Vogel, 2014]. This document introduces, explains and shows, inter alia, principles of applying the DPSIR-framework (Driving forces, Pressures, State, Impact, Responses). Its focus though is on applying a Pressure – Impact analysis for assessing the risks of surface water bodies not achieving good ecological status, regarding hydromorphiological and general physico-chemical parameters. The following document extends on the scope of the aforementioned guidance document by addressing 'Chemical status' of surface water bodies. Here too, it concerns a 'living document', which will be updated throughout the EPIRB's project lifetime.

General principles of Pressure-Impact Analysis/Risk Assessment are not repeated here; readers are referred to [Vogel, 2014] for further details.

[1] Armenia (AM), Azerbaijan (AZ), Belarus (BY), Georgia (GE), Moldova (MD) and Ukraine (UA).

[2] DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2000 establishing a framework for Community action in the field of water policy

[3] ... who are not alone; to some extent, several EU Member States still face comparable challenges …

2 GOOD CHEMICAL STATUS OF SURFACE WATER BODIES

Achieving 'good status' in all water bodies can be considered as the ultimate objective of the WFD. For surface water bodies this means both:

- good *ecological* status, and
- good *chemical* status.

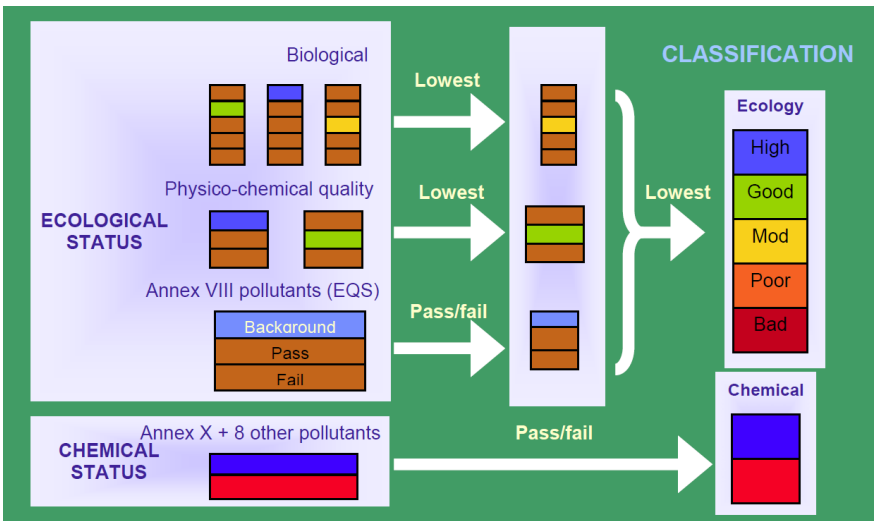

Figure 1 Classification of the status of surface water bodies under the WFD[4]

2.1 Chemical status

Determining the chemical status of surface waters bodies as such is quite straightforward. The Directive 2013/39/EU "*amending Directives 2000/60/EC and 2008/105/EC as regards Priority substances in the field of water policy*" prescribes the list with parameters to be taken into consideration, as well as their related environmental quality standards (EQS). The list with substances and EQSs of the Directive 2013/39/EU are included in Annex 1 of this document.

While the principles for assessing WFD's chemical status of surface waters are quite simple, this cannot be said about collecting actual field data for Priority substances. The chemical status of surface water bodies will finally have to be substantiated via monitoring data. The type of parameters, in combination with the often low concentrations of the EQSs, impose high demands on laboratories. Laboratory analysis of WFD's Priority substances requires modern equipment, up-to-date methods of analysis, a vast array of consumables and chemicals, and well-trained staff. In addition, these analyses are rather expensive.

[4] Copied from WFD Guidance Document No. 27: Technical Guidance For Deriving Environmental Quality Standards. https://circabc.europa.eu/sd/d/0cc3581b-5f65-4b6f-91c6-433a1e947838/TGD-EQS%20CIS-WFD%2027%20EC%202011.pdf

Currently, the availability of field data for Priority substances in the project's pilot river basins is limited, albeit varying from country to country. Thus, it will be virtually impossible to assess the chemical status of the surface water bodies on the basis of monitoring data either data obtained during special investigations.

However, applying the principles introduced in this document can give at least some indications whether certain surface water bodies/sub-basins might be prone to pollution with some of the Priority substances, implying a risk for not achieving good chemical status.

2.2 Priority (hazardous) substances, 'certain other pollutants' and even more pollutants …

After the WFD came into force in the year 2000, a preliminary list with 33 Priority (hazardous) substances was compiled in conjunction with Annex X of the WFD. These substances were included in the Directive 2008/105/EC "*on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council*", together with eight more 'certain other pollutants'. In addition, this Directive provided the EQSs for all the substances. The recently adopted Directive 2013/39/EU includes twelve more (groups of) substances; furthermore, some of the EQSs of the Directive 2008/105/EC have been adjusted.

The WFD Priority substances comprise a heterogenic group of micropollutants, both non-synthetic and synthetic substances.[5] Some features of the original group of 33 Priority (hazardous) substances are listed in Table 1. This table indicates already that one is not only dealing with a heterogenic group of substances, but also with a wide array of sources of pollution. Currently, so-called '*Substance source screening sheets*' are available for the 33 Priority substances listed in Table 1 (refer to Chapter 3 for further details.)

Table 1 Some key features of Priority (hazardous) substances[6]

Priority substance	Some key features
1) alachlor	herbicide
2) anthracene	PAH (see below); used in several industrial manufacturing
3) atrazine	herbicide
4) benzene	used i.a. in various chemical industries
5) brominated diphenylethers	predominantly used as flame retardants

[5] Non-synthetic substances can be present already due to natural conditions, for example metals and polyaromatic hydrocarbons (PAH). Many trace and heavy metals, such as copper and zinc, are actually crucial for proper functioning of many organisms, although only up to certain levels; in higher concentrations, such metals can start having toxic effects. Anthropogenic activities (pressures) can lead to concentrations in surface waters getting beyond natural background levels. Synthetic substances, such as 'biocides' (pesticides, herbicides, insecticides, fungicides, et cetera) , are man-made only and cannot exist from natural origin.

[6] Adopted from the Substance source screening sheets (refer to Chapter 3 for more details).

Priority substance	Some key features
6) cadmium	trace metal; by-product of the extraction, smelting and refining of other nonferrous metal ores; recovered from end of life Ni-Cd batteries.
7) C10-C13 chloroalkanes	used as a fire retardant and as a plasticiser
8) chlorfenvinphos	insecticide
9) chlorpyrifos	insecticide
10) 1,2-dichloroethane	predominantly used in polyvinyl chloride (PVC)-production
11) dichloromethane	used in various industries
12) di(2-ethylhexyl)phtalate (DEHP)	used as a plasticiser to make PVC and other plastics soft and flexible
13) diuron	herbicide
14) endosulfan	insecticide
15) fluoranthene	PAH (see below); no known commercial production or use; intermediate for production of fluorescent dyes, pharmaceuticals and agrochemicals
16) hexachlorobenzene (HCB)	by-product manufacturing chlorinated hydrocarbons/ solvents; impurity in pesticides; produced in combustion processes
17) hexachlorobutadiene (HCBD)	unintentional by-product from chlorinated hydrocarbon production, waste treatment and magnesium production
18) hexachlorocyclohexane (HCH)	insecticide
19) isoproturon	herbicide
20) lead	trace metal; used in a number of industrial processes and is contained in numerous products; leaded vehicle fuel
21) mercury	trace metal; multiple uses and sources
22) naphtalene	PAH (see below); used in chemical industry; used in production of creosote, repellents (moth balls), pyrotechnics, grinding wheels, tar paints and waterproof membranes;
23) nickel	trace metal; i.a. metallurgy
24) nonylphenols	production of modified phenolic resins and surfactants/ emulsifiers, used in various industries
25) octylphenols (OP)	majority of OP-based phenolic resins are used in rubber formation for the production of tyres
26) pentachlorobenzene	by-product of combustion processes and industrial processes; impurity in several biocides and pesticides;
27) pentachlorophenol (PCP)	insecticide, fungicide and herbicide
28) polyaromatic hydrocarbons, PAH	found in coal tars and creosote; used in products such as plastic or rubber handles of tools or in household materials and appliances; PAHs are primarily formed as by-products of incomplete combustion of carbon-containing fuels, including forest fires and volcanoes.
29) simazine	herbicide
30) tributyltin	antifoulant on underwater structures and ships; also used for wood conservation, as antiseptic or disinfectant, as a stabiliser in PVC, as a catalyst for chemical reactions and in glass coatings
31) trichlorobenzenes (TCB)	used intermediate for production of herbicides, pigments and dyes
32) trichloromethane (chloroform)	used in chemical manufacturing; by-product of production PVC products, use of chlorine as a disinfectant (e.g. drinking water and waste water treatment) or a bleach (e.g. pulp paper manufacture)
33) trifluralin	herbicide

3 SOURCE SCREENING

When specific data about pollution sources (Pressures) and/or surface water quality (State) are not available, then the "Substance source screening sheets" can be used in order to make at least preliminary assessments of risks for surface water bodies not achieving good chemical status.

Source screening is the first step of the approach elaborated in the "*Concept paper on the control of emissions, discharges and losses of Priority substances and priority hazardous substances in the framework of article 16 of Directive 2000/60/EC*" [EU, 2005].[7]

Priority substances (as well as other substances/pollutants) can be released to surface waters from multiple sources via several pathways, summarised in Figure 2 and Textbox 1 below.

Meanwhile, *Substance source screening sheets* have been prepared for the 33 Priority substances listed in Table 1 in Chapter 2.[8] An example of such a sheet in included in Annex 2 of the underlying document.

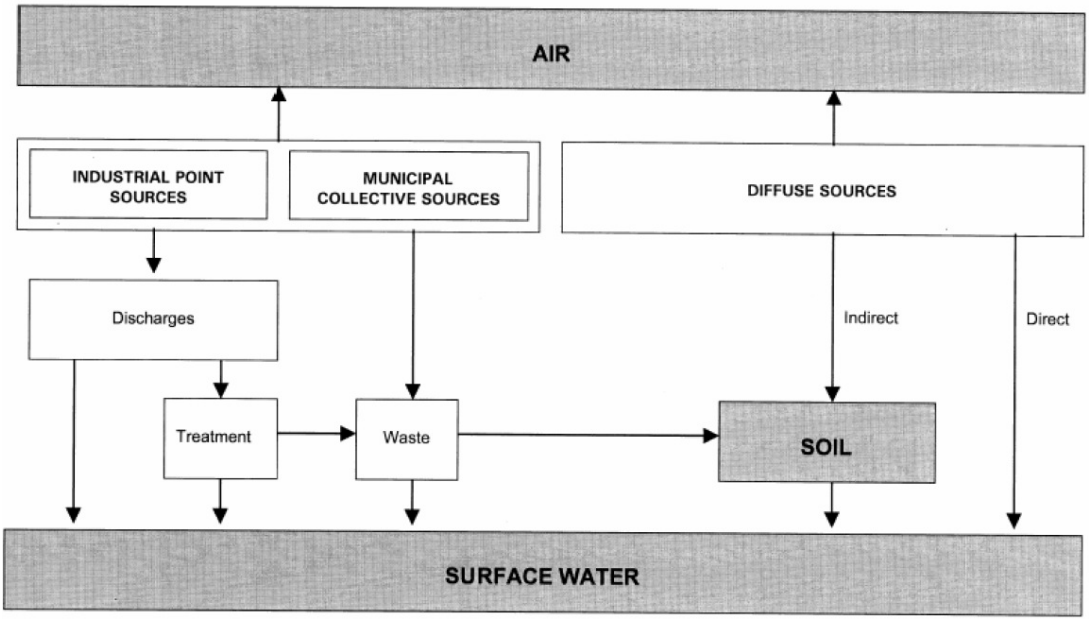

Figure 2 Point, municipal and diffuse sources with main pathways of release to environment [EU, 2005]

[7] This concept paper can be downloaded, for example, at http://www.helpdeskwater.nl/publish/pages/4543/conceptpaper-emissioncontrols.pdf

[8] Useful information about the WFD, including the *Substance source screening sheets*, can be retrieved from the EU CIRCABC (Communication and Information Resource Centre for Administrations, Businesses and Citizens) site at https://circabc.europa.eu via selecting the 'European Commission -> Environment -> WFD CIRCA: "Implementing the Water Framework Directive and the Floods Directive". Unfortunately, it takes quite a few mouseclicks in order to retrieve individual files. Therefore, the files with the currently available *Substance source screening sheets* will be sent to the beneficary countries separately.

Textbox 1: Sources and pathways of Priority (hazardous) substances [EU, 2005]

Losses to surface water by diffuse sources:
S1: Atmospheric deposition on the water surface
S2: Via Drainage and deep ground water
S3: Due to agricultural activities (via leaching, erosion, spills, direct drainage discharges)
S4: Due to transport and infrastructure without connection to collection sytems/sewers (ships, trains, automobiles and airplanes and their respective infrastructures outside the urban area)
S5: Accidental spills
S6: Release from materials and constructions in non urban area

Discharges to surface waters by point sources:
S7: Discharges in sewage effluents or storm water as a result of run off from buildings and constructions in paved urban area including run off from agricultural fields connected to sewer system
S8 Discharges in sewage effluents or storm water as a result of household, consumer use
S9: Due to industrial activities
S9.1: Small and medium enterprises (SME), direct or via sewage treatment plant (STP) (non-IPPC installations including run of from farm yards)
S9.2: Large industrial point sources, direct or via STP (IPPC installations)

S10: Solid waste management
S10.1 Landfills
S10.2 Incineration

S11: Historical pollution
S11.1 Historical pollution from sediments
S11.2 Historical pollution from contaminated land

S12: Natural sources

Emissions to atmosphere
A1 From agriculture and forestry
A2 From traffic and infrastructure
A3 From buildings
A4 From households and other consumer use
A5 From industry IPPC categories including municipal waste incineration
A6 From industry SME and other non-IPPC categories
A7 From waste disposal/treatment areas (landfill and others)
A8 From contaminated land (historical pollution)
A9 From other sources

4 ASSESSING RISKS FOR NOT ACHIEVING GOOD CHEMICAL STATUS

Risk assessment is part of the Pressure-Impact analysis prescribed by the WFD (refer also to [Vogel, 2014]). More specifically, it concerns an assessment of the risks for not achieving the objectives, which in the current document concerns 'good chemical status' of surface water bodies.

Presently, data available for Priority substances regarding "Pressures" (pollution sources) and/or "State" (actual surface water quality) are limited for most of the project's pilot basins.

Fortunately, the *Substance source screening sheets* contain indications for possible risks. The sheets distinguish the following three categories (refer also to the example in Annex 2):

Category 1: source/pathway **may result in or contribute to potential failure of WFD objectives**.

Category 2: **not enough quantitative information available to allow classification in category 1 or 3**; source/pathway will be reviewed as more data becomes available.

Category 3: no potential release from source/pathway or source/pathway **does not contribute to potential failure of WFD objectives**.

The Categories 1 and 3 are directly linked with potential failure of WFD objectives, in this case involving the 'chemical status' component of the overall good status objective for surface waters (Chapter 2). Therefore, the available *Substance source screening sheets* can be used for getting indications whether or not surface water bodies might be at risk of not achieving good chemical status.

The more surface water bodies (either sub-basins) share features described under Category 1 for one or more Priority substances, the higher the likelihood that there is a potential risk for surface waters not being of good chemical status. Vice versa, in case the characteristics of the water bodies/subbasins more resemble the features of Category 3, then risks of surface waters not being of good chemical status are less likely.

The following steps can be undertaken as part of the preliminary assessment of risks for not achieving 'good chemical status'.

1) Examine and evaluate existing monitoring and field data available for the Priority substances.
    a. All project's beneficiary countries should try to collect and analyse already available surface water data for at least some of the Priority substances. It will be very useful to compare these data with the limits mentioned in Annex 1, both the Annual Average (AA-EQS) as well as the Maximum Allowable (MAC-EQS) for fresh surface water bodies.
2) Examine the *Substance source screening sheets* and apply their principles to pilot basins.
    a. Admittedly, the *Substance source screening sheets* might look a bit intimidating in the beginning. However, the more sheets one has studied, the better the contents can be applied.
    b. It is important to underline that the *Substance source screening sheets* are put in a European Union's perspective. Frequently, it is mentioned that the use and/or

emissions of certain Priority substances has been reduced or stopped as the results of implementing specific EU Directives. Of course, most of those specific EU environmental policies have not been implemented yet in the project's beneficiary countries.

c. In the "Sources/pathways" table, the columns of key interest are Category 1 and Category 3. The "Justification of classification" section contains useful narrative descriptions for further interpretation of the "Sources/pathways" table.
d. Some Priority substances are quite specific e.g. for certain industrial manufacturing or uses. Implying that related risks will low in the absence of such manufacturing and uses.
e. The category "*S9.2 Large industrial point sources, direct or via STP (IPPC installations)*" generally concerns quite sizeable enterprises. Interested readers might want to examine for example Annex 1 of the Integrated Pollution Prevention and Control (IPPC) Directive 2008/1/EC.[9] Often, it concerns enterprises having their own sewage (wastewater) treatment plant (STP) discharging directly into surface water bodies. This is contrary to most small and medium-sized enterprises (SME) that normally will discharge their wastewater (whether or not with pre-treatment) into the combined municipal sewage system.
f. It is important to take possible transboundary dimensions into account as well, even though information might be limited. For example, the Romanian tributary Jijiu (transporting i.a. the wastewater of the city of Iaşi) is a significant source of pollution of the Prut River.

Textbox 2: Possible sources of data and information

Below are some examples of possible sources of data and information that could be consulted during an inventory for sources of Priority substances.

1) *Registers with industries and industrial production*. All countries have in some way or another registers containing industries, often in conjunction with discharge permits, for example as part of the Water Cadastre. Environmental Inspectorates or equivalent organisations contain normally such registers. Most likely, such registers contain information about e.g. the category "*S9.2 Large industrial point sources*". An overview of industries, including their core production, would be part of the basin characterization anyway.
2) *Registers with use, sales and/or import of 'biocides'*. It will be worth investigating whether registers for use, sales and/or import of 'biocides' are available and accessible. Besides organisations under the Ministry of Agriculture, for example Statistical Agencies might collate such information.
3) *Registers with use, sales and/or import of other chemicals*. In addition to 'biocides', it will be worth investigating whether similar registers exist for other chemicals that can be

[9] DIRECTIVE 2008/1/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 January 2008 concerning integrated pollution prevention and control can be downloaded at: http://faolex.fao.org/docs/pdf/eur76897.pdf

linked to Priorirty substances.

4) *Reports prepared during projects.* Probably, in all beneficiary countries national and international studies and projects have been conducted whose themes and topics can be related to certain Priority substances as well, like for example studies dealing with persistent organic pollutants (POPs). Such reports might give pointers about the presence, use and/or production of some of the Priority substances.

It will be useful considering to use the coming Joint Field Survey II for testing the outcome of the preliminary risk assessment by taking water (and preferably also sediment) samples to be analysed for Priority substances. Of course, the range of substances that can actually be determined will depend on the analysis' capacity of the laboratories involved.

In Chapter 1 it was already mentioned that this is a 'living document', to be updated throughout the EPIRB's project lifetime. Anticipating the EPRIB's workshop scheduled for 16 – 17 June 2014 in Batumi (Georgia), the Beneficiary Countries are invited to applying the available *Source substance source screening sheets* to their pilot river basins. The collected experiences can be discussed during the meeting in June 2014, possibly resulting in an update of the present document.

References

EU (2005) Concept paper on the control of emissions, discharges and losses of Priority substances and priority hazardous substances in the framework of article 16 of Directive 2000/60/EC. http://www.helpdeskwater.nl/publish/pages/4543/conceptpaper-emissioncontrols.pdf

Vogel, Birgit (2014) Guidance Document addressing hydromorphology and physico-chemistry for a Pressure-Impact Analysis/Risk Assessment according to the EU WFD. *EPIRB project document, May 2014.*

Annex 1 Environmental Quality Standards for Priority Substances and certain other Pollutants

The table below contains the Environmental Quality Standards for Priority Substances and certain other Pollutants included in Annex II of the DIRECTIVE 2013/39/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 August 2013 *amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy*.

The water EQS laid down in this Annex are expressed as total concentrations in the whole water sample.

In the case of cadmium, lead, mercury and nickel (hereinafter "metals"), the water EQS refer to the dissolved concentration, i.e. the dissolved phase of a water sample obtained by filtration through a 0,45 µm filter or any equivalent pre-treatment, or, where specifically indicated, to the bioavailable concentration.

Member States may, when assessing the monitoring results against the relevant EQS, take into account: (a) natural background concentrations for metals and their compounds where such concentrations prevent compliance with the relevant EQS; (b) hardness, pH, dissolved organic carbon or other water quality parameters that affect the bioavailability of metals, the bioavailable concentrations being determined using appropriate bioavailability modelling.';

ANNEX II

'ANNEX I

ENVIRONMENTAL QUALITY STANDARDS FOR PRIORITY SUBSTANCES AND CERTAIN OTHER POLLUTANTS

PART A: ENVIRONMENTAL QUALITY STANDARDS (EQS)

AA: annual average.

MAC: maximum allowable concentration.

Unit: [µg/l] for columns (4) to (7)

[µg/kg wet weight] for column (8)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No	**Name of substance**	**CAS number** [1]	**AA-EQS** [2] **Inland surface waters** ([3])	**AA-EQS** [2] **Other surface waters**	**MAC-EQS** [4] **Inland surface waters** ([3])	**MAC-EQS** [4] **Other surface waters**	**EQS Biota** [12]
(1)	Alachlor	15972-60-8	0.3	0.3	0.7	0.7	
(2)	Anthracene	120-12-7	0.1	0.1	0.1	0.1	
(3)	Atrazine	1912-24-9	0.6	0.6	2.0	2.0	
(4)	Benzene	71-43-2	10	8	50	50	
(5)	Brominated diphenylethers ([5])	32534-81-9			0.14	0.014	0.0085
(6)	Cadmium and its compounds (depending on water hardness	7440-43-9	≤ 0.08 (Class 1)	0.2	≤ 0.45 (Class 1)	≤ 0.45 (Class 1)	

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No	**Name of substance**	**CAS number [1]**	**AA-EQS [2] Inland surface waters ([3])**	**AA-EQS [2] Other surface waters**	**MAC-EQS [4] Inland surface waters ([3])**	**MAC-EQS [4] Other surface waters**	**EQS Biota [12]**
	classes) ([6])		0.08 (Class 2) 0.09 (Class 3) 0.15 (Class 4) 0.25 (Class 5)		0.45 (Class 2) 0.6 (Class 3) 0.9 (Class 4) 1.5 (Class 5)	0.45 (Class 2) 0.6 (Class 3) 0.9 (Class 4) 1.5 (Class 5)	
(6a)	Carbontetrachloride ([7])	56-23-5	12	12	not applicable	not applicable	
(7)	C10-13 Chloroalkanes ([8])	85535-84-8	0.4	0.4	1.4	1.4	
(8)	Chlorfenvinphos	470-90-6	0.1	0.1	0.3	0.3	
(9)	Chlorpyrifos (Chlorpyrifos- ethyl)	2921-88-2	0.03	0.03	0.1	0.1	
(9a)	Cyclodiene pesticides: Aldrin ([7]) Dieldrin ([7]) Endrin ([7]) Isodrin ([7])	309-00-2 60-57-1 72-20-8 465-73-6	Σ = 0.01	Σ = 0.005	not applicable	not applicable	
(9b)	DDT total ([7]), ([9])	not applicable	0.025	0.025	not applicable	not applicable	
	para-para-DDT ([7])	50-29-3	0.01	0.01	not applicable	not applicable	
(10)	1,2-Dichloroethane	107-06-2	10	10	not applicable	not applicable	
(11)	Dichloromethane	75-09-2	20	20	not applicable	not applicable	
(12)	Di(2- ethylhexyl)- phthalate (DEHP)	117-81-7	1.3	1.3	not applicable	not applicable	
(13)	Diuron	330-54-1	0.2	0.2	1.8	1.8	
(14)	Endosulfan	115-29-7	0.005	0.0005	0.01	0.004	
(15)	Fluoranthene	206-44-0	0.0063	0.0063	0.12	0.12	30
(16)	Hexachlorobenzene	118-74-1			0.05	0.05	10
(17)	Hexachlorobutadiene	87-68-3			0.6	0.6	55
(18)	Hexachlorocyclohexane	608-73-1	0.02	0.002	0.04	0.02	
(19)	Isoproturon	34123-59-6	0.3	0.3	1.0	1.0	
(20)	Lead and its compounds	7439-92-1	1.2 [13]	1.3	14	14	
(21)	Mercury and its compounds	7439-97-6			0.07	0.07	20
(22)	Naphthalene	91-20-3	2	2	130	130	
(23)	Nickel and its compounds	7440-02-0	4 [13]	8.6	34	34	
(24)	Nonylphenols (4-Nonylphenol)	84852-15-3	0.3	0.3	2.0	2.0	
(25)	Octylphenols ((4-(1,1',3,3'-tetramethylbutyl)-phenol))	140-66-9	0.1	0.01	not applicable	not applicable	
(26)	Pentachlorobenzene	608-93-5	0.007	0.0007	not	not	

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No	**Name of substance**	**CAS number** [1]	**AA-EQS** [2] **Inland surface waters** ([3])	**AA-EQS** [2] **Other surface waters**	**MAC-EQS** [4] **Inland surface waters** ([3])	**MAC-EQS** [4] **Other surface waters**	**EQS Biota** [12]
					applicable	applicable	
(27)	Pentachlorophenol	87-86-5	0.4	0.4	1	1	
(28)	Polyaromatic hydrocarbons (PAH) ([11])	not applicable	not applicable	not applicable	not applicable	not applicable	
	Benzo(a)pyrene	50-32-8	1.7×10^{-4}	1.7×10^{-4}	0.27	0.027	5
	Benzo(b)fluoranthene	205-99-2	see footnote 11	see footnote 11	0.017	0.017	see footnote 11
	Benzo(k)fluoranthene	207-08-9	see footnote 11	see footnote 11	0.017	0.017	see footnote 11
	Benzo(g,h,i)perylene	191-24-2	see footnote 11	see footnote 11	8.2×10^{-3}	8.2×10^{-4}	see footnote 11
	Indeno(1,2,3- cd)pyrene	193-39-5	see footnote 11	see footnote 11	not applicable	not applicable	see footnote 11
(29)	Simazine	122-34-9	1	1	4	4	
(29a)	Tetrachloroethylene ([7])	127-18-4	10	10	not applicable	not applicable	
(29b)	Trichloroethylene ([7])	79-01-6	10	10	not applicable	not applicable	
(30)	Tributyltin compounds (Tributyltin- cation)	36643-28-4	0.0002	0.0002	0.0015	0.0015	
(31)	Trichlorobenzenes	12002-48-1	0.4	0.4	not applicable	not applicable	
(32)	Trichloromethane	67-66-3	2.5	2.5	not applicable	not applicable	
(33)	Trifluralin	1582-09-8	0.03	0.03	not applicable	not applicable	
(34)	Dicofol	115-32-2	1.3×10^{-3}	3.2×10^{-5}	not applicable [10]	not applicable [10]	33
(35)	Perfluorooctane sulfonic acid and its derivatives (PFOS)	1763-23-1	6.5×10^{-4}	1.3×10^{-4}	36	7.2	9.1
(36)	Quinoxyfen	124495-18-7	0.15	0.015	2.7	0.54	
(37)	Dioxins and dioxin-like compounds	See footnote 10 in Annex X to Directive 2000/60/EC			not applicable	not applicable	Sum of PCDD+PCDF+PCB-DL 0.0065 µg.kg^{-1} TEQ ([14])
(38)	Aclonifen	74070-46-5	0.12	0.012	0.12	0.012	
(39)	Bifenox	42576-02-3	0.012	0.0012	0.04	0.004	

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No	**Name of substance**	**CAS number [1]**	**AA-EQS [2] Inland surface waters ([3])**	**AA-EQS [2] Other surface waters**	**MAC-EQS [4] Inland surface waters ([3])**	**MAC-EQS [4] Other surface waters**	**EQS Biota [12]**
(40)	Cybutryne	28159-98-0	0.0025	0.0025	0.016	0.016	
(41)	Cypermethrin	52315-07-8	8×10^{-5}	8×10^{-6}	6×10^{-4}	6×10^{-5}	
(42)	Dichlorvos	62-73-7	6×10^{-4}	6×10^{-5}	7×10^{-4}	7×10^{-5}	
(43)	Hexabromocyclododecane (HBCDD)	See footnote 12 in Annex X to Directive 2000/60/EC	0.0016	0.0008	0.5	0.05	167
(44)	Heptachlor and heptachlor epoxide	76-44-8/1024-57-3	2×10^{-7}	1×10^{-8}	3×10^{-4}	3×10^{-5}	6.7×10^{-3}
(45)	Terbutryn	886-50-0	0.065	0.0065	0.34	0.034	

([1]) CAS: Chemical Abstracts Service.

([2]) This parameter is the EQS expressed as an annual average value (AA-EQS). Unless otherwise specified, it applies to the total concentration of all isomers.

([3]) Inland surface waters encompass rivers and lakes and related artificial or heavily modified water bodies.

([4]) This parameter is the EQS expressed as a maximum allowable concentration (MAC-EQS). Where the MAC-EQS are marked as "not applicable", the AA-EQS values are considered protective against short-term pollution peaks in continuous discharges since they are significantly lower than the values derived on the basis of acute toxicity.

([5]) For the group of priority substances covered by brominated diphenylethers (No 5), the EQS refers to the sum of the concentrations of congener numbers 28, 47, 99, 100, 153 and 154.

([6]) For Cadmium and its compounds (No 6) the EQS values vary depending on the hardness of the water as specified in five class categories (Class 1: < 40 mg $CaCO_3$/l, Class 2: 40 to < 50 mg $CaCO_3$/l, Class 3: 50 to < 100 mg $CaCO_3$/l, Class 4: 100 to < 200 mg $CaCO_3$/l and Class 5: ≥ 200 mg $CaCO_3$/l).

([7]) This substance is not a priority substance but one of the other pollutants for which the EQS are identical to those laid down in the legislation that applied prior to 13 January 2009.

([8]) No indicative parameter is provided for this group of substances. The indicative parameter(s) must be defined through the analytical method.

([9]) DDT total comprises the sum of the isomers 1,1,1-trichloro-2,2 bis (p-chlorophenyl) ethane (CAS number 50-29-3; EU number 200-024-3); 1,1,1-trichloro-2 (o-chlorophenyl)-2-(p-chlorophenyl) ethane (CAS number 789-02-6; EU Number 212-332-5); 1,1-dichloro-2,2 bis (p-chlorophenyl) ethylene (CAS number 72-55-9; EU Number 200-784-6); and 1,1-dichloro-2,2 bis (p-chlorophenyl) ethane (CAS number 72-54-8; EU Number 200-783-0). [10]

([10]) There is insufficient information available to set a MAC-EQS for these substances.

([11]) For the group of priority substances of polyaromatic hydrocarbons (PAH) (No 28), the biota EQS and corresponding AA-EQS in water refer to the concentration of benzo(a)pyrene, on the toxicity of which they are based. Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene needs to be monitored for comparison with the biota EQS or the corresponding AA- EQS in water.

([12]) Unless otherwise indicated, the biota EQS relate to fish. An alternative biota taxon, or another matrix, may be monitored instead, as long as the EQS applied provides an equivalent level of protection. For substances numbered 15 (Fluoranthene) and 28 (PAHs), the biota EQS refers to crustaceans and molluscs. For the purpose of assessing chemical status, monitoring of Fluoranthene and PAHs in fish is not appropriate. For substance number 37 (Dioxins and dioxin-like compounds), the biota EQS relates to fish, crustaceans and molluscs, in line with section 5.3 of the Annex to Commission Regulation (EU) No 1259/2011 of 2 December 2011 amending Regulation (EC) No 1881/2006 as regards maximum levels for dioxins, dioxin-like PCBs and non-dioxin-like PCBs in foodstuffs (OJ L 320, 3.12.2011, p. 18).

[10] Author' additions: CAS number 50-29-3: 4,4'-DDT (p,p'-DDT); CAS number 789-02-6: 2,4'-DDT (o,p'-DDT); CAS number 72-55-9: 4,4'-DDE (p,p'-DDE); CAS number 72-54-8: 4,4'-DDD (p,p'-DDD)

([13]) These EQS refer to bioavailable concentrations of the substances.

([14]) PCDD: polychlorinated dibenzo-p-dioxins; PCDF: polychlorinated dibenzofurans; PCB-DL: dioxin-like polychlorinated biphenyls; TEQ: toxic equivalents according to the World Health Organisation 2005 Toxic Equivalence Factors.'

Annex 2 Source screening sheet: anthracene

Revised source screening of Priority substances under the WFD

Results for (2) Anthracene (priority hazardous substance)

Version: **2.1**

Date: **September 2010**

Comments on version 1 received from: DE. Sheet also amended to take account of E-PRTR (2008) data

(Comments have been put on the CIRCA website)

The ***Concept paper on the control of emissions, discharges and losses of Priority substances and priority hazardous substances in the framework of article 16 of Directive 2000/60/EC*** (August 2005) outlines the steps needed to identify the relevant measures for emission controls for Priority substances. ***Source screening*** is the first step. For substances identified as PS or PHS in the first list of Priority substances, source screening sheets were agreed in 2004 based on information in draft fact sheets produced by Haskoning (available on CIRCA) supplemented by other information and expert judgement, The process took into account the results of the consultation with the Expert Advisory Forum on Priority substances. General details on the classification system applied can be found in the concept paper and can be summarised as follows:

- Category 1: source/pathway may result in or contribute to potential failure of WFD objectives
- Category 2: Not enough quantitative information available to allow classification in category 1 or 3; source/pathway will be reviewed as more date become available
- Category 3: no potential release from source/pathway or source/pathway does not contribute to potential failure of WFD objectives.

This revised sheet takes account of more recent information from the sources in the reference list.

Summary of production and uses

Anthracene is produced from anthracene oil by crystallisation and vacuum distillation. Anthracene oil in turn is produced from coal tar by distillation (ECHA 2008). There are currently two manufacturers of anthracene in the EU located in German and the Czech Republic. Combined production is less than 5000 t/y (ECHA 2009). There are no known imports of anthracene to the EU (ECB 2008).

The main use of anthracene in the EU is believed to be the manufacture of pyrotechnic products, primarily for use in the film industry and theatre. Anthracene may also be used as a base material for the production of anthraquinone dyes, as a catalyst in the production of wood pulp, as an intermediate in the manufacturing of paints and plastics and as a bird repellent on seeds (ECHA 2008; OSPAR 2008). There is no clear data on the proportion of anthracene used for these purposes. There are several other products that contain anthracene as part of complex mixtures including coal tar, coal tar distillation products, products containing coal tar (e.g. paints, waterproof membranes etc.)

and creosote. Anthracene may also be emitted as a result of the incomplete combustion of fossil fuels and wood (ECHA 2008) and as a result of the offshore production of petroleum (ECB 2008).

The use of creosote as a wood preservative is severely restricted by Commission Regulation EC/552/2009.

Source/pathway	**Category 1**	**Category 2**	**Category 3**
Losses to surface waters by diffuse sources			
***S1** Atmospheric deposition on the water surface*	X		
***S2** Via drainage and deep ground water*		X	
***S3** Due to agricultural, forestry and aquacultural activities (via leaching, erosion, direct drainage discharges)*			X
***S4** Due to transport and infrastructure without connection to canalisation (ships, trains, automobiles and airplanes and their respective infrastructures and maintenance outside the urban area)*		X	
***S5** Accidental spills*	X		
***S6** Release from materials and constructions in non-sewered areas*	X		
Discharge to surface waters by point sources			
***S7** Discharges in sewage effluents or storm water as a result of run off buildings and constructions in paved urban areas (including run off from agricultural fields connected to sewer system)*	X		
***S8** Discharges in sewage effluents or storm water as a result of to households, consumer use*	X		
***S9** Due to industrial activities*			
***S9.1** Small and medium enterprises (SME), direct or via STP (non- IPPC installations, including discharges from farmyards and aquacultural activities)* Pyrotechnic manufacture	X		
***S9.2** Large industrial point sources, direct or via STP (IPPC installations)*			
➢ *Mainly production of creosote*			X
➢ *Metallurgical chemical or electrolytic production of non ferrous metals*	X		
➢ *Prodution of phosphorus, nitrogen or potassium based fertilisers*	X		
➢ *Thermal power stations and other combustion installations*	X		
S10 Solid waste management			
***S10.1** Landfills*		X	
***S10.2** Incineration*		X	
Losses from historically contaminated sediments and soils			
***S11.1** Losses from the historical pollution of sediments*	X		
***S11.2** Losses from the historical pollution of contaminated land*		X	
Emissions to atmosphere			
A1 *From agriculture, forestry, and aquaculture*		X	
***A2** From traffic and infrastructure*		X	
***A3** From buildings*			X
***A4** From households and other consumer use*		X	
***A5** From industry IPPC categories*		X	
***A6** From industry SME and other non IPPC categories*			X
***A7** From waste disposal/treatment areas (land fill and others)*			X
***A8** From contaminated land (historical pollution)*			X
***A9** From other sources*			

Source/pathway	Category 1	Category 2	Category 3
Natural emissions			
N1 Forest fires		X	

Data availability and uncertainties:

The screening is partly based on quantitative information, in particular for releases to water. More quantitative information is now available than in 2007 and therefore this assessment has been updated to reflect that. No relevant quantitative data are available on atmospheric deposition and this remains an area of uncertainty. Data on the emissions to water from pyrotechnic manufacture are not available. The use of creosote is expected to reduce, however diffuse emissions from previously treated wood could be expected to continue.

Justification for classification:

General

Available quantitative information on sources and pathways to surface waters forms the justification for the classifications. For emissions to air, the picture for PAH in general has been translated to anthracene, where emissions to air and consequent atmospheric deposition are considered to be of less importance for anthracene than for PAHs in general.

S1 ECHA (2008) reports that anthracene has a short half-life in air (3.4 hours) and readily volatilises from water. Therefore it could be concluded that atmospheric deposition is unlikely to cause failure of WFD objectives. However, ECB (2008) states that anthracene slowly volatilises from water and therefore it is possible that atmospheric deposition could contribute to the failure of a WFD objectives. Based on estimates for Germany, the fraction of direct atmospheric deposition amounts to 16% of all PAC-16 emissions to surface water.

S4 Anthracene emissions from land based transportation will result from the incomplete combustion of fossil fuels and will therefore be to atmosphere and will be counted under A2. Any discharges of un-burnt fuel is accounted for under S5. However, outboard motors on sports boats cause direct emissions to water. Estimates for Germany are approximately 1.2 PAC 16 per year. This estimate has a very high uncertainty because it is based on few measurements. More information is required to assess the impact of this sources, therefore classification amended to Category 2.

S5 Includes accidental discharges of oil.

S6/S7/S8→ Use of creosote is considered to be an important source of anthracene releases. Some marketing and use restrictions are rather recently strengthened so for the time being still considered to be major. Anthracene has a high potential to adsorb to organic solids and as a result is likely to be removed from effluent in sewage treatment (but will be present in sludge). This is supported by EPRTR (2007) and E-PRTR (2008) where anthracene emissions are reported from only 2 and 3 waste water treatment works respectively.

S9.1 → The production of pyrotechnics are not subject to control under the IPPC Directive and therefore could potentially contribute to a failure in WFD objectives.

S9.2 E-PRTR (2007) reports that 2.11 t/y of anthracene are discharged to water from IPPC facilities. Of this, 2.02 t/y originates from one aluminium manufacturing plant in Sweden. 67 kg/y were discharged from 20 thermal power stations and other combustion plants. The remaining 23

kg/y are discharged by 14 other installations. This indicates that the implementation of the IPPC Directive is sufficient to ensure the achievement of WFD objectives from large industrial sources. E-PRTR (2008) reports total discharges from 24 IPPC installations of 1.17 t/y. Of this the largest emitter continues to be the aluminium plant in Sweden although the emission has reduced to 617 kg/y. 150 kg/y were discharged from 16 thermal power stations and other combustion installations. There was one other large emission of 387 kg/y from one installation for the production of fertilizers in Bulgaria. The remaining 16 kg/y were emitted from 6 other installations. Anthracene is a priority hazardous substance, therefore all emissions are Category 1.

S10/S11.2 Anthracene adsorbs strongly to solids and is therefore unlikely to be a component of landfill leachate. Further evidence required to confirm.

S11.1 Anthracene adsorbs strongly to sediment and therefore this could result in a failure of the WFD's objectives.

A1/A2/A5→ From the combustion of fossil fuels (See also S1)

A4 → The use of creosote as a wood preservative is severely restricted by Commission Regulation EX/522/2009. Germany reports that domestic burning, especially wood ovens, causes the largest fraction of diffuse emissions of PACs to atmosphere. More information required therefore classification as category 2.

A3/A6 → are minor sources in relation to emissions to air and are considered not to contribute to potential failure of WFD objective.

A7 → E-PRTR (2007) shows that landfills do not to contribute to atmospheric emissions of anthracene. This finding is supported by E-PRTR (2008).

N1 → Recent events have confirmed that forest fires incidentally are a source of concern for PAH's emissions to air. (See also S1)

References:

- Haskoning factsheet on anthracene
- Source screening sheet on PAH and fluoranthene
- HARP-HAZ prototype/Progress report to 5th North Sea Ministerial Conference
- OSPAR background document on PAH (June 2001)
- EU Environmental RAR (Risk Assessment Report), ***Anthracene***. Draft of June 2003.
- Presence and movement of dangerous substances in hydrosphere in CZ, CHMI, 2000-2002.
- Information from Spain in the Spanish comments (17 May 2004) on the source screening sheet version 3
- E-PRTR (2007)
- E-PRTR (2008)
- ECHA (2008) REACH Annex XV Dossier - Proposal for identification of a substance as a
    - CMR cat 1 or 2, PBT, vPvB or a substance of equivalent concern (Anthracene)
- ECHA (2009) Prioritisation and Annex XV Background Information – Anthracene
- OSPAR Commission (2008) Towards the cessation target: Emissions, discharges and losses of OSPAR chemicals identified for priority action.
- ECB (2008) European Union Risk Assessment Report – Anthracene Final Report