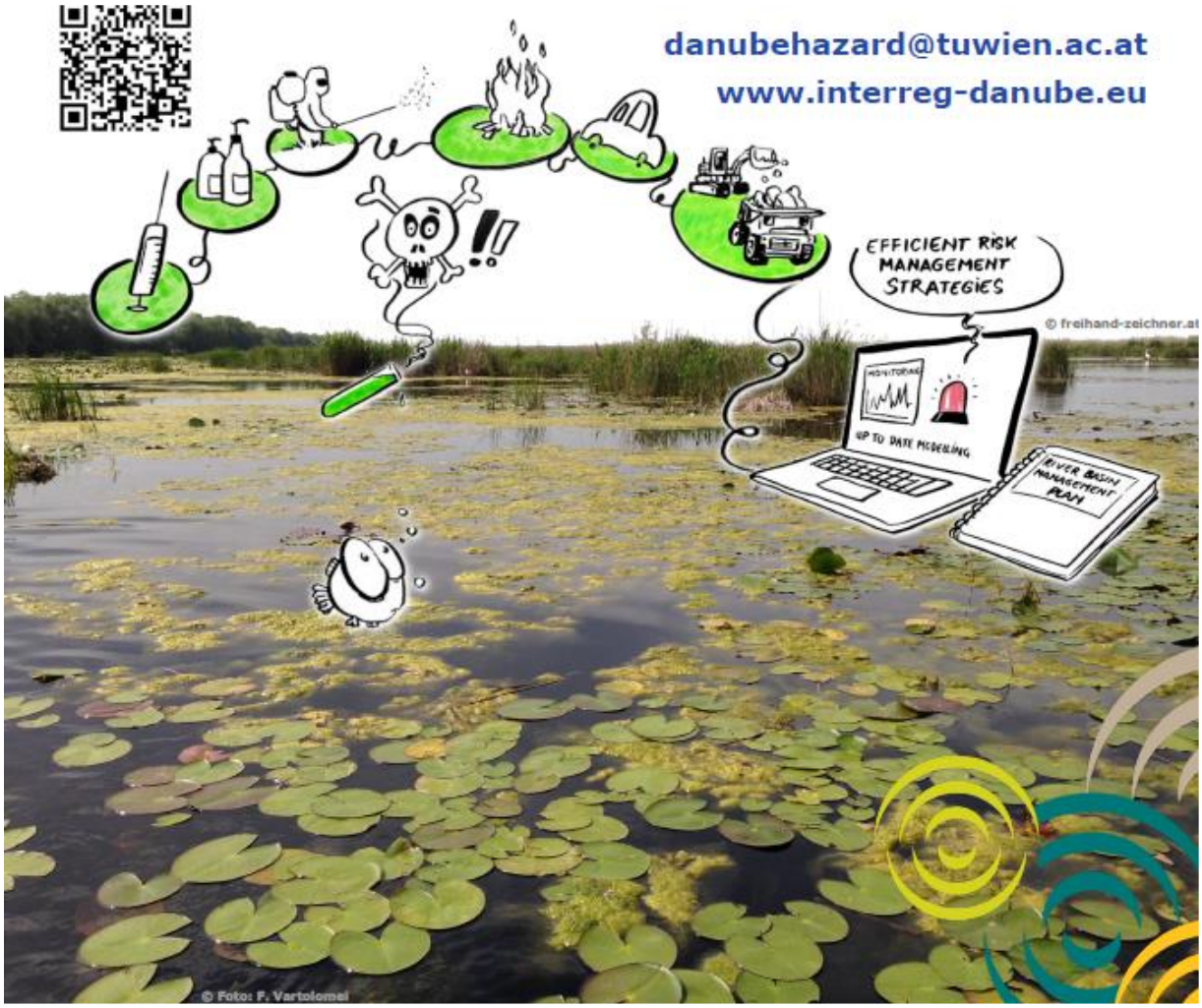

Output T3.1

REPORT

CRITICAL REVIEW OF CURRENT NATIONAL POLICIES REGARDING HAZARDOUS SUBSTANCES WATER POLLUTION IN THE DANUBE RIVER BASIN

Updated version

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Programme co-funded by the European Union funds (ERDF, IPA, ENI)

PROJECT TITLE: Tackling hazardous substances pollution in the Danube River Basin by Measuring, Modelling-based Management and Capacity building

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ABBREVIATIONS FOR ORGANIZATIONS AND TERMS

AA-EQS	Annual average Environmental Quality Standards
BATs	Best available technique
CIS	Common Implementation Strategy
CSO	Combined sewer overflows
DRB	Danube River Basin
EEA	European Environment Agency
EPA	Environment Protection Agency
EQS	Environmental Quality Standards
GQS	Ground Water Quality Standards
GWB	Ground Water Body
HS	Hazardous substances
ICPDR	International Commission for the Protection of the Danube River)
IED	Industrial Emissions Directive
IPPC/IED	Integrated pollution prevention and control /Industrial Emissions Directive
LOQ	Limit of Quantification
MAC-EQS	Maximum allowable concentration Environmental Quality Standards
NAP	National Action Plan
NIP	National Implementation Plan
PAH	Polycyclic aromatic hydrocarbons
PE	Population Equivalent
POP	Persistent Organic Pollutants
PPP	Plant Protection Products
PRTR	Pollutant Release and Transfer Register
PS	Priority substance
RBMP	River Basin Management Plan
SHS	Specific Hazardous Substance
SN	Sewer network
SoE	State of the Environment
SWB	Surface Water Bodies
TNMN	Danube Transnational Monitoring Network
TV	Threshold Value
UWWTD	Urban Wastewater Treatment Directive
WWTP	Wastewater treatment plant
WFD	Water Framework Directive

Countries short names

AT	Austria	**MD**	Moldova
BG	Bulgaria	**RO**	Romania
DE	Germany	**SI**	Slovenia
HR	Croatia	**SK**	Slovakia
HU	Hungary	**SR**	Serbia
ME	Monte Negro	**UA**	Ukraine

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EXECUTIVE SUMMARY

This report is prepared within the activities of the INTERREG project "Tackling hazardous substances pollution in the Danube River Basin by Measuring, Modelling-based Management and Capacity building" shortly named **Danube Hazard m3c**.

It presents a critical review of the currently existing national policies of twelve countries in the Danube River Basin (DRB) for management of water pollution by hazardous substances and their compliance with the key EU legislative acts in the field. These countries are Austria, Bulgaria, Croatia, Germany, Hungary, Moldova, Montenegro, Romania, Serbia, Slovenia, Slovakia, and Ukraine. They cover over 85% of the territory of the DRB and more than 80% of the population in the basin. Based on the analyses have been identified areas for policy improvement and/or harmonization and recommendations have been provided accordingly.

The report is organized in 8 chapters, as six of them present analysis of specific policy field i.e., relevant EU legislative framework and Danube River Basin policies; national policies' frameworks; monitoring and control of hazardous substances in point source emitters (industries and urban wastewater discharges) and in diffuse emitters with a focus on agricultural application of plant protection products. Used analytical methods and their respective limits of quantification (LOQ) for the priority substances and some commonly monitored other specific substances have also been analyzed. Concise but comprehensive information is provided about the existing national registers and databases with links where they can be either accessed or more precise information (by the hosting institution) received. Last but not least, chapter 7 provides a review of the developed inventories of priority substances emissions, discharges and losses.

Based on the provided analyses 8 areas for policy improvement have been identified that can be summarized as follows:

- Enhancement of the relevant EU legislation, in particular overcoming the current fragmented approach and provision of specific rules for control of hazardous substances in urban wastewater discharges.
- Need for higher level harmonization among the DRB countries concerning
  - the regulatory control of specific non-priority hazardous substances and the respective environment quality standards for water bodies
  - the number of hazardous substances and the respective emission standards for industrial wastewater discharges.
  - the monitoring of hazardous substances in the Wastewater treatment plants (WWTPs') discharges and evaluation of the contribution of combined sewer overflows (CSO).
  - the determination of the pollution fees for discharge of hazardous substances.
  - the used analytical methods

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- Improvement of the inventory process towards enhancing the quality of the self-monitored data; application of the pathway-oriented approach for estimation of diffuse emissions; harmonization of data series for transboundary sub basins and consideration of the accumulation of hazardous substances in sediment and biota, as well as in groundwater.
- Improving the format and public accessibility of the existing data basis

The report includes data and analyzes of the policy framework of Ukraine provided before the beginning of the war by the project partner – the Ukrainian Hydrometeorological Institute State Service on Emergencies and National Academy of Sciences. Some of this data may no longer be up to date, but the authors have decided to keep them in this report with respect for the work and dedication of the colleagues who prepared them (personally to Ms. Natalia Osadcha).

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HOW TO READ THIS REPORT

The report deals with both immission and emission policies for management of hazardous substances (HS) in water and is organized in the following chapters:

- ***Chapter 1: INTRODUCTION*** presents the objectives of the report, the participating countries, and the organization of the content.
- ***Chapter 2: EU LEGISLATIVE FRAMEWORK AND DANUBE RIVER BASIN WIDE POLICIES FOR MANAGEMENT OF HAZARDOUS SUBSTANCES IN WATER*** makes a review of the key EU water related policies concerning the management if immissions and emissions of hazardous substances in water, as well as the relevant international agreements in the Danube River Basin – the Danube River Protection Convention and the Danube Transnational Monitoring Program (TNMN);
- ***Chapter 3: NATIONAL POLICY FRAMEWORKS FOR MANAGEMENT OF HAZARDOUS SUBSTANCES IN WATER*** analyses the harmonization of the national policies of the studied countries of the Danube River Basin with the relevant EU legislative framework and reviews the administrative organization of the legislative process, concerning different aspects, e.g. administrative bodies responsible for establishment and implementation of immissions/emissions related policies.
- ***Chapter 4: MONITORING AND CONTROL*** analyzes the control of hazardous substances in surface and groundwater bodies, of point source emitters (industrial and municipal wastewater discharges) and of diffuse pollution. The analyses include and compare the number and type of regulatory controlled priority and other specific hazardous substances in the different countries, the relevant Environmental Quality Standards (EQS) and/or emission standards and the national approaches for their monitoring.

  The most commonly monitored substances and the relevant emission standards for the wastewater discharges of several specific industries (e.g. glass industry, pharmaceutical industry, textile industry) and landfill leachate are also presented.

  The analyses of the policies for control of the diffuse pollution are limited to the control of the air pollution from industries, subject to Industrial Emissions Directive (IED) regulations and the control of plant protection products. Specific attention is paid to the measures implemented in the National Action Plans (pursuant to art. 4 of Directive 2009/128/EC) aimed at the conservation of aquatic environment and drinking water.

  A detailed review of the approaches related to fees and fines for water pollution is also made.

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- ***Chapter 5: ANALYTICAL METHODS*** analyzes the analytical methods used for sampling and measuring of the hazardous substances and the respective limits of quantification
- ***Chapter 6: REGISTERS, DATA BASES AND REPORTING*** makes a review of the way of organization of the monitoring data bases, the data holder and the public accessibility of the data.
- ***Chapter 7: INVENTORY ON PRIORITY SUBSTANCES EMISSION, DISCHARGES AND LOSSES*** analyzes the methodological framework of the investigated countries for preparation of inventories of hazardous substances, the spatial scale, the collection of data for point and diffuse polluters, the established natural background concentrations and the inventories developed so far.
- ***Chapter 8: CONCLUSIONS*** summarizes the key results, outlines areas for improvement and gives recommendations for the next steps for improvement of harmonization of management of hazardous substances in the Danube River Basin countries.

The report contributes to the Danube Hazard m3c specific objectives, in that that it leads to a better knowledge and understanding of the status quo of HS pollution management in the DRB. It also creates a sound basis for prioritization of measures and for elaborating recommendations on effective policies, thus leading to a more effective and harmonized management of HS water pollution in the DRB.

Data and analyzes of the policy framework of Ukraine were provided before the beginning of the war by the project partner – the Ukrainian Hydrometeorological Institute State Service on Emergencies and National Academy of Sciences. Most of this information may no longer be up to date. The authors have decided to keep them in the report with respect for the work and dedication of the colleagues who prepared them.

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1 INTRODUCTION

According to the definition of the Water Framework Directive (WFD), "*hazardous substances mean substances or groups of substances that are toxic, persistent and liable to bio-accumulate, and other substances or groups of substances which give rise to an equivalent level of concern*"[1]. Considering the significant threat of their accumulation and the subsequent impact on human and environmental health, several legislative documents, including the WFD, aim *to "contribute to the progressive reduction of emissions of hazardous substances*" [1].

Fragmentation and heterogeneity in national policies and in their implementation can represent a major obstacle in pursuing an efficient and coordinated transnational control and reduction of hazardous substances pollution of water bodies in the Danube River Basin. In order to identify gaps, inconsistencies and needs of improvements and harmonization, it is necessary to reach an in-depth understanding of the status quo in the different countries and to perform a critical comparative analysis.

This report presents the result of a concerted effort within the Danube Hazard m³c project, namely the comparative analysis of the national policy approaches of twelve countries in the DRB for management of hazardous substances in water. These countries are Austria, Bulgaria, Croatia, Germany, Hungary, Moldova, Montenegro, Romania, Serbia, Slovenia, Slovakia and Ukraine. They cover over 85% of the territory of the DRB and about 80% of the population in the basin.

The aim of the report is to present the updated state-of-art national policy frameworks for management of HS in water in the Danube River Basin and to assess the level of their harmonization for the purpose of effective protection of the DRB. Based on the analyses, areas for improvement of the level of harmonization as well as recommendations for the next steps are provided.

The report deals with both immission and emission policies for management of hazardous substances in water as shown in *Figure 1-1.* The management of HS pollution in surface and ground water bodies is a complex subject, which requires many aspects such as integration within the overall management of water resources and the environmental protection to be considered in the development of the horizontal and vertical policies.

[1] Directive 2000/60/EC of the European parliament and of the Council, https://eur-lex.europa.eu

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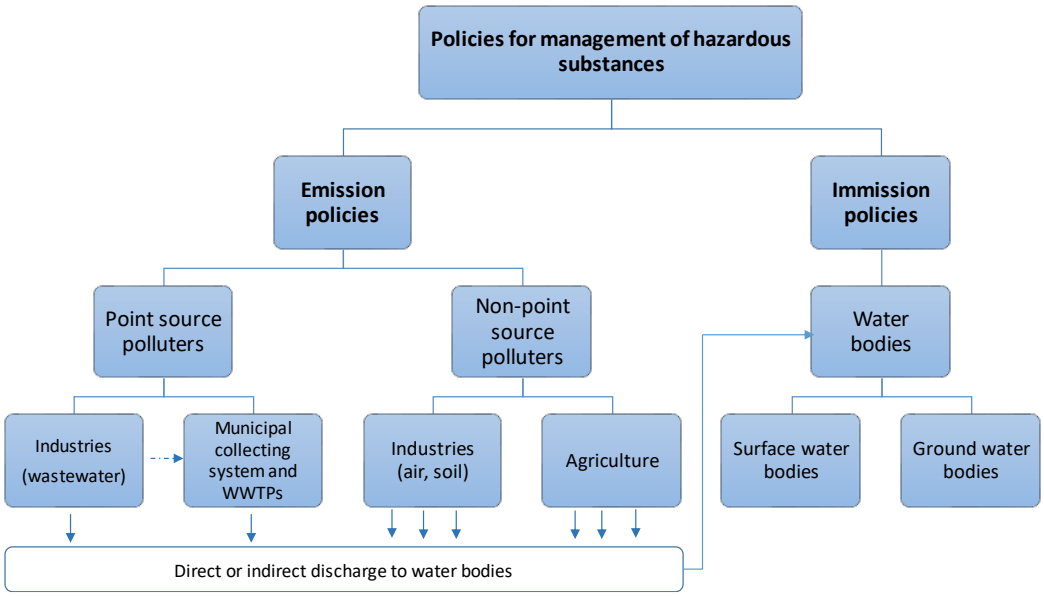

Figure 1-1: Policies and main components discussed in the report.

The comparative analysis in this report focuses on some crucial aspects in the establishment and implementation of the policy framework for management of hazardous substances in water in the analyzed DRB countries. These cover (*Figure 1-2*):

- ✓ **General analysis of the national policy frameworks**, which includes the level of harmonization of the national policies with the EU policies, the conceptual design of the policy framework and the administrative organization of the implementation processes.
- ✓ **Regulatory framework concerning immissions and emissions of hazardous substances.** This includes the main characteristics of the established monitoring programs and approaches for control of the most important point source emitters (i.e., the industrial and municipal wastewater discharges) and for the main diffuse pollution sources. i.e., air deposition and agricultural activities using plant protection products.
- ✓ **The need for harmonization / unification of the sampling and measurement procedures**, which addresses the sampling methods, the analytical methods for measuring the different substances and the respective Limit of Quantification.
- ✓ **Organization of the data collection and its dissemination**, i.e., establishment and maintenance of registers and databases as well as reporting.
- ✓ **Inventory analyses of priority substances emissions, discharges, and losses**, i.e., the implemented national methodological framework and its relevance with the EU Common Implementation Strategy (CIS) Guidance, the spatial scale, the inventoried point and diffuse pollutants and the inventories developed so far.

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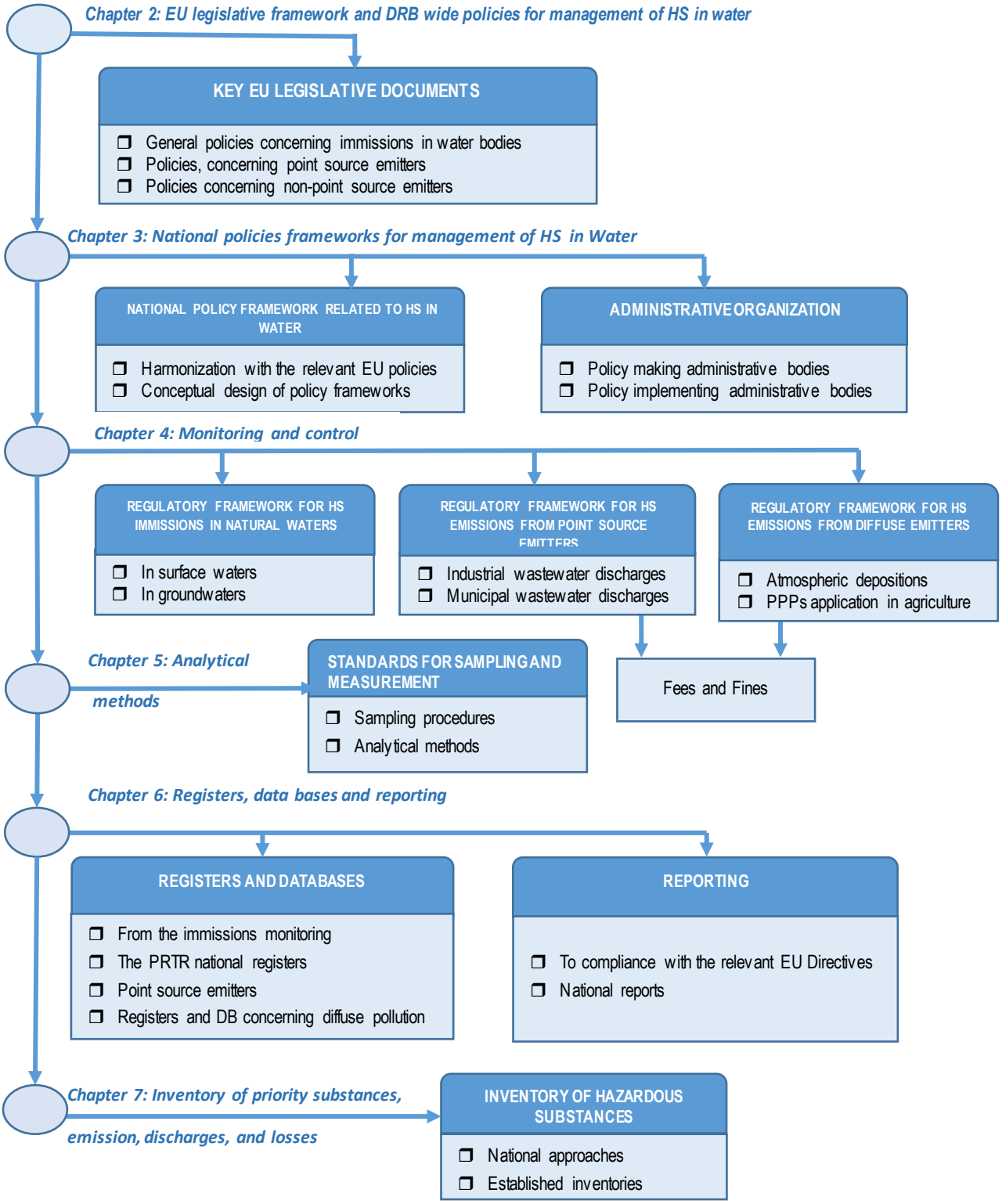

Figure 1-2: Organizational chart of the report

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2 EU LEGISLATIVE FRAMEWORK AND DANUBE RIVER BASIN WIDE POLICIES FOR MANAGEMENT OF HAZARDOUS SUBSTANCES IN WATER

2.1 EU legislative framework

Hazardous substances are released into the environment as a result of production, domestic or non-domestic use and disposal of specific products. Despite the importance of the policies related to the production and use of hazardous substances (summarized in *Figure 2-1*, left side), they are not a subject of the current review. In the scope of the report, only environmental (and particularly water related) policies will be discussed (*Figure 2-1*, right side).

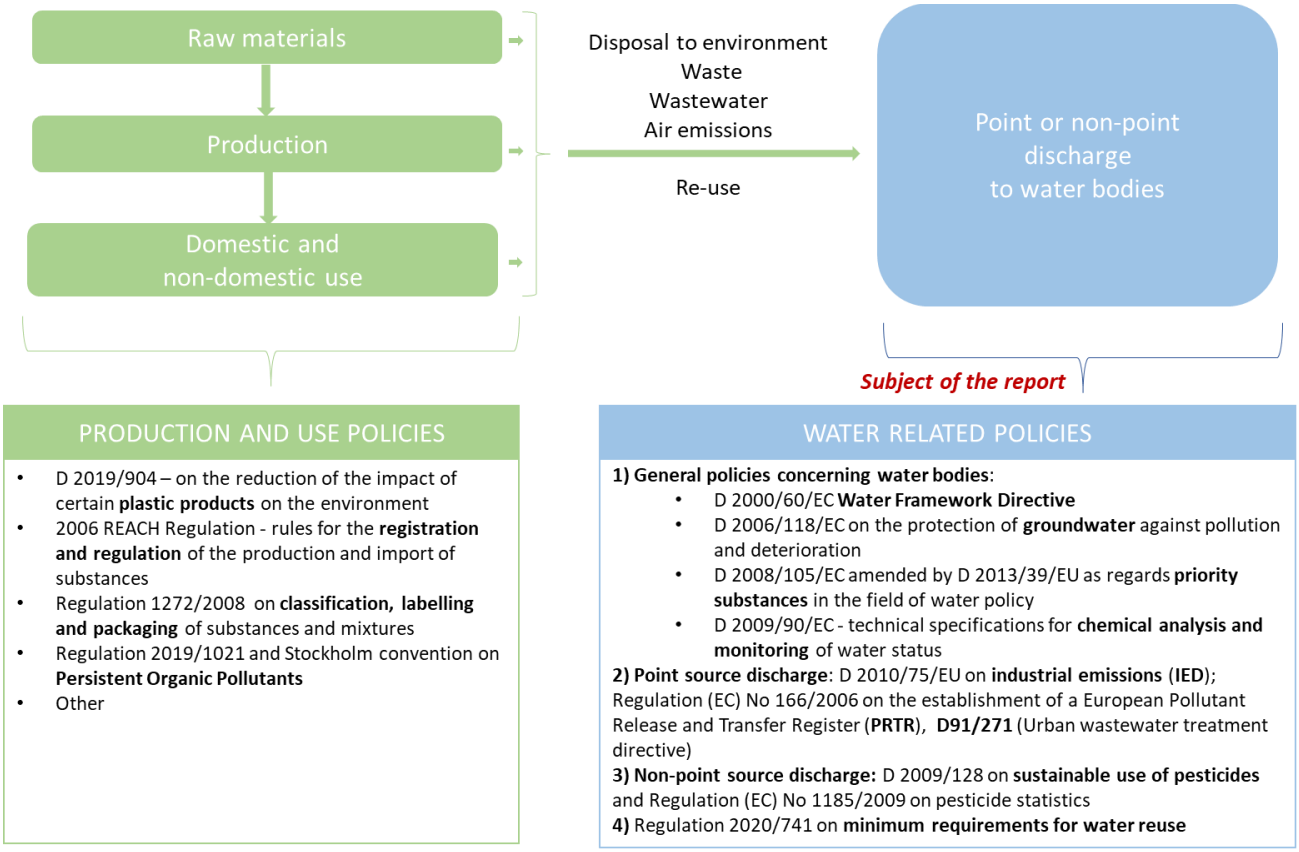

Figure 2-1: Key EU legislative documents concerning production, use and release of hazardous substances.

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The key EU legislative documents concerning environmental (water related) policies are grouped into four clusters *(Figure 2-1, Table 2-1):*

[1] General policies concerning water bodies (mostly immissions oriented)

[2] Policies concerning point source discharges (mostly emissions oriented)

[3] Policies concerning non-point source discharges (mostly emissions oriented)

[4] Policies concerning water re-use

A short description of the key environmental (water related policies) is provided in *Table 2-1.*

The diffuse pollution policy framework is limited in the report to a) the atmospheric emissions from the industries subject to the PRTR reporting procedures and b) the control over the plant protection products application in agriculture.

Table 2-1: Summary of the EU environmental policies included in the scope of this report[2]

[1] General policies concerning water bodies
Directive 2000/60/EC Water Framework Directive (WFD)
The aim: It sets out rules to halt deterioration in the status of European Union (EU) water bodies and achieve 'good status' for Europe's rivers, lakes and groundwater by 2015. Specifically, this includes: • protecting all categories of water (surface, ground, inland and transitional) • reducing pollution in water bodies • restoring the ecosystems in and around these bodies of water • guaranteeing sustainable water usage by individuals and businesses. *Key points:* The legislation places clear responsibilities on national authorities. They have to: • identify the individual river basins on their territory — that is, the surrounding land areas that drain into particular river systems (river catchment); • designate authorities to manage these basins in line with the EU rules. • analyze/characterize the features of each river basin, including the impact of human activity and an economic assessment of water use. • monitor water bodies and assess their status. • establish environmental objectives and exemptions; register protected areas, such as those used for drinking water, which require special attention. • produce and implement 'river-basin management plans' to prevent deterioration of surface water, protect and enhance groundwater and preserve protected areas. • ensure the cost of water services is recovered so that the resources are used efficiently, and polluters pay. • provide public information and consultation on their river-basin management plans.
Directive 2006/118/EC on the protection of groundwater against pollution and deterioration
The aim: • It is designed to prevent and combat groundwater pollution in the European Union (EU). • It includes procedures for assessing the chemical status and trend assessment of groundwater bodies and measures to reduce levels of pollutants.

[2] *Text is adopted from https://eur-lex.europa.eu/browse/summaries.html*

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Key points:

The directive includes:

- criteria for assessing the chemical status of groundwater
- criteria for identifying significant and sustained upward trends in groundwater pollution levels, and for defining starting points for reversing these trends
- preventing and limiting indirect discharges (after percolation through soil or subsoil) of pollutants into groundwater.

Directive 2008/105/EC amended by Directive 2013/39/EU as regards priority substances in the field of water policy

The aim:

- It sets out environmental quality standards (EQS) concerning the presence in surface water of certain substances or groups of substances identified as priority pollutants because of the significant risk they pose to or via the aquatic environment. These standards are in line with the strategy and objectives of the EU's Water Framework Directive (Directive 2000/60/EC).
- It repeals Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC and 86/280/EEC with effect from 22 December 2012.

Key points:

- The directive sets environmental quality standards for priority substances and eight other pollutants. These substances include the metals cadmium, lead, mercury and nickel, and their compounds; benzene; polycyclic aromatic hydrocarbons (PAH) and several pesticides. Several of these priority substances are classified as hazardous.
- The EQS in Directive 2008/105/EC are standard limits on the concentration of the priority substances and 8 other pollutants in water (or biota), i.e., thresholds which must not be exceeded if a good chemical status is to be met. There are 2 types of EQS:
  - A threshold for the annual average concentration (AA-EQS) of the substance concerned - calculated from measurements over a 1-year period. The purpose of this standard is to ensure protection against long-term exposure to pollutants in the aquatic environment.
  - A maximum allowable concentration (MAC-EQS) of the substance concerned, i.e., the maximum for any single measurement. The purpose of this standard is to ensure protection against short-term exposure, i.e., pollution peaks.
- The EQS are different for:
  - inland surface waters (rivers and lakes);
  - other surface waters (transitional, coastal and territorial waters).
- EU countries must ensure compliance with the EQS. They must also take measures to ensure that the concentrations of substances that tend to accumulate in sediment and/or biota do not increase significantly.

Directive 2013/39/EU

Directive 2013/39/EU updated the EQS for 7 of the 33 original priority substances in line with the latest scientific and technical knowledge concerning the properties of those substances.

The revised EQS for those 7 existing priority substances had to be taken into account for the first time in EU countries' river basin management plans (RBMP) from 22 December 2015 with the aim of achieving good surface water chemical status for those substances by 22 December 2021.

It included 12 newly identified priority substances whose EQS were taken into account in drawing up supplementary monitoring programs and in preliminary programs of measures to be submitted to the European Commission by the end of 2018, with the aim of achieving good surface water chemical status for those substances by 22 December 2027.

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Directive 2009/90/EC - technical specifications for chemical analysis and monitoring of water status

The aim:

This Directive lays down technical specifications for chemical analysis and monitoring of water status in accordance with Article 8(3) of Directive 2000/60/EC. It establishes minimum performance criteria for methods of analysis to be applied by Member States when monitoring water status, sediment and biota, criteria to be applied when assessing the chemical status as well as rules for demonstrating the quality of analytical results.

Key points:

- Definitions of 'limit of detection', 'limit of quantification' and 'uncertainty of measurement' are provided to create a solid basis for discussing the results.
- Sets requirements for using wherever possible standardized analytical methods.
- It provides guidelines on how mean values should be calculated.
- It sets basic requirements for Quality assurance and control

[2] Policies, concerning point source discharges

Directive 2010/75/EU on industrial emissions (IED)

The aim:

It lays down rules to prevent or, where that is not practicable, to reduce industrial emissions into air, water and land and to prevent the generation of waste, in order to achieve a high level of environmental protection.

Key points:

- The legislation covers industrial activities in the following sectors: energy, metal production and processing, minerals, chemicals, waste management and other sectors such as pulp and paper production, slaughterhouses and the intensive rearing of poultry and pigs.
- All installations covered by the directive must prevent and reduce pollution by applying the best available techniques (BAT) and address efficient energy use, waste prevention and management and measures to prevent accidents and limit their consequences.
- Permits
  - The installations can only operate if in possession of a permit and have to comply with the conditions set therein.
  - Permit conditions are based on the BAT conclusions adopted by the European Commission.
  - Emission limit values must be set at a level that ensures pollutant emissions do not exceed the levels associated with the use of BATs, unless it is proven that this would lead to disproportionate costs compared to environmental benefits.
  - National authorities are required to conduct regular inspections of the installations.
- Specific rules

The directive sets down minimum requirements for specific sectors in separate chapters. It includes specific rules relating to:

- combustion plants — operating aspects, emission limits, monitoring and compliance rules.
- waste incineration plants and waste co-incineration plants — operating requirements, emissions limits, monitoring, and compliance rules.
- installations and activities using organic solvents — includes emission limits, reduction schemes and requirements to substitute hazardous substances.
- installations producing titanium dioxide — sets emission limits, monitoring rules, and bans the disposal of certain forms of waste into any body of water.

Regulation (EC) No 166/2006 on the establishment of a European Pollutant Release and Transfer Register (E-PRTR)

The aim:

- The regulation establishes the European Pollutant Release and Transfer Register (E-PRTR).
- This is a publicly accessible electronic database of key environmental data from industrial facilities in Europe.

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- In 2019, Regulation (EC) No 166/2006 was amended by Regulation (EU) 2019/1010 to align and streamline the reporting requirements in EU environmental legislation. Among other things, the amending regulation conferred powers on the European Commission to adopt implementing acts specifying the type, format and frequency of information to be reported under Regulation (EC) No 166/2006.
- Commission Implementing Decisions (EU) 2019/1741 and (EU) 2022/142 introduced changes specific to the E-PRTR further to Regulation (EU) 2019/1010.

Key points:

The E-PRTR is available to the public free of charge on the internet. The information it contains can be searched using various criteria (type of pollutant, geographical location, affected environment, source facility, etc.).

Content of the E-PRTR

The register contains information on point source releases of pollutants to air, water and land, as well as of pollutants present in wastewater and of off-site transfers of waste. The register covers 91 pollutants as listed in Annex II of Regulation (EC) No 166/2006, including greenhouse gases, metals, pesticides, and chlorinated organic substances.

Releases and transfers are required to be reported by operators when they originate from one of the 65 activities listed in Annex I of Regulation (EC) No 166/2006 and exceed the activity-related capacity thresholds specified therein and when they furthermore exceed pollutant thresholds as set out in Annex II of Regulation (EC) No 166/2006. The vast majority of these activities are also regulated under Directive 2010/75/EU (IPPC/IED) on industrial emissions and further streamlining is envisaged with the ongoing IED/IEP revisions.

Directive 91/271/EEC concerning urban wastewater treatment (UWWTD)

The aim:

- Protecting the environment in the European Union from the adverse effects such as eutrophication of surface waters caused by urban wastewater discharges.
- Setting out EU-wide rules for collection, treatment, and wastewater discharge. The law also covers wastewater generated by industries such as the agro-food industries (like food-processing and brewing)

Key points:

- EU countries must:
  - collect and treat wastewater in urban settlements (agglomerations) with a population equivalent (PE) of at least 2,000 and apply secondary treatment on the collected wastewaters.
  - apply more advanced treatment in urban settlements with populations equivalent over 10,000 located in designated sensitive areas.
  - guarantee that treatment plants are properly maintained, so as to ensure sufficient performance and quality of treated discharge and can operate under all normal weather conditions.
  - take measures to limit the pollution of receiving waters from storm water overflows under extreme situations, such as unusually heavy rain.
  - monitor the performance of treatment plants and receiving waters.
  - monitor sewage sludge disposal and re-use.
- As well as outlining methods for the monitoring and evaluation of results, Annex I lists general requirements for:
  - collecting systems
  - discharges from urban wastewater treatment plants (WWTP), including emission limit values for these
  - industrial wastewater discharged into urban collecting systems

Annex II describes the criteria for the identification of sensitive and less sensitive areas. Annex III mentions the industrial sectors that generate wastewater (agro-food industries).

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[3] Policies, concerning non-point source discharge, in particular pesticides

Directive 2009/128/EC on sustainable use of pesticides

The aim:

- It sets rules for the sustainable use of pesticides by reducing their risks to human health and the environment.
- It promotes the use of integrated pest management and different techniques such as non-chemical alternatives.

Key points:

- EU countries must:
  - adopt national plans setting objectives, targets, measures and timetables to reduce health and environmental risks from pesticide use
  - ensure all professional users, distributors and advisors receive proper training.
  - inform the general public and promote awareness-raising programmes about the potential risks from pesticides
  - require pesticide application equipment to undergo regular inspections (at least once by 2016, then every 5 years up to 2020 and every 3 years thereafter)
  - ban aerial spraying.
  - protect water, especially drinking water, from the impact of pesticides
  - ensure that the use of pesticides is reduced or banned in certain areas such as public parks, playgrounds, sports fields or near healthcare facilities
  - require professional users to follow safety precautions when handling and storing pesticides and treating their packaging and remnants
  - take all necessary measures to promote low pesticide pest management.
- The legislation does not prevent EU countries from restricting or banning the use of pesticides in specific circumstances or areas.

Regulation (EC) No 1185/2009 on pesticide statistics

The aim:

- It sets up rules and procedures for the collection and dissemination of statistics on the sales and use of pesticides.
- These statistics, together with other relevant data, will allow the EU countries to draw up the national action plans with quantitative objectives, targets, measures and timetables, envisaged in Directive 2009/128/EC and aimed at reducing the risks and impacts of pesticide use on human health and the environment.
- They are also necessary for assessing EU policies on sustainable development and for calculating relevant indicators on the risks for health and the environment related to pesticide use.

Key points:

  - The statistics apply to the annual amounts of pesticides placed for sale on the market in accordance with the regulation's Annex I and the annual amounts of pesticides used in accordance with the regulation's Annex II.
- Data collection, transmission, and processing: EU countries must collect the data necessary for the specification of the characteristics listed in Annex I on an annual basis and for those listed in Annex II in 5-year periods by means of:
  - surveys
  - information concerning the placing on the market and use of pesticides taking into account, in particular, the obligations laid down in Regulation (EC) No 1107/2009;
  - administrative sources; or
  - a combination of these means, including statistical estimation procedures on the basis of expert judgments or models.

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- They must then transmit the results to the European Commission (Eurostat) in line with the schedules and the frequency laid down in the regulation's annexes. They must present the data in accordance with the classification in Annex III and the technical format set out in Commission Implementing Regulation (EU) No 1264/2014.

[4] Policies concerning water reuse

Regulation (EU) 2020/741 on minimum requirements for water reuse

The aim:

- It sets out harmonized parameters to guarantee the safety of water reuse in agricultural irrigation, with the aim of encouraging this practice and helping to address droughts and water stress.
- It also aims to contribute to the UN Sustainable Development Goals, in particular Goal 6 on the availability and sustainable management of water and sanitation for all, and Goal 12 on sustainable consumption and production.

Key points:

- Scope
  - The regulation applies whenever treated urban wastewater is reused for agricultural irrigation
  - An EU country can decide that it is not appropriate to reuse water for agricultural irrigation in one or more of its river basins districts or parts thereof.
  - Such decision must be duly justified and regularly reviewed to consider changing circumstances, such as climate change projections and national climate change adaptation strategies, as well as the river basins management plans.
  - The regulation allows for time-limited exemptions from the rules for research or pilot projects, subject to certain conditions.
- Reclaimed water quality.
  - the minimum requirements for water quality are set out, covering microbiological elements and monitoring requirements for routine and validation monitoring.
- Risk management
  - The relevant national authority must ensure that a water reuse risk management plan to produce, supply and use reclaimed water is drawn up.
  - The water reuse risk management plan can be drafted by the reclamation facility operator, other parties in the water reuse project or the end users, as appropriate, and it must identify the risk management responsibilities of all parties in the water reuse project.
  - It must set out any additional water quality requirements, identify appropriate preventive and/or corrective measures and any additional barriers or measures to ensure the safety of the system.
- Permit obligations.
  - The production and supply of reclaimed water for agricultural irrigation requires a permit.
  - Parties concerned must apply to the relevant national authority.
  - The permits set out the obligations for the reclamation facility operator, and, where relevant, of other parties involved in the water reuse system, which are based on the risk management plan. They must specify a number of elements.
  - Permits must be regularly reviewed and updated where necessary, and at least in the case of significant changes in the treatment processes or in the site conditions.
- Compliance checks
  - The competent national authority must check compliance with the conditions set out in the permit. These can be carried out by on-the-spot checks; monitoring data obtained, in particular pursuant to this regulation; any other adequate means.
  - The regulation also sets out the measures to be taken in case of non-compliance.
  - The competent national authority must also regularly check compliance with risk management plans.

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2.2 International agreements for the Danube River Basin

2.2.1 The Danube River Protection Convention

The Danube River Protection Convention was signed on June 29 in in 1994 by eleven Danube riparian countries (Austria, Bulgaria, Croatia, the Czech Republic, Germany, Hungary, Moldova, Romania, Slovakia, Slovenia and Ukraine). It came into force in 1998. Later on, Bosnia and Herzegovina, Montenegro and Serbia have also signed the convention. The Convention establishes the legal framework for the transboundary management of the Danube River Basin, including both surface and ground waters. The key elements of this management are (www.icpdr.org):

- the conservation, improvement and rational use of surface waters and groundwater
- preventive measures to control hazards originating from accidents involving floods, ice or hazardous substances
- measures to reduce the pollution loads entering the Black Sea from sources in the Danube River Basin

2.2.2 The Danube Transnational Monitoring Network

The TNMN was established in 1996 and is based on the Danube River Protection Convention, Art. 9. The TNMN Inception workshop was held in 1999 in Bratislava.

The original objective of the TNMN was to strengthen the existing network set up by the Bucharest Declaration, to enable a reliable and consistent trend analysis for concentrations and loads of priority pollutants, to support the assessment of water quality for water use and to assist in the identification of major pollution sources. In 2000, having the experience of the TNMN operation, the main objective of the TNMN was reformulated, i.e. to provide a structured and well-balanced overall view of the status and long-term development of quality and loads in terms of relevant constituents in the major rivers of the Danube Basin in an international context.

In line with the requirements of the WFD, the TNMN for surface waters consists of the following elements:

- Surveillance monitoring 1: Monitoring of surface water status.
- Surveillance monitoring 2: Monitoring of specific pressures.
- Operational monitoring
- Investigative monitoring

Surveillance monitoring 1 and the operational monitoring are based on collection of the data on the status of surface water and groundwater bodies in the DRB District to be published in the DRBM Plan once in six years.

Surveillance monitoring 2 is a joint monitoring activity of all ICPDR (International Commission for the Protection of the Danube River) Contracting Parties that produces annual data on concentrations and loads of selected parameters in the Danube and major tributaries.

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Investigative monitoring is primarily a national task but at the basin-wide level the concept of Joint Danube Surveys was developed to carry out investigative monitoring as needed e.g., for harmonization of the existing monitoring methodologies, filling the information gaps in the monitoring networks operating in the DRB, testing new methods or checking the impact of "new" chemical substances in different matrices. Joint Danube Surveys are carried out every 6 years.

A new element of the revised TNMN is monitoring of groundwater bodies of basin-wide importance. The TNMN includes the following hazardous substances:

- Priority substances – Atrazine, Cadmium, Lead, Mercury and Nickel
- Heavy metals – Arsenic, Copper, Chromium and Zinc
- Organic substances – Lindane, p,p´-DDT and its derivatives.

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3 NATIONAL POLICY FRAMEWORKS FOR MANAGEMENT OF HAZARDOUS SUBSTANCES IN WATER

3.1 Harmonization with the EU legislative framework

Detailed information has been collected on the national documents, which transpose the requirements of the EU legislation into national ones. A summary of the information is shown in *Table 3-1*. Details on the national legislative documents are provided in *Annex 3-1.*

Table 3-1: Number of key national harmonization documents

Country	AT	BG	DE	HR	HU	ME	MD	RO	SR	SK	SI	UA
Directive 2000/60/EC Water Framework Directive (WFD)												
Laws	1	1	1	2	2	2	3	1	1	1	2	1
Secondary regulation *	2	3	4	2	6	1	4	1	3	2	3	-
Other**	-	1	-	1	-		5	2	1	1	1	4
Directive 2006/118/EC on the protection of groundwater against pollution and deterioration												
Laws	1	-	-	1	2	-	-	-	1	1	2	-
Secondary regulation *	-	1	1	2	2	1	-	1	1	1	3	-
Other**	1	-	-	1	-		1	1	1	1	1	1
Directive 2008/105/EC amended by D 2013/39/EU as regards priority substances in the field of water policy												
Laws	-	-	-	1	-	-	-	-	1	1	2	-
Secondary regulation *	1	1	1	-	1	1	-	-	1	-	2	-
Other**	-	-	-	1	-		2	1	-	1	-	1
Directive 2009/90/EC - technical specifications for chemical analysis and monitoring of water status												
Laws	-	-	-	1	-	-	-	-	2	-	-	-
Secondary regulation *	1	1	1	1	1	1	-	-	1	-	1	-
Other**	-	-	-	-	-		1	1	2	1	1	1
Regulation (EC) No 166/2006 on the establishment of a European Pollutant Release and Transfer Register (E-PRTR)												
Laws	-	1	1	2	-	1	1	-	1	1	-	-
Secondary regulation *	1	-	-	1	1	-	--	-		-	1	-
Other**	-	-	-	1	-	-		1	1	-	-	1
Directive 2010/75/EU on industrial emissions (IED)												
Laws	2	1	3	1	-	1	2[3]	1	3	1	1	1
Secondary regulation *	-	1	7+	1	1	1	-	1	1	1	1	-
Other**	3	3	-	-	-		1	3	9	-	-	3
Directive 2009/128/EC on sustainable use of pesticides												
Laws	11	1	1	1	1	***	2	1	1	1	5	5
Secondary regulation *	17	7	6		1		-	3		6		
Other**	-	-	2	1	-		4	1	8	-	19	5

** Ordinances, decrees*
*** decisions, regulations, norms for applications, etc.*
**** Monte Negro has not provided data*

[3] Draft Law on Industrial Emissions of 2019

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The EU countries have harmonised their national legislative framework with the main EU directives and regulations addressed in this report.

Concerning non-EU members, most of the relevant EU Directives are transposed into national legislation. Ukraine and Moldova are still in process of implementing the Directive 2010/75/EU (IED), as in Moldova a draft law on Industrial Emissions is currently developed, which is compliant with the IED. Serbia is preparing a new Law on Water which will provide for full transposition of the EU water related legislation. An amended Law on IPPC, fully compliant with IED is also in the process of preparation.

It is noticeable that the transposition of the Directives' provisions into the national legislation in many cases is realized through more than one national document (a law, ordinances/decrees, or other normative documents), based on the existing national legislative structure.

The national water policy framework follows the concept of the relevant EU water policy framework. The main aspects are discussed below.

3.2 Administrative organization of the legislative process

The policy makers are usually state or federal institutions, while the policy implementers can be state/federal institutions and/or administrative institutions at regional or municipal level. *Table 3-2* presents summary information concerning the key national institutions involved in the design and implementation of the policy framework for hazardous substances management. The specific functions of each administrative body are presented in *Annex 3-2.* Diagrams of the management structure at national level are presented in *Annex 3-3.*

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Table 3-2: Administrative bodies involved in hazardous substances management in surface and ground water

Country	Policy managing administrative bodies /Policy makers/	Implementing institutions
Austria	▪ Ministry of Agriculture, Regions and Tourism ▪ Federal state	▪ Ministry of Agriculture, Regions and Tourism together with Federal States ▪ Waste management authority (the Federal State) ▪ Provincial Governments ▪ District governments ▪ Water supply and sewerage operators
Bulgaria	▪ Council of Ministers ▪ Ministry of Environment and Water ▪ Ministry of Agriculture, Food and Forestry ▪ Ministry of Health, Ministry of Economics and Ministry of Regional Development – supporting role to the Ministry of Environment	▪ Ministry of Environment and Water ▪ Environment Executive Agency (EEA) ▪ River Basin Directorates ▪ Regional Inspectorates on Environment and Water ▪ National Institute on Meteorology and Hydrology ▪ Water supply and sewerage operators ▪ Bulgarian Food Safety Agency
Croatia	▪ The Government ▪ Ministry of Economy and Sustainable Development ▪ Ministry of Environmental Protection and Energy	▪ HRVATSKE VODE - Legal entity for water management ▪ Croatian Institute of Public Health
Germany	▪ Federal Ministry of the Environment, Nature Conservation, Nuclear Safety and Consumer Protection ▪ Federal States (federal environmental Ministries)	▪ Federal Ministry of the Environment, Nature Conservation, Nuclear Safety and Consumer Protection: ▪ Federal States (federal authorities): - Regional authorities - Competent authorities on local level ▪ Water supply and sewerage operators ▪ German Environment Agency (UBA)
Hungary	▪ The Government ▪ Ministry of Interior ▪ General Directorate of Water Management (OVF) ▪ Ministry of Agriculture (Department of Environmental Protection)	▪ General Directorate of Water Management (OVF) ▪ Regional Water Directorates ▪ Government office public health and environmental laboratories ▪ County Government Office, General Department of Environment and Nature Protection, Complex Environmental Permitting Department ▪ County Disaster Management Directorate Water Management and Water Protection Authority ▪ Local District Office, Department of Environment and Nature Protection
Moldova	▪ Ministry of Environment ▪ Ministry of Agriculture and Food Industry ▪ Inspectorate for Environmental Protection	▪ Environmental Agency ▪ Apelle Moldova ▪ State Center for Product Certification and Approval of Phytosanitary Use and Fertilizers ▪ Inspectorate for Enviornmental Protection

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Country	Policy managing administrative bodies /Policy makers/	Implementing institutions
Montenegro	▪ Government of Montenegro ▪ Ministry of Agriculture, Forestry and Water Management	▪ Institute of Hydrometeorology and Seismology ▪ Water Administration ▪ Nature and Environment Protection Agency ▪ Environmental Inspection. ▪ Directorate for food safety, veterinary and phytosanitary affairs
Romania	▪ The Inter-ministerial Council of Waters/Basin Committee ▪ Ministry of Environment, Waters and Forests ▪ Ministry of Agriculture and Rural Development	▪ National Administration „Romanian Waters" (national level) ▪ River Basin Administrations (basin level) ▪ Water Management Systems (county level) ▪ National Agency for Environment Protection (through the county and local branches) ▪ National Fitosanitary Authority
Serbia	▪ Ministry of Environmental Protection ▪ Ministry of Agriculture, Forestry and Water Management ▪ Local Self-Government (may issue an ordinance on discharging wastewater into sewer)	▪ Ministry of Environmental Protection - Sector for Environmental Inspection and Precaution ▪ Serbian Environmental Protection Agency ▪ Public Water Management Companies (Srbijavode and Vode Vojvodine) ▪ Ministry of Agriculture, Forestry and Water Management - Directorate for Plant Protection
Slovakia	▪ Ministry of Environment ▪ Ministry of Agriculture and Rural Development	▪ Water Research Institute ▪ Slovak Water Management Enterprise ▪ Slovak Hydrometeorological Institute Slovak Environmental Inspectorate ▪ Central control and testing institute in agriculture Bratislava
Slovenia	▪ Ministry of the Environment and Spatial Planning ▪ Slovenian Environment Agency ▪ Ministry of Agriculture, Forestry and Food	▪ Slovenian Environment Agency ▪ Food Safety, Veterinary and Plant Protection Administration
Ukraine	▪ Cabinet of Ministers of Ukraine ▪ Ministry of Ecology and Natural Resources of Ukraine ▪ Ministry of Agrarian Policy and Food of Ukraine	▪ Ministry of Ecology and Natural Resources ▪ State Water Agency ▪ State Agency of Ukraine on Emergencies ▪ Ukranian Geological Survey ▪ The State Ecological Inspection ▪ State Service of Ukraine for Geodesy, Cartography and Cadastre ▪ State Service of Ukraine on Food Safety and Consumer Protection

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3.2.1 *Administrative bodies responsible for establishment and implementation of policies concerning surface and groundwater quality*

In all the investigated countries there is more than one responsible administrative body, as the leading role is usually hold by a specific Ministry, supported by other ministries (the predominant case) or other administrative bodies e.g., the Slovenian Environment Agency in Slovenia, which is a body of the Ministry of the Environment and Spatial Planning.

In Austria the legislative initiative is held by the Ministry of Agriculture, Regions and Tourism, while the Federal States participate in the policy implementation (e.g. the Federal states act as water rights authority and are responsible for WWTPs > 20,000 PE). The situation is similar in Germany, where the main legislative initiative is held by the responsible federal ministry, while the Federal States (federal authorities) are mainly responsible for granting permits for waste water discharge, elaborating and implementing 'river-basin management plans', carrying out monitoring activities and for the set up and maintenance of the relevant database on the federal-state level.

In some countries (e.g. Bulgaria, Croatia and Montenegro), the Council of Ministers or the Government are also included in the policy making process, e.g. for determination of the tariffs for polluters' taxation or for the national implementation of the requirements of the EU Directives (Romania, Ukraine).

Based on the collected information, two major administrative approaches can be outlined:

- One administrative body is responsible for the water quality monitoring

  This is the case in most of the countries – in Croatia (Hrvatske Vode), in Moldova (the Environmental Agency), in Slovenia (the Slovenian Environment Agency); in Romania (the River Basin Administrations); in Hungary (the Directorate of Water Management); in Montenegro (the Institute of Hydrometeorology and Seismology).

- Different administrative bodies are responsible for different aspects of the monitoring

  For example, such is the approach in Bulgaria - the River Basin Directorates and the Executive Environment Agency execute the surface and ground water quality monitoring; in Slovakia - the Water Research Institute, Slovak Hydrometeorological, State Geological Institute of Dionýz Štúr and the Slovak Water Management Enterprise execute the water quality monitoring and in Ukraine there are 3 state agencies responsible for different parts of the water quality monitoring. Usually in this approach there is one leading institution which coordinates the activities of the rest.

  In Austria the Ministry of Agriculture, Regions and Tourism together with the Federal states are managing the monitoring process, but the monitoring is executed by the provincial governments, which commissions private agencies for this purpose.

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3.2.2 *Administrative bodies responsible for management of wastewater discharges*

The wastewater discharge control is a part of the integrated surface water quality control. Usually, the policy making institutions are the same which establish the general water policy framework (see *Annex 3-2*). As above mentioned, the management of the industrial discharges includes two main issues: the licensing (permitting) regime for discharges and the respective control over its implementation. *Table 3-3* presents summary information for the responsible administrative bodies in the project countries in this process.

Table 3-3: Administrative bodies responsible for issuing wastewater discharge permits and control over their implementation

Country	Issuance of wastewater discharge permissions	Control over the implementation of the permissions
Austria	▪ Waste Management Authorities (Federal level) ▪ Governments of the Federal States - WWTP discharges over 20,000 PE ▪ District Governments – WWTP discharges below 20,000 PE	▪ Waste Management Authorities (Federal level) ▪ Governments of the Federal States - WWTP discharges over 20,000 PE) ▪ District Governments – WWTP discharges below 20,000 PE
Bulgaria	▪ Ministry of Environment and Water – discharges into dams of national significance. ▪ The Executive Environment Agency - discharges under the IPPC Directive ▪ For the rest of the cases - the RBDs – for discharges into surface water and the sewer operator- for discharges into sewer network	The Regional Inspectorates on Environment and Water (act at regional level)
Croatia	Croatian Waters	Croatian Waters
Germany	The authorities at federal level (regions or districts) are responsible for both permitting and supervision/inspection.	▪ Control of emissions is carried out regularly and continuously by the operators (self-monitoring). The monitoring results are sent to competent water authorities on a yearly basis. ▪ Additionally, and in parallel, state authorities carry out monitoring of discharges to establish compliance (frequency depends on size and character of the production facility).
Hungary	County Disaster Management Directorate Water and Water Protection Authority	County Disaster Management Directorate Water and Water Protection Authority
Moldova	Environmental Agency	Inspectorate for Environmental Protection
Montenegro	Water Administration	Water Inspection (within the Directorate for Inspection Affairs of Montenegro)
Romania	▪ RBDs – discharges into surface waters of the relevant river basin users ▪ Water Management Systems (county level)	▪ RBDs – discharges into surface waters (river basin level) ▪ Water Management Systems (county level) – discharges into sewer systems ▪ Sewer operator (local level)

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Country	Issuance of wastewater discharge permissions	Control over the implementation of the permissions
	▪ Sewer operator – discharges into sewer systems (agreement)	
Serbia	▪ Ministry of Agriculture, Forestry and Water Management – Republic Water Directorate (water discharge permit-republic level) ▪ Competent Secretariat of Autonomous Province of Vojvodina (water discharge permit and IPPC permit - provincial level) ▪ Lokal self-Government (water discharge permit and IPPC permit – local level) ▪ Ministry of Environmental Protection (IPPC permit)	▪ Water Inspection (compliance with water permit requirements and influence on recipient) ▪ Environmental Inspection on republic (quality of discharges into surface waters) and local (quality of discharges into sewerage) level
Slovakia	Slovak Environmental Inspectorate (integrated permissions), State water administration bodies	Slovak Environmental Inspectorate
Slovenia	Ministry of the Environment and Spatial Planning Slovenia	Inspectorate for the Environment and Spatial Planning
Ukraine	State Water Agency	The state ecological inspection

Based on the provided information two main approaches can be outlined:

- One and the same institution issues permits and executes the control - this seems to be the case in Austria, Croatia, Hungary, Romania, Slovakia.
- Different institutions issue permissions for discharge and execute the monitoring control - this is the case in Bulgaria, Germany, Montenegro, Moldova, Ukraine, Slovenia and Serbia.

3.2.3 *Administrative bodies responsible for management of diffuse emissions*

As above mentioned, the report focuses only on the air emissions from industries subject to the IED and on the emissions from application of plant protection products.

The policy makers involved are usually the same responsible for the water policy framework (see *Annex 3-2*). *Table 3-4* summarizes the collected information concerning the permits issuing and the implementation control.

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Table 3-4: Administrative bodies responsible for issuing permits for air pollution and control over their implementation

Country	Issuance of air emissions discharge permissions	Control over the implementation of the permissions
Austria	The Federal State	The Federal State
Bulgaria	The Executive Environment Agency - air emissions from industries under the IPPC Directive	The Regional Inspectorates on Environment and Water
Croatia	Ministry of Economy and Sustainable Development	Ministry of Economy and Sustainable Development
Germany	Regional or local competent authorities depending on the administrative structure of the German "Länder" (Federal States)	Regional or local competent authorities depending on the administrative structure of the German "Länder" (Federal States)
Hungary	County Government Offices, General Department of Environment and Nature Protection, Complex Environmental Permitting Department	County Government Offices, General Department of Environment and Nature Protection, Complex Environmental Permitting Department
Moldova	Environmental Agency	Environmental Agency
Montenegro	Nature and Environment Protection Agency	Environmental Inspection (within the Directorate for Inspection Affairs of Montenegro)
Romania	National Agency for Environment Protection (facilities with significant environment impact) Environment Protection Agency (county level)	National Environment Guard (facilities with significant environment impact) Environment Guard (county level)
Serbia	Ministry of Environmental Protection (through IPPC permits)	Environmental Inspection (within the Ministry of Environmental Protection)
Slovakia	Ministry of Environment/Slovak Environmental Inspectorate, Ministry of Interior - State Air Protection Bodies/municipalities (depending on the facility size and the discharging pollution)	Slovak Environmental Inspectorate
Slovenia	Ministry of the Environment and Spatial Planning Slovenia	Inspectorate for the Environment and Spatial Planning
Ukraine	Ministry of Ecology and Natural Resources of Ukraine – for the most significant enterprises (the group #1); local (district or city) authorities – for the other enterprises (the group #2, #3)	State Ecological Inspection

Similar to the control of point source emissions, two main approaches can be outlined:

- One and the same institution issues permits and executes the control - this seems to be the case in Austria, Germany, Croatia, Hungary, Moldova, Serbia and Ukraine. Permitting and supervision of installations may be in different units or departments of the same authority or combined in the same unit.
- Different institutions issue permissions for discharge and execute the monitoring control - this is the case in Bulgaria, Montenegro, Romania, Slovakia, Slovenia.

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Concerning the management of diffuse pollution from agricultural activities, the approaches are similar in all the countries. The ministry in charge for the agricultural development is the policy maker concerning the application of plant protection products (e.g. pesticides). In some countries one and the same ministry governs the agricultural sector and water sector (e.g. Austria, Montenegro and Serbia); in other countries (Bulgaria, Hungary, Moldova, Romania, Slovakia, Slovenia, Germany[4]) the agricultural sector is governed by a separate ministry. The controlling institutions are usually agencies within the administrative organization of the policy maker, e.g.

- Austria - the Austrian Authority for Food Safety
- Bulgaria - the Bulgarian Food Safety Agency
- Croatia - Croatian Agency for Agriculture and Food
- Germany - District governments, federal authorities
- Hungary - National Food Chain Safety Agency
- Moldova - the State Center for Product Certification and Approval of Phytosanitary Use and Fertilizers
- Montenegro - the Directorate for food safety, veterinary and phytosanitary affairs
- Romania - the National Phytosanitary Authority in Romania,
- Slovakia - the Central Control and Testing Institute in Agriculture Bratislava,
- Slovenia - the Food Safety, Veterinary and Plant Protection Administration
- Serbia - Directorate for Plant Protection within the Ministry of Agriculture, Forestry and Water Management
- Ukraine - State Service of Ukraine on Food Safety and Consumer Protection

[4] It might be different on Federal State level.

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4 MONITORING AND CONTROL

4.1 Control of hazardous substances in water bodies

4.1.1 Surface water bodies

4.1.1.1 Monitoring programs

All the countries included in the analysis have a regulatory basis for monitoring of immissions in the surface water bodies following the requirements of the Water Framework Directive. Besides the priority substances, as defined in Annex X of the WFD, each country has established a list of other regulated specific hazardous substances.

All the countries apply the three types of monitoring required by the WFD i.e., surveillance, operational and investigative monitoring. The monitoring of hazardous substances is either integrated within the physico-chemical monitoring of the water bodies or separated in a special monitoring program (e.g. Ukraine).

All the EU-member countries report that they have established national methodologies concerning the monitoring programs. Bulgaria, Hungary and Slovenia confirm that their methodologies follow the recommendations of the CIS Guidance No 19: Guidance on surface water chemical monitoring[5].

Concerning the non-EU members, the regulatory basis (e.g., national methodologies for hazardous substances monitoring) is at different stages of development, i.e.:

- Montenegro – the process is completed i.e., there exists a methodology for monitoring of Hazardous substances, following the principles set in the CIS Guidance of WFD.
- Moldova – a national monitoring methodology is partially developed. The surface water monitoring sites are selected using river basin principles. The frequency of monitoring of hazardous substances is once per year and depends on the possible contamination sources.
- Ukraine – the national monitoring methodology follows the recommendation of CIS Guidance No 19. The frequency of monitoring of hazardous substances is once per month within the first and 4th year for the period covered by the RBMP for all the chemical components.
- Serbia – there exists a methodology for monitoring of Hazardous substances in water matrix, but not in biota, following the principles set in the CIS Guidances of the WFD. Still, not all designated water bodies are covered by the monitoring network.

[5] https://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm

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The frequency of monitoring is stipulated in WFD, Annex V, 1.3 as for the surveillance monitoring, it is:

- For priority substances – once per month within one year for the period covered by the RBMPs.
- For other pollutants – once per three months within one year for the period covered by the RBMPs.

The frequency of operational monitoring should be determined by each country in a way *"...to provide sufficient data for a reliable assessment of the status of the relevant quality element."* (WFD, Annex V, 1.3.4.), however it is not recommendable to exceed the intervals set for the surveillance monitoring in the WFD. Deviations from the prescribed intervals both for surveillance and operational monitoring (intervals than those set into WFD, Annex V, 1.3.4) are however allowed upon justification based on technical knowledge and expert judgement. The practice of applying this condition for exception was surveyed in the different countries. The results are shown in *Table 4-1.* It appears that this principle is introduced in the legislative framework in Bulgaria and Montenegro.

Grab samples are used in all the countries for monitoring the hazardous substances in surface water bodies. Germany reports also of using daily mixed samples for some monitoring stations.

Table 4-1: Application of the clause for deviation of the frequency of monitoring, i.e. extending the monitoring intervals compared to those set in WFD, Annex V, 1.3.4

Country	National practices
Austria	The frequency of the monitoring is in line with the WFD or smaller. The duration of operational monitoring at the temporary monitoring sites is set at one year in accordance with the provisions of the WFD - Annex V, 1.3.4. In the opinion of experts, further measurement data would not provide any additional information due to the current state of knowledge about biological relationships.
Bulgaria	In cases where the results of the previous surveillance monitoring show the preservation of good status of the water body and the review of the impact of anthropogenic activity does not prove that the impacts on this body have changed, the surveillance monitoring is performed once during three RBMPs[6]. In practice this rule has not yet been applied, since at present there is no cumulative fulfilment of all the requirements to the control monitoring programs (specified in the ordinance), predetermining the entry into force of this condition.
Germany	The frequency of monitoring is in line with the requirements of the WFD.
Croatia	The frequency of monitoring is equal or smaller than those set by WFD.
Hungary	The frequency of the surveillance monitoring follows the suggestions of the WFD, i.e., the exceptional clause for decreasing the frequency of monitoring is not applied.

[6] Article 8 (6) of the Bulgarian Ordinance №1 / 11.04.2011 for water monitoring (SG 34 of 29.04.2011)

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Country	National practices
Moldova	The laboratory of the Environmental Agency conducts monitoring programme established by the national regulation. The frequency of monitoring of hazardous substances is once per year and depends on the possible contamination sources.
Montenegro	The monitoring program may deviate from the frequency of measuring the parameters of the chemical state of sediment and biota, if based on an expert assessment it is determined that the measurement can be performed at longer intervals.
Romania	The frequency of monitoring follows the recommendations of the WFD, i.e., the exceptional clause for decreasing the frequency of monitoring is not applied.
Slovakia	The frequency of monitoring is in line with those in the table. Some specific substances are monitored 12 times a year.
Slovenia	The frequency of monitoring follows the suggestions of the WFD, i.e., the exceptional clause for decreasing the frequency of monitoring is not applied.
Serbia	The frequency of monitoring follows the suggestions of the WFD, it varies from 4 to 12 time per year depending on the substance, and the possible contamination sources and previous monitoring results.
Ukraine	The sampling frequency meets WFD requirements, i.e. the exceptional clause for decreasing the frequency of monitoring is not applied. Screening of water samples and bottom sediments is performed to determine the list of specific synthetic and non-synthetic pollutants 1 time in 6 year.

4.1.1.2 List of hazardous substances and respective EQS

The scope of monitored hazardous substances includes:

- priority substances in surface waters
- specific substances - the list of these substances is usually established through specific regulations at national level
- priority substances monitored in biota and sediments.

❒ ***Priority substances in surface waters***

Figure 4-1 shows the total number of monitored priority substances in water and those not yet included in the monitoring programs. Nine countries – Austria, Bulgaria, Germany, Croatia, Hungary, Montenegro, Slovenia, Slovakia and Serbia – have included all the priority substances in their monitoring programs. Serbia reports that Polychlorinated biphenyls (PCBs) (CAS No: 1336-36-3) is also included in the national monitoring list of priority hazardous substances.

Table 4-2 presents the not yet included priority substances. Most of the countries report that these substances will be included in the RBMP cycle 2022-2027.

Detailed information about the included priority substances in the monitoring program of each country can be found electronically in *E-Annex 4-1*

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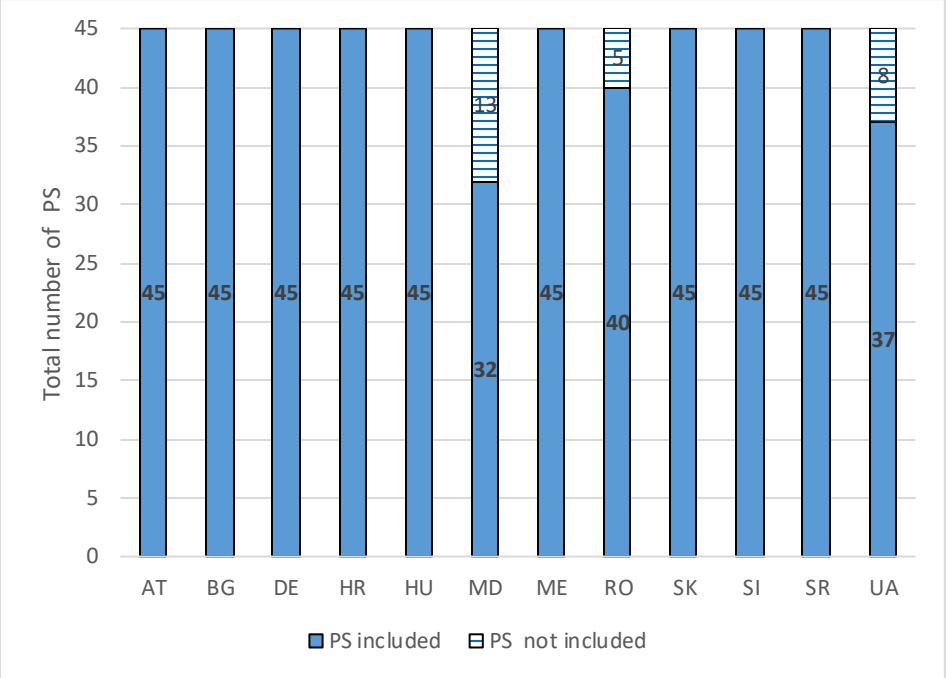

Figure 4-1: Total number of priority substances (PS) included/not included in the national monitoring programs of the investigated countries

Table 4-2: Priority substances that are not yet included in the national monitoring programs for water monitoring

Country	Priority substance not included in the monitoring programs
Moldova	Brominated diphenylethers, Tributyltin compounds, Dicofol, PFOS, Quinoxyfen, Dioxins and dioxin-like compounds Aclonifen, Bifenox, Cybutryne, Cypermethrin Dichlorvos, Hexabromocyclododecane (HBCDD), Terbutryn
Romania	C10-13 Chloroalkanes, Tributyltin compounds, Dioxins and dioxin-like compounds,
Ukraine	Brominated diphenylethers, C10-13 Chloroalkanes Chlorfenvinphos, Di(2-ethylhexyl)-Phthalate (DEHP) Diuron, Isoproturon, Octylphenols, Pentachlorophenol, PFOS, Dioxins, Bifenox, Hexabromocyclododecane (HBCDD)

The following conclusions can be made, concerning the monitoring of priority substances:

- 24 priority substances (out of 45) are included in the national monitoring programs in all the countries. These are: alachlor, anthracene, atrazine, benzene, cadmium and its compounds, chlorpyrifos, 1.2-Dichloroethane, dichloromethane endosulfan, fluoranthene, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclohexane, lead and its compounds, mercury and its compounds, naphthalene, nickel and its compounds,

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nonylphenols (4-nonylphenol), pentachlorobenzene, simazine, trichlorobenzenes, trichloromethane, trifluralin and heptachlor and heptachlorepoxide;

- The three least monitored priority substances (i.e., monitored in 9 countries out of 12) are: Perfluorooctane sulfonic acid and its derivatives (PFOS), Dioxins and dioxin-like compounds, Hexabromocyclododecane (HBCDD).

The EQS set for the priority substances in the national legislations is compliant with the requirements of Directive 2013/39/EU.

❒ ***Other specific hazardous substances***

Each country has included a number of other specific hazardous substances (SHS) in the national monitoring program. These lists include volatile organic substances, substances with industrial origin and plant protection products. *Figure 4-2* presents summary information for each country on the total number of included other specific hazardous substances (including the non-priority substances listed in Annex I of the EQS Directive).

Detailed information about the included SHSs in the monitoring program of each country can be found electronically in *E-Annex 4-2.*

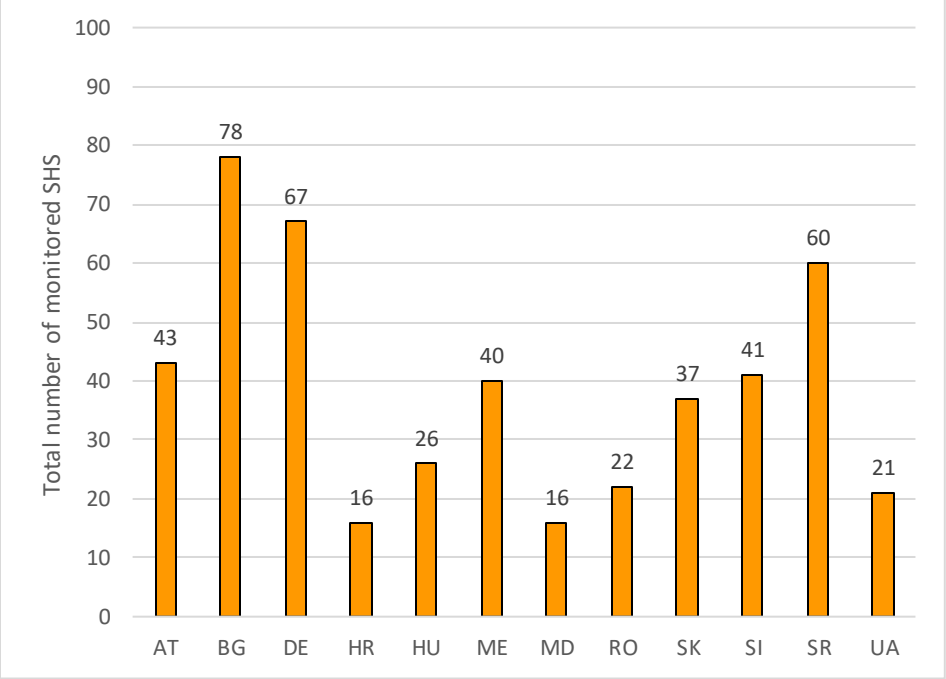

Figure 4-2: Total number of other specific hazardous substances (SHS) included in the national monitoring programs for surface water quality monitoring

NOTE: *Substances like nitrates, nitrites, sulphates, COD, BOD_5, phosphates, chlorides, which in certain concentrations could also be hazardous, as well as radiological substances (like Rubidium, Strontium, etc.) are not included in the data base.*

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13 specific hazardous substances are monitored in over 80% of the countries studied. They can be grouped as follows:

- All 9 non-priority substances listed in Annex I of the EQS Directive i.e., Carbon-tetrachloride, Cyclodiene pesticides (aldrin, dieldrin, endrin and isodrin), DDT total, para-para- DDT, Tetrachloro Ethylene and Trichloro Ethylene.
- 4 heavy metals and metalloids: Arsenic, Chromium, Copper and Zinc

More than half of the studied countries monitor also selenium and cyanides and some organic substances such as:

  - Volatile organic - o, m, p-xylene, phenols, adsorbable organically bound halogens (AOX)
  - Industrial pollutants - Bisphenol A; Polychlorinated biphenyls: (PCB 28, PCB 52, PCB 101, PCB 105, PCB 118, PCB 138, PCB 153, PCB 156, PCB 180);
  - Herbicides - Terbuthylazine

The EQS for the non-priority substances listed in Annex I of the EQS Directive are as stated in the Directive. *Table 4-3* presents the EQS for the other SHSs monitored in more than 50% of the countries. It should be noted that the EQS for certain substances differs substantially from country to country. Some hazardous substances may also have natural origin (e.g., arsenic, copper, chromium) thus the natural condition influences the determination of EQS. For other substances, however (e.g. bisphenol A, terbuthylazine), which are definitely of anthropogenic origin, the significant variation of the EQS requires a more in-depth analysis concerning the methodologies for determining the EQSs.

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Table 4-3: Environment quality standards for some non-priority SHS monitored in over 50% of the countries

HSH names	AT	BG	DE***	HR	HU	ME	MD	RO	SK	SI	SR****	UA
	EQS	AA -EQS	AA-EQS	AA-EQS	EQS	MAC-EQS	EQS	EQS	EQS	EQS	AA -EQS	AA-EQS
	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
AOX	50			50							from 10 to > 250	
Arsenic	24	10		7.5	unique for a waterbody	21	10	49	7.5	25	from 5 (or natural level to > 100	10
Bisphenol A	1.6	1				16			10			
Chromium (total)	8,5			9.0	unique for a waterbody	160		8.8	9	3.4	25 (or natural level to > 250	5
Copper*	0.5 + 1.1 Cl 1-2 4.8 Cl 3 8.8 Cl 4-5	1 (0-50) 6 (50-100) 10 (100-250) 22 (>250)		5 (inland water) for other waters ≤1.1 Cl 1-2 4.8 Cl 3 8.8 Cl 4	unique for a waterbody	74	<5 Cl 1 10 Cl 2 15 Cl 3 30 Cl 4 >30 Cl 5	1.22 Cl 1 5 Cl 2 10 Cl 3	1.1 Cl 1-2 4.8 Cl 3 8.8 Cl 4-5	5 Cl 1-3 30 Cl 4-5	from 5 to >1000 depending on the water hardness and water category	3
Cyanides	5	1	10			17		50	5	10		
O, m, p-xylene	10	15				1850		33	10	10		
Phenols						77		11			from <1 to >50	
Polychlorinated biphenyls:**		0.0005	0.0005	0.01			0,05 Cl 1 0,1 Cl 2 0,5 Cl 3 1 Cl 4 >1 Cl 5	0.013	0.01		not allowed in any concentration	
Terbuthylazine				0.5	0.2	5.3				n.a.	no EQS established	0.022
Zinc*	1.0+ 7.8 Cl 1-2 35.1 Cl 3 52 Cl 4-5	8 (0-50) 40 (50-100) 75 (100-250) 100 (>250)		40 (inland water) for other waters ≤7.8 Cl 1-2 35 Cl 3 52 Cl 4	unique for a waterbody	82.4 Cl 1-2 355.2 Cl. 3 524.2 Cl 4-5	<20 – Cl 1 30- Cl 2 50– Cl 3 120 – Cl 4 >120 – Cl 5	11.8 Cl 1 50.2 Cl 2 73 Cl 3	7.8 Cl 1-2 35.1 Cl 3 52 Cl 4-5	8 Cl 1 50 Cl 2-3 100 Cl 4-5	from 30 to >5000 depending on the water hardness and water category	12

* Depending on the water hardness: Cl 1: < 40 mg $CaCO_3$/l; Cl 2: 40 - 50 mg $CaCO_3$/l; Cl 3: 50 - < 100 mg $CaCO_3$/l; Cl 4: 100 < 200 mg $CaCO_3$/l; Cl 5: > 200 mg $CaCO_3$/l.
For BG the class categories according to $CaCO_3$ are given in brackets

** PCB 28, PCB 52, PCB 101, PCB 105, PCB 118, PCB 138, PCB 153, PCB 156, PCB 180

*** Germany monitors arsenic, chromium (total), copper and zinc only in sediments. The respective EQS are as follows: EQS Ac – 40 mg/kg; EQS Cr – 640 µg/kg, EQS Cu – 160 mg/kg and EQS Zn – 800 mg/kg The PCB is monitored also in sediments EQS – 0.02 mg/kg

**** Limit values (quality standards) are given as annual average concentrations for different Classes of water regarding their quality. Each class responds to certain water status as described in WFD.

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4.1.1.3 Comparison of the monitored parameters with the Danube TNMN

The TNMN necessitates monitoring of the Danube River and its main tributaries. *Table 4-4* presents to what extent the hazardous substances listed in the TNMN are also implemented in the national monitoring programs in the Danube River Countries.

Table 4-4: Hazardous substances from the TNMN included also in the national monitoring programs of surface water bodies

Hazardous substance*	AT	BG	DE	HR	HU	ME	MD	RO	SK	SI	SR	UA
Atrazine (P)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cadmium (PH)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Lindane (as individual parameter, not a group member of HCH)	[1]	NO[2]	YES	YES	[3]	YES	NO	YES	YES	YES	YES	NO
Lead (P)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Mercury (PH)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Nickel (P)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Arsenic	YES	YES	NO [4]	YES	YES	YES	YES	YES	YES	YES	YES	YES
Copper	YES	YES	NO [4]	YES	YES	YES	YES	YES	YES	YES	YES	YES
Chromium	YES	YES	NO [4]	YES	YES	YES	NO	YES	YES	YES	YES	YES
Zinc	YES	YES	NO [4]	YES	YES	YES	YES	YES	YES	YES	YES	YES
p,p´-DDT and derivatives (P) (as invidual parameter, not a group member of TotalDDT)	YES[3]	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

**(P) priority substance and (PH) priority hazardous substance pursuant to WFD*
[1] In Austria lindane was measured in the frame of a special monitoring program in the year 2018
[2] In Bulgaria Lindane is included only within the TNMN programme of Danube river
[3] In Hungary monitored under group of HCH (hexachlorocyclohexanes)
[3] In Austria DDT is measured every six years in the frame of special monitoring programs
[4] In Germany these substances are monitored only in the sediments

Obviously, with small exceptions, all the TNMN substances are also included in the national monitoring programs for surface water bodies, which creates a good background for comparing the results and tracing the origin of sum substances in the Danube River. In some countries, like in the case of Austria, selected compounds (lindane and DDT) are measured in the frame of specific monitoring programs.

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❒ ***Hazardous substances monitored in biota and sediments.***

Several countries, i.e. Austria, Bulgaria, Hungary Slovakia and Germany provided information concerning the monitoring of hazardous substances in biota and sediments *(Figure 4-3).*

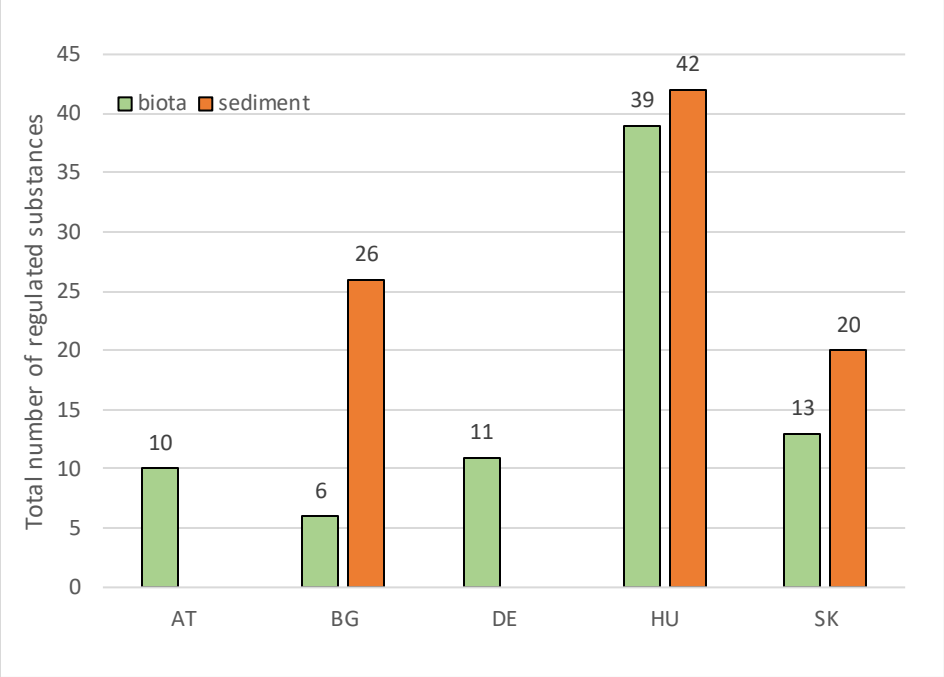

Figure 4-3: Total number of priority substances monitored in biota and sediment

Concerning the monitoring of biota, the regulated priority substances, monitored in all four countries are: hexachlorobenzene, hexachlorobutadiene, perfluorooctane sulfonic acid and its derivatives (PFOS) and hexabromocyclododecane (HBCDD). The EQS for the priority substances in biota are compliant with the standards set in the Directive 2013/39/EU (the EQS Directive). Besides the priority substances Hungary is also monitoring Tetrachloroethylene and Slovakia is monitoring the following substances: arsenic, chromium, copper, zinc, polybrominated diphenyl ethers (PBDE-100, PBDE-153, PBDE-154, PBDE-28, PBDE-47, PBDE-99).

Concerning the monitoring of sediments, 16 priority substances are monitored in 3 of the 4 countries that have submitted information. These substances are: cadmium and its compounds, C10-13 Chloroalkanes, Di(2-ethylhexyl)-Phthalate (DEHP), fluoranthene, hexachlorobenzene, hexachlorocyclohexane, lead and its compounds, nickel and its compounds, pentachlorobenzene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g.h.i)perylene, indeno(1.2.3cd)pyrene, dicofol, heptachlor and heptachlorepoxide.

Besides the priority substances several countries are also monitoring other hazardous substances in sediments, e.g.:

- Hungary is monitoring the cyclodiene pesticides (aldrin, dieldrin, endrin, isodrin), DDT total, para-para- DDT, tetrachloroethylene and trichloroethylene.

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- Slovakia is monitoring additional 19 specific hazardous substances: arsenic, chromium, copper, zinc, polybrominated diphenyl ether (PBDE-100, PBDE-153, PBDE-154, PBDE-28, PBDE-47, PBDE-99), Polychlorinated biphenyls (PCB -101, PCB – 118, PCB -138, PCB -153, PCB – 180, PCB -203, PCB -28, PCB -52 and PCB - 8).
- Germany is monitoring arsenic, chromium (total), copper, polychlorinated biphenyls (PCB 28, PCB 52, PCB 101, PCB 105, PCB 118, PCB 138, PCB 153, PCB 156, PCB 180), triphenylzinn-kation and zinc.

4.1.2 Ground water bodies

4.1.2.1 Monitoring programs for evaluation of the chemical status of groundwater bodies

The Water Framework Directive requires surveillance and operational monitoring for the groundwater bodies. Several CIS Guidelines have been developed to support the implementation of the Directive, in particular concerning the groundwater bodies monitoring:

- CIS Guidance No 2: Identification of Water Bodies
- CIS Guidance No 15: Groundwater Monitoring
- CIS Guidance No 18: Guidance on groundwater status and trend assessment
- CIS Guidance No 26: Guidance on risk assessment and the use of conceptual models for groundwater

Each country, except for Moldova, has established a national regulatory basis for ground water monitoring which is compliant with the relevant CIS Guidance. Moldova is in process of development of such a regulatory framework.

The frequency of ground water monitoring is summarized in

Table 4-5. Apparently, most of the countries have different criteria concerning the frequency of monitoring depending on the type of the monitored substance and/or the type of groundwater body.

Table 4-5: Frequency of groundwater monitoring

Country	Surveillance monitoring*	Operational monitoring
Austria	At least once a year, provided that there have been no quality problems encountered in the first year (overview monitoring)	Minimum of 2 measurements per year
Bulgaria	The frequency of monitoring depends on the monitored parameters: ▪ Physic-chemical parameters and metals - 1 to 4 times per annum, as for some metals the frequency can be 6 times per annum in certain monitoring cites ▪ For organic compounds: 1 per annum, as for some specific substances could be 2 times per annum	The frequency of monitoring depends on the monitored parameters: ▪ Physic-chemical parameters and metals – 1, 2 or 4 times per annum. ▪ For organic compounds: 1 per annum, as for some specific substances could be 2 and 4 times per annum
Germany	In principle, measurements must be taken once a year. Measuring points that show pronounced	In principle, measurements must be taken once a year. Measuring points that show pronounced

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Country	Surveillance monitoring*	Operational monitoring
	variations in concentration within the year must be examined more often accordingly. At least two measurements per year are recommended (once each in spring and autumn).	variations in concentration within the year must be examined more often accordingly. At least two measurements per year are recommended (once each in spring and autumn).
Croatia	4 times a year	2 times a year
Hungary	Frequency and parameters are depending on the type of the aquifer, i.e.: ▪ Shallow groundwater, karstic water: - physico-chemical parameters - 2-4 times/year - hazardous substances - 1 time per 6 years. ▪ Deep groundwater: general physico-chemical parameters 1 times per 6 years	▪ Physico-chemical parameters - 2-4 times per year, ▪ Other selected pollutants 1 times per year
Monte Negro	Surveillance monitoring is performed for at least one year in a period of 6 years with frequency minimum 2 times a year	At least twice a year
Moldova	Not regulated	Operational monitoring is conducted fragmentary mainly due to lack of laboratory facilities. ▪ Some shallow groundwater bodies are monitored for general physico-chemical parameters & nutrients, selected hazardous substances - 1 time in 5 years. ▪ Selected deep groundwater - general physico-chemical parameters - 1 per 5 years
Romania	1-2 times per year	2 times per year
Slovenia	The frequency of monitoring depends on the monitored parameters: ▪ Metals: twice a year ▪ Organic compounds: twice a year	The frequency of monitoring depends on the monitored parameters: ▪ Metals: twice a year ▪ Organic compounds: twice a year
Slovakia **	Field measurements: ▪ in all monitoring sites - general physico-chemical parameters, metals, total organic compounds ▪ in selected monitoring sites - organic compounds, cyanides The frequency depends on the type of aquifer: ▪ Quaternary - 2 times per annum, ▪ Pre-Quaternary, karst-fissured: 4 times per annum, ▪ Other - once per annum.	Field measurements: ▪ in all monitoring sites - general physico-chemical parameters, metals, total organic compounds ▪ in selected monitoring sites - organic compounds, cyanides The frequency depends on the type of aquifer: ▪ Quaternary: 2 times per annum, ▪ Pre-Quaternary: Karst-fissured: 4 times per annum, ▪ Other: once per annum.
Serbia		The monitoring network of groundwater still does not cover all of designated water bodies, it is focused on those that are used for water supply. The frequency of monitoring is once or twice per year

** The surveillance monitoring is once within the RBMP cycle.*

*** When the ground water is used for drinking water production Water Supply Companies provides monitoring with higher frequencies depending on the size of the area (number of inhabitants) supplied with drinking water in line of theirs Operational Monitoring Programs. These results are also used in SK for assessment of GWB status and also for assessment of implementation of NiD.*

4.1.2.2 List of hazardous substances and respective EQS

Figure 4-4 presents the total number of hazardous substances included in the programs for groundwater monitoring. In Serbia, additional substances are being monitored through Annual water status monitoring program, but not for all groundwater bodies, together with iron and its compounds, anthracene, fluoranthene, hexachlorbutadiene, hexachlorocyclohexanes (α- hch, β- hch, γ- hch, δ- hch), octiphenols 4-(1,1,3,3-tetramethylbutyl) phenol, naphthalene, 4-(para)nonylphenol, pentachlorobenzene, pentachlorophenol, dicofol, quinoxyfen, aclonifen, bifenox and cibutrin.

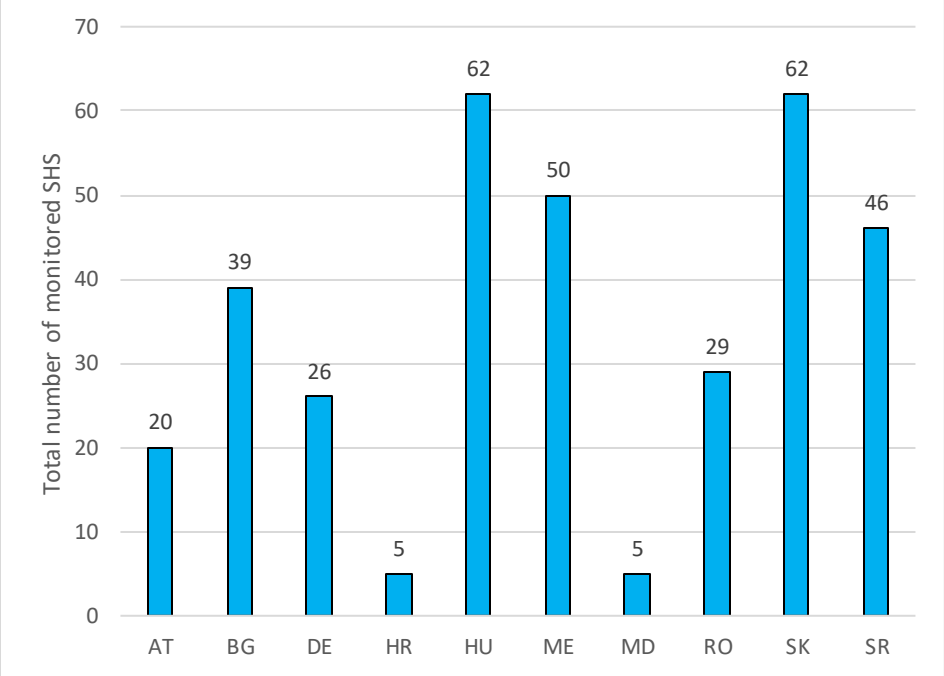

Figure 4-4: Total number of monitored specific hazardous substances (SHS) in ground water

Slovenia reports that a common list of specific pollutants subject to monitoring in ground water is not defined in the national regulatory bases and Ukraine reports that ground water monitoring program is not yet established.

Twelve substances are commonly monitored in over 50% of the investigated countries and they are presented in *Table 4-6.*

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Table 4-6: Hazardous substances monitored in groundwater in over 50% of the countries

Type	Hazardous Substance name
Metals	Arsenic, Cadmium**, Lead*, Mercury**, Nickel*
Plant protection products	Aldrin, Alachlor*, Atrazine*, Dieldrin, HCH compound **, Simazine*
Industrial origin	Trichlorethylene

* Priority substances, ** Priority hazardous substances

Directive 2006/118/EC on the protection of groundwater from pollution and deterioration gives Groundwater Quality Standards (GQS) only for pesticides, as the GQS for a given pesticide is 0.1 µg/l and for the total sum of pesticides 0. 5 µg/l. It also recommends each country to develop threshold values at least for the following substances: Arsenic, Cadmium, Lead, Mercury, Trichloroethylene and Tetrachloroethylene.

Such threshold values have been determined in Austria, Bulgaria, Germany, Croatia, Hungary and Romania. In Montenegro, Moldova, Slovakia and Serbia the development of GQS for these substances is not yet completed. *Table 4-7* presents the GQS/threshold values for the specific hazardous substances in *Table 4-6* set by the countries. Some countries monitor certain pesticides but have not yet established GQS.

Table 4-7: Ground Water Quality Standards (GQS)/threshold values (TV) for the specific hazardous substances (SHS) monitored in ground water in over 50% of the countries

SHS name	CAS No	AT	BG	DE	HR	HU	ME	MD	RO	SK	SR**
		µg/l	µg/l	µg/l		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Aldrin	309-00-2	0.03	no GQS			0.1	0.03		0.1		0.01***
Alachlor	15972-60-8					0.1	0.1		0.1	0.1	0.3
Arsenic	7440-38-2	9	10	10	10	unique for a waterbody			10; 50; 80		no GQS
Atrazine	102029-43-6		no GQS	0.1		0.1	0.1		0.1	0.1	0.6
Cadmium	7440-43-9	4.5	10	0.5	5	unique for a waterbody		unique for a waterbody	5		0.07
Dieldrin	60-57-1	0.03	no GQS			0.1	0.030		0.1		0.01***
HCH compound	-		no GQS	0.1		0.1	0.1		0.1		0.02
Lead	7439-92-1	9	10	10	10	unique for a waterbody		unique for a waterbody	10		no GQS
Mercury	92786-62-4	0.9	1	0.2	1	unique for a waterbody			1		no GQS
Nickel	7440-02-0	18	20			unique for a waterbody		unique for a waterbody	20		no GQS
Simazine	122-34-9		no GQS	0.1		0.1	0.1		0.1	0.1	1
Trichlorethylene	79-01-6	9*	10	10	10	10	2		0.1	.	

Notes: * In Austria a threshold of 9 is given jointly for Trichloroethene and Tetrachloroethene.

** Establishment of full GQS/TV list for Serbia is expected for 2024. For now, the values of maximum allowed concentrations in drinking water are used for the assessment since the monitored piezometers are in Groundwater Bodies (GWBs) used as water sources.

***0.01 is a threshold value for the sum of aldrin, dieldrin, endrin and isodrin.

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Detailed information on the monitored hazardous substances in ground water in the different countries is provided electronically in *E-Annex 4-3.*

4.2 Control of hazardous substances in point source emitters

4.2.1 Industrial discharges

The national legislation of the EU countries is fully harmonized with the EU legislation regarding industrial discharges. Concerning the non-EU countries, regulatory bases have been developed or are under preparation, which also follow the requirements of the key EU Directives.

All countries have developed a regulatory framework concerning specific emission standards that must be met by the operators discharging wastewater either in municipal sewer networks (indirect discharges) or in surface water bodies (direct discharges). The regulatory framework may comprise both *horizontal regulations and specific regulations* addressing concrete industries or industrial processes.

In all the countries, the responsible administrative bodies have the legal possibility to impose stricter (i.e. stricter than those set in the national regulatory framework), "tailor-made" requirements in the individual discharge permits, based on the combined "emission-immission principle" considering the performance of the best available techniques (BATs) for a given industrial sector and the targets and measures envisaged in the RBMPs for the receiving water body.

4.2.1.1 Industries subject to control under Directive 2010/75/EU

The Industrial Emission Directive (IED) applies to 6 main groups of activities as set up in Annex I of the IED: 1) energy industry, 2) production and processing of metals, 3) mineral industry, 4) chemical industry, 5) waste management and 6) other activities each of them having several subcategories listed in *Annex 4-4.* The EC Regulation No 166/2006 (PRTR) requires the establishment of an electronic, publicly available database of their emissions concerning specific hazardous substances.

The regulatory framework addressing the respective industries contains the following key elements according to the IED:

- An installation subject to IED can operate only if it holds a permit.
- There is an appropriate administrative organization in each country, i.e. administrative bodies responsible for the permit issuance and the control over its implementation (see section 3.2)
- The operators should submit applications for permits presenting all the information necessary, as per Art. 12 of the IED, so that the competent authority is able to determine the permit conditions.

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- The Permit conditions should be defined based on the Best Available Techniques. The competent authority shall set emission limit values that ensure that, under normal operating conditions, emissions do not exceed the emission levels associated with the best available techniques (BAT AELs).The Permit conditions are regularly reviewed and updated following the requirements of Art. 21 of the IED.
- Appropriate regulatory measures are envisaged to ensure compliance with the conditions of the permit.

Concerning the non-EU countries:

- In Moldova, a list of pollutants from enterprises of various industries was developed. According to the draft law On Industrial Emissions to be approved shortly, the Moldovan competent authority (Environmental Agency) responsible for issuing the integrated environmental permit may set stricter permit conditions than those resulting from the use of best available techniques, as described in the BAT conclusions.
- In Ukraine, at national level, there is a list of hazardous substances which should be included in the discharge permit for different industry branches and new permits should be issued including these substances.
- In Serbia emission limit values for discharges into water are prescribed based on the use of BATs for different industrial sectors, and they also include relevant priority substances. These values are taken into account in the permitting process, but competent authorities may set stricter permit conditions.

The emission standards for discharge of hazardous substances are "tailor made" for each operator. Comparison concerning the level of application of BATs for certain industrial processes in the different countries, in particular concerning the emissions of hazardous substances in water requires detailed review of the permit conditions for specific industrial processes and this is not a subject of this report.

4.2.1.2 Regulatory framework concerning industrial wastewater discharges into sewer network

In all the investigated countries, industrial wastewater discharges which do not fall under the scope of the IED are also subject to control and need a permit for discharge.

The policy framework however differs from country to country:

- In Austria, Croatia, Germany, Hungary and Slovenia there is horizontal regulatory framework which is supplemented with specific technical legislation targeting certain industrial sectors, as the emission standards for a given industry may differ from those set in the horizontal legislation.
- In Bulgaria, Moldova, Montenegro, Romania, Serbia, Slovakia and Ukraine there is only horizontal regulatory framework, i.e. the emission standard for a given substance is equal

for all the industries. In Bulgaria there are also different emission standards for discharge into sewer networks with and without WWTP.

Below, the list of substances subject to control (both through horizontal and/or specific regulatory framework) is analyzed as well as some requirements of the monitoring procedures to evaluate the level of harmonization of the control of industrial emitters in the countries of the Danube River Basin.

❒ **Industrial wastewater discharges into sewer networks**

Controlled hazardous substances

Table 4-8 and *Figure 4-5* summarize the total number of the regulated hazardous substances (PS and SHS) in the investigated countries for which are set limiting concentrations. Full list of the controlled hazardous substances in each country is provided electronically in *E-Annex 4-5.*

Table 4-8: Total number of regulated hazardous substances (as concentrations) in industrial wastewater discharges into sewer networks

Country	AT	BG	DE	HR	HU	MD	ME	RO	RS	SI	SK	UA
Priority substances	13	4	7	31	5	4	29	3	4	4	4	6
Other specific substances	25	10	35	40	28	10	37	9	17	30	12	74
Total number HS	38	14	42	71	33	14	66	12	21	34	16	80

Based on the analyzed data, the following conclusions can be made:

- Austria, Bulgaria, Germany[7], Hungary, Moldova, Romania, Serbia, Slovenia, Slovakia and Ukraine monitor a limited number of priority substances (metals) into sewer discharges predominantly through a horizontal regulatory framework.
- Croatia and Montenegro monitor over 75% of the priority substances into sewer discharges through the horizontal regulatory framework.

  These countries, together with Ukraine, have also the highest number of monitored hazardous substances. It has to be noted that Ukraine has a significantly longer list of regulated hazardous substances, most of them however (i.e. more than 50) are not monitored in any other of the investigated countries.

[7] In Germany, a sector-specific wastewater regulation applies that includes sector-specific emission limit values for all relevant dischargers.

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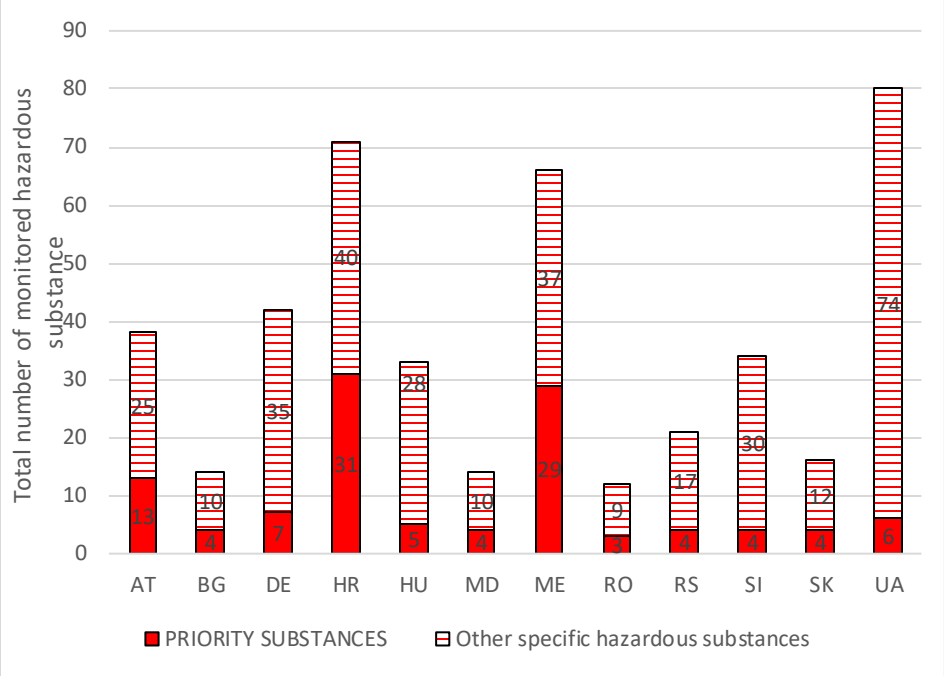

Figure 4-5: Total number of regulated priority substances (PS) and other specific hazardous substances (SHS), as concentrations, in the industrial wastewater discharges into sewer networks

Note: *Chemical substances like Ammonia nitrogen, nitrite, Iron (total & dissolved), sulphate, sulphide, sulphite, phosphates, BOD_5, COD are not regarded as hazardous substances and therefore are not included in these analyses.*

Nevertheless, the substantial number of hazardous substances regulated in most of the countries, the priority and other hazardous substances monitored in all the countries is relatively small (*Table 4-9*). There are also several priority substances that seem not to be regulated through the national regulatory framework in the industrial wastewater discharges into sewer networks. These substances, however, might be regulated subject to a tailor-made permission for discharge.

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Table 4-9: Coverage of priority substances (PS) regulatory control for industrial wastewater discharges into sewer networks in the investigated countries

Condition	Substance	CAS No
PS regulated in at least 80% of the countries	Cadmium	7440-43-9
	Lead	7439-92-1
	Mercury	7439-97-6
	Nickel	7440-02-0
PS regulated in less than 10% of the countries	Brominated byphenil ether (PBDE)	32534-81-9
	Hexachlorocyclohexane (HCH)	608-73-1
	Octylphenols (4-(1, 1',3,3'- tetramethyl-butyl)-phenol)	140-66-9
PS not yet monitored	Trifluralin	1582-09-8
	Dicofol	115-32-2
	Perfluorooctane sulfonic acid and its derivatives (PFOS)	1763-23-1
	Quinoxyfen	124495-18-7
	Aclonifen	74070-46-5
	Bifenox	42576-02-3
	Cybutryne	28159-98-0
	Cypermethrin	52315-07-8
	Dichlorvos	62-73-7
	Hexabromocyclododecane (HBCDD)	Not applicable
	Heptachlor and Heptachlorepoxide	76-44-8/1024-57-3
	Terbutryn	886-50-0

Other SHS monitored in over 80% of the countries are: Arsenic (CAS No 7440-38-2), Chrome 6+ (CAS No 18540-29-29), Copper (CAS No 7440-50-8), Cyanides total (CAS No 143-33-9) and Zinc (CAS No 7440-66-6).

Emission standards for hazardous substances

Usually, the emission standards for waste water discharge are expressed as concentration (mg/l). The emission standards refer to the concentration measured in one or more composite samples and – depending on the type of sampling – is expressed for defined averaging periods.

Averaging periods associated emission limit values usually refer to daily average values, i.e. 24-hour flow-proportional composite samples. In Germany, a qualified random sample or a 2-hour composite sample is used instead. Other countries may use also long-term average periods such as monthly averages. There are cases however (e.g. in Austria and Hungary) where permit conditions are expressed as emission loads discharged into the receiving water bodies – in g/d or kg/d; Hungary has emission standards both for average monthly and average daily values.

Below, in *Table 4-10,* the emission standards for the priority substances and other SHS controlled in at least 80% of the countries are presented and expressed as concentration (mg/l). Detailed information about the applied emission standards for all the regulated hazardous substances in each country is given in the electronic *E-Annex 4-5.*

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In the table below, the minimum and maximum values for a given substance are marked in bold and red-bold, respectively. It can be clearly seen that the thresholds differ, sometimes significantly, for the investigated substances among the analyzed countries. Austria, Germany, Croatia, and Hungary apply different emission standards for a given substance, depending on the type of the industrial activity, the wastewater characteristic of the industrial sectors, available abatement techniques and the date of the last update of the BAT-based requirements for a given sector. In Germany, the emission limit values for the hazardous substances shown in table 4-10 apply equally to both indirect and direct discharge (the latter by applying a mixed calculation).

It could be concluded that Germany has stricter emission standards for discharge into sewer networks than other Danube Riparian countries. In Bulgaria the emission standards are less strict for most of the presented substances.

Table 4-10: Emission standards (as concentrations) for the hazardous substances in industrial wastewater discharges into sewer networks regulated in at least 80% of the investigated countries

(**in bold** is marked the minimum value and **in red** is marked the maximum value in the row)

Parameter	AT		BG	DE		HR		HU		MD	ME	RO	SR	SI	SK	UA
	mg/l		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
	min	max		min	max	min	max	min	max							
Cadmium	0.05	0.1	**0.5**	**0.008**	0.2	0.1	0.2	0.01	0.4	0.2	0.1	0.3	0.1	0.025	0.1	0.01
Lead	0.05	0.5	**2.0**	**0.02**	1.0	0.5	0.5	0.2	1.0	0.2	0.5	0.5	0.2	0.5	0.3	0.1
Mercury	0.005	0.02	0.05	**0.001**	0.1	0.01	0.05	0.01	**2.0**	0.1	0.01	-	0.05	0.005	0.05	0.005
Nickel	0.1	0.5	**2.0**	**0.05**	**2.0**	0.3	0.5	0.2	1.0	0.8	0.5	1.0	1.0	0.5	0.2	0.5
Arsenic	0.1	0.1	**0.5**	**0.05**	0.3	0.1	0.3	0.1	0.3	-	0.1	-	0.2	0.1	0.2	0.1
Chromium (6+)	0.1	0.1	**0.5**	**0.05**	0.1	0.1	0.1	**0.05**	**0.5**	0.2	0.1	0.2	**0.5**	0.1	0.1	0.1
Copper	0.1	0.1	**2.0**	**0.05**	1.0	0.4	1.0	0.5	**2.0**	0.2	0.5	0.2	**2.0**	0.5	1.0	0.5
Cyanides (total)	-	-	1.5	-	-	**0.1**	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10**	0.20	1.5
Zinc	**0.5**	2.0	5.0	**0.5**	4.0	**0.50**	3.0	1.0	**10**	1.0	2.0	1.0	5.0	2.0	2.0	1.00

❒ Industrial wastewater discharges into river bodies

Concerning the ***direct industrial discharges*** in Austria, Croatia, Hungary, Romania and Slovenia there are horizontal emission standards, which in some cases are supplemented by additional requirements concerning specific industrial processes, for example:

- In Austria and Germany, there are sector-specific minimum requirements for the discharge of wastewater (presented in respective annexes) as part of a wastewater emission ordinance[8]. For constituents for which no emission limitation has been laid down in the

[8] Ordinance of the Federal Minister of Agriculture and Forestry on the general limitation of wastewater emissions into running waters and public sewers (General Waste Water Emissions Ordinance - AAEV)

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specific ordinances, the emission limitation of the general ordinance applies. In Germany the wastewater ordinance consists of a general section (§§1 – 7), a list of acknowledged analytical methods, and its 57 annexes that set up emission limit values and other best available techniques to be applied as minimum requirement by all relevant dischargers.

- In Hungary, the emission thresholds for a given pollutant are limited within a minimum and maximum value and the responsible authority defines specific value, within the given range, for a certain direct industrial wastewater discharge.
- In Romania, horizontal emission standards apply both for industrial and municipal discharges into natural receptors. According to the national legislation, for the substances (e.g priority substances or other pollutants) for which maximum admissible limits are not provided in the enforced legislative framework, such should be established based on specific studies.
- In Moldova there seems to be only horizontal legislation for emission standards of specific hazardous substances and Ukraine is in process of developing such standards.
- In Bulgaria, Serbia and Slovakia there are no horizontal emission standards concerning hazardous substances, but the regulatory requirements are focused on specific industrial branches and/or technologies.
- In Montenegro the regulatory approach is very specific. A significant number of parameters must be measured for each industrial wastewater discharge when obtaining discharge permit. After issuing the discharge permission, a mandatory monitoring program is established with a shorter list of specific parameters, also including priority substances, characteristic for the production processes.

Controlled hazardous substances

Table 4-11 summarizes the total number of the regulated hazardous substances and *Figure 4-6* presents the number of regulatory controlled priority substances and other specific hazardous substances for which the emission standards for waste water discharge are expressed as concentrations. Serbia is not included in the comparison since most of the emission standards are expressed not as concentrations but as mass pollutant per mass production[9]. Bulgaria and Hungary apply similar approach for some hazardous substances (i.e. the emission standards are based on mass pollutant per mass production).

StF: BGBl. No. 186/1996.

[9] For direct industrial discharge, Serbia has prescribed ELVs for all industries or type of activities and technological processes currently existing in Serbia, in total 53, they are all based on BREF documents adopted by the end of 2016 and application of BAT. In addition, there are 8 chapters prescribing ELVs for certain priority substances (Cd, Hg, HCH, *endosulfane, aldrin, dieldrin, endrin, isodrine, asbestos, organo-halogene compounds and titanium dioxide), used if these substances are not already included in previous 53 chapters.*

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Table 4-11: Total number of regulated hazardous substances (as concentrations) in industrial wastewater discharges into the surface water bodies in the investigated countries

Country	AT	BG	DE*	HR	HU	MD	ME	RO	SI	SK
Priority substances	13	11	7	31	8	4	30	42	4	13
Other specific substances	25	19	35	40	27	14	39	33	30	26
Total number HS	38	30	42	71	35	18	69	75	34	39

* In Germany the chemical substances Cd, Cr (total), Cu, Pb, Hg, Ni and Zn are regulated for specific industries. In Germany, the emission limit values for the hazardous substances shown in table 4-10 for indirect discharge apply equally to direct discharge (the latter by applying a mixed calculation)..

The full list of the controlled hazardous substances in each country is provided electronically in *E-Annex 4-6.*

Similar to the discharges into sewer network cadmium, lead, mercury and nickel are again the priority substances regulated in most of the countries.

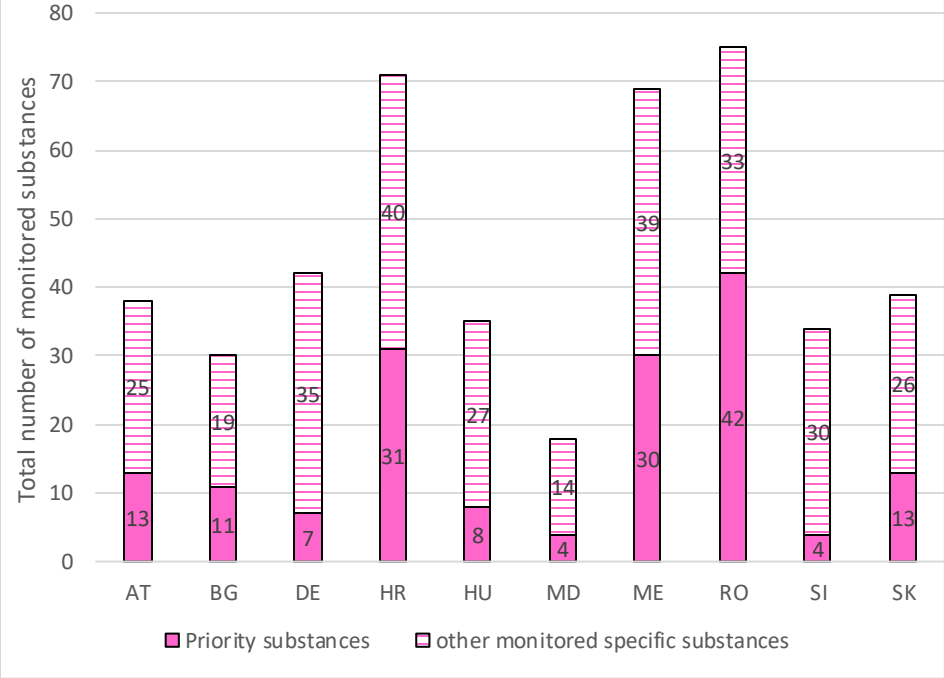

Figure 4-6: Total number of controlled priority substances (PS) and other specific substances (SHS) in industrial wastewater discharges into surface water bodies

Note: *Chemical substances like Ammonia nitrogen, nitrite, Iron (total & dissolved), sulphate, sulphide, sulphite, phosphates, BOD_5, COD are not regarded as hazardous substances.*

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Table 4-12: Coverage of priority substances (PS) regulatory control for industrial wastewater discharges into sewer networks in the investigated countries

Condition	Substance	CAS No
PS regulated in at least 80% of the countries	Cadmium	7440-43-9
	Hexachlorobenzene (HCB)	118-74-1
	Lead	7439-92-1
	Mercury	7439-97-6
	Nickel	7440-02-0
PS regulated in less than 10% of the countries (i.e. at least 1 country)	Trifluralin	1582-09-8
	Dicofol	115-32-2
	Perfluorooctane sulfonic acid and its derivatives (PFOS)	1763-23-1
	Quinoxyfen	124495-18-7
	Aclonifen	74070-46-5
	Bifenox	42576-02-3
	Cybutryne	28159-98-0
	Cypermethrin	52315-07-8
	Dichlorvos	62-73-7
	Hexabromocyclododecane (HBCDD)	
	Heptachlor and Heptachlorepoxide	76-44-8/1024-57-3
	Terbutryn	886-50-0

Other SHS monitored in over 80% of the countries are: aluminum, AOX (halogenated organic compounds), arsenic, chrome 6^+; chrome total, cobalt, copper, selen and zinc. It has to be noted that Romania is monitoring the highest number of priority substances, for most of them the emission standards are determined based on the basis of a study and based on the environmental objectives of the natural receiver.

Emission standards for hazardous substances

Usually, the emission standards for wastewater discharge are expressed as concentration (mg/l). The emission standards refer to the concentration measured in one or more composite samples and – depending on the type of sampling – is expressed for defined averaging periods.

Averaging periods associated with emission limit values usually refer to daily average values, i.e. 24-hour flow-proportional composite samples. In Germany, a qualified random sample or a 2-hour composite sample is used instead. Other countries may use also long-term average periods such as monthly averages. In some countries (e.g. Austria, Bulgaria, Hungary, Slovakia and Serbia) some emission standards are expressed as mass of substance per mass production.

Hungary, Slovakia and partially Bulgaria apply both requirements for the average monthly and average daily values of the discharged substances.

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Table 4-13 presents information concerning the emission standards for the hazardous substances monitored in 80% of the countries (i.e. in at least 9 countries). The maximum range of concentrations for several parameters seems to be higher in Hungary and Slovakia. It has to be noted however that the responsible administrative bodies may impose stricter values depending on the characteristic of the industrial process and the ecological status of the receiving water body. The minimum values for emission standards in Croatia seem to be the strictest ones.

Table 4-13: Emission standards for the hazardous substances in industrial wastewater discharges into surface water bodies regulated in at least 80% of the investigated countries

Parameter	AT		BG		DE**		HR		HU*		MD	ME		RO	SI		SK	
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
	min	max	min	max	min	max	min	max	min	max*		min	max		min	max	min	max
Cadmium	0.008	0.1	0.1	**0.4**	0.008	0.2	0.05	0.2	**0.005**	0.3	0.1	0.05	0.2	0.2	0.025	0.025	0.05	**0.4**
Hexachlorobenzene (HCB)	0.003	1.00	2.0	**3.0**			**0.001**	0.001	0.003	0.006	-	**0.001**	0.001	-	-	-	2.0	**3.0**
Lead	0.03	**0.5**	0.1	0.3	**0.02**	1.0	0.1	**0.5**	0.05	0.4	0.1	0.1	**0.5**	0.2	0.5	**0.5**	0.2	**0.5**
Mercury	**0.001**	0.02	0.01	0.2	**0.001**	0.1	0.01	0.05	**0.001**	0.08	0.05	0.01	0.05	0.05	0.005	0.005	0.03	**2.0**
Nickel	0.1	0.5	0.5	0.5	**0.05**	**2.0**	**0.05**	0.5	0.1	0.5	0.5	**0.05**	0.5	0.5	0.5	0.5	0.5	0.8
Aluminum	2.0	3.0	**0.2**	0.2	2.0	**6.0**	3.0	3.0	2.0	3.0	5.0	3.0	3.0	5.0	3.0	3.0	3.0	3.0
AOX	**0.1**	0.5	0.5	**8.0**	0.5	1.0	**0.1**	0.5	**0.1**	7.0	-	**0.1**	0.5	-	0.5	0.5	**0.1**	2.0
Arsenic	0.1	0.1	0.1	0.1	**0.05**	0.3	0.1	0.3	0.1	0.15	0.1	0.1	0.15	0.1	0.1	0.1	0.1	**0.5**
Chromium (6+)	0.1	0.1	0.1	0.1	**0.05**	0.1	0.1	0.1	0.1	**0.5**	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Chromium total	-	-	0.50	0.50	**0.025**	**0.5**	0.1	1.0	0.2	0.5	1.0	0.1	1.0	1.0	0.5	0.5	0.5	**2.0**
Cobalt	0.1	0.5	-	-	-	-	1.0	**1.0**	0.1	**1.0**	**1.0**	0.1	**1.0**	**1.0**	**0.03**	0.03	1.0	**1.0**
Copper	0.1	0.1	0.5	0.5	**0.05**	1.0	0.1	0.5	0.1	**2.0**	0.1	0.1	1.0	0.1	0.5	0.5	0.5	1.0
Selen	0.1	0.5	-	-	-	-	**0.02**	0.02	1.0	**2.0**	0.1	0.02	0.02	0.1	-	-	0.1	0.1
Zinc	0.5	2.0	1.0	3.0	0.5	4.0	**0.1**	3.0	0.5	**5.0**	0.5	**0.1**	3.0	0.5	2.0	2.0	1.5	3.0

* For Hungary, In individual cases the maximum limiting concentrations may be higher for Nickel (up to 2 mg/l), Aluminium (up to 6 mg/l), Arsenic (up to 1 mg/l), Chromium 6+ (up to 1 mg/l), Chromium total (up to 2 mg/l) , Copper (up to 4 mg/l) , Cobalt (up to 2 mg/l) and Ziinc (up to 10 mg/l)

** In Germany, the emission limit values for the hazardous substances shown in table 4-10 apply equally to indirect and direct discharge. In case of direct discharge, a mixed calculation is applied that considers process water flows that do not contain the pollutant of concern. Requirements specified in form of concentration values (mg/l) shall not be achieved via dilution. That means that that if e.g. a polluted waste water stream containing cadmium is mixed with an unpolluted waste water stream of the same volume the emission limit values for cadmium express as concentration would be divided by two. With reference to the combined approach, where quality objectives or quality standards require stricter conditions than those which would result from the application of best available techniques (BAT), more stringent emission controls are set accordingly (see Article 10 Water Framework Directive).

❒ Monitoring approaches and frequency

For indirect discharges and for industrial dischargers not subject to IED the discharge permits are usually issued by the operator of the sewer network, as the Operator stipulates the parameters subject to monitoring, the emission standards and the frequency and type of monitoring following the requirements of the legislative framework. In Germany, the permits are always issued by water authorities without exceptions and the compliance is assessed also by the water authorities. Operators of municipal WWTPs and sewer networks my set additional requirements such as pH, suspended solids and alike in order to protect the sewer systems and the workers.

For direct industrial discharges the frequency and type of sampling are regulatory established in each country. The frequency and conditions of sampling for a specific industrial emitter are stipulated in the individual discharge permit. Some of the monitoring approaches, practiced in the different countries, are summarized in Table 4-14.

The monitoring approaches vary significantly from country to country. In some countries, the procedures seem to be simplified, not considering the amount of the industrial discharges, while in the other countries (e.g., Slovenia, Montenegro, Croatia, Serbia), the frequency of monitoring is related to the size of the industrial discharges. Grab samples or continuous mixed or flow proportional are practiced.

Table 4-14: Summary of the monitoring procedures used in the different countries

Country	Monitoring approaches
Austria	• Self-monitoring: Application of "4 out of 5" principle, i.e. 5 consecutive measurements with one exceeding not more than 50%. This principle is determined as the standard evaluation for several parameters in various industries, though there are single substances with different regulations. • External monitoring: 4 measurements per year with one exceeding by 50% there is a need for revision, more than 5 measurements per year same principal as self-monitoring
Bulgaria	• The frequency of monitoring is stipulated in the individual permit. i.e. no general regulations • Full monitoring procedure: A composite 24 h representative sample is taken and parallel flow measurement. Where it is possible to measure or determine by calculation the quantity of the dangerous substance manufactured, treated or used. • Simplified procedure: Taking 2 grab samples for a period of 24 hours with an interval between them not less than 2 hours and parallel flow measurement; the daily average concentration is determined as the arithmetic mean of the single samples. Simplified procedure is applied for certain type of industries. In both procedures the quantity of the dangerous substance discharged with the waste waters for a month is calculated based on the daily discharged quantities. • The level of compliance in not specified, i.e. the general rules apply that all the monitored emissions shall be lower or at least equal with the emission standards.
Germany	• Industrial emitters not subject to IED requirements are generally regulated in the same manner as IED-plants. Non-IED plants have to comply with the emission limit values that are also applied for IED plants. However, monitoring requirements according to BAT conclusions are restricted to IED emitters. • Non-IED emitters have to comply with similar monitoring requirements. They are stipulated in the Self-Monitoring Ordinances of the German Länder (Federal States). Additionally, monitoring carried out by competent water authorities takes place. The monitoring frequency carried out by water

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<table>
<tr><th>Country</th><th>Monitoring approaches</th></tr>
<tr><td></td><td>authorities depends on the size of the installation, the emission load discharged, and the relevance of the pollutants discharged.
• Compliance check of legal requirements for discharge is controlled by regular measurements of pollutants and flow and assessment of results. Additionally, reports of self-monitoring are sent to water authorities and checked by them.
• If discharge of Priority Substances (PS) is expected to happen in a given industrial sector, emission limit values for those substances are part of the permit condition. Normally, these PS are already included by the updated requirements of the German wastewater Ordinance (AbwV). The general approach in Germany is that all relevant pollutants including PS are regulated by the respective Annex of the wastewater ordinance. That means, usually no additional or separate limit values for priority substances is required. They are already covered by the wastewater ordinance. There might be a few specific cases where this however happens (exception from the rule). In these cases, the respective sector-specific Annex of the wastewater ordinance is updated in the light of new BAT conclusions if they contain new parameters.
• German limit values usually refer to a qualified random sample or a 2-hour composite sample. In the case of pulp mill discharge, a 24-hour flow-proportional composite samples is taken and analyzed.</td></tr>
<tr><td>Croatia</td><td>• The minimum sampling frequency of industrial wastewater depends on the amount of wastewater discharged.
• Sampling of treated and / or untreated industrial wastewater before discharge into the public sewerage system is performed from an instantaneous or composite sample, composite sampling is performed every hour.
<table>
<tr><td>Receiver</td><td>up to 10 m³ of water / day</td><td>10 – 100 m³ of water / day</td><td>100 – 1000 m³ of water / day</td><td>More than 1000 m³ of water / day</td></tr>
<tr><td>Water</td><td>2 times per year</td><td>4 times per year</td><td>6 times per year</td><td>8 times per year</td></tr>
<tr><td>Public sewerage system without treatment plant</td><td>2 times per year</td><td>4 times per year</td><td>6 times per year</td><td>8 times per year</td></tr>
<tr><td>Public sewerage system with treatment plant</td><td>1 per year</td><td>2 times per year</td><td>4 times per year</td><td>6 times per year</td></tr>
</table></td></tr>
<tr><td>Hungary</td><td>Self-monitoring, qualified point sample or 2-hour average sample. The frequency of monitoring is specified in the individual permit.</td></tr>
<tr><td>Romania</td><td>A composite representative sample for a period of 24 hours and parallel flow measurement. Where it is possible to measure or determine by calculation the quantity of the dangerous substance manufactured, processed, or used.</td></tr>
<tr><td>Serbia</td><td>• The minimum sampling frequency of industrial wastewater depends on the amount of wastewater discharged
• Sampling of treated and/or untreated wastewater is performed by taking composite or instantaneous grab sample, depending on the dynamics of the release of waste waters, as well as the technological process.
• The method of 24-hour composite sample is used, unless otherwise regulated by the act regulating ELV. A composite sample may be taken in proportion with time or flow. If wastewater is released discontinuously, and the time of release is not above 24 h, a current sample is taken instead of a representative composite sample.
Frequency for industrial wastewater:
<table>
<tr><td rowspan="2">Wastewater flow at an individual outflow (l/s)</td><td colspan="2">Wastewater containing hazardous matter</td><td colspan="2">Other waste water</td></tr>
<tr><td>Annual number of samples</td><td>Testing frequency</td><td>Annual nr of samples</td><td>Testing frequency</td></tr>
<tr><td>< 50</td><td>4</td><td>once every three months</td><td>3</td><td>once per 4 months</td></tr>
</table></td></tr>
</table>

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Country	Monitoring approaches
	50 - 99 | 6 | once every two months | 4 | once per 3 months 100 - 499 | 12 | once per month | 6 | once per 2 months ≥ 500 | 24 | twice per month | 12 | once per month
Slovenia	The frequency of monitoring is specified in Annex 1 of the Rules on initial measurements and operational monitoring of wastewater: • 1 time per year for discharges of < 4.000 m³/year, • 2 times per year for discharges from 4.000 m³/year to < 10.000 m³/year, • 3 times per year for discharges from 10.000 m³/year to <50.000 m³/year, • 4 times a year for discharges from 50.000 m³/year to <200.000 m³/year, • 6 times a year for discharges from 200.000 m³/year to <500.000 m³/year, • 12 times a year for discharges more than 500.000 m³/year, For sampling a flow proportional composite sample for a period of 24 hours has to be obtained and flow measurement has to be provided. The frequency is stated in the permission.
Slovakia	• Full procedure: A flow proportional composite sample for a period of 24 hours, flow measurement. The frequency is stated in the permission (if necessary, continuously; minimal frequency 12/year, limit concentration stated in permission has to be meet with 98% reliability). • Simplified procedure: If the concentration of discharged hazardous substances is below a half of the EQS or the concentration of the relevant hazardous substances in the recipient is continuously 3 years low, the monitoring can be simplified for 2-4 samples/year.
Moldova	Self-monitoring specified in the permit, • In addition, Inspectorate for Environmental Protection carries out simplified monitoring procedure, implying grab sampling for the 24 hours period
Montenegro	• 2 times a year for discharges up to 10 m3/d • 4 times a year for discharges of 10-100 m3/d • 6 times a year for discharges of 100-1000 m3/d • 8 times a year for discharges more than 1000 m3/d
Ukraine	Simplified procedure. Taking grab samples for the 24 hours period and parallel flow measurement; the daily average concentration is determined as the arithmetic mean of the single samples.

❒ Comparison between the controlled hazardous substances for indirect and direct industrial wastewater discharges

The table below (*Table 4-15*) presents comparison between the total number of controlled hazardous substances of discharges into sewer networks and surface water bodies through horizontal regulatory framework. Bulgaria, Slovakia and Romania have only specific industrial emission standards targeting concrete industrial branches or processes.

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Table 4-15: Comparison of controlled hazardous substances (as concentrations) in the industrial wastewater discharges into sewer networks (SN) and surface water bodies (SWB)

Country	SN	SN	SN	SWB	SWB	SWB
	Priority substances	other specific substances	Total hazardous substances	Priority substances	other specific substances	Total hazardous substances
Austria	13	25	**38**	13	25	**38**
Bulgaria	4	10	**14**	11	19	**30**
Germany*	7	35	**42**	7	35	**42**
Croatia	31	40	**71**	31	40	**71**
Hungary	5	28	**33**	8	27	**35**
Moldova	4	10	**14**	4	14	**18**
Montenegro	29	37	**66**	30	39	**69**
Romania	3	9	**12**	42	33	**75**
Serbia**	4	17	**21**	-	-	-
Slovenia	4	30	**34**	4	30	**34**
Slovakia	4	12	**16**	13	26	**39**
Ukraine	6	74	**80**	In process	In process	In process

* In Germany the chemical substances cadmium, chrome (total), copper, lead, mercury, nickel and zinc are regulated for specific industries. The emission limit values for the hazardous substances shown in table 4-10 and 4-13 apply equally to indirect and direct discharge. In case of direct discharge, a mixed calculation is applied that considers process water flows that do not contain the pollutant of concern.

*** Serbia is not included in the comparison for SWB since most of the emission standards are expressed not as concentrations but as mass pollutant per mass production*

The number of controlled hazardous substances is either equal or increases for discharges into surface water bodies. More substantial increase is observed in Bulgaria, Romania and Slovakia.

Comparison of the emission standards for some hazardous substances

Table 4-16 presents comparison of the threshold values (in mg/l) for cadmium, lead, mercury and nickel, i.e. the priority substances which are monitored in over 80% of the countries.

In most of the countries the threshold values for discharge of industrial wastewater into surface water bodies are either the same as the ones for discharge into sewer networks or stricter.

Only in Slovakia, the range of maximum values for emission standards for some parameters seems to be higher for direct discharges than for the indirect discharges. It has to be noted however, that the limit value depends on the character of industrial facility. Pursuant to the Slovakian Water act*: "In the interest of water quality and water conditions protection, the state water administration body for discharged wastewater and special waters may set permissible pollution values stricter than the pollution limit values or determine other permissible pollution values"* (another parameters). The emission-immission principle is

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considered when determining the concentration values in the permit. This principle applies to the other countries as well.

Table 4-16: Comparison of emission standards (as concentrations) for cadmium, lead, mercury and nickel in the industrial wastewater discharges into sewer networks (SN) and surface water bodies (SWB)

SN/SWB	SN	SWB	SN	SWB	SN	SWB	SN	SWB
Substance	Cadmium		Lead		Mercury		Nickel	
Country	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Austria	0.05-0.1	0.008-0.1	0.05-0.5	0.03-0.5	0.005-0.02	0.001-0.02	0.1-0.5	0.1-0.5
Bulgaria	0.5	0.1-0.4	2.0	0.1-0.3	0.05	0.01-0.2	2.0	0.5
Germany	0.008-0.2	0.008-0.2	0.02-1.0	0.02-1.0	0.001-0.1	0.001-0.1	0.05-2.0	0.05-2.0
Croatia	0.1-0.2	0.05-0.2	0.5	0.1-0.5	0.01-0.05	0.01-0.05	0.3-0.5	0.05-0.5
Hungary	0.01-0.4	0.005-0.3	0.20 -1.00	0.05-0.4	0.01-2	0.001-0.08	0.2-1.0	0.1-2.0
Moldova	0.2	0.1	0.2	0.1	0.1	0.05	0.8	0.5
Montenegro	0.1	0.05-0.2	0.5	0.1-0.5	0.01	0.01-0.05	0.5	0.05-0.5
Romania	0.3	0.2	0.5	0.2	n.a.	0.05	1.0	0.5
Slovenia	0.025	0.025	0.5	0.5	0.005	0.005	0.5	0.5
Slovakia	0.1	0.05-0.4	0.3	0.2-1.5	0.05	0.03-2.0	0.2	0.5-0.8

4.2.1.3 Regulatory framework concerning some specific industrial processes.

As mentioned above, most of the countries have regulatory framework, which targets specific industrial processes or branches. Usually, it implies additional hazardous substances to be monitored or stricter emission standards to be applied. The number of industrial processes and/or branches subject to specific regulation is different in the different countries. The list of controlled substances is specific for each industrial branch and/or technological process.

Annex 4-7 presents an indicative list of hazardous substances subject to regulatory control for several specific industrial processes: glass production industry, pharmaceutical industry and textile industry for which the project partners have provided data, based on the national regulatory framework. The mentioned industries also fall within Annex 1 of the controlled industries according to the IED. It is supposed that their emission standards & monitoring programs are tailor made, including BATs, and therefore the presented information in *Annex 4-7* cannot be considered complete.

Nevertheless, the presented information gives an idea about some of the most monitored hazardous substances and the respective emission standards.

For comparison only those substances specifically mentioned in the national regulations in at least two countries are presented in the tables below. Stricter values or inclusions of other specific hazardous substances might be subject to individual permit for a specific industrial enterprise in each country.

- **Glass industry**

Glass industry belongs to the category of Mineral industries. Glass factories with melting capacity over 20 tones/day are subject to specific regulations within the IED and the E-PRTR

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register (see *Annex 4-4).* The analysis of the collected information shows that several countries report specific national regulatory requirements related to the glass producing facilities. The level of regulatory control is either for direct or indirect discharges or both.

Table 4-17 presents comparison of some of the commonly monitored priority substances and their respective emission standards for discharge into surface water bodies. The emission standards for lead and arsenic show the most significant differences in the value.

Table 4-17: Emission standards of some commonly monitored hazardous substances in the wastewater from glass industry discharged into surface water bodies in investigated countries

Parameter/country	Austria	Bulgaria	Croatia	Germany*	Serbia	Slovakia	Slovenia
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Cadmium	0.05		0.05	0.05	0.1		
Lead	0.05	0.1	0.3	0.3	0.5	1.5	
Nickel	0.5		0.5	0.5	0.5		
Antimony		0.5	0.5	0.3			
Arsenic		0.10	0.30	0.3	0.3	1.00	
Barium			3	3.0	3	5	
Chromium total			0.3	0.3	0.5		0.5
Fluoride	30	20		6.0 [30]	30		
Zinc	0.5		0.5	0.5			

* In Germany, the emission limit values refer to indirect discharge (and direct discharge also considering that values shall not be achieved via dilution). Emission limit values refer to qualified random samples or 2-hour composite samples.

❖ **Pharmaceutical industry**

The pharmaceutical industry belongs to the Chemical industry branch, and it falls within the regulations of the IED and E-PRTR regulation, no matter the production capacity (see *Annex 4-4).* In *Table 4-18* are presented the emission standards for some of the commonly monitored priority substances. Only those values, which are specifically mentioned in the national regulations for being monitored for pharmaceutical wastewater discharges are presented. Stricter values or inclusion of these substances, for which are not presented values, might be subject to individual permission.

Table 4-18: Emissions standards of some commonly monitored hazardous substances in the wastewater from pharmaceutical industry discharged into surface water bodies in the investigated countries

Parameter/country	Austria	Bulgaria	Croatia	Monte Negro	Slovakia
	mg/l	mg/l	mg/l	mg/l	mg/l
Lead			0.50	0.50	
Mercury	0.01	0.01	0.01	0.01	
Nickel	0.50		0.05	0.05	
AOX (halogenated organic compounds)		1	0.5	0.5	0.5
Chromium total			0.05	0.05	
Copper			0.1	0.1	
Cyanides (free)			0.1	0.1	

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Cyanides (total)			0.5	0.5	
Detergents anionic			1	1	
Detergents non-ionic			1	1	
Hydrocarbons Volatile Aromatic (BTX)			0.1	0.1	
Hydrocarbons Volatile chlorinated			0.1	0.1	
Oils and fats total (hard volatile lipofilic substances)		10	20		
Zinc	2.0		0.1	0.1	

It must be noted that in Hungary there are also requirements concerning the manufacture of basic pharmaceutical products and preparations. According to the provided information the regulatory controlled parameters are *Toxicity fish, Toxicity algae and Toxicity Daphnea* which are biological indicators for the summary effect of the hazardous substances in the pharmaceutical wastewater over the water ecosystems. Similar index is applied also in Slovakia, i.e. *Ecotoxicity (TOXind)* applicable in general for the wastewater from chemical industry.

❖ **Textile industry**

The textile industry covers various types of industrial activities. The IED defines *"Pre-treatment (operations such as washing, bleaching, mercerisation) or dyeing of textile fibers or textiles, where the treatment capacity exceeds 10 t/d"* in category "Other industries" in Annex I as subject to specific requirements concerning the pollution control. These processes also fall within the regulations of the E-PRTR register (see *Annex 4-4).*

Table 4-19: Emission limit values of hazardous substances in the wastewater from textile industry discharged into surface water bodies in investigated countries

Parameter/Country	Austria	Bulgaria	Croatia	Germany	Hungary	Monte Negro	Serbia	Slovakia
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Cadmium						0.1	0.1	
Lead	0.5					0.5	0.5	
Nickel	0.5	0.5		0.5			0.5	
Aluminium	3					3	3	
AOX (halogenated organic compounds)	0.5	8.0		0.5		0.5	0.5	
Chlorine active					0.3		0.3	
Chromium (six-valent)	0.1			0.1		0.1		
Chromium total		0.5		0.5	2	0.5	0.5	2
Cobalt	0.5					0.5	1	
Copper		0.5		0.5	1	1	0.5	1
Detergents anionic & nonionic	2		1				1	
Hydrocarbons (total)			10			10		
Hydrocarbons Volatile chlorinated			0.1			0.1		
Petroleum products	5	10						
Phenol			0.1			0.1		
Phenols (volatile)		0.50						
Tin			1	2		1	2	

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Zinc	2	2	3	2	3	3	2	3

❖ **Landfill leachate**

Landfills (excluding landfills of inert waste) receiving 10 tons per day or with a total capacity of 25 000 tones fall within the requirements of the PRTR. Below are presented the emission standards in several countries.

Table 4-20: Emissions limit values of hazardous substances in the wastewater from landfills discharged into surface water bodies in the investigated countries

Parameter/Country	Austria	Croatia	Germany*	Serbia	Slovakia	Slovenia
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Cadmium	0.1	0.1	0.1	0.1	0.15	0.025
Lead	0.5	0.5	0.5	0.5	0.5	0.5
Mercury	0.01	0.01	0.05	0.05		0.005
Nickel	0.5	0.5	1	1	0.5	
AOX (halogenated organic compounds)	0.5	0.5	0.5	0.5	1	
Arsenic	0.1	0.1	0.1	0.1	0.2	0.1
Chromium total		0.5	0.5	0.5	0.5	
Copper		0.5	0.5	0.5	0.5	0.5
Zinc	0.5	2	2	2	2	2

*In Germany, the emission limit values refer to both indirect discharge and direct discharge considering that values of the latter shall not be achieved via dilution. Emission limit values refer to qualified random samples or 2-hour composite samples. See Annex 51 of the Waste Water Ordinance

4.2.2 Municipal wastewater discharges

The regulatory control for the **municipal wastewater discharges** (i.e., from the sewerage systems) is either organized in separate legislative acts (e.g., Austria, Moldova, Montenegro) or it is integrated in the horizontal legislative acts concerning the (direct) wastewater discharges into surface water bodies.

Controlled hazardous substances

The information provided by the partners concerning the controlled hazardous substances in the WWTPs discharges is summarized in the table *Table 4-21.* It could be concluded that different countries control different hazardous substances in WWTPs effluent, and the most common substances are metals. Some countries however (e.g. Montenegro, Romania) monitor significant range of other substances as well.

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Table 4-21: Controlled hazardous substances in WWTP discharges

Country	Monitoring approaches
Austria	The monitoring for municipal discharge is in line with the UWWTD and therefore operators have no general obligation to monitor hazardous substances. The issuing authority can however set higher standards, if lower threshold values are required due to a pre-pollution of the water body or the urban WWTP shows a specific discharge, e.g. due to an indirect discharge. However, there is an obligation for municipal wastewater treatment plants to monitor ***Nickel, Nonylphenole and Mercury***. The chosen substances are based on a 2017 survey and have to be monitored according to the amount of the discharge. The annual load for municipal treatment plants not smaller than 2,000 PE has to be determined and reported every 6 years.
Bulgaria	The controlled substances are specified in the discharge permit. By presumption, WWTP operators must control the industrial enterprises that discharge wastewater into the city sewerage and do not allow industrial wastewater containing heavy metals, priority or specific pollutants to enter the WWTPs. Control of WWTP sludge quality for presence of heavy metals, priority and specific pollutants has to be made and this will be the reason for changing the discharge permits to include new individual emission limits for new control indicators. Usually, the most controlled parameters are the heavy metals (e.g. ***arsenic, mercury, cadmium, copper, nickel, lead, chromium and zinc and their compounds***) and other specific chemical substances (***cyanides, phenols*** (expressed as total C) especially for the WWTPs subject to PRTR reporting.
Croatia	Croatia has a mandatory list of substances that are regularly monitored as is stated in Regulation on limit values for wastewater emission (https://narodne-novine.nn.hr/clanci/sluzbeni/2020_03_26_622.html).
Germany	Wastewater Ordinance (Annex 1) which is in line with the UWWTD only provides requirements for **COD, BOD_5, N, NH_4 and P** (based on urban WWTP size). Therefore, operators have no general obligation to monitor hazardous substances. The competent (issuing) authorities at Länder level can however set emission limit values for priority (hazardous) substances if they are expected to be discharged.
Hungary	There is no obligatory list of substances, the controlled substances are specified in the discharge permit. Usually the most controlled parameters are the ***heavy metals***, however, for several WWTPs there is no requirement for monitoring hazardous substances at all.
Montenegro	The following groups of substances are monitored *organohalogen compounds* ***(Tetrachloromethane, Trichloromethane, 1,2 – dichloroethane, 1,1 – dichloroethene, Trichloroethene, Tetrachlorethylene, Hexachloro-1,3 butadiene, Dichloromethane, Hexachlorobenzene (HCB), Lindane, Endosulfan, Aldrin, Dieldrin, Endrin, Isodrine, Pentachlorobenzene, Total DDT, p-p DDT), organophosphorus compounds (Chlorfenvinphos, Chlorpyrifos), organotin compounds (Tributyltin, Dibutyltin, Monobutyltin, Tetrabutyltin),*** substances that have been proven to have carcinogenic properties or acquire such properties in the aquatic environment, (***Policyclic Aromatic Hydrocarbon (Anthracene, Naphthalene, Fluoranthenes, Benzo(a)pyrene, Benzo (b)fluoranthene, Benzo(k)fluoranthene, Benzo(g, h, i)perylene, Indeno(1,2,3-cd)pyrene), Hg, Cd, Zn, Cu, Ni, Cr, Pb, Se, As, Sb, Mo, Ti, Sn, Ba, Be, B, U, V, Co, Tl, Te, Ag and their compounds, stable total hydrocarbons***)
Moldova	Extractable substances with organic solvents ***(fats), total cyanides (CN), Water Vaporizable Phenols (C6H5OH), petroleum products, biodegradable active anion synthetic detergents, lead, cadmium, chromium total, chromium (6+), copper, nickel, zinc, fluorides, acids, flammable, toxic mixtures***.
Romania	The monitored substances are those stipulated in the horizontal legislation concerning wastewater discharges into surface water bodies (*4.2.1.2 and Annex 4-6*), i.e., ***cadmium, lead, mercury, nickel, aluminium, arsenic, chromium (six-valent), chromium total, cobalt, copper,***

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	cyanides (total), detergents anionic and nonionic, fluoride, iron (total), manganese, molybdenum, organic solvent extract (oils, fats) total, petroleum products, phenol, selen, silver, zinc.
Serbia	The monitoring of municipal discharges is harmonized with UWWTD and focuses on BOD_5, COD, total suspended matter, total N and total P. WWTPs subject to PRTR reporting also monitor ***As, Cd, Cr, Cu, Hg, Ni, Pb, Zn and their compounds, atrazin 1,2-dichloroethan (EDC), dichloromethane (DCM), diuron, linden, AOX, hexachlorobenzene (HCB), pentachlorophenol (PCP), PCBs, simazin.*** Industrial discharges into sewer have to be treated, especially if they contain priority substances. Priority substances in all wastewaters have to be treated before mixing with other wastewaters on the facility level.
Slovakia	It is **individually stated in the permission** based on the character of the producers connected to the WWTPs.
Slovenia	It **is individually stated in the permission** based on the character of the producers connected to the WWTPs
Ukraine	There are *15 mandatory parameters (e.g. t, pH, O2, susp., mineralization, COD, BOD, TN, NH_4, NO_2, NO_3, TP, PO_4, Cl, SO_4).* **Other components (e.g. hazardous substances) are specified depending on industry and river basin conditions.**

While the control of WWTPs discharges is apparently regulated in all the countries, although the control of hazardous substances is national specific, the control of combined sewer overflows seems to be modest. In Austria there is a "state of the art" standard of the Austrian Water and Waste Management Association (ÖWAV)[10]. In Germany, a national regulation for storm water overflows is in process, but there is not yet a national regulation for CSOs concerning the discharge of hazardous substances. The rest of the countries have not yet developed such a regulatory basis. Bulgaria, Hungary and Slovakia report for passive measures (i.e. a requirement for 3 to 5-time dilution before discharge) for control of pollutants emissions through the combined sewer overflow.

Monitoring procedures and frequency

Table 4-22 summarizes the information provided by the partners concerning the frequency of monitoring of WWTP discharges.

Table 4-22: Summary of the monitoring procedures for WWTP discharges

Country	Monitoring approaches
Austria	• Self-monitoring: Application of "4 out of 5" principle, i.e. 5 consecutive measurements with one exceeding not more than 50%. • External monitoring: usually up to four times a year. The frequency depends on the monitoring results, i.e. if a measured value of a waste water parameter is greater than the emission standard but not greater than 1.5 times the emission standard, the measurement shall be repeated. If the measured value in the repeat measurement is not greater than the emission value, the emission value shall be deemed to be complied with. In case of more frequent external monitoring per year, the "4 out of 5" rule shall apply.

[11] https://ec.europa.eu/food/system/files/2021-09/pesticides_sup_nap_2019-23_hun_en.pdf

<table>
<tr><th>Country</th><th>Monitoring approaches</th></tr>
<tr><td></td><td>• External monitoring: The regulation is similar to self-monitoring.</td></tr>
<tr><td>Bulgaria</td><td>• The frequency of sampling and the compliance rules are regulatory established in line with the requirements of Annex I of Directive 91/271/EC
• Flow proportional or 24 h mixed samples at equal time intervals shall be collected.</td></tr>
<tr><td>Croatia</td><td>Annual number of composite samples depending on the size of the municipal wastewater treatment plant and the duration of sampling
<table>
<tr><th>PE</th><th>The smallest number of composite samples per year</th><th>Sampling time (h)</th></tr>
<tr><td>12-49 PE</td><td>1</td><td>4</td></tr>
<tr><td>50-999 PE</td><td>2</td><td>8</td></tr>
<tr><td>1,000-1,999 PE</td><td>4</td><td>12</td></tr>
<tr><td>2,000-9,999 PE</td><td>• 12 samples during the first year.
• 4 samples during the following years, if it is determined that the treated wastewater during the 1st year complied with the requirements for the stage of treatment or the load reduction (%) was in accordance with the constructed stage of treatment
• 12 samples during the year, if one of the four samples does not meet the allowable values.</td><td>24</td></tr>
<tr><td>10,000-49,999 PE</td><td>12</td><td>24</td></tr>
<tr><td>50,000 PE and more</td><td>24</td><td>24</td></tr>
</table></td></tr>
<tr><td>Romania</td><td>• The frequency of monitoring and the minimum number of samples depend on the size of the WWTP and the quality impact of effluents on water resources.
• Composite samples are taken, as the sampling process can be discontinuous or automated. Samples are taken from the control points for a period of 24 hours or at regular intervals, proportional to the flow. If necessary, samples can be taken from the inlet of the WWTP.</td></tr>
<tr><td>Hungary</td><td>Qualified point sample or 2-hour average sample. The frequency of monitoring is specified in the individual permit, general rules are depending on the load capacity (PE):
• < 2,000 PE: 2 times / year
• 2,000 – 9,999 PE: 12 measurements during the first year of self-monitoring, and four measurements in the following years if it can be shown that the quality of the treated water in the first year meets the requirements specified in the permit. If the result of one of the four measurements per year is unsatisfactory, 12 measurements must be taken again the following year. If the inadequate measurement was in the first half of the year, the sampling program should be expanded and the sampling dates sent to the authority.
  • 10,000 – 49,999 PE: minimum 12 times / year
  • >= 50,000 PE: minimum 24 times / year</td></tr>
<tr><td>Serbia</td><td>Frequency of measurement and time of sampling for municipal waste waters and technological waste waters with dominant organic load:
<table>
<tr><th>The capacity of the municipal waste water treatment plant expressed in PE (population equivalent)</th><th>Frequency of measurement for basic and specific parameters (number of measurements per year)(1), (2)</th><th>Sampling period o representative sa (hours)</th></tr>
</table></td></tr>
</table>

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Country	Monitoring approaches			
	< 50	1 measurement per year	2	
	50 -999	2 measurements per year	2	
	1,000-1,999	3 measurements per year	6	
	2,000 -9,999	12 measurements per year during the first year(3)	24	
	10,000 -49,999	12 measurements per year	24	
	> 50,000	24 measurements per year	24	
	(1) The first measurement shall be implemented after the test operation. (2) The first year of operation shall be the first calendar year upon receiving the operating permit. (3) If the quality of treated water during the first year of testing is proven not to exceed the limit values of emission for pollutants listed in the act regulating ELV, during subsequent years the analysis shall be implemented only for 4 samples. If one of 4 samples during one of the following years fails to comply with the limit values of emission for pollutants stated in the Regulation hereof, the frequency shall be returned to 12 samples per year.			
Slovakia	The frequency of sampling and the type of monitoring is individually stated in the permission based on the character of the emitters connected to the WWTPs. The frequency of sampling and type of monitoring depends on the size of the WWTP.			
Slovenia	• The frequency of monitoring is specified in Annex 1 of the Rules on initial measurements and operational monitoring of wastewater • The frequency of sampling and the compliance rules are regulatory established in line with the requirements of Annex I of Directive 91/271/EC • Flow proportional or 24 h mixed samples at equal time intervals shall be collected.			
Moldova	The frequency of sampling and type of monitoring is individually stated in the permission based on the character of the emitters connected to the WWTPs.			
Montenegro	• 2 times a year for discharges up to 10 m^3/d • 4 times a year for discharges of 10-100 m^3/d • 6 times a year for discharges of 100-1,000 m^3/d • 8 times a year for discharges more than 1,000 m^3/d			
Ukraine	Each enterprise has to conduct self-monitoring at two control points: water inlet and water outlet. The frequency of sampling is specified in the permission. The frequency of sampling is 12 times a year for most enterprises. Composite samples are taken for a period of 24 hours proportional to the flow. The environmental department of the enterprise calculates the actual monthly discharge of pollutants.			

4.3 Control of diffuse pollution

The analyses of the control of diffuse pollution within this report are limited to the control of the air emissions of the industrial sectors subject to the IE Directive and the application of plant protection product on agricultural land.

As above mentioned all the countries, except for Ukraine, have implemented the IE Directive in their national legislation. The EU countries and Moldova have also established national PRTRs and provide information to the European PRTR pursuant to the obligations set in Regulation 166/2006 (see for details item 6). Ukraine currently controls the release of pollutants into air via the National Inventory.

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Thus, the significant air polluters in a given region can be easily identified, and their emissions to air, water and soil evaluated. The share of the air depositions however on the surface water quality is still a subject of uncertainty, which can be tackled e.g. with appropriate modelling.

All the EU Members follow the conceptual framework of Directive 2009/128/EC for establishing sustainable use of pesticides. Ukraine hasn't implemented yet Directive 2009/128/EC. The national regulatory basis for the control over pesticides however contains similar requirements concerning trade and handling with pesticides.

The Farm to Fork Strategy (F2F), as part of the European Green Deal (GD), was published in May 2020 and highlights that "*there is an urgent need to reduce the dependency on pesticides […]*". Therefore, the GD targets are to reduce the use and risk of chemical pesticides by 50%, and the use of more hazardous pesticides by 50% by 2030. These objectives form the basis for the current revision of the SUD, which is also intended to introduce better control mechanisms (application registers) of the actual use of PPPs.

The control of plant protection products was analyzed in several aspects:

- ***Control of plant protection products before application***

In all the countries use of uncertified plant protection products is prohibited and there is well established regulatory basis concerning their certification, packaging, transport storage and trading. Pursuant to Regulation 1107/2009, the responsible administrative bodies (see item 3.2) prepare periodically (e.g. annually) registers of certified and banned plant protection products, containing information about the content of the active substances, the manner of application, the target crops and recommendable dosage (only Croatia reports that the recommended dosage is not provided).

Some countries (e.g. Slovakia and Austria) prepare also a list of pesticides that are banned from use in certain areas (e.g. protected zones for ground and surface water sources intended for potable water supply), meantime in Romania the use of all pesticides in protected zones for groundwaters and surface waters sources intended for potable water supply is forbidden. In most of the countries there are also registers of the companies producing, repackaging and trading with plant protection products.

- ***Control of plant protection products during application***

The pesticides application is regulated though permission procedures, i.e., the companies that provide plant protection services should be certified and the personnel that execute such services need to have specific qualifications. The farmers should keep a record on the pesticide's utilization, with information on the date of pesticides application, the type of pesticides used, the treated terrain, etc.

- ***Post-control of plant protection products after application***

A few countries report on effective post-control of plant protection application. Their feedback is summarized in *Table 4-23.*

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Table 4-23: National practices for post-control of pesticides application

	How is the post control of pesticides application executed?
Austria	Applications of plant protection products are controlled by the responsible administrative bodies by means of soil samples, on-site inspections, specific rules for plant protection product storage. With regard to pesticide contamination, a special measuring program will be carried out in 2021/2022 at the overview measuring points, which will allow a comparison with the results of the measuring campaign from 2015, which has an additional focus on smaller rivers.
Bulgaria	The regulatory control over the pesticides uses and application is provided by the Bulgarian Agency on Food and Safety. On annual basis, the control should encompass at least 1% of the registered agricultural farmers and they should be chosen at random or as a result of a signal for committed violations. The control encompasses the rate of compliance with the established regulatory procedures (e.g. maintenance of the diary for the conducted plant protection measures and fertilization; the availability and validity of the necessary certificates). Based on a risk analysis, samples may be taken from plants or plant products to identify used PPPs or pesticide residues.
Croatia	Indirectly monitored quantities of pesticides through the information for residues. A Rulebook on the maximum levels of pesticide residues in and on food and animal plants is adopted. The Law on Sustainable Use of Pesticides defines several different scenarios and related misdemeanor provisions if there is evidence for misusing pesticides. A certain fine (defined in the law) is imposed on a legal person for a misdemeanor, for example, if it trains taxpayers without a permit from the Ministry, sells and distributes pesticides and is not registered in the FIS register or does not have a registered office and address in Croatia, controls pesticide application machinery without a permit from the Ministry, applies pesticides from the air without a permit from the Ministry, distributes and sells pesticides, gives advice on the safe and proper use of pesticides without prescribed training, etc. According to the Agricultural Land Act - A fine of 10,000.00 to 30,000.00 kuna (EUR 1,300 – 3,900) will be imposed on a legal entity that does not monitor the condition of agricultural land registered in ARKOD by testing soil fertility and does not keep records on the application of fertilizers (mineral and organic), soil improvers and pesticides.
Germany	Farmers are generally provided with advisory services and are required to apply good agricultural practices. While applying plant protection products farmers must take into account the risk management requirements associated with product authorization e.g. distance to surface waters or the use of drift-reducing nozzles. Violations can be punished with fines, but controls take place only to a limited extent. Less than 2 % of all farmers are annually controlled on a regular basis. Specific control for violation of good agricultural practices might be executed, if there are signals for this..
Romania	The responsible administrative bodies inspect the marketing and use of the plant protection products, execute control by laboratory analysis of the quality of the plant protection products and control of pesticide residues in plant protection products.
Hungary	Authorization for the placing on the market and use of plant protection products is regulated by a government decree. National Food Chain Safety Agency is responsible for controlling the application of pesticides.
Serbia	Every year, the Rulebook on determining the annual program of post-registration control of plant protection products is adopted, which defines the sampling plan, type and number of samples, method of sampling and testing, facilities from which samples are taken, sampling dynamics and measures taken when it is determined that the residues of plant protection

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	How is the post control of pesticides application executed?
	products are higher than the prescribed maximum permitted quantities. Samples are taken by inspectors in accordance with their competencies (phytosanitary, agricultural, veterinary) and samples are sent to authorized laboratories.
Slovakia	The Central Control and Testing Institute in Agriculture collects information on the amount of plant protection products (PPPs) used by soil blocks and it is as also to be notified prior to PPPs application and thus is eligible for field inspections during and after PPPs application. Specific rules for PPPs application and storage are set. Soil Science and Conservation Research Institute is eligible for analysis of pesticide residues in the soil.
Moldova	The Environmental Agency has a duty to control of pesticides in different environmental objects, including air, water and soil. Actually, very limited capacities to effectuate pesticide monitoring in country.
Montenegro	Residue monitoring program for plant protection products (pesticides) is organized by the Directorate for food safety, veterinary and phytosanitary affairs
Ukraine	The control over the use of pesticides is carried out by 2 State authorities: 1. The State Ecological Inspection (belongs to the Ministry of Ecology and Natural Resources of Ukraine - Provides the control of pesticides handling, their use in forests, transportation, storage, use, disposal of chemical plant protection products. 2. State Service of Ukraine on Food Safety and Consumer Protection (belongs to the Ministry of Agrarian Policy and Food of Ukraine) provides over the circulation of pesticides and agrochemicals, compliance with state sanitary norms and rules, hygienic standards and regulations for safe production, transportation, storage, use of pesticides and agrochemicals, the content of residual pesticides and agrochemicals in food and raw materials, soils, etc .; ▪ approving of the plans for state testing of pesticides and agrochemicals and lists of pesticides and agrochemicals approved for use in Ukraine. ▪ determines the list of institutions that conduct toxicological and hygienic (medical and biological) research of pesticides and agrochemicals; organizes research (tests) in laboratories for the purposes of state control. ▪ approving methods for determining the conformity of pesticides and agrochemicals to quality certificates and guidelines for determining the content of residual amounts of pesticides in water, soil and agricultural products. All farmers are required to submit a report on the use of pesticides to the statistical service

Based on the provided information from the partners it could be concluded that there is well developed regulatory bases at national level. The onsite control of the pesticide's application is predominantly passive, however. It mostly relies on good agricultural practices (e.g., recommended doses for each crop, the appropriate time, techniques for application, including requirements for air spraying and the appropriate product for the specific culture and pest), following the regulatory administrative procedures (e.g., availability of necessary certificates) and keeping of appropriate records for pesticides application. Most of the countries report for control of residues of the pesticides in the plants and only Austria and Slovakia report for programs for control of plant protection products through analyses of soils.

- ***Measures for conservation of the aquatic environment and drinking water, envisaged in the National Action Plans (latest versions)***

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Below is presented summary information from the latest update of the National Action Plants for sustainable use of pesticides, pursuant to art. 4 of Directive 2009/128/EC on sustainable use of pesticides.

- ***Austria***

As part of the authorization of plant protection products, specific requirements and conditions are established with the aim to protect the aquatic environment and drinking water. Among them there already are e.g., minimum distances from surface waters, ban on direct use on sealed surfaces and surfaces with a high risk of run-off. It is also mentioned that where necessary, stricter measures can be applied, e.g. prohibition of their use in water protection and water conservation areas.
Based on expert advice to users' assistance in the selection of crops and their rotation, and suitable plant protection measures, especially with a view to protecting the aquatic environment and drinking water is indicated.
There are a number of further necessary steps mentioned to be needed:

- further development of the targeted expert advice to users,
- information on the characteristics of plant protection products whose active substances and relevant degradation products are particularly relevant in terms of protecting the aquatic environment and drinking water.

Where necessary, the provinces will introduce restrictions in terms of time, location or content on the use of plant protection products under the relevant legislation.

- Continuing inspections by the water supervisory authorities (e.g. in particularly sensitive areas, leaf and soil samples, primarily from land in water protection and conservation areas, will be taken and analysed, on-the-spot inspections of farms in those areas will be carried out).
- In certain circumstances restrictions or prohibitions under water legislation on the use of plant protection products in river basins used by water supply facilities (protection/conservation areas) might need to be adopted or adapted.

- ***Bulgaria***

The latest update of the National Action Plan contains specific chapter dedicated on the measures for conservation of the aquatic environment and drinking water. 17 measures are envisaged among which:

- Ban on use of specific plant protection products or complete ban of use of such products into water
- Utilization of specific equipment for the application of plant protection products with limited spray drift, in particular for crops such as hops, orchards and vineyards.
- Giving preference to plant protection products, according to the ecotoxicological assessment which are not classified as hazardous to the aquatic environment, in accordance with Regulation (EC) № 1272/2008 and which do not contain priority hazardous substances.

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- Establishment of untreated buffer zones of appropriate size for protection of aquatic non-target organisms - buffer zones are determined individually for each plant protection product in the process of its assessment and authorization and are indicated on the product label.
- Establishment and maintenance of an information system for plant protection products, production / import, composition, quantity, place of application, type and quantity imported.
- Reduction of the risks of pollution outside the area of application due to the removal of the jet during spraying, run-off or leakage, incl. establishment of: untreated buffer zones of appropriate size for the protection of aquatic non-target organisms. Buffer zones are determined individually for each plant protection product in the process of its assessment and authorization and are indicated on the product label.
- Reduction or cessation of the application of plant protection products on or along roads, railways, highly permeable surfaces or other infrastructure located near surface or groundwater, or on impermeable surfaces where there is a high risk of leakage into surface waters water or in sewerage networks.

➢ ***Croatia***

- Pesticide users must respect the restrictions on the use of pesticides for the protection of waters and the aquatic environment in accordance with the instructions, warnings and notices on the label or the decision on registration or the decision on authorization of pesticides, and respect prohibitions and restrictions on the use of pesticides in certain soils and areas which regulate the protection of waters.
- Detailed measures for the protection of the aquatic environment and drinking water shall be prescribed by the Minister in a regulation.

➢ ***Germany***

The German National Action Plan was established for 2013-2018 and have not yet updated.

- Drawing up criteria for identifying active substances of particular concern according to Article 4, as well as substances hazardous for the aquatic environment or priority hazardous substances, according to Article 11 of the Sustainable Use Directive, target quotas specific to active substances; also dates for reduction of the use of plant protection products containing those active substances and a concept for effective implementation.
- Setting up a working group on „plant protection and protection of water bodies“, with the participation of experts from the relevant authorities at Federal and Länder level and also of other groups of relevant stakeholders. The working group is analysing new knowledge obtained and drawing up suggestions for a targeted and appropriate improvement to the protection of water bodies against entries of plant protection products.

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- Supporting the introduction of operational management systems that take into account the plant protection aspects in addition to the aspects of biodiversity and of protection of water bodies.
- Supporting the introduction both of plant protection equipment with fresh-water tanks for the purpose of cleaning equipment in the field and also of spray-drift-reducing equipment.
- Examining the possibilities of existing regulations at Länder level for mandatory minimum distances to surface water bodies, in cases where plant protection products are used, and are taking suitable measures for establishing these harmonized minimum distances.
- Relevant associations, institutions and organizations are supporting measures aimed at improving the protection of water bodies by means of avoiding entries of plant protection products.
- Identifying fields of activity with increased risk levels (hot spots), defined in terms of location and time and associated with the use of plant protection products: these organizations are drawing up targeted and adapted measures for improving the situation with regard to protection of water bodies (hot-spot management concepts), also involving other relevant authorities at Federal and Länder level.
- Within the framework of agri-environmental programs, the Länder are supporting the creation of buffer zones at all surface waters, permanently covered with vegetation and at least 5 m in width, particularly in protected areas for drinking water, nature reserves and in sensitive areas identified by hot-spot analyses.
- Supporting management concepts and information offerings aimed at avoiding entries of plant protection products in water bodies, especially entries from point sources.

Drawing up a monitoring concept for determining the pollution status with regard to plant protection products in small water bodies located in the agricultural landscape and implementing this concept.

➢ ***Hungary***

The National Action Plan was established (and updated) for 2019 - 2023 period[11]. It contains specific chapter dedicated on the measures for conservation of the aquatic environment and drinking water. These measures are as follows:

- Raising the environmental awareness of plant protection product users by introducing risk reduction measures, host courses, further training, etc.
- Establish a data collection system that ensures the availability of data on the amount and location of plant protection products actually used in order to determine as accurately as possible the effects of each product.

[11] https://ec.europa.eu/food/system/files/2021-09/pesticides_sup_nap_2019-23_hun_en.pdf

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- Facilitate the availability of low environmental impact application techniques and encourage their dissemination through publications and leaflets.
- Establish a list of low-risk plant protection products for use in the environment of drinking water bases, highly sensitive groundwater protection areas and surface waters and publication.
- In the vicinity of surface water, the establishment of a windshield tree line, waterfront vegetation to reduce the drift of the plant protection product is mandatory.
- Restrict the use of plant protection products and encourage the use of low-risk plant protection products in particularly sensitive groundwater protection areas, and in the vicinity of fast-flushing surfaces, roads, railways, and easily permeable or watertight surfaces.
- Establishment of a protection strip of at least 5 meters along the surface waters, covered with vegetation.
- Restrictions on the authorization of plant protection products and legislation, risk mitigation measures, and the use of low-risk plant protection products and application techniques have been given greater consideration in inspections.
- Continuous monitoring of environmental elements (soil, surface water vegetation, groundwater) in sensitive areas for pesticide active substances - analysis and publication of these data, modification of restrictions on the use of plant protection products if necessary, definition of new protection zones.
- Periodic review and extension of the list of monitored substances.

➢ ***Montenegro***

The National Plan for Sustainable Use of Plant Protection Products from 2021 to 2026 (hereinafter: the National Plan) is a plan which in a five-year period should ensure that the harmful effects of plant protection products on reduce human health to a minimum, reduce the negative impact on the environment to an acceptable level and use plant protection products in a sustainable way. The objectives of the National Plan are defined in a way that ensures the achievement of sustainable use of pesticides by reducing their negative impact, ie reducing risks to human health and the environment, while promoting integrated and non-chemical pest control measures and alternative approaches and techniques to reduce dependence on use. pesticide. Within the Phytosanitary Measures Program, one of the Component is: "Monitoring the impact of pesticide use on the environment". Pollution refers to possible sources: improper preparation, leakage or leakage, application of plant protection products, improper rinsing of packaging (spillage during preparation), cleaning or improper disposal of the remaining amount of working solution. In order to preserve water, it is necessary to take into account the protection of springs, surface and groundwater, and in particular:

- areas of surface and groundwater sources for public water supply that must be protected from intentional or accidental pollution and other impacts that may

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adversely affect the abundance of the source and the health of water (sanitary protection zones);

- protect surface and groundwater sources.
- sanitary protection of the source for public water supply where protection zones are determined, as follows: wider protection zone, narrower protection zone and immediate protection zone.
- zone of sanitary protection of springs determined in accordance with hydrological, hydrogeological and other properties of land and catchment areas and the envisaged manner of their use in accordance with the Rulebook on determination and maintenance of zones and zones of sanitary protection of springs and restrictions in those zones ("Official Gazette of Montenegro", No. 66/09);
- ban on the use of pesticides in protection zone I (immediate protection zone) for all types of sources.
- Prohibit the use of pesticides in the II protection zone (narrower protection zone) for springs in compacted and karst releases, and in the case of interventions from reservoirs and lakes, limit their use to the use of easily degradable pesticides.

In accordance with the Rulebook, users of water intake are obliged to fence the protection zone I, and to mark the II protection zone and display a notice about it.

- ***Moldova***

Currently, there is an on-going GEF project "Review and Update of the National Implementation Plan for the Republic of Moldova under the Stockholm Convention on Persistent Organic Pollutants (POPs)". The National Implementation Plan (NIP) update process will investigate the extent to which the measures listed in the first National Implementations Plan in relation to the initial 12 POPs have been achieved and will establish an inventory of products and articles containing new POPs identifying where new POPs are employed or unintentionally produced. The proposed project component will focus on the inventory of the eleven (11) new POPs including a comprehensive assessment of conditions for the use, production, import, storage and disposal of these. The final number of POPs included for the assessment shall be defined at inception phase of the project implementation. The inventory process will also look at the effectiveness of 2004 NIP implementation process in order to identify gaps or barriers that might persist. This comprehensive information on POPs will facilitate the revision of the national priorities and the development of specific action plans for eliminating or reducing the production, use, import, export and releases of the new POPs. The revision and update of the NIP will be undertaken in accordance with the provisions of Article 7 of the Stockholm Convention.

The first NIP addressed the twelve (12) POPs initially listed on the SC. Following the adoption of the initial NIP, the country managed to safely repackage, export and destroy around 1,293 tons of obsolete POPs pesticides and collected another 1,900 tons in 23 warehouses around the country. Additionally, 1,060 tons of PCB containing capacitors were exported for disposal

and eventually destroyed. Besides the Obsolete Pesticides, the country has as well undertaken the steps to inventor and seek for the opportunities to eliminate the Polychlorinated biphenyls, etc.[12]

- ***Romania***

The latest update in 2019 of the National Action Plan includes specific chapter dedicated on the measures for reducing the risks associated with the use of plant protection products to protect human health and the environment (conservation of the aquatic environment and drinking water sources). The National Action Plan highlights the specific objectives and measures with relevance mainly for the following topics: the training system for professional users, distributors and consultants, the marketing, handling and storage of plant protection products, the aerial spraying of plant protection products and the inspection of equipment application, specific measures for the protection of water, soil and air, the use of products in specific areas, integrated pest management and the implementation of information and awareness-raising programs on the use of plant protection products.

11 measures on specific measures for the protection of water, soil and air are envisaged among which:

- Complete ban use of plant protection products in protected zones for ground and surface water sources intended for potable water supply (severe health protection areas and restricted health protection areas), mineral water sources and therapeutic lakes;
- Application of any type of fertilizers and pesticides is prohibited on the multifunctional protection areas such as lands adjacent to the watercourses, protection zones and buffer zones. These prohibitions are completed with the provisions of the Code of Good Agricultural Practice for the protection of waters against pollution by nitrates from agricultural sources, in the sense that on the lands adjacent to the watercourses, protection zones and protective buffer zones are established in which it is forbidden to carry out agricultural activities, i.e. to apply fertilizers and pesticides of any type;
- Training of professional users in the field of management of multifunctional protection areas.
- Control and inspection of compliance with the requirements in multifunctional protection areas
- Promoting the technology of reducing the drift of sprayed products by using anti-slip nozzles and screens to recover the excess of the spraying solution.
- Reduce the risks associated with the use of plant protection products by strengthening the consulting and training services, including training of trainers (i.e. application of requirements of the Code of good practice for the safe use of plant protection products.

[12] Source: https://www.thegef.org/projects-operations/projects/10354

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- Providing certification services, in particular for the implementation of environmental management systems and techniques for handling and storing plant protection products.
- Improvement and maintenance the information system for plant protection products, production / import, composition, quantity, place of application, type and quantity imported.
- Development of information and awareness programs on reducing the risks associated with the use of plant protection products.

➢ ***Slovenia***

Slovenia follows the EU Directive 2019/782 of 15 May 2019 amending Directive 2009/128/EC of the European Parliament and of the Council as regards the establishment of harmonized risk indicators:

- To reduce risks and impacts of pesticide use on human health and the environment and to promote the use of integrated pest management and of alternative approaches or techniques in order to reduce dependency on the use of pesticides.

➢ ***Slovakia***

The latest update of the National Action Plan was in 2021 and it contains also specific measures for protection of the aquatic environment and drinking water, e.g.:

- Giving preference to plant protection products with lower environmental risk; support for the authorization of low-risk plant protection products, plant protection products based on microorganisms and on natural substances
- Utilization/modernization of specific equipment for the application of plant protection products with limited spray drift; utilization of precise agricultural practices, environmental and ecological schemes
- Reviewing the list of relevant pesticides/ plant protection products and stepping up their monitoring
- Streamlining the controls performed on agricultural, forestry and non-professional use
- Streamlining the controls performed on foods and environment
- Continuous education of plant protection products users, labeling of plant protection products
- Streamlining of public information
- Laboratory equipment innovation
- Upgrading of information system.

➢ ***Serbia***

Pesticide users are obliged to respect the restrictions on the use of pesticides for the protection of water and the aquatic environment in accordance with the instructions, warnings and notes on the label or decision on registration or decision on approval of

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pesticides, as well as to prohibit and restrict the use of pesticides on specific soil and land with the aim of water protection.

Within the approval of plant protection products, specific requirements and conditions are determined in order to protect the aquatic environment and drinking water. Among them there are already e.g. minimum distances from surface waters, prohibition of direct use in closed areas and areas with a high risk of runoff. It is also mentioned that stricter measures can be applied where necessary, e.g. ban on their use in areas designated for water protection.

On the basis of expert advice, assistance was provided to the users in the selection of crops and crop rotation, as well as appropriate plant protection measures, especially in order to protect the aquatic environment and drinking water. Raising the environmental awareness of users of plant protection products by introducing risk reduction measures, through user training, lectures and advice from advisory services.

The Ordinance on the conditions and manner of application of plant protection products, which do not endanger the life and health of humans and animals and the environment, as well as the conditions and manner of handling, storage, transport and disposal of plant protection products and the Ordinance on integrated pest management, define ways and actions that ensures the achievement of sustainable use of pesticides by reducing their negative impact, i.e. reducing risks to human health and the environment, while promoting integrated and non-chemical pest control measures and alternative approaches and techniques to reduce dependence on use of pesticides.

- ***Ukraine***

The first RBMPs are currently being developed in Ukraine, which should be completed by 2024. National action plans have not yet been developed.

Rules for the use of pesticides are partly specified in the Code of good agricultural practice. Storage and use of pesticides are prohibited in protective strips along rivers, around water bodies. Protective strips are:

- 25 meters for small rivers, streams and ponds with an area of less than 3 hectares.
- 50 meters for medium rivers, reservoirs and ponds with an area of more than 3 hectares.
- 100 meters for large rivers, reservoirs and lakes.
- The use of persistent and potent pesticides is prohibited in coastal protection zones along seas, bays and estuaries and on islands in inland waters.

4.4 Fees and fines for water pollution

4.4.1 Fees and fines for point source emitters

The "polluter pays" principle is implemented for the wastewater discharge into sewer systems and surface water bodies through introduction of fees for discharge. Fees are applied for wastewater discharge into sewer networks and river bodies in all the countries except in Austria, where fees are applied only for indirect wastewater discharges. The presumption in

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Austria for "no fees" for the direct wastewater discharges is that the operators must make the necessary expenses for design and operation of treatment facilities in order the quality of treated wastewater to reach the normative requirements before discharge into the river bodies. In contrast, in Germany, a levy must be paid for each discharge. If the requirements of the best available technologies (BAT) are met, the fee is reduced by 50% (this was an economic incentive for compliance in the 1980s and 1990s, but today it has virtually no incentive function)..

The fees for discharge into surface water bodies are regulatory established at national level. The calculation of the fees however, (e.g. the included parameters and the unit costs) differs from country to country.

For indirect discharges from industrial emitters to the municipal sewer network the costs are calculated by the sewer network operator based on the discharged amount and the polluting substances.

For direct discharges into surface substances each country has specific regulations. *Table 4-24* summarizes the formulas used in the different countries for calculating the fees for wastewater discharge. *Annex 4-8* gives detailed information concerning the fees for wastewater discharges in each country.

Based on the information from the partners, the following general approaches for wastewater discharge fees can be outlined:

- The fees are formed based on the specific constant unit fee (i.e. money per m^3) and the discharged wastewater amount (in m^3) adding some general correction coefficients taking into account the character of the river body and/or the treatment rated before discharge and/or the deterioration of the water quality due to the discharge and/or the needs for water protection. No specific parameters accounting for the discharge of hazardous substances. This approach is applied in Bulgaria (for discharge of municipal wastewater only), in Croatia and in Montenegro.
- The fees are formed based on the specific constant unit fee (i.e. money per unit COD load), the pollution load of COD (e.g. mass per unit time) corrected with some general coefficients taking account for the summary discharge of priority, priority hazardous and other specific hazardous substances, without however accounting for the specific contribution of each one hazardous substance. This approach is applied in Bulgaria for the industrial wastewater discharges into river bodies.
- The fees are based on a specific unit fee, which is different for the different hazardous substances (i.e. money per unit load from a specific hazardous substance) and the respective exceeding discharged load of the questioned hazardous substance than the one negotiated in the permit. This approach is practiced in Hungary and Romania.

  In Hungary the pollution taxes for water discharges have 3 components: 1) a periodic fine for breaking the conditions of the individual permit which accounts for the excessive loads discharged (i.e., excessing the permitted ones); 2) Extraordinary fine based on the attitude/motivation of the polluter to solve the problem and a water protection fine which seems to be constant (i.e. flat rate) for a given operator.

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Table 4-24: Formulas for calculating the fee for wastewater discharge in the different countries

Country	Calculation formula	Definitions
Austria	The calculation of fees for indirect wastewater discharges differs from one federal country to another. No fee for direct wastewater discharges.	
Bulgaria	Discharge of municipal wastewater **T = W x E x [1 + (K2 + K3 +K4)]**	T the due fee W the annual accounted wastewater discharge, m3 E unit amount of the fee – for 2021: BGN 0,007 per m3 (EUR 0.0036 per m3) K2, K3, K4 – correction coefficients (see below)
	Discharge of industrial wastewater **T = Tp + Td** **Tp = Ep x Wp x [1 + N1 + N2 + N3]** N1 = n1 x 0.03; N2 = n2 x 0.02; N3 = n3 x 0.01; **Td = Wd x Ed x [1 + K2 + K3 + K4]**	T the due fee Tp the due fee for industrial wastewater on the basis of COD annual load with correction coefficients for hazardous substances Td the due fee for domestic wastewater Ep unit amount of the fee –BGN 0.035 per kg COD (0.018 EUR per kg COD) Wp the annual load of COD (acc. to the Permit), kg/a N1,N2,N3 – coefficients for taking into account the priority and specific substances n1 the number of priority hazardous substances n2 the number of priority substances n3 the number of specific substances Wd the annual discharged domestic wastewater, m^3/a; Ed the unit amount of the fee - BGN 0.015 (EUR 0.0077 per m^3) K2, K3 and K4 - the correction coefficients: K2 = 0 for discharge into rivers; K3 depends on the rate of treatment before discharge (K3 = 0 for fully treated wastewater; K3 = 0.75 for untreated water); K4 = 0.01 (n-1), where n is the number of discharges
Croatia	For the discharge of waste water into public drainage buildings, collection pits or water: **N = (T x V x k1 x k2 x k3) + (TΔt x Vt x Δt)**	N the amount of the fee for wastewater discharge T the amount of the fee for 1 m3 discharged wastewater, except for cooling water TΔt the amount of the fee for 1 m3 of discharged cooling water V amount of discharged wastewater, except cooling water, expressed in m3 Vt amount of discharged cooling water expressed in m3 k1 variable or fixed correction coefficient from the regulations on the amount of the fee for water protection

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Country	Calculation formula	Definitions
		k2 correction coefficient on the amount of water protection fee k3 correction coefficient from the regulations on the amount of the fee for water protection and Δt difference of arithmetic means of all relevant measured values of cooling water temperatures at the outlet and inlet expressed in ° C.
Germany	The fee is based on the quantity and harmfulness of certain discharged constituents, which are defined in the legal text of the Wastewater Levy Ordinance and expressed by a "harmful unit" (SE). The Annex of the Wastewater Levy Act specifies threshold values for irrelevant discharge and associated analytic methods. Threshold values (concentrations and annual loads) and harmfulness units were derived for the following substances: COD, P, N, AOX, Hg, Cd, Ni, Cr, Pb, Cu. The fee per harmful unit amounts to (since the beginning of the year 2002) 35.79 €.	
Hungary	**Periodic fine = Mf x k,** **Mf = Mt – Me** Mt = Ci x Qt Me = Ce x Qe	Mf the amount of emitted polluter over the allowed amount, [kg/time interval] k specific fine, [HUF/kg] (see *Annex 4-8)* for more details) Mt actual emitted contaminant mass flow [kg/time interval] Me permitted amount of pollutant for the time interval [kg/time interval] Ci contaminant concentration [mg/L] Qt volume of emitted wastewater [m^3/time interval] Ce max allowed concentration of the pollutant given in the permission [mg/L] Qe maximum allowed volume of the wastewater given in the permission for the examination period [m3/time interval].
	Extraordinary fine **Fine = Q x C x k x R**	R is the extraordinary pollution coefficient ranging from 1-5, based on the behaviour of the polluter (missed to report the pollution, uncooperative in the remediation, etc.)
	Water protection fine	200 000 HUF – 10 000 000 HUF (549 – 27 426 EUR),

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Country	Calculation formula	Definitions
Montenegro	The fee is for the protection of water against pollution: **N = T x Q x K1 x K2** **Without WWTP:** **N = T x Q x K3**	N fee T the amount of the fee per 1 m^3 of discharged wastewater Q monthly amount of discharged wastewater in m3; K1 coefficient of influence on deterioration of water quality or conditions and K2 coefficient of construction of wastewater treatment plant K3 pollution coefficient depending on the activity of pollutants. K3=35 for wastewater from the production of refining and trade of petroleum and petroleum products, ferrous metallurgy, non-ferrous metallurgy, textile industry, chemical industry, paper industry, pulp, leather and textile, pig farms, slaughterhouse industry, alcoholic and non-alcoholic beverage industry and vehicle and machinery services K3=22 for shipbuilding, electrical, rubber, food industries, TPP, metal and construction industries K3=20 for wood, non-metals industry, construction materials and tobacco processing K3=2 for municipal wastewater K3=10 others types
Romania	QUANTUM - specific contributions to water resources management **Kd = 0.0036 x d x q x [Call - Cannual]** Km = n x Kd	Kd daily quantity discharged into the water receiver, kg /d d daily operating time of the discharge for which the calculation is made, in hours C_{annual} average annual concentration of suspensions in the receiving body water sample, mg/l Call allowed concentration of suspensions in the discharged wastewater; mg/l q discharged wastewater flow, l/s Km monthly quantity discharged into water receiver, kg/month n number of days The total amount of contribution for receiving wastewater in water resources, mentioned in the use/operation agreement, is determined by summing the results of multiplying the monthly quantities for each quality indicator by the amount of months/year in which the waste water discharge operates and the ***quantum of specific contribution*** in force on the date of establishing the agreement according to the legal provisions applicable. (see *Annex 4-8* for more details)
	The system of penalties for exceeding the maximum allowed concentrations	The system of penalties for exceeding the maximum allowed concentrations of pollutants in the discharged wastewater is applied depending on the nature and amount of the pollutant; the amount of penalties is expressed in lei/mass of pollutant (see *Annex 4-8* for more details)

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Country	Calculation formula	Definitions
Slovenia	**Calculation of the amount of environmental tax based on the number of unit load:** $OD = EO \cdot E_S$	OD environmental tax EO number of unit load E_S financial value of one unit load (currently 26,4125 EUR) Number of unit loads (EO) is defined in the Decree on the environmental tax on pollution due to the waste water discharge and takes into account the volume of emitted wastewater, the annual amount of the pollutant (COD, total phosphorus, total nitrogen, AOX, metals and their compounds) and the dilution factor.
Slovakia	**Fee=∑Ti*(Ci*Qa)**	Fees are calculated on yearly basis and depend on discharged pollution quantity and stated tariffs for the relevant parameter (Ti). The annual balance (amount) of discharged wastewater pollution is result of the average annual concentration of discharged pollution in the relevant parameter (Ci) and the annual amount of discharged wastewater (Qa). *(see Annex 4-8* for more details)
Serbia	Fee for discharged water **m^3 * RSD** Fee for water pollution **P+B** **$P = Q_A \cdot \Sigma ELV_i * RSD_P * 365 * 10^{-3}$** **$B = QS*[(COD/(BOD_5/COD) - ELV_{COD}) + (N_U - ELV_{Nu}) + (P_U - ELV_{Pu}) + (\Sigma M_i - \Sigma ELV_{Mi})] * RSD_V * 365 * 10^{-3}$** The annual fee is increased when recipient is in a protected area by 50% for zones of sanitary protection of springs, or by 25% for water bodies intended for recreation. The established fee is reduced by 50% in the period of construction of a new plant or reconstruction of an existing plant in order to	The basis of the fee for discharged water is the amount of discharged water in m^3 (or kWh when there is no flowmeter). The basis for the fee for water pollution is the amount of discharged wastewater expressed in cubic meters (m^3) and the amount of pollution expressed in kilograms (kg) in discharged wastewater. P is the amount of the annual fee for treated water, where: Q_A projected average aily flow per year, m^3/day; ΣELV_i sum of ELV for parameters of interest (e.g. COD, BOD_5, total N, total P, metals), mg /l 10^{-3} correction factor for conversion of g into kg; RSD_P price for discharge of projected treated wastewater, RSD/kg of pollution per day B annual fee for water pollution above the permitted wastewater load, where: Q_S measured average daily wastewater flow per year level, m^3 / day; COD mean value of HPK per year, mgO^2/dm^3; BOD_5 average value of BOD_5 per year, mgO^2/dm^3; N_U average value of total nitrogen per year, mg/dm^3; P_U average value of total phosphorus per year, mg/dm^3;

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Country	Calculation formula	Definitions
	improve the efficiency of the wastewater treatment process. If the taxpayer does not carry out the appropriate activities within a period of three years, the fee is calculated retroactively up to the full amount, with a payment deadline of 90 days.	ΣM_i sum of average values of toxic metals per year, mg/dm³; 10^{-3} correction factor for converting grams (g) into kilograms (kg); ELV emission limit values for pollutants of interest, mg/dm³; RSD_V price for discharge of untreated or insufficiently treated wastewater, RSD/kg pollution/d In cases when the measured value of the pollutant of interest is less than the ELV, this term of the equation is denoted as zero (0). For example, in the case of NU<GVEN, in the equation will be NU = 0. For the sum of metals (ΣM), each metal is calculated individually. Metals that are below ELV are not taken into account, i.e. the value of this article in the sum is 0, and metals that are above ELV are taken into account in the calculation.
Moldova	▪ Fee for immissions within the established limits into the sewer system = normative fee x amount of pollutants (in conventional tons*) ▪ Fee for immissions in excess of established limits into the sewer system = (normative fee x amount of pollutants) + normative fee x (actual amount of pollutants – established standard) x K, where K is the coefficient of multiplicity of excess of the actual concentration in relation to the allowed one	Fee for the pollution is established in accordance with allowed (fixed) limits (or maximum allowable discharges) of pollutants indicated in project documentation. These limits are established based on water flow of receiving water bodies, their designation, etc. Fees for specific pollutants are paid by water users, which discharge wastewater into sewerage system. The list of these pollutants and maximum allowable concentrations of pollutants are established by WWTP in coordination with environment protection authorities. * Conventional tons is counted by multiplying pollutant mass by established hazard coefficient (hazard coefficients varies from 200 for lead to 2000 for mercury)
Ukraine	According to the Tax Code of Ukraine, 2010 all water users pay rent for special water use: 1) rent for water intake; 2) environmental tax for discharges into water bodies. **Fee = ∑ (Mi * Hbi * Kpop * Ke)**	Mi actual emission of i-th pollutant, ton Hb standard tax of the i-th pollutant, in hryvnias (UAH / t) Kpop correction factor, set depending on the number of inhabitants of the settlement Ke correction factor, set depending on the economic importance of the settlement (see *Annex 4-8* for more details)

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4.4.2 *Fees and fines for agricultural diffuse emitters*

Only two countries – Croatia and Serbia mention about existing of fines for diffuse pollution. In Croatia the fine is between EUR 1,300 to 3,900 and should be imposed on a legal entity that does not monitor the condition of the registered agricultural land by testing soil fertility and does not keep records on the pesticide's application. In Serbia, there is a fee for indirect water pollution. For chemical plant protection products, the basis for the fee is the amount (kg) of active substance that have been produced or imported into the territory of the Republic of Serbia. This is also paid for mineral fertilizers and phosphate in detergents.

In Bulgaria, tariffs for diffuse pollution are envisaged in the Water Law, but the appropriate regulatory framework is not yet established. No appropriate regulatory basis seems to be established also in Romania, Moldova and Ukraine.

The Romanian partner informs that the country will apply commonly agreed guidelines in relation with economical mechanism for diffuse pollution coming from agriculture once this will be made available in the process of Water Framework Directive implementation. Now it is difficult to promote regulatory basis concerning fees for diffuse pollution having in view also the gaps in assessment of the contribution of diffuse pollution to the environmental impact and of the environmental costs.

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5 ANALYTICAL METHODS

All the countries tend to follow standardized methods (e.g. ISO EN methods or EPA methods) for sampling and analytical measurement of hazardous substances. Application of internal, laboratory validated methods however is also practiced. Most of the countries mention that different laboratories use different analytical methods for measuring one and the same chemical substance, and each method has different limits of quantification. Only Moldova and Montenegro seem to be an exception since there is only one national laboratory who performs analyses of priority (or specific) hazardous substances.

Annex 5-1 presents detailed information about the analytical methods and the LOQs concerning the analyses of priority substances. The table is prepared based on information from Austria, Bulgaria, Croatia, Hungary, Montenegro, Romania, Slovenia and Slovakia. The information of Moldova and Ukraine is incomplete and therefore it is not included.

Table 5-1 summarizes the information of *Annex 5-1*, giving also information about the annual average (AA-EQS) and the maximum allowable (MAC-EQS) environment quality standards for priority substances for inland surface waters (as per Annex I of the EQS Directive).

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Table 5-2 presents similar information concerning the analytical methods and respective LOQs for measuring the most commonly monitored specific hazardous substances (*see item 4.1*) Detailed information about each country can be found *in Annex 5-1.*

Obviously, there are variety of analytical methods for each of the listed hazardous substances. Except for the Hexabromocyclododecane (HBCDD) for all the other substances, there are internationally acknowledged ISO standards, which however are not used in all the countries. Many countries apply in-house standardized methods. The reported LOQs differ also significantly for the different methods, as well as in the different countries. It has to be noted that not always the LOQ seems to be *"equal or below a value of 30% of the relevant environmental quality standards"* as required in Art. 4 of Directive 2009/90/EC concerning the minimum performance criteria for the methods of analyses. Most problematic seem to be the analyses for the Tributyltin compounds (Tributyltin cation), Cypermethrin and Heptachlor and heptachlorepoxide where the minimum reported values for LOQ are above the 30% of the respective EQS value.

Similar conclusions can be reached concerning the specific hazardous substances.

Due to the relatively small number of countries that have provided data about the monitored hazardous substances in sediments and biota, sound conclusions about the used analytical methods cannot be made. Detailed information about the used methods is presented in *Annex 5-1*, *Table 3 and Table 4.*

Table 5-1: Used analytical methods and range of change in the limit of quantification concerning the measurement of pollutants listed in Annex I of Directive 2008/105/EC

Priority and other substances	CAS No	Analytical methods		AA-EQS	MAC-EQS	30% EQS based on AA-EQS	Limit of quantification	
		Total nr. used methods	Available EN ISO methods				MIN value,	MAX value,
				µg/l	µg/l	µg/l	µg/l	µg/l
Alachlor	15972-60-8	10	EN ISO 10695 EN ISO 11369 EN ISO 6468	0.3	0.7	0.09	0.001	0.09
Anthracene	120-12-7	6	EN ISO 17993	0.1	0.1	0.03	0.0005	0.7
Atrazine	1912-24-9	10	EN ISO 10695 EN ISO 11369 EN ISO 17993	0.6	0.6	0.18	0.001	0.06
Benzene	71-43-2	7	EN ISO 10302 EN ISO 15680 ISO 11423	10	50	3	0.1	3
Brominated diphenylethers	32534-81-9	7	BS EN 16694	-	0.14	-	0.000109	0.14
Cadmium and its compounds	7440-43-9	7	EN ISO 5961 EN ISO 11885	< 0,08 Cl1 0,08 Cl2 0,09 Cl3	< 0,45 (Cl 1) 0,45 (Cl 2) 0,6 (Cl 3)	< 0,024 (Cl 1) 0,024 (Cl 2) 0,027 (Cl 3)	0.01	0.1

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Priority and other substances	CAS No	Analytical methods		AA-EQS	MAC-EQS	30% EQS based on AA-EQS	Limit of quantification	
		Total nr. used methods	Available EN ISO methods				MIN value,	MAX value,
				µg/l	µg/l	µg/l	µg/l	µg/l
(depending on water hardness Cles)			EN ISO 15586 EN ISO 17294	0,15 Cl4 0,25 Cl5	0,9 (Cl 4) 1,5 (Cl 5)	0,045 (Cl 4) 0,075 (Cl 5)		
Carbon-tetrachloride	56-23-5	5	EN ISO 10301 EN ISO 15680	12	n.a.	3.6	0.1	3
C10-13 Chloroalkanes	85535-84-8	5	EN ISO 12010	0.4	1.4	0.12	0.04	1.4
Chlorfenvinphos	470-90-6	9	EN ISO 10695 EN ISO 11369 EN ISO 12918 EN ISO 6468	0.1	0.3	0.03	0.001	0.003
Chlorpyrifos	2921-88-2	11	EN ISO 10695 EN ISO 12918 EN ISO 6468	0.03	0.1	0.009	0.001	0.025
Aldrin	309-00-2	6	EN ISO 10695 EN ISO 6468	0.01	-	0.003	0.0005	0.003
DDT total		6	EN ISO 6468	0.025	-	0.0075	0.00005	0.01
para-para-DDT	50-29-3	6	EN ISO 6468	0.01	-	0.003	0.00005	0.003
1.2-Dichloroethane	107-06-2	6	EN ISO 10301 EN ISO 15680 EN ISO 17852	10	10	3	0.01	5
Dichloromethane	75-09-2	6	EN ISO 10301 EN ISO 15680 EN ISO17852	20	20	6	0.01	6
Di(2-ethylhexyl)-Phthalate (DEHP)	117-81-7	4	EN ISO 18856	1.3	-	0.39	0.005	0.4
Diuron	330-54-1	7	EN ISO 11369	0.2	1.8	0.06	0.001	0.06
Endosulfan	115-29-7	7	EN ISO 6468 EN ISO 3890	0.005	0.01	0.0015	0.0005	0.017
Fluoranthene	206-44-0	7	EN ISO 17993	0.0063	0.12	0.00189	0.0005	0.01
Hexachlorobenzene	118-74-1	6	EN ISO 6468 EN ISO 22863	-	0.05		0.0005	0.05
Hexachlorobutadiene	87-68-3	8	EN ISO 10301 EN ISO 15680 EN ISO 6468 EN ISO 20595	n.a.	0.6		0.0009	0.6
Hexachlorocyclohexane	608-73-1	7	EN ISO 6468 EN ISO 3890	0.02	0.04	0.006	0.00005	0.029
Isoproturon	34123-59-6	5	EN ISO 11369	0.3	1	0.09	0.001	0.06
Lead and its compounds	7439-92-1	6	EN ISO 11885 EN ISO 15586 EN ISO 17294	1.2	14	0.36	0.08	1
Mercury and its compounds	7439-97-6	9	EN ISO 12338 EN ISO 1483 EN ISO 12846 EN ISO 17294 EN ISO 17852	n.a.	0.07		0.005	0.07
Naphthalene	91-20-3	10	EN ISO 17993 EN ISO 15680	2	130	0.6	0.0005	0.72
Nickel and its compounds	7440-02-0	5	EN ISO 11885 EN ISO 15586 EN ISO 17294	4	34	1.2	0.01	2

Priority and other substances	CAS No	Analytical methods		AA-EQS	MAC-EQS	30% EQS based on AA-EQS	Limit of quantification	
		Total nr. used methods	Available EN ISO methods				MIN value,	MAX value,
				µg/l	µg/l	µg/l	µg/l	µg/l
Nonylphenols (4-Nonylphenol)	84852-15-3	6	EN ISO 18857 EN ISO 12673 EN ISO 24293	0.3	2	0.09	0.01	2
Octylphenols (4-(1,1',3,3'-tetramethylbutyl)-phenol)	140-66-9	5	EN ISO 18857 EN ISO 12673	0.1	n.a.	0.03	0.01	0.2
Pentachlorobenzene	608-93-5	6	EN ISO 6468 EN ISO 17070	0.007	n.a.	0.0021	0.0005	0.0026
Pentachlorophenol	87-86-5	5	EN ISO 12673	0.4	1	0.12	0.01	0.25
Benzo(a)pyrene	50-32-8	5	EN ISO 17993	0.00017	0.27	0.000051	0.00005	0.004
Simazine	122-34-9	8	EN ISO 11369 EN ISO 10695	1	4	0.3	0.001	0.1
Tetrachloroethylene	127-18-4	4	EN ISO 10301 EN ISO 15680	10	n.a.	3	0.1	3
Trichloroethylene	79-01-6	4	EN ISO 10301 EN ISO 15680	10	n.a.	3	0.05	3
Tributyltin compounds (Tributyltin cation)	36643-28-4	4	EN ISO 17353	0.0002	0.0015	0.00006	0.000244	0.0005
Trichlorobenzenes	12002-48-1	6	EN ISO 6468 EN ISO 10301 EN ISO 15680	0.4	n.a.	0.12	0.002	0.2
Trichloromethane	67-66-3	5	EN ISO 10301 EN ISO 15680	2.5	n.a.	0.75	0.05	1
Trifluralin	1582-09-8	10	EN ISO 10695 EN ISO 6468	0.03	n.a.	0.009	0.00005	0.03
Dicofol	115-32-2	7	ISO 10382	0.0013	n.a.	0.00039	0.00005	0.009
Perfluorooctane sulfonic acid and its derivatives (PFOS)	1763-23-1	6	ISO 25101 EPA 537	0.00065	36	0.000195	0.00002	0.001
Quinoxyfen	124495-18-7	8	EN ISO 11369	0.15	2.7	0.045	0.001	0.05
Dioxins and dioxin-like compounds		3	ISO 17858		n.a.	0		0.1
Aclonifen	74070-46-5	5	EN ISO 11369	0.12	0.12	0.036	0.01	0.05
Bifenox	42576-02-3	6	EN ISO 11369 EN ISO 6468	0.012	0.04	0.0036	0.0025	0.01
Cybutryne	28159-98-0	5	EN ISO 11369	0.0025	0.016	0.00075	0.0005	0.02
Cypermethrin	52315-07-8	5	EN ISO 6468	0.00008	0.0006	0.000024	0.0002	0.04
Dichlorvos	62-73-7	6	EN ISO 10695 EN ISO 11369	0.0006	0.0007	0.00018	0.0001	0.05
Hexabromocyclododecane (HBCDD)		4	n.a	0.0016	0.5	0.00048	0.0002	0.5
Heptachlor and heptachlorepoxide	76-44-8/1024-57-3	7	EN ISO 6468	0.0000002	0.0003	0.00000006	0.00001	0.05
Terbutryn	886-50-0	7	EN ISO 10695 EN ISO 11369	0.065	0.34	0.0195	0.0005	0.05

Table 5-2: Used analytical methods and range of change in the limit of quantification concerning most commonly monitored other specific hazardous substances

		Analytical methods		Limit of quantification	
Priority and other substances	**CAS No**	**Total number used methods**	**Available EN ISO methods**	**MIN value, µg/l**	**MAX value, µg/l**
Arsenic	7440-38-2	8	EN ISO 11885 EN ISO 11969 EN ISO 15586 EN ISO 17294-2 EN ISO 17378-2 ISO/TS 19620	0.01	10
Bisphenol A	80-05-7	3	ISO 18857-2	0.025	0.1
Chromium (total)	7440-47-3	7	EN ISO 11885 EN ISO 15586 EN ISO 17294-2 EN 1233	0.05	15
Copper	7440-50-8	6	EN ISO 11885 EN ISO 15586 EN ISO 17294-2 ISO 8288:2006	0.2	2
Cyanide	57-12-5	5	ISO 16703-2 ISO 6703-1	0.01	10
O, m, p-xylene	1330-20-7	5	EN ISO 10301 EN ISO 15680 ISO 11423/1	0.3	5
Polychlorinated biphenyls*	7012-37-5, 35693-99-3	3	EN ISO 6468	0.0005	0.0029
Selenium	7782-49-2	4	EN ISO 11885 EN ISO 15586 EN ISO 17294-2 ISO 8288:2006	0.18	1
Terbuthylazine	5915-41-3	4	EN ISO 11369	0.001	0.01
Zinc	7440-66-6	6	EN ISO 11885 EN ISO 15586 EN ISO 17294-2 EN ISO 8288/2001	0.2	300

* PCB 28, PCB 52, PCB 101, PCB 105, PCB 118, PCB 138, PCB 153, PCB 156, PCB 180)"

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6 REGISTERS, DATA BASES AND REPORTING

6.1.1 Registers and data bases for surface and groundwater quality monitoring

The results of monitoring and control over the emitters are organized in regulatory established electronic registers and data bases in all the countries (*Table 6-1*). Only Montenegro reports that "such data base" is not available. Not all the registers however and data bases are online or public available in the different countries. Only Ukraine has not yet adopted the PRTR register although the country maintains national registers concerning air and water pollution.

Table 6-1: Existing data bases for the monitoring of hazardous substances in water

Country	Public availability of the data base	Responsible institution (data holder)
Austria	YES https://wasser.umweltbundesamt.at/h2odb/	Environment Agency Austria (on behalf of Federal Ministry of Agriculture, Regions and Tourism)
Bulgaria	YES (upon request) No online access	Executive Environment Agency
Croatia	YES	Croatian Waters
Germany	YES (there is a national data base which is not publicly available yet (only upon request), but on RBD-level public available data bases exist e.g. http://www.mkoo.pl/index.php?mid=35&lang=DE; https://www.fgg-elbe.de/elbe-datenportal.html; http://iksr.bafg.de/iksr/; https://datenbank.fgg-weser.de/weserdatenbank/)	The federal states (Länder) Selected information is send to UBA and stored in national data bases
Hungary	YES (partly, online access to surface water quality measurements annual statistics http://web.okir.hu/sse/?group=FEVISZ Further data can be assessed upon request http://vpf.vizugy.hu/reg/ovfen/doc/data_request_jav.docx	Ministry of Agriculture (Department of Environmental Protection) - National Environmental Information System General Directorate of Water Management
Moldova	YES Surface water; https://date.gov.md/ckan/organization/2898-agentia-de-mediu Groundwater: http://www.ehgeom.gov.md/ro/proiecte-din-bugetul-de-stat/monitorizarea-apelor-subterane	Surface Water: Environmental Agency Groundwater: Agency for Geology and Mineral Resources/ Hydro-Geological Expedition
Romania	YES (upon request), No online access	River Basin Administrations
Serbia	YES (upon request) No online access. Publicly available is Annual Report on the results of monitoring of surface and ground water quality: http://www.sepa.gov.rs/download/KvalitetVoda_2020.pdf	Serbian Environmental Protection Agency

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Slovenia	YES https://www.arso.gov.si/vode/podatki/arhiv/kakovost_arhiv2020.html	Slovenian Environment Agency
Slovakia	YES (upon request) No online access	Slovak Hydrometeorological Institute
Ukraine	NO online access. Upon request.	State Water Agency (GeoPortal and relevant data base)

In general, the database contains processable information concerning the water body (e.g. ID, name), the monitoring site (name code, coordinates), date of monitoring, the monitored substance, the measured value, method of monitoring, etc. The data base is on-line available in Austria, Croatia and Slovenia and available upon request in Slovakia, Bulgaria, Hungary and Ukraine following an established procedure for data access.

No fees are applied for access in any of the countries.

A national register on the occurrence of hazardous substances in surface water and groundwater bodies is confirmed in Austria and Slovenia. In Slovakia, the National Chemical Database contains all data from the monitoring of surface and ground waters. This database is not online available. Data can be requested, fees are applied. In Bulgaria, the monitoring data base of surface and ground waters also contains information concerning the occurrence of hazardous substances in each monitoring point. The data however must be processed in order to derive a conclusion concerning the frequency and places of occurrence of a certain hazardous substance.

6.1.2 *Registers and data bases concerning point source emitters*

❒ ***National Pollutant and Transfer Release Registers***

The development and maintenance of a data base is stipulated in Art. 4 of the Regulation EC 166/2006 for the establishment of a national E-RPTR register. All the countries, except for Montenegro and Ukraine, confirm the existence of a national E-RPTR (*Table 6-2).*

Table 6-2: Links to the national Pollutant Release and Transfer Registers

Country	Link to the national E-PRTR
Austria*	www.prtr.at
Bulgaria	http://pdbase.government.bg/forms/public_eprtr.jsp
Croatia	http://pproo.azo.hr/hr
Germany	www.thru.de
Moldova	https//retp.gov.md
Montenegro	Not yet established
Hungary	http://web.okir.hu/sse/?group=KAR
Romania	http://prtr.anpm.ro/
Slovenia	The data is available at European PRTR site
Slovakia	http://nrz.shmu.sk/index.php
Serbia	https://www.nriz.sepa.gov.rs/TeamsPublic/teamssr.aspx?FormName=PRTRPublicForm

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Ukraine	Establishing of PRTR didn't include to the Association Agreement / State Water Agency maintenance the national inventory 2TP-Wodhoz on water; State Statistical Agency – data on air

* For air emissions pollution data are not publicly available; database enquiry service for registered companies is possible.

The content of the national PRTRs is in line with the requirements of the Regulation EC No 166/2006 and those of the Commission Implementing Decisions (EU) 2019/1741 and (EU) 2022/142. It allows searching the data entered in the national information systems for reporting on the E-PRTR, according to different search criteria (e.g. location of the site, category of activity, type of pollutant, waste code).

The non-EU member states are at different stage concerning the development of a national PRTR, i.e.:

- Montenegro has ratified the Protocol on PRTR in July 2017, pursuant to the requirements of Regulation (EC) No 166/2006 (E-PRTR). So far, certain progress has been made in establishing a mechanism for creating and maintaining a quality database in relation to industrial waste, as the initial phase of designing the data base infrastructure has been fully completed. A Blueprint document was finalized and approved concerning the industrial waste management and cleaning followed by coding and software development. The obligations defined by the Rulebook on the detailed content and manner of keeping the Register of environmental pollutants will be incorporated into the national register, which will be harmonized with the Pollutant Register (PRTR).
- Moldova has implemented Regulation EC No 166/2006 in its national legislation. The national e-PRTR Register was established in 2017, but it's not fully operational yet and requires further improvement followed by data updating
- Ukraine – the PRTR register has not yet been developed.
- Serbia – signed PRTR Protocol in 2003 and ratified in 2011. Implementation of PRTR Protocol and E-PRTR directive started in 2008. Information system of the national register of pollution sources was developed in 2012 and is being constantly enhanced. Serbia started reporting to European Agency in 2011 on voluntary basis.

❒ ***National registers and data bases for wastewater discharges (different from the PRTR data base)***

Apart from the obligations for reporting under Regulation No 166/2006, most of the countries maintain other data bases and registers at national or regional level (*Table 6-3*).

In Serbia, all polluters (operators) are obliged to deliver a report on wastewater discharges once a year, containing information for the previous year. The data base is being kept by the Serbian Environmental Protection Agency. The public water companies are also keeping their data bases for the territories in their competence. Croatia, Moldova and Montenegro report that there are no such databases.

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It can be concluded that the national registers of point source wastewater discharges are in general public available in most of the countries, the monitoring data base however on the implementation of the conditions stipulated in the discharge permit is not public available, although e.g. in Bulgaria and Slovakia certain data can be received upon request.

The information concerning WWTPs discharges is included within these registers.

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Table 6-3: National registers and data bases concerning point source wastewater discharges

Country	National Registers & data bases	Short description of the content of the registers and data bases	Public availability	Responsible institution (data holder)
Austria	Point Source Emission Register (EmRegV-OW 2017, BGBl. II Nr. 207/2017)	Any physical or juridical body entitled to use water through a point source, is obligated to measure emissions and report them to the emission register. Emitters included in the register: • All the IED facilities, which produce wastewater, and WWTP > 2,000 PE • The food processing industries, incl. also manufacture of animal feed from plant products and manufacture of hide glue, gelatine and bone glue, maltings. • The register contains general master data, water management master and movement data	Not publicly available	Environment Agency Austria (on behalf of the Federal Ministry of Agriculture, Regions and Tourism)
Bulgaria	Register of industries subject to integrated permissions under IPPC Directive	The register contains information about the operator, location, the controlling Regional Inspectorate on Environment and Water and all the documentation concerning the integrated permit issuance and subsequent control in PDF format.	http://registers.moew.government.bg/kr/	Ministry of environment and water
	Register of emitters discharging wastewater into surface water bodies	Developed at regional level. The register is in Excel format and contains information about the operator and the conditions of the discharge permit (operator's details, coordinates of the discharge, permitted flows and wastewater quality emission standards)	Publicly available at the site of the River Basin Directorate	River Basin Directorates
	Monitoring data base of point source wastewater discharges (control & own monitoring) Register of emitters forming emissions of priority substances	The monitoring data base of wastewater discharges contains information about the operator, the sampling points, the sampling date and the values of monitored parameters. Some of the files are in Excel format, some of the files are in PDF format. The Register of emitters forming emissions of priority substances contains information about the operator, the receiving water body, the discharge permission and the priority substances subject to control. No monitoring data included.	Some data available upon request The register is public available at the site of the Regional Inspectorates	Regional Inspectorates
Germany	National database for UWWTD (WWTPs only (only nutrient emissions)	The data base includes UWWTD data (WWTP > 2,000 PE) and additional information on WWTPs > 50 PE – 2,000 PE.	Selected UWWTD-data is publicly available: https://kommunales-abwasser.de/ (download of data is possible).	German Environment Agency

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Country	National Registers & data bases	Short description of the content of the registers and data bases	Public availability	Responsible institution (data holder)
		Furthermore, there is a data base including monitoring data of a national monitoring project/campaign (49 WWTPs, hazardous substances).	Monitoring data on hazardous substances is not publicly available	
Hungary	National Environmental Information System (OKIR)	Permit holder details (name, address, category), type of receiving water body and amount of substance annual released	Not publicly available	Ministry of Agriculture (Dept. of Environmental Protection)
Moldova	Narrative Information on the industrial and WWTPs' discharges	Information about connected industries, discharged volumes and concentrations of pollutants Information on volumes of discharges and number of connected economic agents	NO YES, http://amac.md/public/files/indici-financiari-interactiv/chisinau.pdf	Inspectorate for the Environmental Protection Association Moldova Apa-Canal
Romania	General register of industrial emitters with common and with complex permission discharges	The register content the name of industrial facilities, name of the project/activity, data on issuing of permit and their validity, location of the activity (river basin, water body, locality, county). Also, the technical documents and permits can be online uploaded and obtained at https://avize-autorizatii.rowater.ro/modules/site/page?id=2 Information on the discharged hazardous substances can be found only in the individual permits which makes the tracking of substances very difficult.	The register is publicly available at the site of National Administration Romanian Waters https://rowater.ro/documente-de-interes-public/transparenta/avize-si-autorizatii/lista-avizelor-si-autorizatiilor-de-gospodarire-a-apelor-emise/	National Administration Romanian Waters River Basin Administrations
	National data base on wastewater discharges and pollution loads	General information about the point source emitters (e.g. ID, type of WWTP), the allowed emission values at the discharge point into water resources, discharged flow, monitoring data (concentrations) at the discharge control point, information regarding the receiving water bodies (qualitative monitoring data), assessment of the status of water bodies, etc.	Not publicly available	NA Romanian Waters
Slovenia	Emissions to water from industrial and other installations	The register contains information about the operator, location of discharge and information's regarding measurements of parameters in waste water	http://vode.arso.gov.si/dist_javna/izpusti/iskalnik_in.jsp	Slovenian Environment Agency
Slovakia	National Pollution Register	Information about the industrial facility, discharged load (parameter, concentration, Q)	Only limited information is available upon request	Slovak Hydrometeorological Institute

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Country	National Registers & data bases	Short description of the content of the registers and data bases	Public availability	Responsible institution (data holder)
		UWWTPs included – only those subjects to Regulation No 166/2006		
Ukraine	E-database of the industrial and WWTPs' discharges	Information about the industrial and UWWTP facility, the discharged volumes and annual substances emissions (acc. to the permission). All the information is submitted in on-line mode.	Not publicly available	State Water Agency

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6.1.3 *Registers and data bases concerning diffuse pollution*

❒ ***Registers and data bases concerning air emissions***

As above mentioned, concerning the air pollution, the report focusses on the data provided within the PRTR register (see item 6.1.2).

❒ ***Registers and data bases concerning pesticides regulation and use in agriculture***

All the countries have public registers concerning the authorized/non-authorized plant protection products on the market and recommendations for use on different crops, based on the active substances contained.

Data bases however concerning the amount and type of the applied pesticides on certain agricultural areas seems to be yet established only in several countries. Slovakia confirms that there are existing data base concerning the annual application of pesticides on field blocks, which however is not public available. In Bulgaria, Romania and Moldova, there are some statistical aggregated data (at regional or county level) about the amount of the applied pesticides, as Bulgaria the information is available only upon request.

Austria reports that pursuant to Regulation (EC) No 1185/2009 concerning the statistics on pesticides, for the first five-year period 2010-2014, AGES carried out the statistical evaluations on behalf of the Federal Ministry of Agriculture, Regions and Tourism (BMLRT) and the Federal Provinces. The quantities of plant protection products used were extrapolated to the use in Austria on the basis of farm records and seed certification data. Austria is considered as one survey region, there is no evaluation at the federal state level. The application data come from farms that voluntarily participated in the survey. Around 940 farms took part in the survey in the reference year 2017. The total area surveyed is 28,200 ha. Information on seed treatment of 88,000 tons of seed is available from the seed certification. In addition to the crop's apple, potato, maize, rape, soybean, spring barley, wine, winter wheat and sugar beet, for which an evaluation of use was already carried out in the first five-year period, oats, oil pumpkin, spring wheat, sunflower, winter barley, winter rye and winter triticale are now also included in the survey. an overview of the quantities of active substances used, aggregated by groups of active substances. The aggregates correspond to those used in the presentation on placing on the market in the Green Report. (https://gruenerbericht.at/cm4/)

The amounts of PPPs applied in agriculture in the Slovak Republic are monitored by the Central Agricultural Inspection and Testing Institute (ÚKSUP) on the basis of data from business entities.

Table 6-4: National registers and data bases concerning pesticides use regulation and application in agriculture

Country	National Registers & data bases	Short description of the content of the registers and data bases	Public availability	Responsible institution (data holder)
Austria	Register of plant protection products authorized in Austria	In the Register all plant protection products approved by the Federal Office for Food Safety are entered under a consecutive number. In addition to general information on the approval, such as the start and end of the approval, the approval holder, the manufacturer of the formulation, the active ingredients contained and the active ingredient content, the detailed application regulations, conditions and instructions are also listed.	https://psmregister.baes.gv.at/psmregister/;jsessionid=Jyf47C5SsUdDbWjXb5YhIFGVQ_-siFNMk7gXYKRvGPAMtsibipqA!1308652300	The Federal Office for Food Safety
Bulgaria	List of plant protection products authorized for placing on the market and use *	Contains information about the trade name of the product, the active substances content, the suitable crops, recommendable dosage of application	https://www.bfsa.bg/	Bulgarian Food Safety Agency
	Data base on the application of plant protection products in agriculture	Aggregated data at municipal level about the number of farms and areas (in ha) where pesticides have been applied (separately for herbicides, fungicides, and insecticides).	Not publicly available	Ministry of Agriculture Food and Forests
Croatia	List of registered plant protection products	Contains information about the trade name of the product, the active substances content, the suitable crops, recommendable dosage of application	https://fis.mps.hr/trazilicaszb/	Ministry of Agriculture
Germany	Register of plant protection products authorized in Germany	In the Register all plant protection products approved by the Federal Office for Food Safety are entered under a consecutive number. In addition to general information on the approval, such as the start and end of the approval, the approval holder, the manufacturer of the formulation, the active ingredients contained and the active ingredient content, the detailed application regulations, conditions and instructions are also listed.	https://www.bvl.bund.de/EN/Tasks/04_Plant_protection_products/01_ppp_tasks/02_ppp_AuthorisationReviewActSub/01_ppps_authorised/01_ppp_online_database/ppp_online_database_node.html	Federal Office of Consumer protection and Food Safety
Hungary	Data base of authorized plant protection products:	Issuing field identifiers (name, address, category), type and name of the used pesticides, and amount of substance used	https://novenyvedoszer.nebih.gov.hu/Engedelykereso/kereso	National Food Chain Safety Agency

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Country	National Registers & data bases	Short description of the content of the registers and data bases	Public availability	Responsible institution (data holder)
Moldova	Information on pesticides use	Presents a general information about pesticides: name, active substances, characteristic, mode of the utilization	http://www.pesticide.md/registrul-de-stat/	State Center for Product Certification and Approval of Phytosanitary Use and Fertilizers
	National statistics	General information about the emission and contamination sources	https://statistica.gov.md/category.php?l=ro&idc=99&	National Bureau of Statistics
Monte Negro	List of active substances allowed for use in plant protection products	Adopted every year and published in the Official Gazette.	file:///C:/Users/Korisnik/Downloads/Lista%20aktivnih%20supstanci%20dozvoljenih%20za%20upotrebu%20u%20sredstvima%20za%20za%C5%A1titu%20bilja%20za%202021.%20godinu_.pdf	Directorate for food safety, veterinary and phytosanitary affairs
Romania	National Statistical Database	Statistical information about the areas of applied pesticides and the quantity of pesticides produced and imported by county level	http://statistici.insse.ro:8077/tempoonline/#/pages/tables/insse-table;	National Statistical Institute
	Lists of allowed pesticides List of not allowed pesticides	The names of trade products given that contains the specific active substances and the prescribed dosage for agricultural application.	https://www.anfdf.ro/central/omologare/ppp/ppp_omol.html (pestexpert program))	National Fitosanitary Authority
Slovenia	List of PPPs registered to date List of PPPs allowed in organic production	Information from the Ministry of Agriculture in the field of plant protection products	https://www.gov.si/podrocja/kmetijstvo-gozdarstvo-in-prehrana/varstvo-rastlin/fitofarmacevtska-sredstva/ http://spletni2.furs.gov.si/FFS/REGSR/FFS_RegSezn.asp?top=1 http://spletni2.furs.gov.si/FFS/REGSR/FFS_sezn.asp?L=1&S=2&top=1	Food Safety, Veterinary and Plant Protection Administration
Slovakia	List of registered plant protection products is published on yearly bases.	The list also contains target pests in combination with crops for which the pesticide can be used and way the pesticide can be applied.	https://www.uksup.sk/orp-zoznamy-pripravkov-na-ochranu-rastlin	Ministry of Agriculture and Rural Development,

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Country	National Registers & data bases	Short description of the content of the registers and data bases	Public availability	Responsible institution (data holder)
	Data base authorized PPPs	Trade name of the product, authorization number, decision holder, crop or area of use, harmful organism or other purpose of use, type of product function, name of the active substance, determination of use, parallel import, method of application, package size, product type, group of active substances, authorization period.	http://pripravky.uksup.sk/pripravok/search	Central Control and Testing Institute in Agriculture
	List of pesticides that are banned from use in the protected areas of gorund and surface water colectors used for extraction of water for human consumption	trade name of PPPs, authorization number, active substance	https://www.uksup.sk/orp-zoznamy-pripravkov-na-ochranu-rastlin	Ministry of Agriculture and Rural Development
	Data base about the amount of applied plant protection products on field blocks	Data base about the amount of applied plant protection products on field blocks	Not publicly available	The Central Control and Testing Institute in Agriculture
Serbia	Register of distributors and importers of plant protection products Database of advisory and operational service providers	All legal entities that meet the requirements in terms of facilities and professional qualifications of persons engaged in the trade of plant protection products are entered in the Register of Distributors and Importers All legal entities that meet the requirements in terms of facilities, equipment and training of professionals receive a Decision on the provision of advisory and operational services in the field of plant protection products.	YES (Website of the Directorate for Plant Protection) YES (Website of the Directorate for Plant Protection -)	Ministry of Agriculture, Forestry and Water Management - Directorate for Plant Protection Ministry of Agriculture, Forestry and Water Management - Directorate for Plant Protection
Ukraine	1.The State Inventory of allowed and not allowed active chemical substances for plant protection. 2. Annual data on applied pesticides	1)Trade names of the products, active substances content, for which crops is it used, the prescribed dosage for agricultural application; 2) The State Statistical Agency presents annual information on the areas where chemical substances for plant protection (i.e. herbicides, fungicides and	1) YES (https://mepr.gov.ua/content/derzhavniy-reestr-pesticidiv-i-agrohimikativ-dozvolenih-do-vikoristannya-v-ukraini-dopovnennya-z-01012017-zgidno-vimog-postanovi-	1) Ministry of Ecology and Natural Resources of Ukraine

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Country	National Registers & data bases	Short description of the content of the registers and data bases	Public availability	Responsible institution (data holder)
		insecticides) were applied and value of applications in kg/ha"	kabinetu-ministriv-ukraini-vid-21112007--1328.html) 2) For the whole country and district level – YES; for local level (rayons) – upon request, charged	2) The State Statistical Agency
	Data base with monitoring data on pesticides concentrations in surface water	Monthly concentrations of different type of pesticides within river basins	Not public available, upon request	State Water Agency

***** Besides this register, there are a number of other registers concerning the companies that have permissions for repackaging/production/trading/air spraying of plant protection products production, register of persons performing specialized plant protection services and holding a certificate to use products of plant protection products of professional category of use (https://www.bfsa.bg)

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6.2 Reporting

Annual reports on the groundwater and surface water status have been prepared by all the EU members in lieu of their obligations for implementation of the relevant EU Directives (e.g. the WFD). The collected monitoring information is also used for assessing the RBMPs management cycle (pressures and measures, risk analyses, environmental objectives and exemptions, modelling of emissions) and updating the monitoring programs within the management cycle.

The information collected from the industrial emitters is used for the purpose of strategic planning and for fulfilment of the obligations pursuant to IED and PRTR.

Concerning the non-EU members:

- In Moldova, annual reports on the surface water status are prepared by the Environmental Agency on the basis of operational monitoring data. Reports on the groundwater quality are being elaborated once per 5 years.
- In Montenegro an annual report is prepared by the "Institute of Hydrometeorology and Seismology", which is the responsible institution for the implementation of the monitoring program. The report is submitted to the Ministry of Agriculture, Forestry and Water Management and adopted by the government.
- In Ukraine: An analysis of the anthropogenic pressure and its impact was carried out for all main river basins in the process of preparation of the RBMPs.

  Monitoring, pursuant to WFD was started in all river basin but covered from 20% to 50% water bodies. Primary monitoring data were submitted to the State Water Agency as well as the Ministry of Ecology and Natural Resources of Ukraine. The ecological and chemical status of water bodies was assessed and submitted to the State Water Agency what is the responsible body for the RBMPs developing. Spatial pattern of the ecological and chemical status is reflected on the GeoPortal (State Water Agency).
- In Serbia annual report on the groundwater and surface water status is prepared by Serbian Environmental Protection Agency and Republic Hydrometeorogical Institute. Monitoring, harmonized to WFD was started in 2012, but it still does not cover all of designated water bodies and it depends on the allocated funds on an annual basis.

The annual reports containing aggregated data and the conclusions are public available.

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7 INVENTORY ON PRIORITY SUBSTANCES EMISSION, DISCHARGES AND LOSSES

7.1 Legal requirements

According to Article 5 of the Directive 2008/105/EC (the EQS Directive), Member States shall establish an inventory, including maps, if available, of emissions, discharges and losses of all priority substances for each river basin district or part of a river basin district lying within their territory including their concentrations in sediment and biota, as appropriate. An update and reporting of the inventory on a regular basis as part of the river basin management process shall be done.

The updated list of the priority and priority hazardous substances is provided in Annex I of the Directive 2013/39/EU. In line with the latest scientific and technical knowledge seven new priority substances are included to the initial list provided in the Directive 2008/105/EC. The total number of the priority substances for which inventory shall be done (if such substance is relevant for the particular RBD) is 45. Nearly half of them, 21 in total are considered as hazardous substances.

The inventories[13]:

1) give information on the relevance of priority substances at the spatial scale of the RBD;
2) enable compliance check with the environmental objectives of the WFD on reduction of discharges, emissions and losses
3) provide input for the Commission report according to Art. 7(1) of the EQS Directive on the possible need to amend existing acts
4) ensure greater transparency to the public.

7.2 National approaches

7.2.1 The methodological framework

A methodology for preparation of inventories is suggested at EU level in the CIS Guidance No. 28 "Preparation of an Inventory of Emissions, Discharges and Losses of Priority and Priority Hazardous Substances". The document recommends a tiered approach for establishing of the inventories as follows:

- **1st step: Assessment of relevance**

[13] *CIS Guidance document N28: Preparation of an Inventory of Emissions, Discharges and Losses of Priority and Priority Hazardous Substances, Technical report 2012-058*

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This step aims at identification of substances with minor relevance for the RBD (at present and in the foreseeable future), which shall not be included in the inventory.

- **2nd step: Approaches for relevant substances**

For substances which pass the relevance criteria a more detailed analysis aiming at providing further estimates of emissions, discharges and losses from point and diffuse sources, as well as loads transported in rivers should be performed. Three approaches are suggested: riverine load approach; pathway-oriented approach and source-oriented approach.

Table 7-1 provides information on how the **1st step** was adopted in each country.

Table 7-1: Criteria for selection on HSs for inventory

Country	Criteria used to select the substances subject to inventory
Austria	An essential aspect in the selection of substances was the consideration of ubiquitous persistent bioaccumulating and toxic substances (uPBTs). Many of these substances have a pronounced toxicity and are therefore subject to very low environmental quality standards (EQS)
Bulgaria	▪ the substance is the cause of not achieving good condition in at least one water body ▪ the concentration for a substance is above 1/2 EQS for more than one aqueous body ▪ the monitoring results show a tendency to increase concentration, which can lead to problems within the next RBMP cycles ▪ EPRI data show releases that may emit a concentration, which may lead to a problem within the next cycles of the RBMP ▪ there are sources and activities in the basin that could emit concentration leading to problems within the next cycles of the RBMP.
Croatia	▪ concentrations of the substance to be determined pose a significant risk to the aquatic environment ▪ substances whose concentrations exceed the average or maximal annual values of environmental quality standards
Germany	Two immision and two emission related criteria were applied following the Technical Guidance No 28: ▪ the substance causes a failure of good chemical status in at least one water body or ▪ the level of concentration for a substance is above half of the EQS in more than one water body or ▪ PRTR data show releases which might lead to concentrations matching the criteria above or ▪ known sources and activities causing inputs in the RBD exist which might lead to concentrations matching the criteria above.
Hungary	▪ substances causing bad status of 1 waterbody ▪ substance exceeds half of any EQS at 2 waterbodies ▪ known and measured emission of the substance occurs in the country ▪ possibly high emissions based on EU source screening and EQS dossiers
Romania	▪ the substance causes a failure of good chemical status in at least one water body ▪ the level of concentration for a substance is above half of the EQS in more than one water body ▪ monitoring results show an increasing trend of concentration which may cause problems, for at least one body of water
Slovakia	Those, which exceeded the half of EQS.
Slovenia	All substances monitored in surface waters (Annex 2 and 8 of the Decree on surface water status) were a subject of inventory.

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It is noticeable that the approaches for assessing the relevance (the 1st step) of all countries are similar.

Regarding the 2nd step, five out of eight EU member partners confirmed consistence of their methodologies with this Guidance document. These are Austria, Germany, Hungary, Slovakia and Slovenia.

- Austria's latest inventory is based on a path-oriented emission modelling as proposed in the Inventory Guideline. First, a targeted monitoring is implemented in order to close existing data gaps on the content of trace substances in different environmental compartments relevant for a water body input in the best possible way and thus to create an adequate database. Together with other monitoring programs and literature data running in Austria, a comprehensive inventory of the concentrations of selected substances in various environmental compartments could be compiled. The estimation of emissions is calculated with the MoRE model (Modelling of Regionalized Emissions).
- Germany used two of the approaches proposed in the Technical Guidance No 28: the riverine load approach and the pathway-oriented approach. The riverine load approach was applied for substances with a lack of e.g. emission data. For most substances information to calculate diffuse emissions are missing. For some substances even, emissions from point sources are unknown. To close data gaps and to get a more reliable information a monitoring project for WWTs was executed. For substances with a sufficient database Germany applies the pathway-oriented approach calculating regionalized emission using the MoRE[14] model. For the latest inventory the Model was applied for the metals Ni, Hg, Cd and Pb and PAH16.
- Hungary uses all 3 methodologies: riverine load, pathway oriented, source oriented. Mainly riverine load method is applied. All available data is evaluated and afterwards the most suitable method is used.
- Slovenia and Slovakia use the method based on the riverine load. In Slovakia only emissions of significant pollution sources and riverine load in monitoring sites where the yearly average exceeds the half of the EQS are considered.

The other three MSs, Croatia, Bulgaria and Romania reported partial consistence with deviations in the load calculations. Ukraine developed only database on monitoring results. Montenegro, Moldova and Serbia have also not developed a national HS inventory.

[14] https://isww.iwg.kit.edu/english/MoRE.php

7.2.2 *Spatial scale*

The EQS Directive requires inventories to be prepared for each river basin district but does not specify explicitly the *spatial scale*. The practical usefulness of an inventory in River Basin Management significantly increases with a more detailed analysis and higher spatial resolution[15]. *Table 7-2* provides an overview on the adopted national spatial scales.

Table 7-2: Spatial scale used in preparation of the inventories

Country	Spatial scale
Austria	Catchment area sizes as uniform as possible, with a size of approx. 100 km²
Bulgaria	RBD
Germany	RBD, sub basins, catchment area sizes (approx. 130 km²)[16]
Hungary	RBD
Romania	Sub-basin
Slovakia	Whole country
Slovenia	RBD

The provided information shows that related to the pathway-oriented approach Austria and Germany apply higher spatial resolution for the substances related to modelling, i.e. ensures higher usefulness of the inventory.

7.2.3 *Point and diffuse pollutants*

The diffuse pollution is among the challenges of the establishment of a correct inventory. *Table 7-3* provides an overview on how this challenge was addressed in the Member States. It could be concluded that all countries consider the diffuse pollution using material balance, but each country has adopted specific calculation method. It appears that the predominant approach is the estimation of the diffuse load through the difference between the riverine load and the point source load.

[15] *CIS Guidance document No28, https://circabc.europa.eu/sd/a/6a3fb5a0-4dec-4fde-a69d-5ac93dfbbadd/Guidance%20document%20n28.pdf*

[16] On RBD-level (reporting scale) for substances which are not relevant (following the recommendations of Technical Guidance) only river loads should be reported; on sub-basin level (reporting scale) for all relevant substances using the different approaches described in the guidance (riverine approach for substances for which there are not enough emission information and pathway-oriented approach (for metals and PAHs))

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Table 7-3: Methods for addressing the diffuse pollution

	Method to consider the diffuse pollution
Austria	Material flow analyses were used for diffused loads: mass balance of soils, as soil is not seen as the source of pollution. For diffuse inputs via groundwater, surface runoff, drainage and erosion, soils are the main source areas and play an important role in this context as storage and transport media (erosion).
Bulgaria	Most often determined as the difference between the riverine loads and the summary loads from the point source emitters
Croatia	As a difference between the riverine load and the point source load
Germany	For the priority metals and PAHs, the diffuse emissions are calculated by using the MoRE model. Diffuse emissions were calculated for the following pathways: soil erosion by water, groundwater, surface runoff, tile drainage, combined sewer overflows, storm water outlets and atmospheric deposition to water surfaces. For the other substances, the diffuse emissions are estimated based on the difference between the riverine loads and the point sources emissions.
Hungary	Diffuse modelling prepared based on emission factors of UWWTPs and diffuse emissions estimated bases on the difference between point sources and riverine load.
Romania	Diffuse load is estimated as the difference between the total load and that discharged from point sources
Slovakia	Diffuse loads are estimated as a difference between the riverine load and the point source load.
Slovenia	The loads are estimated using riverine load approach.

Point source pollution is easier to be considered than the diffuse pollution provided that the necessary data are available and reliable. Only Austria reports of using material flow analyses concerning the diffuse pollution. *Table 7-4* provides information on which sources were used in each country.

In most cases, inventory is prepared with data, collected from the self-monitoring of the point-source polluters. It is not always clear whether and how the quality control of these data was ensured. In some countries like Romania a validation process of the operator's data is carried out by cross-checking with the control monitoring data of water authorities and other EU reported data (i.e SoE).

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Table 7-4: Data sources for point sources of pollutants

	Data sources for point sources of pollutants
Austria	Electronic Emission Register for all point sources, based on self-monitoring of the emitters and external monitoring
Bulgaria	Control and Operational Monitoring Programs, as well as the own monitoring of the operators holders of Discharge Permits and the Complex Permits
Croatia	Emitters through self-control measurements. Sometimes Authority control is done. Only accredited sampling and analyses is accepted.
Germany	▪ for industrial point sources: E-PRTR; loads based on self-monitoring of the operators; ▪ for urban wastewater treatment plants – UWWTD-data (meta-data) combined with derived mean effluent concentrations for certain substances based on monitoring results of a monitoring project (https://www.umweltbundesamt.de/publikationen/prioritaere-stoffe-in-kommunalen-klaeranlagen). For the following substances mean effluent concentrations could be derived: Pb, Cd, Ni, Hg, DEHP, Nonylphenole, PFOS, Fluoranthene, Diuron, Isoproturone and Terbutryne. For the other substances either more than 50% of monitoring values were < LOQ or there are not data, or the substances are not released via UWWTPs.
Hungary	European Pollutant Release and Transfer Register (E-PRTR); data on annual emissions from point sources of pollutants into water, as part of the report to the European Environment Agency (EEA)
Romania	European Pollutant Release and Transfer Register (E-PRTR); operators data on annual emissions from point sources of pollutants into water, as part of the report to the European Environment Agency (EEA); Control and Operational Monitoring Programs of Discharges Permits
Slovakia	The Central Water Register and E-PRTR are the main data sources in Slovakia

7.2.4 Natural background concentration

Another challenge of the inventory is the way of addressing the natural background concentration of the priority substances in the water bodies. *Table 7-5* provides an overview of this issue.

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Table 7-5: Methods for considering the background concentration

Country	Method to consider the natural background concentration
Austria	Is considered for metals **As, Pb, Cd, Cr, Cu, Ni, Se, Ag, Zn** The AA-EQN is considered as the total amount of the allowed concentration and the background concentration.
Bulgaria	National methodology available for background concentrations for: **Al, As, Cr, Cu, Cd, Ni, Pb, Fe, Mn, Zn and U.**
Croatia	National methodology available for background concentrations for: **As, Cd, NO3-, NO2-, Pb, Cd, Zn, Cu, Hg** Some ground water, due to their geological origin, contain higher concentrations of As, Pb, total P, orthophosphate, sulphate and ammonium, so they are not subject to the limit values prescribed by the "Regulation on water quality standard". This is the case for the ground water in Eastern Slavonia (Drava, Sava and Danube basins), the area of Legrad - Slatina and Lekenik - Lužani, the area of the rivers Lonja, Ilova and Pakra, the area of the city of Zagreb and of the Neretva River.
Germany	In the context of the inventory background concentrations are included in diffuse pollution pathways (MoRE-modelling) and not reported separately. Is considered for metals based on requirements of WFD (only applied in context with EQS assessment).
Hungary	It is considered for Metals: **As, Cd, Cr, Cu, Hg, Ni, Pb, Zn**
Romania	RO has a national methodology concerning the natural background for non-synthetic substances (metals). The list contains: **As, Cd, Cr, Cu, Ni, Pb, Hg, Zn.**
Slovakia	National Methodology on Monitoring and Assessment of Surface Water, waterbodies and background concentrations of metals. The list contains: **As, Cd, Cr, Cu, Ni, Pb, Hg, Zn**.
Ukraine	It is considered for Metals in the Don basin: **Pb, Ni, Cd, Ba, Li, Sr, Zn, Cu, Cr, Mn.**

It is noticeable that in all countries there are national methodologies addressing mainly for the background concentrations of metals.

7.2.5 *Sediment and biota*

The inventories should provide not only yearly inputs but also to include, as appropriate, concentrations in sediment and biota aiming at helping to substantiate the relevance of a substance for the RBD.

Only Hungary reports that the results from sediment and biota monitoring are considered in the inventory for selecting relevant substances.

7.2.6 *Established inventories*

Article 5 of the Directive 2008/105/EC stipulates that the reference period for the estimation of pollutant values to be entered in the inventories shall be one year between 2008 and 2010 and that for priority substances or pollutants covered by Directive 91/414/EEC, the entries may be calculated as the average of the years 2008, 2009 and 2010. However, due to different reasons, the first inventories were done in different time periods, which leaded to different reference years (*Table 7-6*).

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Table 7-6: Established inventories

	Number of completed cycles of inventories	The first reference year	The reference year of the last inventory
Austria	2	2004	2009-2014
Bulgaria	1	2009	2015
Croatia	1	2009	2015
Germany	2	2007-2011 (emission data, point sources only) 2006-2008 (pathway oriented approach)	2013-2016 (emission data, point sources only) 2012-2016 (pathway oriented approach)
Hungary	2	2010	2016-2018
Romania	2	2009-2011	2017-2019
Slovakia	2	2011	2017
Slovenia	2	2011	2017

Six countries, Austria, Germany, Romania, Hungary, Slovakia and Slovenia completed two cycles of inventories. The other two countries did inventories only once. The non-EU members (Moldova, Montenegro, Serbia and Ukraine) have not yet developed inventories.

Annex I of Directive 2013/39/EU identifies 45 hazardous substances, of which 21 are marked as priority hazardous substances. Table 7-7 presents information concerning the inventory of these substances, as:

- "1" means that the priority substance has been included in the 1st step: Assessment of relevance
- "2" means that the priority substance has been included in the 2nd step: Approaches for relevant substances
- "3" means that the priority substance has not been included in the inventory, e.g. due to lack of sufficient emissions (3a) or immissions (3b) data base
- "white cell" means that no information has been provided

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Table 7-7: Priority and priority hazardous substances, subject to the established inventories

Substance name	AT	BG	CR	DE**	HU	RO	SK	SL
1,2-dichloroethane	1	2		1	2	1	1	1
Aclonifen	1	3		2	3	3	1	1
Alachlor	1	3		1	1	1	1	1
Anthracene	1	3		2	2	1	1	1
Atrazine	1	3		1	2	1	1	1
Benzene	1	3		1	2	1	1	1
Bifenox	1	3		2	3	3	1	1
Brominated diphenylethers	2	3		2	3	1	1	1
Cadmium and its compounds	2	2	2	2	2	2	2	2
Chlorfenvinphos	1	3		1	3b	1	1	1
Chloroalkanes, C10-13	1	3		2	3b	3	1	1
Chlorpyrifos (Chlorpyrifos-ethyl)	1	3		2	3b	1	1	1
Cybutryne	1	3		2	3	3	1	1
Cypermethrin	1	3		2	3	3	1	1
Di(2-ethylhexyl)phthalate (DEHP)	1	3		2	3a	1	2	1
Dichloromethane	1	3		1	2	1	1	1
Dichlorvos	1	3		2	3	1	1	1
Dicofol	1	3		1	3	1	1	1
Dioxins and dioxin-like compounds	1	3		2	3	3	1	1
Diuron	1	3		2	2	1	1	1
Endosulfan	1	3		1	2	1	1	1
Fluoranthene	2	3		2	2	1	2	1
Heptachlor and heptachlor epoxide	1	3		2	3	1	1	1
Hexabromocyclododecanes (HBCDD)	1	3		1	3	1	1	1
Hexachlorobenzene	1	3		2	3	1	1	1
Hexachlorobutadiene	1	3		1	3	1	1	1
Hexachlorocyclohexane	1	3		2	2	1	1	1
Isoproturon	1	3		2	3a	1	1	1
Lead and its compounds	2	2	2	2	2	2	2	2
Mercury and its compounds	2	2	2	2	2	2	2	2
Naphthalene	1	3		2	2	1	1	1
Nickel and its compounds	2	2		2	2	2	2	2
Nonylphenols	2	3		2	2	1	2	1
Octylphenols	1	3		1	3a	1	2	1
Pentachlorobenzene	1	3		2	3	1	1	1
Pentachlorophenol	1	3		1	1	3	1	1
Perfluorooctane sulfonic acid and its derivatives (PFOS)	2	3		2	3	3	1	1
Polyaromatic hydrocarbons (PAH)	1*	3		2	2	1	2	1
Quinoxyfen	1	3		1	1	1	1	1
Simazine	1	3		1	1	1	1	1
Terbutryn	1	3		2	1	3	1	1
Tributyltin compounds	2	3		2	3b	3	2	1
Trichlorobenzenes	1	3		2	2	1	1	1
Trichloromethane (chloroform)	1	3		1	3a	1	1	1
Trifluralin	1	3		2	1	1	1	1

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Note: * In Austria, Benzo(a)pyren (belonging to PAHs) falls under category 2.

**information is appropriate for the 2nd inventory (German-wide results); Based on immission data 19 substances are locally relevant in up to 3 RBDs (Anthracen, Chloralkane (C10-C13), Chlorpyrifos, Cyclodien-Pestizide (Drine), Summe DDT und pp'-DDT, DEHP, HCB, HCH, Naphthalin, Nonylphenol, Pentachlorbenzol, Tetrachlorethylen, Trichlorethylen, Trichlorbenzole, Trifluralin, Dioxine, Aclonifen and Bifenox). The other substances are relevant in more than 3 RBDs (Cadmium, Diuron, Fluoranthen, Isoproturon, Lead, Nickel, PAK No 28, Tributylzinn (TBT), PFOS, Cybutryn, Cypermethrin, Dichlorvos, Heptachlor/-epoxid und Terbutryn); 2 substances (Hg and BDE) are relevant in all 10 German RBDs. Emission data are rarely available for most of the substances. Therefore, even if the substances were included in the inventory neither immission nor emission loads could be calculated. Emissions from UWWTPs could be calculated for 11 substances using mean effluent concentrations (Cadmium, Mercury, Nickel, Lead; Diuron, Isoproturon, DEHP, 4-iso-Nonylphenol, PFOS, Terbutryn und Fluoranthen). For Hg, Cd, Ni, Pb and PAK16 regionalized pathway specific emissions (using the MoRE-model) could be calculated.

It can be concluded that further profound analysis will be necessary to harmonize the list of the priority substances, subject to inventory in each country in regard to Danube RBD.

Some countries (Bulgaria, Hungary, Romania, Germany) report for difficulties in developing inventory of hazardous substances due to lack of sufficient data, e.g., most of the operators are not obliged to measure HSs or lack of data from smaller industrial facilities or impossibility to assign a certain substance found into the aquatic environment to an appropriate source. One of the most common problems is the insufficiency of data on diffuse pollution and absence of modelling to fill in the monitoring gaps.

8 CONCLUSIONS

8.1 Key findings

On the basis of the presented analyses of the main aspects of policies related to the management of hazardous substances in water it could be concluded that:

1) **Concerning the national legislative frameworks**
   - All EU partners have harmonized their national legislation with the relevant EU directives and regulations.
   - The harmonization in the non-EU member countries is well advanced, but still some issues are in process of implementation, except Montenegro, where the process is completed.
     - in Moldova a national monitoring methodology is partly developed.
     - Ukraine has made significant progress, but there are still some regulatory issues to be solved like harmonization with the IPPC Directive.
     - in Serbia - application of EQS for priority hazardous substances in biota is missing, the inventorying process has not yet started, and the IED is in process of implementation.

2) **Concerning the monitoring of hazardous substances in surface water**
   - Austria, Bulgaria, Croatia, Germany, Hungary, Montenegro, Slovakia, Slovenia and Serbia have included the full list of priority substances as set in Annex X of the Water Framework Directive in their monitoring programs. The rest of the countries (Moldova, Romania and Ukraine) monitor between 70 and 90% of all the priority substances and will complete the list in the next River Basin Management Plans (*Figure 4-1*).
   - 24 (out of 45) priority substances are monitored in the surface water in all countries. These are: *alachlor, anthracene, atrazine, benzene, cadmium and its compounds, chlorpyrifos, 1.2-dichloroethane, dichloromethane endosulfan, fluoranthene, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclohexane, lead and its compounds, mercury and its compounds, naphthalene, nickel and its compounds, nonylphenols (4-nonylphenol), pentachlorobenzene, simazine, trichlorobenzenes, trichloromethane, trifluralin and heptachlor and heptachlorepoxide*.
   - Besides the priority substances, all the countries have regulatively established monitoring of additional specific hazardous substances in the natural water bodies. Their number ranges in the investigated countries from 16 to 78 (*Figure 4-2).*

     21 chemical substances are observed in more than half of the countries studied, including the non-priority substances listed in Annex I of the EQS Directive, 4 heavy

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metals (*arsenic, chromium, copper, zinc), selen,* organic substances (*o,m,p-xylene, phenols, polychlorinated biphenyls, bisphenol A, AOX)* terbuthylazine and cyanides. The established EQS for surface waters for some of the specific hazardous substances varies significantly, even over one order of magnitude, from country to country. For example, the EQS for Bisphenol A ranges from 1 µg/l (Bulgaria) and 1.6 µg/l (Austria) to 10 µg/l (Slovakia) and 16 µg/l (Monte Negro), (*Table 4-3).*

- All the countries have included the hazardous substances from the Danube TNMN also into their national monitoring programs for inland water bodies. Exception is made only for *lindane* (BG, MD, UA) and *chromium* (MD) – *(Table 4-4).*

3) Concerning the management of hazardous substances in ground water

- The number of monitored hazardous substances in groundwater ranges from 5 to over 60 in the different countries (Figure 4-4). Twelve hazardous substances (among which 8 priority substances) are monitored in over 50% of the countries. These are: 5 metals (arsenic, cadmium, lead, mercury, and nickel); 5 PPPs (aldrin, alachlor, atrazine, dieldrin, HCH compound and simazine) and trichlorethylene. Some countries are lagging behind. Slovenia reports that a common list of specific pollutants subject to monitoring in ground water is not defined in the national regulatory bases and Ukraine reports that the ground water monitoring has not yet started, although the regulatory basis has been established.

- Directive 2006/118/EC (i.e. the ground water directive) recommends each country to develop threshold values at least for the following hazardous substances: *arsenic, cadmium, lead, mercury, trichloroethylene and tetrachloroethylene.* Such threshold values have been determined in Austria, Bulgaria, Croatia, Germany, Hungary, and Romania. In Montenegro, Moldova, Slovakia, and Serbia the development of environment quality standards for these substances is not yet completed although significant progress has been done *(Table 4-7).*

4) Concerning point source emitters

- Regulation of priority and other specific substances in the wastewater discharges is introduced either through horizontal and/or specific emission standards addressing certain industrial facilities and/or technological processes. In all the countries the responsible administrative bodies may impose tailor-made stricter requirements based on the results of the combined immission-emission approach.

  The control of priority and other hazardous substances is a part of the discharge permit conditions.

- The number of regulated priority substances in industrial wastewater varies from country to country. It is predominantly limited to about 4-13 priority substances (mostly metals) depending on the recipient *(*Table 4-15*).* Four priority substances -

cadmium, lead, nickel and mercury are regulated in over 80% of the investigated countries (*Table 4-16*). Croatia and Montenegro monitor over 75% of the priority substances in the industrial wastewater discharges.

Other specific hazardous substances in the industrial discharges are regulated in all the countries as again the number of controlled substances varies significantly from 8 to over 70 depending on the country and the type of discharge (i.e. indirect or direct). Nine specific hazardous substances (other than the priority ones) are monitored in over 80% of the countries. These are: *aluminum,* AOX, *arsenic, chrome (6+ and total), copper, cobalt, selen and zinc.* The emission standards also very significantly from country to country, sometimes in an order of magnitude *(Table 4-10, Table 4-13).*

It should be noted that these conclusions concern only hazardous substances for which the emission standards are expressed as concentrations. There are countries (e.g. Austria, Bulgaria, Germany, Hungary) which have emission standards for some hazardous substances expressed as mass pollutant per mass production and/or waste. Such emissions standards have not been analyzed in this report.

- The control of hazardous substances in the WWTPs discharges varies substantially in the different countries and is also not consistent for all the WWTPs, but in most of the cases depends on the size of the WWTPs (i.e., hazardous substances are monitored only in WWTPs above certain size). The most monitored substances seem to be the heavy metals, although there are countries like Montenegro, Romania and Serbia which monitor a longer list of specific hazardous substances (*Table 4-21*).

  The control of hazardous substances discharged through the combined sewer overflows is not regulated in any of the investigated countries. Only Austria reports for "state of the art" standard of the Austrian Water and Waste Management Association.

- The analyses of regulated hazardous substances in some specific industrial processes (e.g., glass industry, pharmaceutical industry, textile industry) could not reach a sound conclusion on the number of regulated substances, since these industries are subject to IED and they have a tailor-made Integrated Discharge Permit. The purpose of this report was not to analyze Integrated Discharge Permits issued pursuant to the IED provisions.

  The comparison of the emission standards of some commonly monitored hazardous substances, however, showed that the values are in general similar, but for some parameters differences of an order of magnitude are observed (see *Table 4-17, Table 4-18, Table 4-19, Table 4-20).*

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5) Concerning diffuse polluters

- All the countries, except for Ukraine, follow the procedures set in the IE Directive concerning the release of pollutants into air for the respective industrial installations.
- All the countries have well developed regulatory basis for preventive control, in particular from agricultural activities (e.g. various permissions and certifications related to plant protection products activities).
- The on-site control of the PPPs application is predominantly passive however, relying on good agricultural practices, following the regulatory established administrative procedures for pesticides application and control of pesticides' residues in the plants *(Table 4-23).* Only Austria and Slovakia report programs for control of plant protection products including analyses of soils.
- Addressing the requirement of art. 4 of EU Directive 2009/128/EC, all the studied EU countries have adopted National Action Plans (NAP) for enhancement of management of pesticides. The development of NAPs is at different phase of implementation for non-EU members, participating in the project, e.g. in Montenegro and Serbia NAP is adopted.

  In the developed NAPs are envisaged measures for protection of aquatic environment and drinking water against pollution with hazardous substances. Besides some conventional measures (e.g., establishment of protection zones, ban of some PPPs on certain zones, etc.), some countries (Hungary, Romania, and Slovakia) propose development/improvement/ enhancement of the informational system concerning PPPs application.

6) Concerning fees

- In all the countries, except for Austria, there are fees for discharging wastewater into surface water bodies. The way of calculating the fee however differs significantly in the countries. Only in Hungary and Romania, the fee reflects the specific contribution of each hazardous substance. In addition, in Hungary, there is an extra penalty fine for the operator for inappropriate or insufficient actions for solving the problem of excessive loads. In Germany a levy is payable for each discharge even if the Best Available Technologies (BAT) requirements are met. Compared to the practice in Germany, Hungary and Romania, the way of calculating the fees in the other countries seems to be not stimulating enough for the operators to limit the release of specific hazardous substances through their wastewater discharges.
- The regulatory basis concerning the fees for diffuse pollution seems to be at initial stage of development. One of the reasons mentioned are the gaps in assessing the contribution of diffuse pollution to the environmental impact and environmental costs. Only Croatia reports a regulatory established fine to be imposed on a legal entity that does not monitor the condition of agricultural land registered by testing

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soil fertility and does not keep records on the application of fertilizers (mineral and organic), soil improvers and pesticides.

7) Concerning analytical methods

All the partners confirm the use of standardized methods for sampling and analytical measurements. Most of the countries mention that different laboratories use different methods for measuring one and the same chemical substance, and each method has different limits of quantification *(*Table 5-1*,* Table 5-2*).*

8) Concerning data bases and registers

- The information concerning the point source emitters of hazardous substances is organized in data bases, predominantly electronic. While the registers of emitters (and their discharges) seem to be characterized by free access in most of the countries, the data bases concerning the results of the monitoring are predominantly not freely accessible, although in some countries they can be accessed upon request (e.g. Bulgaria, Slovakia).

9) Concerning the inventories

- Inventories on priority substances emission, discharges and losses have been developed in all the EU-member countries.
- Similar approaches based on CIS Guidance document No. 28 are followed in all countries, but mostly limited to riverine load and source-oriented approaches. The lack for application of the pathway-oriented approach (with exception of Austria, Germany and Hungary) implies that diffuse emissions are estimated as black-box and specific pathways are not identified.
- Some countries like Austria, Germany, Hungary, Romania, Slovakia and Slovenia have completed more than one inventory cycle. Non-EU members have not yet developed inventories.

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8.2 Areas for improvement

Despite the great progress made by each country regarding harmonizing and implementing up-to date management of hazardous substances, some aspects that need improvement have been revealed in this report as follows:

1) **Imperfection of the current EU legislation concerning the management of the hazardous substances in water**

Two shortcomings in the EU hazardous pollutions legislation concluded in a recent Dutch report[17] are considered relevant for the purposes of the current report:

a) Fragmented approach

- The legislation is not based on life cycle approach to assess the risk and to regulate the whole production chain - from the source to the release into the environment
- Water related environmental policies are not well linked to soil and air related environmental policies despite the cause-effect relationships between these components of the environment.

b) The cumulative effect of different pollutants is not always well considered

Hazardous substances are not specifically regulated in the Urban Wastewater Directive 91/271/EEC[18]. At EU level, regulatory control of some hazardous substances is provided through the requirements of the E-PRTR for the WWTPs over 100 000 PE.

Regulatory background for control of the pollution through the combined sewer overflows is also missing.

2) **Need for higher level harmonization among the DRB countries concerning the regulatory control of specific non-priority hazardous substances and the respective environment quality standards**

While some hazardous substances may have also natural origin (e.g. some metals) and thus the EQS may differ depending on the specific characteristics of the water bodies, other hazardous substances e.g. nonylphenol, PCBs, Terbuthylazine have definitively an anthropogenic origin. Their corresponding EQS need to be harmonized or the reasons for greater differences in the limiting concentrations need to be investigated in depth.

[17] A GRIP ON HAZARDOUS SUBSTANCES, Rli, 2020, http://eeac.eu/wp-content/uploads/2020/04/a-grip-on-hazardous-substances.pdf

[18] On 26.10.2022 was published a Proposal for a Directive of the European Parliament and of the Council concerning urban wastewater treatment (recast) (COM 2022, 541 final) was published, establishing stricter requirements concerning the control of hazardous substances, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52022PC0541

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3) Need for higher level harmonization among the DRB countries concerning the number of hazardous substances and the respective emission standards for industrial wastewater discharges.

It is understandable that the development of regulatory framework for control of ever-increasing number of hazardous substances is a long process and each country has specific industrial environment which is inevitably linked with the socio-economic development and population well-fare. A better harmonization however, especially concerning the list of monitored hazardous substances in specific industrial processes would facilitate the implementation of the integrated approach for protection of the surface water bodies in the Danube River Basins and the application of the "polluter pays" principle.

- The rate of application of BATs and the number of monitored substances and their emission standards for similar industrial enterprises and/or processes need to be investigated in depth in the different countries.
- Each country has specific definitions used for the industrial processes, subject to regulation concerning the industrial wastewater discharges. Some of the provided definitions seem to be very general, some very detailed. A future harmonization of the definitions of the industrial processes would facilitate the analyses and the comparison of the results.
- The concentration unit (i.e. mg/l) is the most commonly applied unit concerning the emission standards for wastewater discharges, since no doubt, it is easy to measure. It however may create non-equal conditions for applying the "polluter pays" principle, in particular affecting negatively the smaller industrial enterprises.

  Therefore, the absolute mass load of the pollutant (e.g. expressed in kg/month or kg/year) needs also to be taken into account when setting industrial emission standards. There is already good experience in some of the countries (Austria, Bulgaria, Hungary, Slovakia) which apply emission standards in mass pollutant per unit production per time. This experience needs to be analyzed in depth and broader applied.

4) Need for preparation of common rules for monitoring of hazardous substances in the WWTPs' discharges and an approach for evaluation of the contribution of combined sewer overflows.

The lack of appropriate regulatory framework at EU level concerning the monitoring of hazardous substances in the urban wastewater discharges seems to discourage the responsible administrative bodies to develop and introduce a regulatory basis at national level and/or river basin level. The estimation (i.e. quantification) of hazardous substances' contribution of the combined sewer overflows would significantly improve the management of hazardous substances in urban water.

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5) **Need for higher level of harmonization in the way the pollution fees for hazardous substances are determined.**

There should be evident stimulus for the operators to decrease the emission of a specific hazardous substance through the wastewater discharge. A more harmonized approach in defining the way of calculation the pollution fees, assessing the specific contribution of each hazardous substance and the corresponding risk to the environment would improve the level of control and would provide equal background for applying the "polluter pays" principle in the Danube river basin.

6) **Need for higher level of harmonization concerning the analytical methods**

Unified analytical methods for measuring the concentrations of hazardous substances subject to monitoring in all the Danube River Basin countries (e.g. the substances of the TNMN) would improve the level of comparison of the results among the different countries. In case there are available ISO standards they should be applied with preference than e.g. internally validated laboratory methods.

7) **The inventory process should be improved** towards:

- more stringent control of the quality of the self-monitored data.
- application of the pathway-oriented approach for estimation of diffuse emissions rather than riverine load and source-oriented approaches.
- harmonization of data series for transboundary sub-basins
- Consideration of the accumulation of hazardous substances in sediment and biota in the inventories.

8) **Improving the format and public accessibility of the existing data basis**

The databases should allow easy tracking of the availability or frequency of occurrence of a certain hazardous substance.

Based on the existing data basis, a new register/data base could be made searchable by e.g. hazardous substance name (or CAS-No) so that easily to be allocated the area (or water body) or the type of industrial emitter with higher frequency of occurrence of specific hazardous substances. This will facilitate the harmonization of monitoring of the hazardous substances, especially in the wastewater discharges of specific industrial sectors.

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