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Emissions of pollutants to Europe's waters – sources, pathways and trends

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Abbreviations

UWWTP	Urban Waste Water Treatment Plants
E-PRTR	European Pollutant Release and Transfer Register
As	Arsenic
BOD5	Biological Oxygen Demand
CAS	Chemical Abstracts Service
Cd	Cadmium
CIS	Common Implementation Strategy
COD	Chemical Oxygen Demand
Cr	Chromium
Cu	Copper
DPSIR	Driver Pressure State Impact Response
DSD	Dangerous Substances Directive
EEA	European Environment Agency
EFTA	European Free Trade Association
EMEP	European Monitoring and Evaluation Programme
EQSD	Environmental Quality Standards Directive
ETC/ACM	European Topic Centre on Air and Climate Mitigation
ETC/ICM	European Topic Centre on Inland, Coastal and Marine waters
HCH	Hexachlorocyclohexane
HELCOM	Helsinki Commission for the Protection of the Marine Environment of the Baltic Sea
Hg	Mercury
IED	Industrial Emissions Directive
IOWWTP	Independently Operated Waste Water Treatment Plants
JRC	Joint Research Centre
MS	Member States
NGO	Non-governmental organisation
Ni	Nickel
NiD	Nitrates Directive
NO3	Nitrate
Ntot	Total Nitrogen
OECD	Organisation for Economic Co-operation and Development
OSPAR	OSlo-PARis (Convention for the Protection of Marine Environment of the North-East Atlantic)
PAHs	Polycyclic Aromatic Hydrocarbons
p.e.	Population equivalent
Pb	Lead
PBT	Persistent, Bioaccumulative or Toxic
PCB	Polychlorinated biphenyl
PS	Priority substances
PHS	Priority hazardous substances
POP	Persistent Organic Pollutants
Ptot	Total phosphorus

RBD	River Basin District
RBMP	River Basin Management Plans
REACH	Regulation on Registration, Evaluation and Authorisation of Chemicals
SoE	The State of the Environment
TOC	Total Organic Carbon
UWWTD	Urban Waste Water Treatment Directive
WFD	Water Framework Directive
WISE	Water Information System for Europe
Zn	Zinc

Summary

This report provides an overview of the emissions to water at a European level for the major groups of pollutants (nutrients, organic matter, and priority substances) and the key emission sources: point sources such as urban waste water treatment plants (UWWTPs) and industry, and diffuse sources like agriculture, atmospheric deposition and traffic. The report gives both an overview at the European level and at the same time provides relevant spatial and temporal information on where emission sources are primarily located and how emission loads have developed in the last years. The analysis includes data from reporting of Member States on relevant EU legislation, e.g. in particular the relevant information contained in the European Pollutant Release and Transfer Register (E-PRTR), the Urban Waste Water Treatment Directive (UWWTD) and other data flows such as WISE – State of the Environment (SoE).

The available EU-reported data on emissions to surface water have been analysed and commented, while proposals have been made to improve the quality of the reporting of these emissions to water. Although this report is a technical ETC report and especially suitable for use by experts and specialists on water quality and emissions, the conclusions might also be interesting for a broader audience like policy makers, representatives of industrial sectors, NGOs and consultants.

Conclusions
Comparison of national inventories on emissions to water is hampered by differences in definitions (sources, pathways), methods, reporting timeframes, formats and thresholds. Therefore it is complicated and time consuming for countries to submit the right information requested in an international inventory, which may result in reports that are incomplete, inconsistent and incomparable on an EU scale.

Analysis of the data reported under the European Pollutant Release and Transfer Register (E-PRTR) Regulation (EC, 2006a) for both industrial facilities and the UWWTPs, shows that a high percentage of the release reports are related to only a small set of pollutants (total nitrogen, total phosphorus, total organic carbon (TOC), arsenic, copper, lead, nickel and zinc).

It is notable that for many years a small percentage of the industrial facilities has been responsible for a large percentage of the releases of the 8 most reported pollutants, and that big differences are observed in the average release per facility per year for the different E-PRTR sectors.

Analysing the trends in E-PRTR reported data, it appears to be impossible to distinguish between a “real increase” of emissions to water and one that is due to changes in monitoring and/or reporting. It is even possible that a reported increase of emissions is the result of a decrease of the WWTP performance. These type of questions cannot be answered by this analysis as related background information is not available at an EU-wide scale.

The industrial emissions of the 8 most reported pollutants to water in the period 2007–2014 reported under E-PRTR, have been stable for the last 5 years for total nitrogen, total phosphorus and TOC, have been declining for lead, nickel and zinc, and show large fluctuations for copper and arsenic. For 46 other pollutants, the emissions in 2007 and 2014 have been compared, where 75% show a decrease since 2007 and 25% show an increase. For most pollutants with an increasing trend a very low number of releases is reported. Among the increasing pollutants are priority (hazardous) substances of the Water Framework Directive (WFD) (EC, 2000b).

The emissions of nutrients and TOC to water from UWWTPs and reported under the E-PRTR have been stable since 2008. Arsenic shows an enormous increase of 424% between 2012 and 2014. For copper and zinc a slight increase between 2008 and 2014 is observed. Releases of copper, zinc and lead were quite consistent over the last few years, but highly influenced by extreme releases from individual UWWTPs. More than half of the other 55 pollutants (30) show an increasing trend, among them are 17 priority

substances of the WFD, although it has to be noted that most of these pollutants are only reported occasionally.

Although large regional differences can be noticed for both industrial releases and UWWTPs, these trends in the different regions cannot easily be explained without further assessment and in-depth knowledge of these facilities.

For a set of 8 most commonly-reported pollutants, the present E-PRTR releases seem only to represent a limited part of the total releases to water. An estimate of the potentially missing releases is provided in chapter 5. Although there is uncertainty related to these estimates, there are strong indications that available reporting gives an incomplete view of the total releases to surface water.

Quite some attention has been paid to quantify the diffuse emissions to water. Moreover, many countries do not report on diffuse sources, or only for a few sources and pollutants. For most key pollutants the contribution of the diffuse sources to the total releases to water greatly exceeds the contribution of point sources.

The present E-PRTR reporting and other EU-emission reporting is partly overlapping, show differences in definitions (sources, pathways), methods, reporting timeframes, formats and thresholds. As a result, big differences between countries may exist in terms of methodology used to allocate emissions to a group of sources, which limits the applicability of the information in terms of assessment of production methods and levels of resulting emission.

Significant issues in the reported emissions data have been identified in the following areas: the lack of data concerning production capacity (or real production data) of facilities in the different activities; missing industrial releases in E-PRTR; missing UWWTPs > 100 000 p.e. in E-PRTR; and releases of pollutants from UWWTPs expected to be above the pollutant threshold, but are not reported; the smaller UWWTPs < 100 000 p.e. and diffuse sources reporting. For heavy metals, potentially missing releases are quantified to be within a range of 1–3 times the reported UWWTP loads in E-PRTR. For nitrogen, total phosphorus and TOC about half of the reported UWWTP loads in E-PRTR are quantified as potentially missing.

The way forward:

Short-term

For the short term, data gaps (“incompleteness”) have to be reduced and the quality of the E-PRTR datasets has to be increased through a limited number of specific actions in close co-operation with the countries, such as: communicating the (about 25%) missing UWWTPs with the countries; implementation of standard quality data checks and encouraging the use of emission factors in the calculation of releases to water from UWWTPs for non-monitored pollutants. Attention has to be paid to the large amount of potentially missing UWWTP loads above the threshold values for most of the reported pollutants (for heavy metals up to 3 times the UWWTP loads mentioned in the E-PRTR) Another issue is the revision of the UWWTP activity threshold: the existing threshold capacity of 100.000 p.e. seems not to be consistent with the pollutant thresholds for a.o. total nitrogen, total phosphorus and total organic carbon (TOC). Even a medium sized UWWTP with a high level of (tertiary) treatment, releases pollutants 5 times higher than the existing pollutant thresholds. An updated threshold capacity for UWWTP facilities of 20.000 p.e. would therefore seem more appropriate.

Mid-term

For the mid-term, arrange detailed studies for specific activities and add releases of diffuse sources to E-PRTR. This should be combined with the start of a process of data and knowledge exchange on diffuse sources data and harmonization of quantification methods. Recent studies clearly identify that a significant share of diffuse emissions is due to point sources (widespread small UWWTPs) not covered

under the E-PRTR. It is necessary to reach an EU-agreement on the minimum set of sources, parameters and assessment methods for diffuse emissions relevant at EU-level. To allow reporting and subsequent use of datasets, a common framework including a set of unique lists, definitions and metrics has to be established and used. This is currently not the case, and the E-PRTR can provide a sound basis for this development, not only to ensure that the strong link between diffuse and point emissions is taken into account at all levels.

The reporting of diffuse sources under WISE-SoE Emissions and the WFD shows that an increasing number of countries succeed in reporting diffuse releases for a number of key pollutants. This might be the right moment to start inclusion of diffuse sources in E-PRTR, as described in Article 8 of the Regulation, through a streamlining with the existing reporting obligations.

It is suggested to the European Commission, to keep playing a facilitating and stimulating role in the process of the quantification of diffuse water emissions and to take additional initiatives under the umbrella of the CIS Working Group Chemical, like the establishment of a group on the harmonization and quantification of emissions of diffuse sources.

Other actions the European Commission could undertake include:

- Organize meetings for the quantification of diffuse water emissions and the harmonization of definitions and methods;
- Stimulate involvement of European / international water organizations with specialist groups on diffuse water pollution;
- Set up a database to exchange information concerning emission factors;
- Create an online platform (website or social media) for sharing information, data and knowledge of the quantification of diffuse water emissions.

To Member States, it is suggested to:

- actively share information about projects, activities, data and methods about the quantification of emissions of diffuse sources
- to participate in international working groups, River Basin Committees and discussions about diffuse water emissions and
- to report on diffuse water emissions in official requests, even when the emissions have a limited reliability.

Long-term

For the long-term, the challenge is to harmonize EU emission reporting, to improve the transparency, consistency and completeness of the emission inventories and to reduce the reporting burden on the countries at the same time by combining of related reporting in UWWTD, WFD and E-PRTR and integration with the voluntary WISE-SoE Emissions reporting. The reporting frequency has to be discussed, as the present 6-yearly reporting frequency under the WFD is regarded as insufficient, while the annual reporting required under the E-PRTR is rather burdensome. For diffuse sources, a 2 or 3 year reporting cycle seems appropriate.

1 Introduction

1.1 Purpose of this report

The purpose of this report is to give an overview of the annual emissions to water at the European level for the major groups of pollutants (nutrients, organic matter, and priority substances) and the key emission sources: point sources such as urban waste water treatment plants (UWWTPs) and industry, and diffuse sources like agriculture, atmospheric deposition and traffic. The report gives both an overview at the European level and at the same time provides relevant spatial and temporal information on where emission sources are primarily located and how emission loads have developed in the last years. The analysis includes data from reporting of Member States on relevant EU legislation, e.g. in particular the relevant information contained in the European Pollutant Release and Transfer Register (E-PRTR), the Urban Waste Water Treatment Directive (UWWTD) and other data flows like the WISE State of the Environment (SoE) on emissions. Emission reports or data flows related to European marine conventions, like the Convention for the Protection of Marine Environment of the North-East Atlantic (OSPAR) and the Helsinki Commission for the Protection of the Marine Environment of the Baltic Sea (HELCOM), are not included in this report. For pragmatic reasons, also no specific analysis is carried out in this report on emissions into coastal or marine waters.

This report can be seen in a long tradition of reviews and assessments by the EEA, often in cooperation with the European Topic Centres on Air and Climate Mitigation (ETC/ACM) and Inland, Coastal and Marine waters (ETC/ICM), in the field of emissions and water quality. As examples of recent reports on these activities can be mentioned: Informal Review Report E-PRTR (Mareckova et al., 2011), Hazardous substances in Europe's fresh and marine waters (Collins et al., 2011), European waters – assessment of status and pressures (Kristensen et al., 2012), Emissions of pollutants to Europe's waters (Prchalova et al., 2014) and the E-PRTR Completeness checks Water (Roovaart et al., 2016).

The results of the Water Framework Directive (WFD) reporting on the second River Basin Management Plans (RBMPs) and Programme of Measures to the European Commission due in March 2016, will not be included in this report as these have not yet been fully reported.

Although this report is a technical ETC report and especially suitable for use by experts and specialists on water quality and emissions, the conclusions might also be interesting for a broader audience like policy makers, representatives of industrial sectors, NGOs and consultants.

1.2 Emissions to water

Emissions, discharges and losses of pollutants to air, water and soil clearly link economic activities with the environment. To analyse the interactions between society and the environment with regards to emissions, and identify the possible actions, the DPSIR (Driver Pressure State Impact Response) framework is useful. This is illustrated in a simplified scheme (Figure 1.1): emissions are one of the pressures generated by driving forces (like agriculture, population, industry) and will have an influence on the state of the aquatic environment. This influence is expressed by the possible impacts on the environment like loss of biodiversity or a lower ecological status of the surface waters.

Emissions to water can be seen as a key element within this cycle and a quantification of the releases to water, the different emission sources and pathways are essential steps when trying to come to a definition of possible mitigation measures to reduce existing or potential water quality problems. Figure 1.2 gives a schematic overview of the different steps needed to define and prioritize effective emission reduction measures.

Figure 1.1 Emissions to water: position in DPSIR

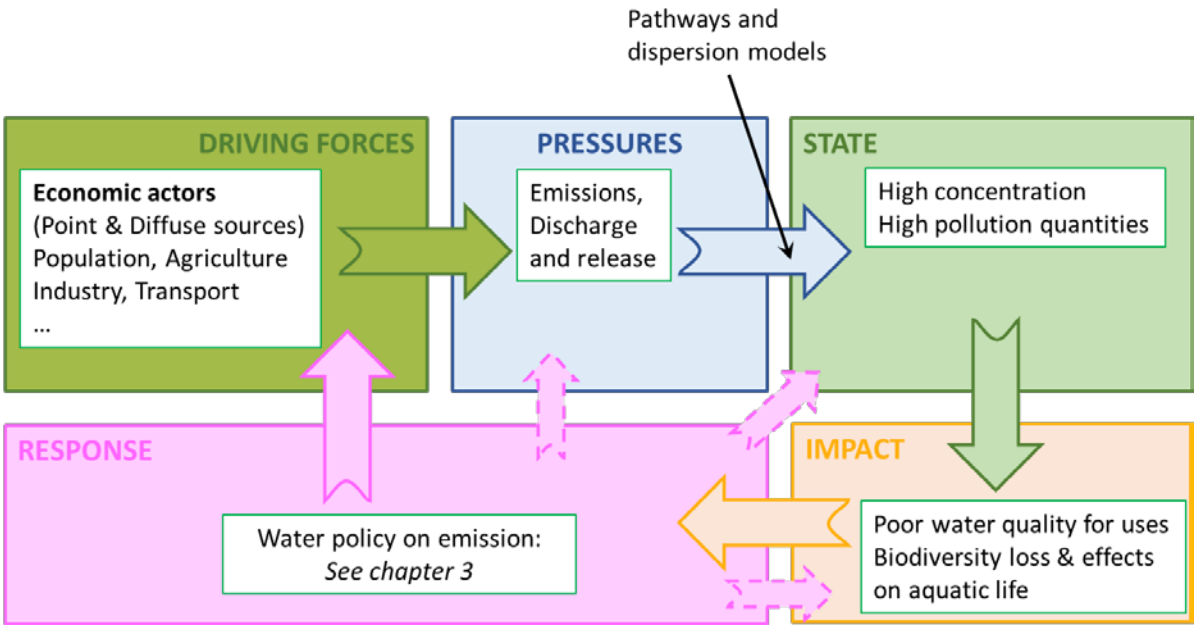
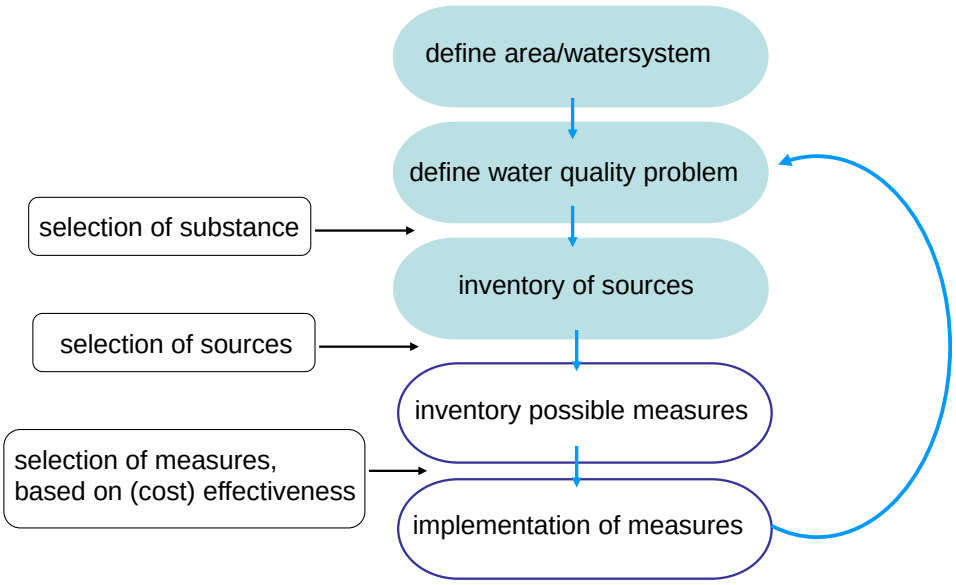


Figure 1.2 Steps in the selection of measures for emission reduction



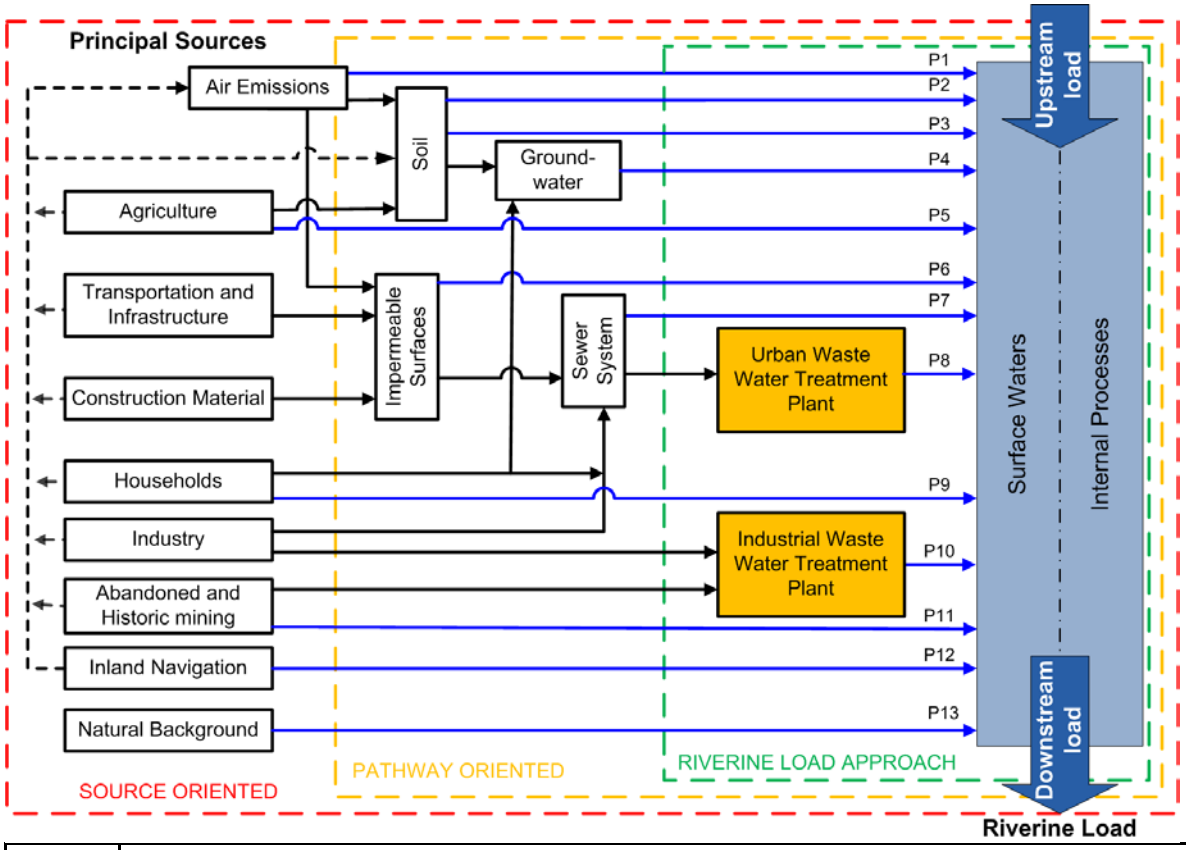
A high quality emission inventory over a number of years which includes detailed information and clear definitions of sources, locations and pathways can help to carry out trend analysis, source apportionment assessments, ex post and ex ante evaluations and is indispensable as input for water quality modelling. It will help in formulating adequate measures on the right scale (EU, river basin, national, regional or local) to reduce emissions and improve water quality. Conversely said: incomplete or unreliable emission data and unclear definitions will be a major obstruction to select and implement cost-effective measures and may result in not meeting WFD good status within the agreed time frame.

2 Emission sources, pathways and pollutants

2.1 General scheme of emission sources and pathways

A general scheme in which the main (groups of) principal sources, pathways and intermediates are represented has been developed under the WFD for the Inventory of emissions, discharges and losses of priority substances (EC, 2012). This scheme can be helpful in this report and is presented below (Figure 2.1).

Figure 2.1 Relationship between the different surface water compartments and pathways (P1–P13)



P1	Atmospheric Deposition directly to surface water
P2	Erosion
P3	Surface runoff from unsealed areas
P4	Interflow, Tile Drainage and Groundwater
P5	Direct discharges and drifting
P6	Surface Runoff from sealed Areas
P7	Storm Water Outlets and Combined Sewer overflows + unconnected sewers
P8	Urban Waste Water treated
P9	Individual – treated and untreated – household discharges
P10	Industrial Waste Water treated
P11	Direct Discharges from Mining
P12	Direct Discharges from Navigation
P13	Natural Background

Source: (EC, 2012)

This scheme can be used as a common basis for the definitions of sources and pathways. On the left, the principal sources of the pollutants are shown, representing groups of sources which can be related to economic sectors or activities. Also the natural background is represented as a source. Emissions, discharges or loads can follow different pathways, either directly to surface water, or to other

compartments of the environment (air, soil, groundwater). A specific place is given to urban areas with the impermeable surfaces, the sewer system and the urban waste water treatment plants (UWWTPs).

Although different approaches are shown in the scheme (riverine load approach, source oriented approach and pathway oriented approach), the quantification of the different pathways (P1–P13) can be seen as the core of a complete emission inventory. Most of the existing emission reporting requirements can be related to one or more of these defined pathways (see Table 3.1).

2.2 Definitions and quantification methods

Comparison of national emission inventories is often hampered by differences in definitions (sources, pathways), methods, reporting timeframes, formats and thresholds. Monitoring, definitions and quantification methods may differ not only between countries, also the emission reporting requirements show on the one hand differences and on the other hand overlap. Therefore it can be complicated and time consuming for countries to submit the right information requested in an international inventory. For the European Commission and the EEA this often results in reports which are incomplete, inconsistent and incomparable on an EU scale.

To facilitate consistent reporting on emissions and to reduce the risk of differing interpretations, the WFD Reporting Guidance (2016) gives a set of tables with the relations between the Inventory Guidance pathways, the WISE-SoE Emissions codes and the WFD pressure type (codes).

Some specific items that often cause confusion or misinterpretation are:

- Primary and secondary sources:
  Although UWWTPs can be seen as sources, in fact they are secondary sources, receiving their influents from other (primary) sources like households, small industries and a variety of diffuse sources like atmospheric deposition in urban areas and corrosion processes of building materials. Measures can be taken on different places in the system: prevention or “source control”, end of pipe measures.

- The use of thresholds:
  Thresholds, representing a certain minimum quantity required to be reported, are often used to focus effort and attention on main sources. The E-PRTR Regulation shows both capacity thresholds for the facilities and pollutant thresholds that vary per pollutant. Although most countries only report releases above the indicated thresholds to E-PRTR, it is possible to report also releases below the thresholds. Some countries indeed do report a number of releases below the thresholds.

- More detailed approaches aim at a complete (or as complete as possible) overview of the releases to water, but these can be onerous and difficult to achieve. The priority substances inventory of emissions, required under the WFD and being reported in 2016 for the first time, aims at providing a more complete overview.

- Distinction between point sources and diffuse sources:
  The difference between these two types of sources is not always clear, as it can depend on the perspective taken. Sources can be defined as diffuse sources, but often exist as a lot of small point sources, for instance storm water overflows may be considered as diffuse inputs at regional level but point sources by water utility managers, or UWWTPs below the E-PRTR threshold of 100 000 population equivalent may be regarded as diffuse sources. This can result in confusion as to which categories of emission sources are included in reporting and databases.

- Quantification of diffuse sources:
  The quantification of diffuse sources is not easy because: the existing data regarding diffuse emissions is limited; differences exist between countries in definitions and models used; local or regional factors may have a high impact on the emissions; a general lack of transparency of the quantification methods; limited reliability of the underlying data.

- Agriculture and natural background:
  It is difficult to quantify all the specific fluxes between soil, groundwater and surface water in agricultural areas. The exchanges between these compartments are complex processes, that will differ in time and space and are often quantified by using models.

2.3 Key pollutants to water

Pollution is assessed via the use of monitoring or modelling, at end of pipe in the receiving aquatic environment or along the pathways from emission source to discharge in the aquatic environment. More specifically it is assessed by measuring the concentration of pollutant parameters which may be individual chemical substances (like mercury, zinc), groups thereof (like total PCB, total PAH) or parameters defined by their measurement method (like COD, BOD5).

While more than 47 million chemical substances are registered in the world (CAS database 2009), and a little less than 200 Mt of toxic chemicals were produced in Europe in 2008 (figure covering 168 toxic substances, EEA technical report n°8/2011), the number of individual substances relevant as pollutant parameters for the aquatic environment lies more in the range of 3000 to 5000, to which groups and measurement method parameters have to be added.

During previous decades, large amounts of different pollutants were discharged, released or transferred to the aquatic environment by human activities, via different pathways (see Figure 2.1), leading to various impacts on the status of the aquatic environment and sometimes on human health. These pollutants can also occur naturally for some substances (natural background).

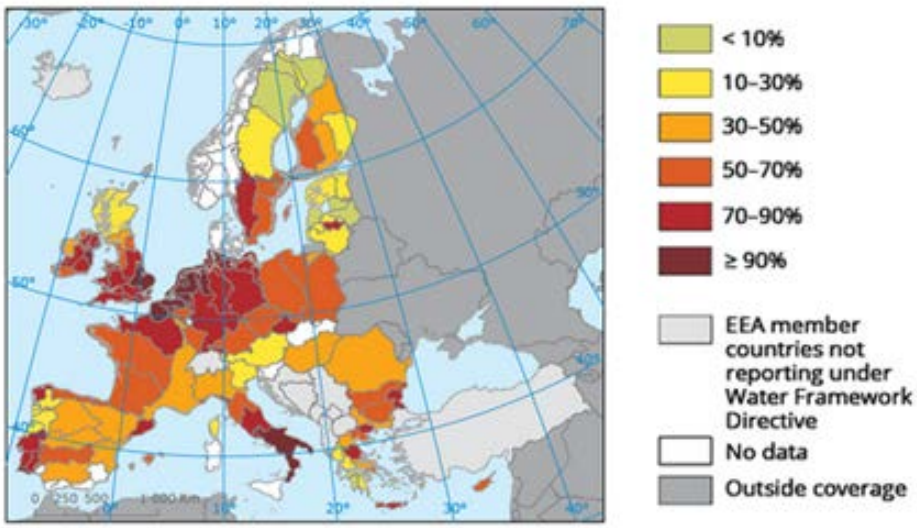
The most well-known groups for which emission data are available are organic pollution, nutrients, heavy metals, pesticides and biocides, Persistent Organic Pollutants (POPs) and priority substances, which are presented in this section. Many other groups also exist which can be split or aggregated with the above. Classifying pollutants into groups to simplify discussion is difficult (owing to different uses and overlaps), so a set of criteria can and are often used for that which are: chemical families, uses, properties, or legislation.

A wide and complex range of pollutants occur in aquatic environments, being a mixture of priority substances, emerging substances, by-products (generated during production processes or transformation products) and natural compounds. Only a sub-set is considered in the monitoring programmes and in the legislation and emission inventories, but the list of relevant substances evolves with human uses, scientific knowledge or monitoring capabilities. To keep the monitoring and legislation targeted to the most prominent pollutants it is therefore necessary to adjust regularly the list of substances considered in emission inventories.

The WFD (EC, 2000b) distinguishes pressures (P in DPSIR) from point and diffuse sources, and the resulting status (S in DPSIR) as a combination of ecological and chemical status, which both entail pollution, the chemical status being focused solely on priority substances.

As it is shown in the map presented in Figure 2.2, the majority of surface water bodies are affected by pressures from emissions from point or non-point sources.

Figure 2.2 **Map presenting the impact of pollution in water bodies per RBD as reported in WISE-WFD for the year 2010: Percentage of classified water bodies affected by point and/or diffuse pressures in rivers and lakes.**



Source: (EEA ETC/ICM 2012)

In this chapter, the main groups of already well-known pollutants relevant for emission to water at European level, are presented. two main groups of pollutants are identified according to the quantities found in the environment:

- the macro pollutants (organic pollution and nutrients) found in large amounts: ton/a is the standard emission unit, with mg/l as the aquatic environment monitoring unit;

- and the micro pollutants (like heavy metals, pesticides, POPs) found in small amounts: kg/a is the standard emission unit, with µg/l as the aquatic environment monitoring unit, and requiring more sensitive monitoring methods.

2.3.1 Macropollutants

Emission of macropollutants stems from industry, in particular the food and beverages industry, from agriculture and inhabitants, and from excretion by living organisms.

Organic pollution
Excess of organic pollution in the aquatic environment leads to a decrease in the oxygen content of natural water with a great influence on biota community, because oxygen is key for the survival of aquatic life. Organic pollutants are classified by their properties, generally expressed in terms of consumed oxygen for the degradation of that pollution, the specific parameters defined by the monitoring method which is used (BOD5, BOD7, TOC, COD), reflect its biodegradability. A distinction is made between easily (BOD5, BOD7) and not easily biodegradable organic pollution (COD, TOC). Easily biodegradable organic pollution comes mainly from inhabitants, animals and the food industry.

Nutrients
Excess of nutrients leads to abnormal growth of algae and plants and creates as a consequence a disequilibrium of trophic communities. This can lead to eutrophication phenomena, starting with an abnormal growth of algae and plants, generating various disturbances like a reduction of visibility in water, excess of organic matter when this vegetation decays, or excessive consumption of oxygen, thus influencing the aquatic community (fish kills, selection of fauna resistant to low oxygen). Nutrients are

important for the aquatic environment because nutrient is generally a limiting factor for the growth of plants and algae, primary producers in the food web.

Classified by their chemical family, two main parameters are generally used: Total nitrogen (Ntot) and total phosphorus (Ptot) and the group contains mainly nitrogen compounds (ammonium, nitrate) and phosphorus compounds (phosphate and orthophosphates). Major sources of nutrients are runoff of fertilizers and animal waste from farms, waste water from the food and beverages industry and some others like pulp and paper (see E-PRTR for more details), human waste from cities, sewage treatment plants, and failing **septic systems.**

2.3.2 Micropollutants

Emission of micropollutants is more difficult to assess as it covers a wide set of substances, found in small concentration, which can sometimes not be easily attributed to a geographically located source. Reasons for this include widespread use by many actors, transfer from other environment media (air, soil) and high temporal variations in use throughout the year. It is sometimes possible to link to a specific sector for some groups, such as pesticides mostly used in agriculture and gardening, or some very specific groups linked to one or a small set of uses. This category is continuously evolving with improvement of monitoring methods and knowledge on the individual substances, and when new evidence on their effect becomes available. They can be classified in sub-groups along different criteria.

For emissions to water the most relevant micropollutants are: heavy metals, pesticides and biocides, and POPs. Other sub-groups exist or are created, and overlap between sub-groups is more a rule than an exception The substance list in the E-PRTR regulation contains both macro- and micropollutants, heavy metals, pesticides and more The priority and priority hazardous substances listed in Annex X of the WFD focusses on micropollutants of which are heavy metals, pesticides or POPs. In most cases, the introduction of these substances into the aquatic environment can create eco-toxicological effects on one or more trophic levels of the aquatic life or affect the potential use of this water by humans.

Pesticides and Biocides

Biocides are a larger family, containing pesticides, but covering a wider set of uses from disinfection to the protection of products, to combating pests, and other types of products. These substances are identified by their use and can therefore be part of various chemical families. They are generally composed of a mixture of substances of which one or more are the main active substances and various additives. Most countries report monitoring data in surface water but emission data are rarely available.

The principal emission pathway that causes ecological impacts is that of water contaminated by pesticides/biocides, either in waste water for many biocides and sometimes pesticides, or runoff from areas where pesticides or biocides are used: mainly in agriculture or aquaculture but also in forests, and in linear infrastructures maintenance (railways, roads).

Emission trends for pesticides can be difficult to capture owing both to the way pesticides are used: a short application period dependent upon weather, and to their behaviour and fate: some substances are used in the range of a gram per hectare, some have limited persistence, complex transfers, low concentration and short temporal peaks in emission into the aquatic environment.

Heavy metals

Part of the micropollutant group, there are no criteria-based widely agreed definition for heavy metals, but this generally includes metals assumed to present some environmental and human health issues to a certain extent. In this restricted sense, heavy metals are bio-accumulative, toxic at high concentrations, have neurological impacts, and some are carcinogenic. They can also interfere with chemical processes by poisoning chemical catalysts and can impact on biochemical processes by interfering with enzyme

action. Serious environmental, economic and social impacts could hence be associated with heavy metal pollution.

These pollutants generally cover 8 metals (cadmium, mercury, chromium, lead, copper, tin, nickel and zinc) and a metalloid (arsenic). A key specificity is that they are present in the earth's geological structures, and are therefore naturally emitted by natural processes, via dissolution processes through rains or leaching by flowing water for example. There are thus natural background concentrations of heavy metals in water bodies. However, many human activities constitute sources of emission of heavy metals: direct pollution by mining activity, electroplating industry, lead-acid battery manufacturing industry and also non-point source pollution such as coal-fired power generation, use of heavy metal containing artificial fertilizers or manure or sludge, roof coating and rain water collection (copper, zinc) or via the contaminated ash produced in large amounts by industries.

Persistent Organic Pollutants

Persistent Organic Pollutants (POPs (latest update) is a group gathering of substances which can be progressively accumulated higher up the food chain (biomagnification), and have a number of toxicological properties. They are now seldom emitted directly to water, with atmospheric deposition being the most common input. Identified by their properties, a large number of POPs exist and a specific international Convention (Stockholm Convention) provides a structured approach with 3 sub-lists. Initially, twelve POPs of 3 use categories (pesticides, industrial chemicals and by-products) have been recognized as causing adverse effects on humans and the ecosystem. They are important for aquatic environment because of their effects on the aquatic food chain with a possible role in carcinogenic, immunological and reproductive effects.

Many POPs are found in water which comes from transfer from air. Emission to air generally decreased between 1991 and 2013 with up to a 96% decline for emission of Hexachlorobenzene. But an increase in the emission of some substances is still reported in a number of countries. Main sectors emitting are services and households, industrial processes and product use (source: EEA 2016). Recognised as being directly toxic to biota, they have biomagnification properties such that chronic exposure of lower organisms to much lower concentrations can expose predatory organisms, including humans and wildlife, to potentially harmful concentrations.

3 European policy and data requirements

3.1 European legislation on emissions

Emission pressure, and especially that on water, is one of the key drivers of the European water, environment and, to a lower extent, chemical policy, because the resulting impact on human health and in terms of pollution of water or other ecosystem disturbances mostly stem from human and their water use. To tackle this, European policies on water have a long history with a dual objective of preserving human health and the environment. A wide range of legislation is relevant to the topic and the following present the most prominent. Water is used in a wide set of industrial, agricultural and domestic processes, and the direct or indirect discharge or release of the waste water to the aquatic environment can create pollution or other environmental problems. Other human driven processes can also lead to emissions, in particular unintended transfers of pollution from other compartments like natural dissolution from soil or subsoil (the geochemical background), or from polluted areas (soil, underground, mines, polluted sediment…), or from air pollution and atmospheric deposition.

European policy targets different parts of the substances cycle and emission to water:

- the substances themselves;
- the emission sources;
- the pathways from production to use and release;
- the status and impact.

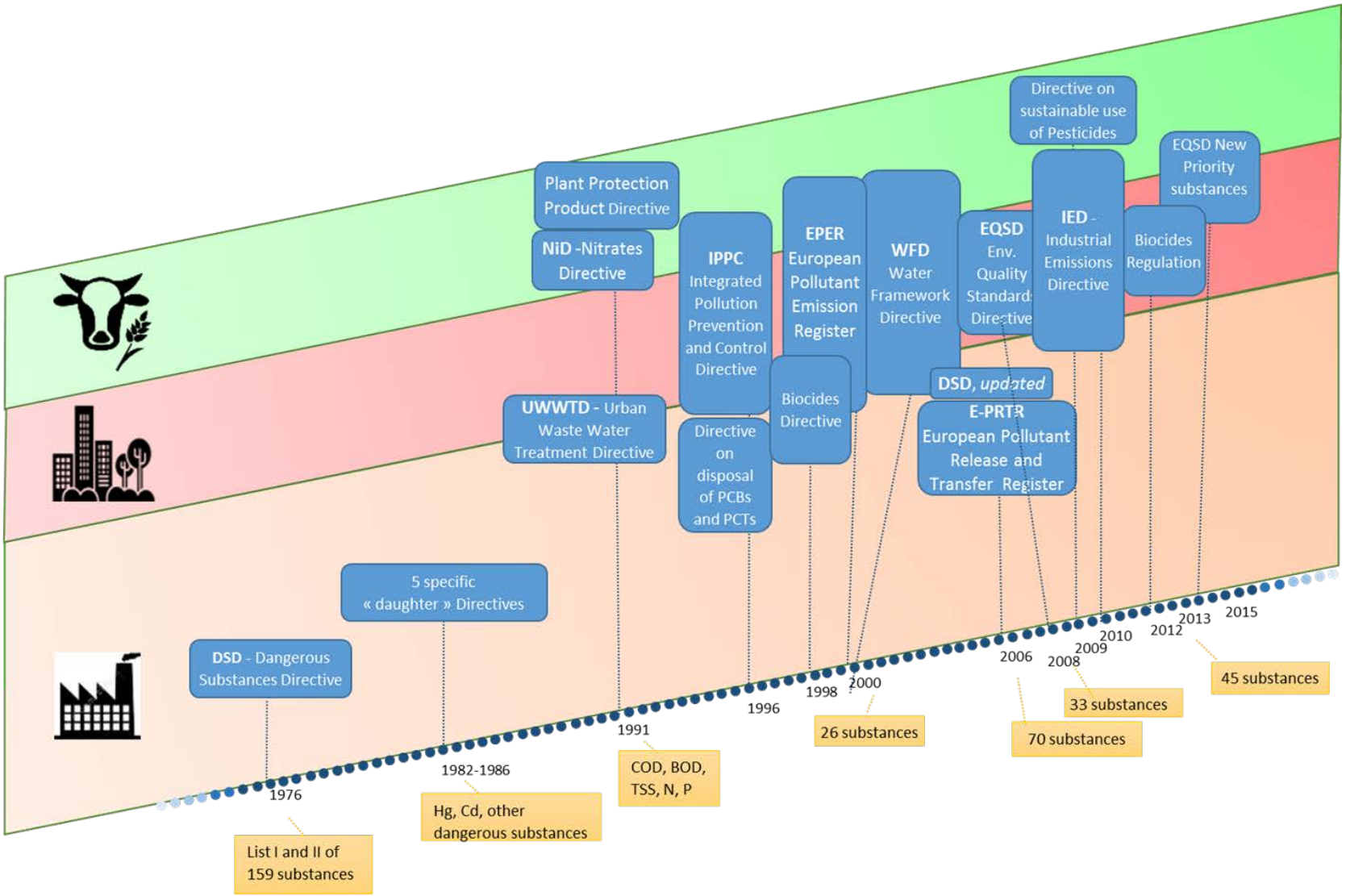
For water, the main policy specifically targeting emissions is the Industrial Emissions Directive (IED, 2010/75/EU). Recasting 7 previously existing directives (including in particular the Integrated Pollution Prevention and Control Directive, IPPC 96/61/EC), the directive targets the biggest 50.000 installations undertaking industrial activities listed in annexe I and covering all main industrial sectors. It is associated to a European Pollutant and Transfer Register (E-PRTR) making reported emission data accessible in a public register with annual data since 2007. Some other policies are addressing emission but more incidentally and to a lower extent: the Nitrate Directive (NiD 91/676/EEC), the Urban Waste Water Treatment Directive (UWWTD, 91/271/EEC) and Environment Quality Standard Directive (EQSD, 2008/105/EC).

In addition to legislation, specific data collections targeting emissions to water exist, which were implemented by 3 main European bodies for their own needs:

- Eurostat has been collecting data on emission sources and pathways of a small range of parameters in its Joint Questionnaire since 1988.
- The European Environment Agency (EEA) and its European Topic Centre for Inland, Coastal and Marine waters (ETC/ICM) has implemented a data collection on emissions since 2009 gathering data with a wide temporal coverage (back to 1977) under its WISE-SoE Emissions.

The European Commission's Joint Research Centre (JRC) is conducting specific projects to support the improvement of knowledge, by developing models and assessments for specific substances or tackling some specific problems like diffuse sources, in particular on nutrient surpluses or for the selection of relevant substances (on nitrogen see for instance Westhoek et al (2015), on priority substances see Pollesello et al. (2012).

Figure 3.1: Chronogram of key EU legislation on emission and reporting



As can be seen from the chronogram (Fig. 3.1), the European legislation on water and emissions has evolved and was progressively enriched in the past 50 years:

- starting with a focus on properties of substances to target harmful substances: Persistent, Bio-accumulative or Toxic (PBT) substances with a Directive on pollution caused by certain Dangerous Substances discharged into the aquatic environment of the Community (EC, 1976), and five specific Directives for list I substances focusing on some substances and sectors (mercury discharges by chlor-alkali electrolysis industry, cadmium, mercury discharged by other sectors, hexachlorocyclohexane, certain dangerous substances), and the Directive on protection of groundwater against pollution caused by certain dangerous substances (EC, 1980);
- then continuing with a source control approach, to prevent significant releases of harmful pollutants to the environment:
  - on the one hand targeting main sources susceptible to release these (cities, agriculture and industry), with the Urban Waste Water Treatment Directive (EC, 1991a), the Nitrate Directive (EC, 1991b) or the Integrated Pollution Prevention and Control Directive (EC, 1996b, EC, 2008a) and its register European Pollutant Emission Register (EC, 2000a) then transferred to E-PRTR (166/2006/EC) and to the Industrial Emissions Directive (EU, 2010),
  - on the other hand targeting more specifically producers, users and dischargers of these harmful substances: DSD Daughter Directives, Plant Protection Products Directive (EC, 1991c), Directive on the disposal of PolyChloroBiphenyls (PCBs) and PolyChloroTerphenyls (PCTs) (EC, 1996a), and Directive on sustainable use of pesticides (EC, 2009), Biocides Directive (EC, 1998) and its following Biocide Regulation (EU, 2012), REACH regulation, with the aim of preventing significant release of harmful substances to the environment.
- and then with a more integrated approach covering the entire DPSIR from source to pathways to discharge and impacts over the entire territory with the Water Framework Directive (EC, 2000b), in particular Article 5 on characterisation requiring identification of the significant point and diffuse sources, and Environmental Quality Standard Directive (EC, 2008c) requiring an inventory of emissions, discharges and losses of PS/PHS, the Groundwater Directive (EC, 2006b) and the counterpart for the marine side, the Marine Strategy Framework Directive (EC, 2008b).

Along this evolution, the scope for direct and indirect emission in terms of substances, of sources, of pathways, was enlarged and the level of details required was refined. In parallel, the legislation targeting substances and their use and release in the environment was also progressively enriched.
Emission and discharge of harmful substances being an important topic for all water categories, other European or international bodies are also gathering emission data, for example for the marine area (OSPAR: Convention for the Protection of Marine Environment of the North-East Atlantic; HELCOM: Helsinki Commission for the Protection of the Marine Environment of the Baltic Sea) or river conventions (e.g. ICPR: International Commission for the Protection of the Rhine; ICPDR: International Commission for the Protection of the Danube River), national or regional authorities.

This can be summarised by the following table (Table 3.1) which gives for each reporting an overview of the coverage in terms of emission model, sources and aggregation, pathways, parameters, temporal and geographical coverage.

In the following sections more details are given on the respective datasets available at EU level.

Table 3.1 Overview of requirements of emission to surface water reporting

Reporting requirements		E-PRTR (release data, water part)	UWWTD discharges data	EQSD emissions inventory *(first reporting in 2016)*	WISE-SoE Emissions data	OECD Eurostat emissions data	OSPAR	HELCOM
Dataset used in the current report		yes	yes	no	yes	no	no	no
Emission model		source oriented	pathway oriented	all 3 possible, depend on the RBD	source oriented and load oriented	source oriented and pathway oriented	pathway and load oriented	pathway and load oriented
Sources	**Diffuse sources**	not reported	not reported	aggregated at RBD for all diffuse	aggregated per RBD or sub-unit, detailed apportionment	aggregated per country and region (NUTS2)	aggregated per RBD or sub-unit, detailed apportionment	aggregated per RBD or country area discharging in Baltic Sea, detailed apportionment including industrial sectors, fish farms and municipal waste water
	Point sources – UWWTPs	above 100.000 p.e., facility level	facility level	aggregated at RBD for all point				
	Point sources – untreated urban waste water	not reported	rarely, facility level					
	Point sources – industrial waste water treated	selected sectors, facility level	not reported					
	Point sources – industrial waste water untreated	not reported	not reported					
Pathways (Figure 2.1)		P5, P7, P8, P10	P7, P8, P9	all relevant	all	all	Riverine load approach	Riverine load approach
Parameters		organic pollution, nutrients, heavy metals, pesticides, POPs, other pollutants	organic pollution, nutrient	heavy metals, pesticides, POPs, other pollutants if relevant for the RBD	organic pollution, nutrients, heavy metals, pesticides, POPs, other pollutants	organic pollution, nutrients, 6 heavy metals (2 in 2014)	organic pollution, nutrient, 34 priority dangerous pollutants, a larger set of substances with equivalent level of concern	organic pollution, nutrients, 11 dangerous substances
Temporal coverage		annual, 2007-ongoing similar reporting for 2001 and 2004 in European Pollutant Emission Register (EPER)	First report in 1998, second in 2002, then 2004, 2007, 2009, 2011, 2013, 2016 and on-going	one year emission or average over 3 years for pesticides for years between 2008 and 2010, and then on going with WFD article 5 update	annual, 2000-on going	biannual, since 1988 and on-going, stopped in 2014 for 4 heavy metals and in 2016 for the 2 remaining	every 5 years, on going	Comprehensive report every six years, reporting annually

3.2 Mandatory EU emission reporting

In this section, reporting required by European legislation and which are providing a significant amount of data are presented. The primary objective of these reporting is to identify and locate the main polluters and quantify their emission within view to protect the environment from pollution by human activities. It is also used to check compliance to the relevant legislation.

3.2.1 E-PRTR release data

The E-PRTR is the biggest and most complete source of emission data (http://prtr.ec.europa.eu/) with a mandatory reporting. It was primarily implemented to make public the emission of a set of substances by all industry sectors, in order to track progress towards reduction or phasing out. The terms used refer in particular to Figure 2.1.

- Emission model: source oriented
- Sources: point sources from 65 economic activities covering 9 industrial sectors[1] and exceeding at least one of the E-PRTR capacity thresholds (see hereunder).
- Some information on releases from diffuse sources (to air, and nitrogen and phosphorus loss from agriculture to water) is also available. Diffuse sources are defined as the many smaller or scattered sources from which pollutants may be released to water, whose combined impact may be significant and for which it is impractical to collect reports from each individual source.
- Pathways: 4 pathways are covered, namely P5 direct discharge and drifting, P7 for unconnected sewers (when an industry on-site treatment allows discharge: direct emission to water), indirectly P8 Urban waste water treated when facility waste water are directed to urban waste water treatment) and P10 Industrial waste water treated (see Figure 2.1).
- Temporal scale: annual direct and indirect emission to water
- Geographic scale: 34 countries, of which 28 are EU Member States, as well as the European Free Trade Association (EFTA) countries (Iceland, Liechtenstein, Norway and Switzerland) plus Serbia and Kosovo.
- Parameters: Direct and indirect (via sewer network and treatment plant) emission to water as well as off-site transfers of 91 key pollutants including chlorinated organics, other organics, heavy metals, pesticides, and inorganic substances.
- Thresholds: A set of industrial and similar facilities thresholds and pollutant thresholds fixed by the regulation Pollutant releases have to be reported when exceeding specific thresholds specified in Annex II of the E-PRTR Regulation and defined to cover the biggest dischargers in Europe: UWWTPs with a capacity of above 100 000 p.e. (population equivalent) and Independently Operated Waste Water Treatment Plants (industrial facilities' waste water which is not treated in UWWTPs) serving one or more E-PRTR Annex I activities (IOWWTP) with a capacity of above 10 000 m^3 per day. Emissions to water (releases) are reported if they exceed threshold values (e.g. 50 000 kg per year of nitrogen, 5 000 kg of phosphorus, 5 kg of arsenic or 1 kg of atrazine.
- Unit: kg per year.
- Gaps and other difficulties: The coverage is limited to the biggest sources and does not include services. The objective is to cover 90% of emissions but it is not easy to assess if this is the case as no alternative information source exists, and some sectors like metal coating are probably not

[1] (energy, production and processing of metals, mineral industry, chemical industry, waste and waste water management, paper and wood production and processing, intensive livestock production and aquaculture, animal and vegetable products from the food and beverage sector, and other activities).

well covered as they are mainly made up of small facilities which are likely to be below the emission thresholds.

- Use: This data source is the most complete and detailed information source for point sources and is therefore the basis of the assessment made in the current report. Main weakness lies with the limited number of pathways covered and the limitation to biggest sources, and exclusion of the economic sector of services (administrations, banks… European classification Nace codes 45 to 96). A significant proportion of smaller plants and services are connected to urban waste water treatment plants, so the emissions are therefore covered in part in E-PRTR for the biggest UWWTPs. There is limited information available for smaller UWWTPs which are reported only under the Urban Waste Water Directive.

3.2.2 UWWTD discharges data

The UWWTD database (UWWTD, 2012) contains data obtained from the biannual reporting of Member States (MS) on the UWWTD implementation.

- Emission model: pathway oriented
- Sources: All connected sources including industry, services and population from households with no source apportionment: a treatment plant is considered as a source.
- Pathways: 4 pathways, P7 Storm Water Outlets and Combined Sewer overflows + unconnected sewers, P8 Urban waste water treated, including from independent treatments, P9 Individual – treated and untreated – household discharges and partially P10 Industrial waste water treated for the food industry (see Figure 2.1).
- Temporal scale: low, irregular at the beginning of implementation (see summary table 3.1), it became biannual reporting in the recent years, but data on loads were introduced more recently. The UWWTD was adopted by the EU in May 1991. The first reporting of UWWTD was in 1994 to produce first implementation report published in 1998, collection of data came later. In 1998, the first Implementation report included 14 Member States; the last one in 2016 included 28 Member States.
- Geographic scale: 28 EU Member States + Norway but reporting on loads is non-mandatory: in the 8th UWWTD data call, 15 Member States reported data on discharge loads.
- Parameters: incoming and discharged loads of nutrients (N, P) and organic matter, (BOD and COD) (expressed in tonnes per year) and Total Suspended Solids
- Thresholds: agglomerations with a generated load of ≥ 2 000 p.e. and the food industry with a generated load of ≥ 4 000 p.e.
- Unit: tons per year.
- Gaps and other difficulties: The coverage is not complete for small and scattered dwellings, while they may constitute a significant amount of loads, especially in rural countries. The ID codes of UWWTPs are different from those used in the E-PRTR database, which makes comparative analyses more difficult.
- Use: This data source is limited to mostly urban waste water and treatment plants which are more a pathway from source to aquatic environment than a source. Nevertheless, it is a crucial pathway for emissions to water and the data coverage is very complete as it is backed by mandatory reporting.

3.2.3 EQSD emissions inventory

The Environmental Quality Standards Directive (EC, 2008c) requires Member States to establish an inventory of emissions, discharges and losses of all priority substances and pollutants listed in Part A of

Annex I to this Directive with first reference year between 2008 and 2010. Currently, no datasets are available for use in this report, new data should become available 2017–18, and older data are not sufficiently homogeneous for use. The main aspects expected of this dataset are presented here.

- Emission model: load, source and pathway oriented depending on chosen methodology
- Sources: All sources.
- Pathways: all pathways (see Figure 2.1).
- Temporal scale: low, every 6 years with WFD Article 5.
- Geographic scale: 28 EU Member States.
- Parameters: all priority and hazardous substances which are relevant for the RBD
- Thresholds: set by Member States.
- Unit: kg per year.
- Gaps and other difficulties: No data available for the moment. The temporal coverage is low and the methods used by the different MS can be very different, comparability is likely to be a major issue.
- Use: This data source is limited to a very aggregated level, and one year: no trend analysis is currently possible hence it will probably be more useful for checking other data sources.

3.3 Non mandatory EU emission reporting

In addition to the above, two voluntary reporting streams provide some limited emission datasets: the WISE State of the Environment (SoE) emissions and to a lower extent the OECD/Eurostat Joint Questionnaire.

3.3.1 WISE-SoE Emissions data

WISE-SoE Emissions data have been voluntarily submitted by countries on an annual basis through the Water Information System for Europe (WISE) reporting process since 2009. The reported emissions data are available in the Eionet Central Data Repository: http://www.eea.europa.eu/data-and-maps/data/waterbase-emissions-3. Detailed information about required emission data is available in the Data Dictionary (http://dd.eionet.europa.eu/datasets/3091). The data are used to provide a general overview of emissions from point and diffuse sources for the different countries, with a view to produce EEA indicators supporting EEA assessment reports.

- Emission model: source oriented and load oriented
- Sources: organised between point and diffuse (urban waste water, industrial waste water, agriculture diffuse etc.), a treatment plant is considered as a source, size of UWWTPs according to p.e. and the type of treatment (treated/untreated). All point sources emissions can be labelled during reporting if they contain E-PRTR emissions only, non E-PRTR emissions or both. Sources are grouped by principal source categories (see figure 2.1).
- Pathways: all pathways and at river mouth or downstream of river thus considering in-river processes (see Figure 2.1). Net loads by source at point of discharge.
- Temporal scale: data available for fifteen countries and some years on the period 2000–2011. Annual collection since 2009 for point sources. Diffuse sources are requested to be reported at least every 6 years.
- Parameters: nutrients (total N, total P), organic matter (BOD, COD) and hazardous substances (mainly heavy metals)
- Thresholds: no threshold, ambition is full coverage
- Unit: tonnes per year or kg per year.

- Gaps and other difficulties: The reporting is voluntary and data collection is not priority data flow within Eionet. Emissions data have a hierarchical structure, thus while disaggregated information are preferred, data could be provided on a more aggregated level.
- Use: As detailed in ETC/ICM technical report 1/2014, this data source is rich but can only to a limited extent be combined with mandatory reporting due in particular to uneven geographic, temporal and parameter coverage

3.3.2 OECD/Eurostat emissions data

Eurostat collects data on water every two years via the OECD/Eurostat Joint Questionnaire. It collects emission data in Table 8 (previously Table 7). OECD/Eurostat emission database is publicly available on Eurostat website (http://ec.europa.eu/eurostat/data/database).

- Emission model: source oriented and pathway oriented (2 parts in the table)
- Sources: all sources, point and diffuse sources, with clear reference to NACE classification, and aggregated at national level
- Pathways: from the beginning, the ambition was to cover all pathways (see Figure 2.1). Figures are provided along the main pathways, i.e. urban waste water is divided up into the following categories – discharges after treatment in WWTPs (UWWTPs), discharges after independent treatment and discharges without treatment. Industrial waste water is reported as discharges after treatment in 'other' WWTPs, discharges without treatment and total industrial discharges.
- Temporal scale: bi-annually since 1988 but only the last 10 years are available online
- Geographic scale: all EU countries
- Parameters: BOD, COD, Suspended Solids, Nitrogen total, Phosphorus total, Arsenic, Cadmium, Copper, Mercury, Chromium, Nickel, Lead, Zinc until 2012 Arsenic, Cadmium, Mercury, Chromium, Nickel, Lead were not required for 2014 and Copper and Zinc were also deleted for the 2016 data request.
- Thresholds: Mandate for statistics is to have full coverage. Depending on country, data include only the biggest sources or also the smaller ones.
- Unit: tons or kg per year depending on parameter
- Gaps and other difficulties: The provision of these data is not mandatory, the table is not well filled in by countries and time series are poor or inconsistent. Eurostat is progressively reducing the ambition of the data collection to a more limited set of parameters.
- Use: This data source was tentatively used in some emission assessments but the only regular use is the public dissemination of the collected datasets.

3.4 Conclusions

The following conclusions can be drawn:

- Emissions to water are reported under two main obligations: the European Pollutant Release and Transfer Register (E-PRTR – as the main focus) and the Urban Waste Water Treatment Directive (UWWTD – as additional data). If we consider a UWWTP as an emission source, we can say both cover detailed point sources data at facility level for most macropollutants, while E-PRTR also includes a set of micropollutants for a limited set of pathways.
- In contrast, WISE-SoE Emissions and OECD/Eurostat Joint Questionnaire and in the near future the EQSD inventory, include aggregated point and diffuse sources emissions at RBD (or country) level and cover all pathways for a limited set of substances or polluting parameters.
- The present relation between E-PRTR and other EU emission reporting is complex, is partly overlapping and shows differences in definitions (sources, pathways), methods, reporting

timeframes, formats and thresholds. As a result, big differences between countries can exist in terms of methodology used to allocate emission to a group of sources, which limits the possible EU-wide assessments with regards to emissions. A joint effort, maybe under the umbrella of the CIS, in particular on description of above listed key components, and an intercalibration exercise may support improvement of the situation.

- Main issues arising from or related to the reporting requirements:
  - Voluntary or mandatory reporting
    Three of the five reports mentioned above have a voluntary character and are reported by a limited and from year to year changing set of countries. Although the reported data are very valuable, the quality, completeness and transparency of the data is limited. With the mandatory reporting, a set of reference lists already exist which provide a first reporting framework. As demonstrated above, reporting emissions to water is not an easy task and covers a wide set of elements to consider. Each reporting requirement has its own purpose, and it is probably difficult to consider for this specific case a "report once use many" approach which would require a large effort. However a common framework and some harmonization would allow combination of datasets and higher quality of results. The existing reference lists could be widened, tested and used for the voluntary reporting.
  - Pollutants
    Most of the reports mentioned cover a very limited (UWWTD) or a limited number of "old" pollutants: macropollutants and heavy metals. Only the mandatory E-PRTR and WFD tend to cover a wider list of pollutants, macropollutants and heavy metals but also a set of micro pollutants for which good knowledge of their adverse effect on environment exist, with some even banned. Some countries also assess emission of pollutants out of the EU legislation lists and the list of pollutants will continuously evolve. A unique and well organized reference list, with possibility to widen should be considered.
  - Geographical level of reporting
    Differences in the geographical level of reporting, in combination with reporting thresholds can lead to incomparable datasets from different reporting requirements. In a lot of cases it is not clear if total releases are reported or only a part of the existing emission sources.
  - Reporting frequency
    Different reporting frequencies result in an increasing number of datasets with partially overlapping data, making combination of them and/or assessment of historical trend more difficult.
  - Correction of historical data
    Emission data are generally reported in three groups: monitored, calculated, or estimated. This may give rise to potential mistakes or later revision of the methodology used. It is therefore necessary to consider possible correction of historical data. Only in E-PRTR and WISE-SoE Emissions does such a mechanism exist. Particularly in the case of the reporting of diffuse sources, it is important to allow revision of old data when new sources are considered or quantification methods are redefined. The lack of historical consistent data often results in incomparable datasets and limits the possibility to use the existing datasets for trend analysis.
  - Definitions
    While the EQSD states the emissions inventory should cover "emissions, discharges and losses of all priority substances and pollutants", it does not define the threshold to consider (quantity per year, concentration...). Under E-PRTR the term "diffuse sources" covers all emissions below the fixed thresholds but in many countries the emissions below these thresholds are at least partly qualified as stemming from point sources. Many other examples can be found, and this causes differences between countries in coverage, completeness, quality and scope of the reported datasets. A common semantic within and between reporting's would ease comparability and aggregation of the data.
  - "Report only once" principle

The WISE-SoE Emissions reporting supports the SEIS “report only once” principle (EU, 2008d). This means that countries can opt not to report data which are already covered under any other reporting obligation. While this helps to limit the reporting burden, the different types of information necessary for an inventory (see in sections above the main points) can limit possible aggregation levels and therefore the usefulness of the data for a consistent assessment. Datasets are mostly organized in electronic form allowing different combinations, and an alternative would therefore be to have wider shared semantic and common rules to aggregate or disaggregate datasets.

- Diffuse sources

  Overall, there is a lack of transparent, consistent, comparable and actual data concerning releases of diffuse sources at an EU level. This arises for various reasons. For instance, different definitions for diffuse sources and pathways are used by different institutions, and within this there is a lack of consistency between local, regional and international scales). Methods for the quantification of releases by diffuse sources may differ between countries or are not well described. Voluntary reporting can lead to uncertainty and coverage inconsistency in geographic, temporal, parameter or other element, while there is limited mandatory reporting of diffuse sources.

4 Emissions from industry

This chapter focusses on emissions from industrial facilities as reported under the European Pollutant Release and Transfer Register (E-PRTR) Regulation. It starts with an overview of what is reported in E-PRTR (sectors, pollutants). The industrial releases to be reported in E-PRTR are divided in 9 sectors. Within each sector different activities are defined. In paragraph 4.2 the apportionment of the sectors in the total loads will be discussed. The trends per pollutant and per sector are analysed in paragraph 4.3. Paragraph 4.4 elaborates on regional differences of reported loads. In paragraph 4.5 the reporting of E-PRTR and WISE-SoE Emissions are compared. Finally, conclusions are given in paragraph 4.6.

Large UWWTPs (>100 000 p.e.) also have to report to E-PRTR. Because the UWWTPs are a rather specific source, they are not included in this chapter, but discussed in Chapter 0. All data, figures and tables shown in this chapter refer to the E-PRTR dataset **excluding** Annex I activity code 5.f: Urban waste water treatment plants.

4.1 Overview of E-PRTR reporting

In the E-PRTR database, see paragraph 3.2.1, two categories of reported annual pollutant releases refer to water:

- The **off-site transfers in water** refer to annual pollutant releases in the waste water of a facility that are transferred to another facility, often a waste water treatment plant. The sum of the number of pollutant transfer reports of off-site transfer in water in the E-PRTR (sum of all reported years in the period 2007–2014) is 30 173.
- The **pollutant releases to water** refer to direct releases in surface water. The total number of pollutant release reports to water in the E-PRTR (sum of all reported years in the period 2007–2014) is 126 982 for the sum of industrial and UWWTP releases. For the industrial releases the total number in the same period is 67 055.

This chapter only refers to the direct releases of industrial releases to surface water. No attention is given to the releases of “off-site transfers to water” because these releases have no direct relation with surface water. In addition, off-site transfers may be taken to UWWTPs, so adding up the direct releases and the off-site transfers may lead to (a partial) double counting of loads and confuse the analysis.

Figure 4.1 shows the annual number of pollutant release to water reports. The number of releases is rather stable during the reporting period 2007–2014. This is an indication that the trends we see in the loads are not determined by large fluctuations or trends in reporting. The figure only shows the number of release reports, not the total loads reported. The number of release reports is not the same as the number of reporting industrial facilities, since one facility may report about more than one pollutant in a specific year.

In the period 2007–2014, E-PRTR releases are reported for 78 pollutants. The focus of this chapter is on the 8 most reported pollutants in the E-PRTR database between 2007 and 2014. These pollutants are shown in Figure 4.2. Total organic carbon, zinc, total phosphorus and total nitrogen are the most reported pollutants in E-PRTR, followed by the heavy metals nickel, copper, arsenic and lead. These 8 pollutants cover 74% of all the release reports. The other 26% of the release reports refer to the other 70 reported E-PRTR pollutants. Annex 1 shows an overview of the contribution for all the pollutants. Heavy metals and inorganic substances are reported most. Chlorinated substances, pesticides and other organic substances are the least reported pollutants. No large changes in the percentages per pollutant are seen during the period 2007–2014. The figure 4.2 and Annex 1 only shows the number of release reports, not the total loads reported.

Figure 4.1 **Number of industrial pollutant release reports to water per year in E-PRTR, excluding activity 5.f: UWWTPs**

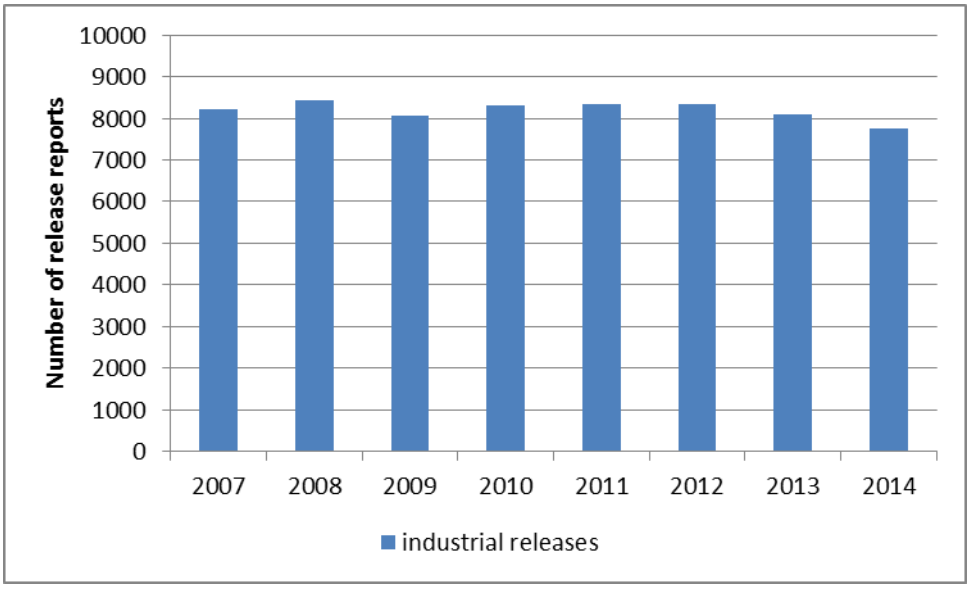
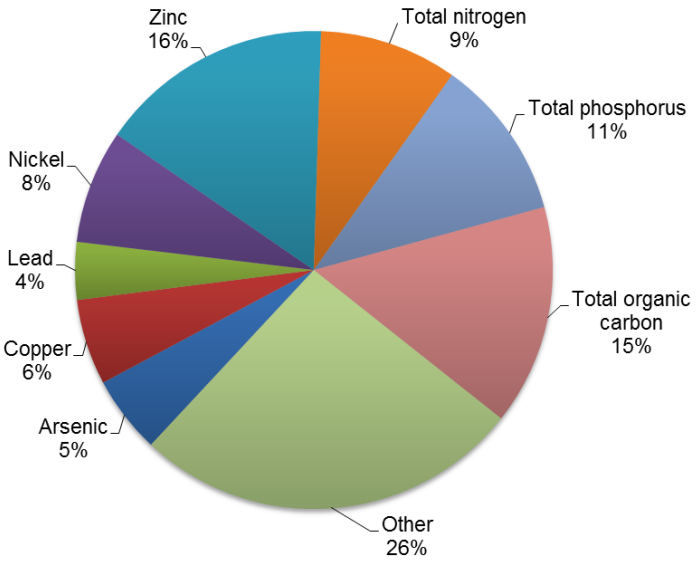


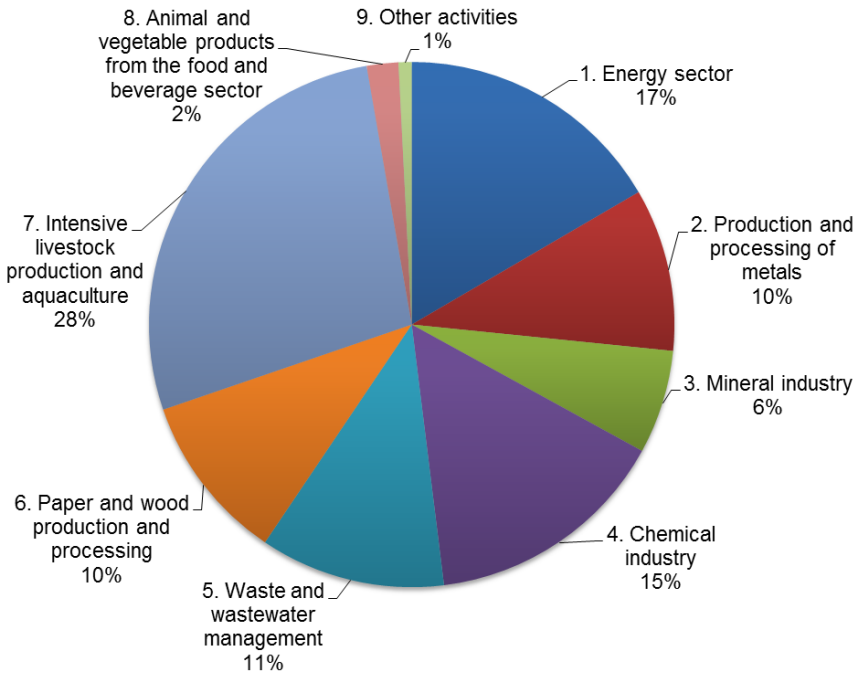
Figure 4.2 **The pollutants with the largest number of reported releases in E-PRTR, excluding activity 5.f: UWWTPs (sum period 2007–2014)**



In the E-PRTR, accidental releases can be reported and labelled as such. The percentage accidental releases compared to the total release is very small. For the 8 most reported pollutants (Figure 4.2) the percentage of the accidental releases is less than 0.5%. Only for Nickel in 2014 the accidental releases are significant: 37% of the total release. This is caused by one facility in Finland in the sector *Production and processing of metals.* Because the limited contribution to the total releases, the accidental releases have been excluded from the analysed dataset.

Figure 4.3 shows the percentage of release reports per sector during the period 2007–2014. Most release reports relate to the sector *Intensive livestock production and aquaculture* (28%), followed by the *Energy sector* (17%). The figure only shows the percentage of the number of release reports, not of the total loads reported.

Figure 4.3 **Percentage of the number of release reports per sector in E-PRTR, excluding activity 5.f: UWWTPs (sum period 2007–2014)**



4.2 Sectors and activities

More interesting than the number of release reports per activity sector is the source apportionment of the sectors to the total reported loads per pollutant. Table 4.3 shows the contribution per sector to the total load to surface water for the 8 most reported pollutants.

Table 4.1 **Average contribution per sector (%) to the total release to surface water for the most reported pollutants in E-PRTR, excluding activity 5.f: UWWTPs (period 2007–2014).**

sector	Total nitrogen (kton)	Total phosphorus (kton)	Total organic carbon (kton)	Arsenic (ton)	Copper (ton)	Lead (ton)	Nickel (ton)	Zinc (ton)
1. Energy sector	11%	4%	5%	56%	23%	16%	17%	10%
2. Production and processing of metals	6%	0%	1%	9%	9%	32%	39%	18%
3. Mineral industry	2%	1%	0%	8%	26%	33%	9%	23%
4. Chemical industry	24%	8%	6%	13%	6%	11%	15%	12%
5. Waste and wastewater management	13%	13%	7%	9%	7%	6%	14%	8%
6. Paper and wood production and processing	6%	6%	34%	4%	6%	3%	5%	12%
7. Intensive livestock production and aquaculture	35%	59%	43%	0%	23%	0%	0%	16%
8. Animal and vegetable products from the food/beverage sector	2%	9%	4%	0%	1%	0%	1%	1%
9. Other activities	0%	0%	0%	0%	0%	0%	1%	0%
Total average release per year (2007-2014)	112	14	489	53	316	116	161	1243
blue = 10-25%, orange = 25-50% and red = >50%.								

The sector *Intensive livestock production and aquaculture* shows a relative large contribution to the loads of the pollutants total nitrogen, total phosphorus and total organic carbon. Almost all releases reported by the sector *Intensive livestock production and aquaculture* are reported in the activity *7.b Intensive aquaculture* and are related to the food supply in sea fish farming. Only 1% or less (depending the specific pollutant) of the releases are reported in the activity *7.b Poultry and pigs*.

For sector *Energy sector*, arsenic and copper (to a lesser extent) are important pollutants, especially in the activity *Thermal power stations and other combustion installations*. The sector *Mineral industry*

seems to be less important for the nutrients compared with other activity sectors. But for the metals copper, lead and zinc, the most reported releases are in the mining sector.
Copper and zinc are mostly released in the activity *Underground mining and related operations*, lead in the activity *Opencast mining and quarrying*. For nickel, finally, facilities in the sector *Production and processing of metals* show the highest contribution.

Of course the sectors may differ in the size and number of the facilities reporting in E-PRTR. To analyse this, two tables were made. In the first table (Table 4.2) the average number of facilities per year over the period 2007–2014 per sector is presented. Table 4.1 and Table 4.2 are combined in Table 4.3, showing the average release per facility per year for the different sectors.

Table 4.2 Number of facilities reporting releases to surface water per year per sector in E-PRTR, excluding activity 5.f: UWWTPs (average of the period 2007–2014)

sector	Total nitrogen	Total phosphorus	Total organic carbon	Arsenic	Copper	Lead	Nickel	Zinc
1. Energy sector	42	23	63	114	92	51	100	117
2. Production and processing of metals	33	5	23	57	67	74	155	121
3. Mineral industry	10	5	12	41	27	38	44	67
4. Chemical industry	99	49	125	61	58	47	102	122
5. Waste and wastewater management	67	59	71	76	51	47	97	103
6. Paper and wood production and processing	54	58	197	51	54	43	80	92
7. Intensive livestock production and aquaculture	407	600	610	0	96	0	0	590
8. Animal and vegetable products from the food/beverage sector	11	44	53	7	5	3	12	11
9. Other activities	2	1	4	2	4	3	16	8

Table 4.2 shows the sector *Intensive livestock production and aquaculture* has the highest number of reporting facilities, while the sectors *Other activities* and *Animal and vegetable products from the food/beverage sector* have the lowest number of reporting facilities.

The high contribution from sector *Intensive livestock production and aquaculture* appears to be the result of a large number of facilities with an average release per facility. The high release of arsenic from the *Energy sector* is the result of a high average release per facility, as is the same for the releases of copper, lead and zinc from sector *Mineral industry*. Medium high releases in combination with a medium number of facilities result in the high contributions of lead, nickel and zinc from sector *Production and processing of metals* and in a contribution of 10–20% for a number of pollutants from sector *Chemical industry*.

Table 4.3 Average release to surface water per facility per year per sector in E-PRTR, excluding activity 5.f: UWWTPs (average of the period 2007–2014)

sector	Total nitrogen	Total phosphorus	Total organic carbon	Arsenic	Copper	Lead	Nickel	Zinc
	ton	ton	ton	kg	kg	kg	kg	kg
1. Energy sector	292	24	360	260	780	357	269	1108
2. Production and processing of metals	209	12	204	85	426	505	406	1868
3. Mineral industry	269	19	175	110	3024	992	324	4236
4. Chemical industry	273	23	232	116	301	267	236	1185
5. Waste and wastewater management	220	30	468	64	417	137	231	984
6. Paper and wood production and processing	118	15	840	39	351	82	98	1670
7. Intensive livestock production and aquaculture	98	14	347	0	775	0	0	328
8. Animal and vegetable products from the food/beverage sector	215	27	382	17	382	49	108	640
9. Other activities	75	8	127	17	114	56	60	239

Working with the data, the question raised is, to what extent do individual facilities contribute to the total reported release for a pollutant? Table 4.4 gives this overview for one specific year (2014).

Presented are the total number of reporting facilities in 2014 and the contribution of the highest (top 1), 5 highest (top 5) and 10 highest (top 10) reporting facilities to the total reported release in 2014. It can be concluded that a small percentage of the facilities is responsible for a large percentage of the releases of the 8 most reported pollutants.
For three pollutants (arsenic, lead and nickel) more than half of the total Europe wide reported release to surface water is reported by the top 10 facilities. Note that the facilities in the top 1, top 5 and top 10 may differ per pollutant.

Table 4.4 Number of reporting facilities and percentage of the total reported release in E-PRTR covered by the highest releases for the top 1, 5 or 10 facilities in 2014, excluding activity 5.f: UWWTPs

Pollutant	number of facilities	top 1	top 5	top 10
Arsenic and compounds (as As)	387	15%	51%	63%
Copper and compounds (as Cu)	403	18%	40%	48%
Lead and compounds (as Pb)	262	37%	60%	70%
Nickel and compounds (as Ni)	570	37%	49%	56%
Total nitrogen	755	8%	16%	21%
Total organic carbon (TOC) (as total C or COD/3)	1165	2%	7%	11%
Total phosphorus	897	3%	9%	11%
Zinc and compounds (as Zn)	1250	15%	27%	35%

It can be regarded as remarkable that releases of a single facility can cover almost 40% (lead and nickel) of the total reported E-PRTR release (excluding activity 5.f: UWWTPs). Since these releases did pass the standard E-PRTR checks and reviews and are not labelled as accidental releases, they are assumed to be realistic. These high releases could be the result of (extremely) high production capacities of the facilities combined with a state of the art treatment process and are as such are not proof of a bad performance of the waste water treatment, or of the facilities operational management.

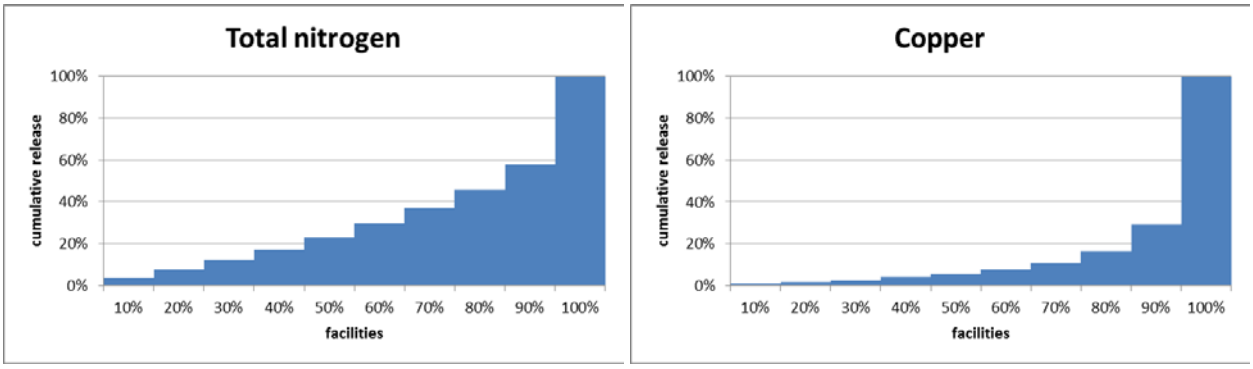
Table 4.5 shows this high contribution of a set of top 5 facilities with the highest releases, which can be seen during the whole E-PRTR period.

Table 4.5 Percentage of the total reported release in E-PRTR covered by the five facilities with the highest releases, excluding activity 5.f: UWWTPs (period 2007–2014).

Pollutant	2007	2008	2009	2010	2011	2012	2013	2014
Total nitrogen	28%	10%	7%	9%	9%	8%	10%	16%
Total phosphorous	19%	12%	11%	12%	11%	12%	11%	9%
Total organic carbon	12%	17%	10%	6%	10%	5%	6%	7%
Arsenic	28%	23%	32%	56%	63%	60%	39%	51%
Copper	28%	24%	21%	52%	37%	34%	37%	40%
Lead	54%	51%	61%	60%	60%	57%	61%	60%
Nickel	34%	35%	28%	26%	22%	18%	27%	49%
Zinc	31%	18%	21%	24%	22%	23%	28%	27%
Red = >50 %.								

In Figure 4.4 the cumulative release in steps of 10% is given for two pollutants: total nitrogen and copper. The figures indicate that only a small percentage of the facilities produces a high percentage of the releases to surface water. For total nitrogen 10% of the facilities with the highest releases causes more than 42% of the total E-PRTR release, for copper this percentage is even higher: 71%.

Figure 4.4 Cumulative releases for total nitrogen (kton/year) and copper (ton/year) in E-PRTR in 2014, excluding activity 5.f: UWWTPs



These (extremely) high releases caused by a limited number of facilities will be the explanation of (relatively) large fluctuations in the total load of certain pollutants.

One possibility presented by these data is the potential for a significant reduction of emissions from a limited number of facilities with very high releases, by taking measures on the waste water treatment or production processes.

4.3 Trends

Analysing the trends in E-PRTR, it appears to be not possible to distinguish between a “real increase” of releases to water and to an increase in reporting as a result of an increase of knowledge or monitoring efforts. It is also possible for there to be an increase in the reported release, as is the result of a decrease of the performance of the waste water treatment of a facility. This question cannot be answered within this report because the background data is not available on an EU-scale.

4.3.1 Trends in number of release reports per country

Table 4.6 shows the number of release reports per country for the 8 most reported pollutants for the years 2007–2014. All countries have reported since 2007, except Serbia which began reporting in 2010. The number of reports of most countries is rather stable. A number of countries show a declining trend: Belgium, Czech Republic, France, Germany, Portugal, and Romania. Only Norway shows an increasing trend, obviously related to an expansion of the intensive aquaculture sector.

Norway is the country with the most reported releases over the years, followed by the United Kingdom, Italy, France and Germany. Even for these most reported pollutants, a large part of countries (58%) show less than 100 release reports per year.

Table 4.6 Trends in number of release to surface water reports of the 8 most reported pollutants per country per year in E-PRTR, excluding activity 5.f: UWWTPs (2007–2014)

Country	2007	2008	2009	2010	2011	2012	2013	2014
Austria	80	91	75	95	103	90	100	56
Belgium	338	304	270	277	284	256	231	247
Bulgaria	48	49	60	52	55	60	50	47
Cyprus	1	4	1	2	0	2	2	2
Czech Republic	130	126	137	130	121	113	98	86
Denmark	25	47	41	30	25	27	18	29
Estonia	7	9	2	1	8	7	6	6
Finland	238	246	222	233	244	238	264	246
France	865	814	748	790	788	732	712	699
Germany	641	646	586	614	570	539	541	528
Greece	33	36	38	36	37	32	28	31
Hungary	39	36	37	37	44	27	24	34
Iceland	7	18	16	16	11	17	17	16
Ireland	32	25	26	30	29	29	24	26
Italy	754	814	729	757	744	746	686	709
Latvia	5	0	1	0	0	0	0	2
Lithuania	6	8	4	3	5	5	2	5
Luxembourg	8	8	8	9	10	6	5	6
Malta	20	22	21	14	15	18	21	13
Netherlands	320	351	350	349	316	312	291	282
Norway	1939	2005	2130	2104	2211	2449	2451	2416
Poland	384	358	359	388	387	347	348	334
Portugal	170	173	152	116	101	100	96	89
Romania	118	101	64	64	58	48	42	40
Serbia	0	0	0	59	82	106	91	91
Slovakia	85	83	82	98	84	75	71	59
Slovenia	41	26	17	15	17	12	10	11
Spain	323	338	322	335	330	351	317	311
Sweden	408	382	361	347	377	351	333	328
Switzerland	42	52	47	51	47	48	45	45
United Kingdom	1318	1468	1332	1436	1415	1377	1358	1141

4.3.2 Trends of releases per pollutant

The relative trends of the total release per pollutant for the period 2007–2014 are shown in the figure below.

Figure 4.5 Trend of relative releases to water (2007 = 1) of nutrients, TOC and metals in E-PRTR, excluding activity 5.f: UWWTPs (2007–2014)

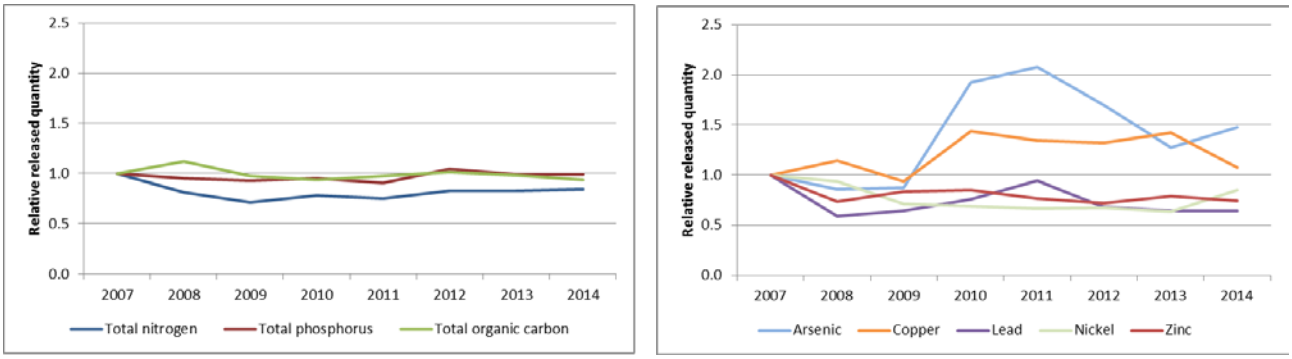


Table 4.7 Number of facilities per pollutant per year for the most reported pollutants, excluding activity 5.f: UWWTPs (2007–2014)

Pollutant	2007	2008	2009	2010	2011	2012	2013	2014
Total nitrogen	663	680	710	693	715	802	784	755
Total phosphorus	812	830	819	817	850	871	860	897
Total organic carbon	1 130	1 181	1 145	1 134	1 174	1 175	1 160	1 165
Arsenic	379	409	388	426	448	419	407	387
Copper	483	501	442	437	447	465	447	403
Lead	325	331	292	328	323	304	288	262
Nickel	664	644	597	625	600	577	572	570
Zinc	1 190	1 253	1 233	1 208	1 228	1 244	1 238	1 250

Table 4.7 shows the number of reporting facilities per pollutant per year. For the left-hand figure (Figure 4.5) the trend of the pollutants shows to be rather stable, especially in the last five years. The number of the facilities shows a slight increase during the years, so more facilities report, but with a lower (average) load per facility. For the metals in the right-hand figure, the trend is not very clear. We see a slight decreasing trend for lead and nickel (combined with a decrease of the number of release reports) and zinc (combined with a small increase of the number of release reports). The trends for copper and arsenic show large fluctuations.

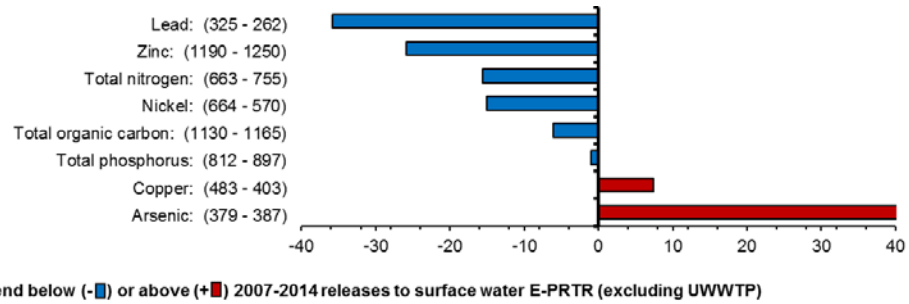
The fluctuating arsenic trend is mainly caused by new reporting by Serbia[2]. In 2010 51% of the total arsenic releases to surface water was caused by three Serbian facilities in the *Energy sector*. Then the reported releases decline, but are still 34% of the total E-PRTR release in 2014. Without the releases of the Serbian facilities, the trend of arsenic still increases as well after 2009. Several countries show these increasing releases.

Also for copper the influence from the new reporting countries does exist. Releases in the *Energy sector* and in the *Mineral industry* in Serbia are responsible for 25% of the total E-PRTR copper release in 2014.

4.3.3 Comparing 2007 and 2014

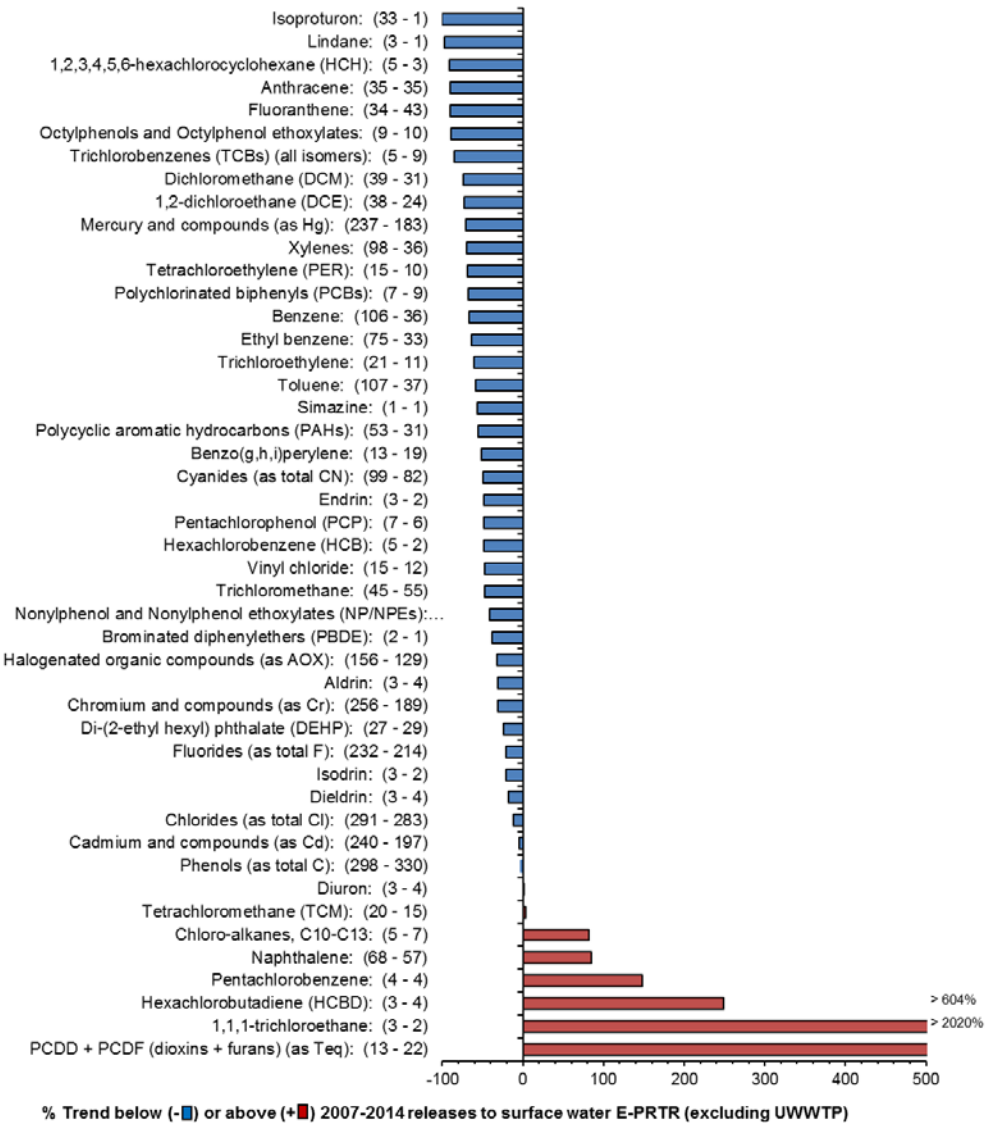
The absolute trends of the 8 most reported pollutants between the years 2007 and 2014 are shown in Figure 4.6. The blue bars show a decrease, the red bars an increase. Only copper and arsenic show an increase with 7% and 48% respectively. Lead shows the biggest decrease with almost 40%.

Figure 4.6 Trend as % reduction (blue) or increase (red) of releases to surface water for the 8 most reported pollutants in 2014 compared to 2007 in E-PRTR, excluding activity 5.f: UWWTPs. Between parentheses the number of releases, left: 2007, right: 2014



[2] Shortly before publication, ETC received notice that Serbia are checking the data which have been officially reported to the EPRTR. Data analysed in this report are those which were in the database as of 2016.

Figure 4.7 Trend as % reduction (blue) or increase (red) of releases to surface water for the other pollutants in 2014 compared to 2007 in E-PRTR, excluding activity 5.f: UWWTPs. Between parentheses the number of releases, left: 2007, right: 2014

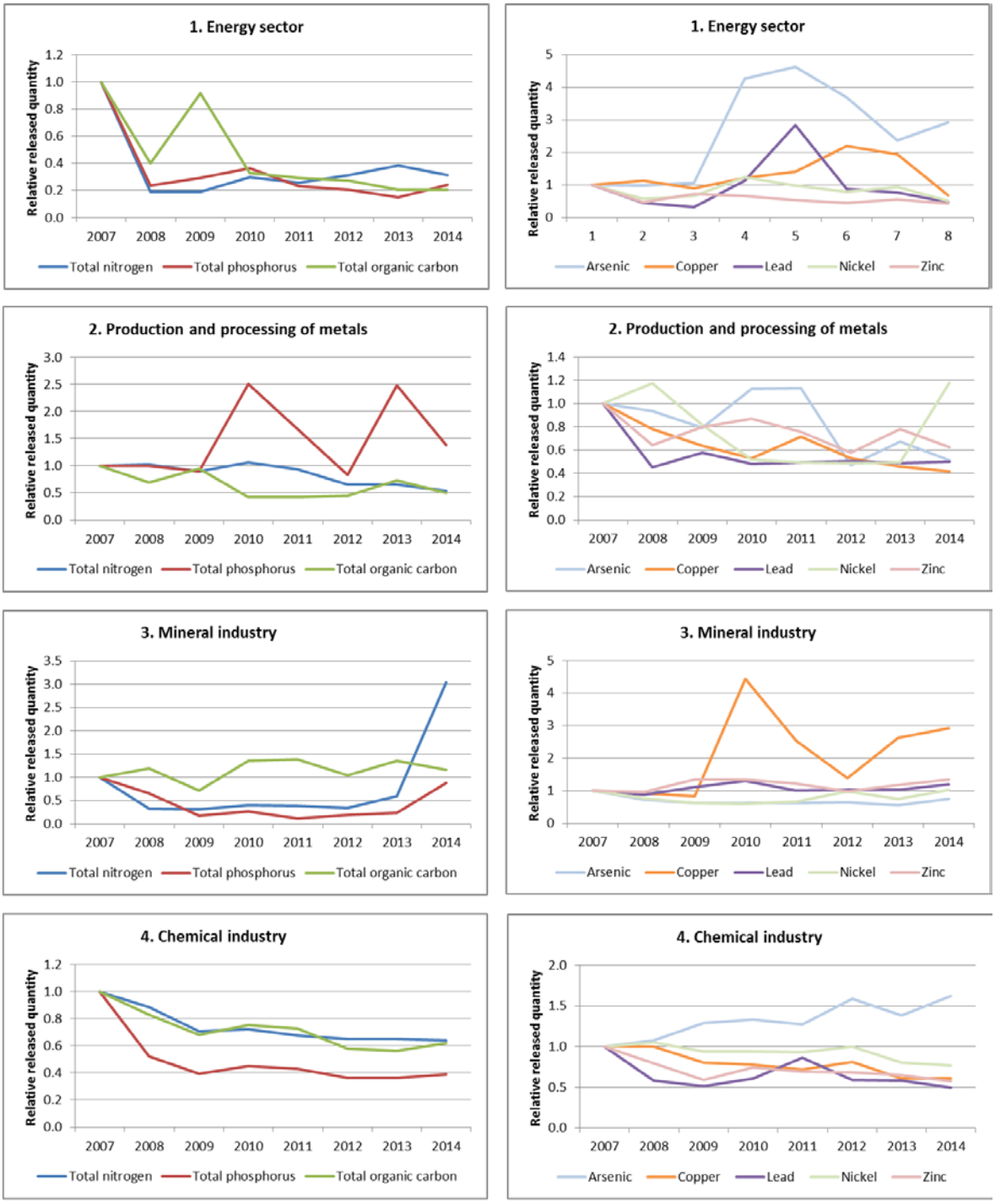


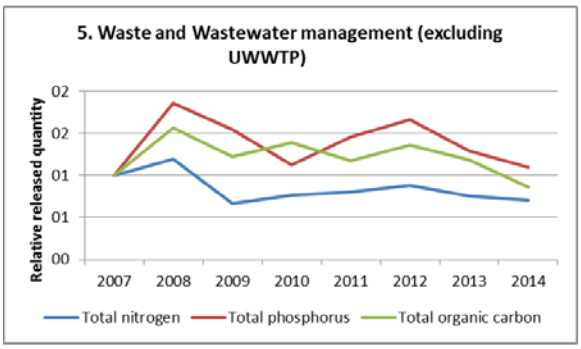
*= The increase of PCDD+PCDF is 2020% and the increase of 1.1.1-trichloroethane is 604%

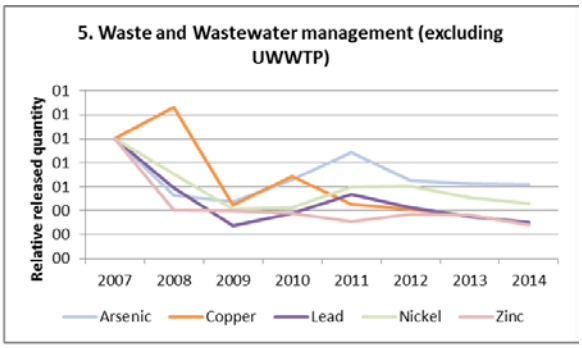
4.3.4 Trends per sector

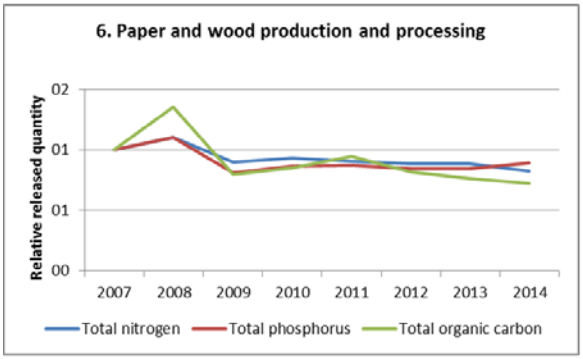
Figure 4.8 shows the relative trends (2007 = 1) for the 9 E-PRTR sectors for the 8 most reported pollutants. The left-hand figures show the nutrients, the right-hand figures the heavy metals. It is not easy to draw conclusions from this figure. We see a declining trend for most pollutants for most of the sectors (1, 2, 4, 5, 6, 8), although large differences between pollutants within one sector may exist and large fluctuations for a lot of pollutants in time do occur. An increasing trend, can be seen in sector 3 (at least for a number of pollutants) and for all pollutants in sector 7. The trend in sector 9 varies enormously between pollutants: from almost 100% reduction of reported releases of lead in 2014 to a 700% increase in reported releases (compared to 2007) for Arsenic in 2011.

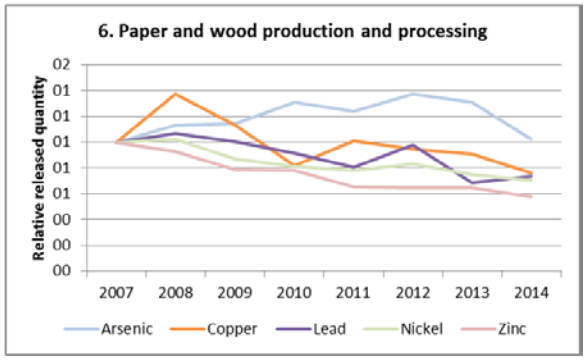
Figure 4.8 **Relative trends of releases to surface water per sector for the 8 most reported pollutants in E-PRTR, excluding activity 5.f: UWWTPs between 2007 and 2014 (2007 = 1)**

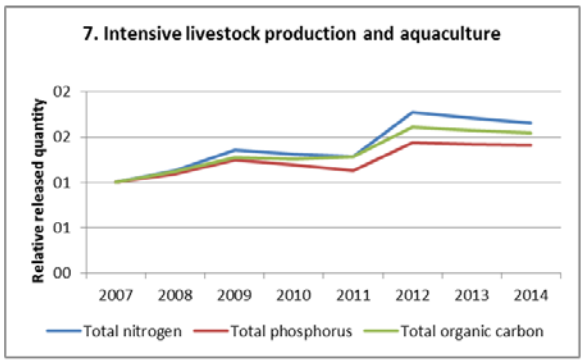


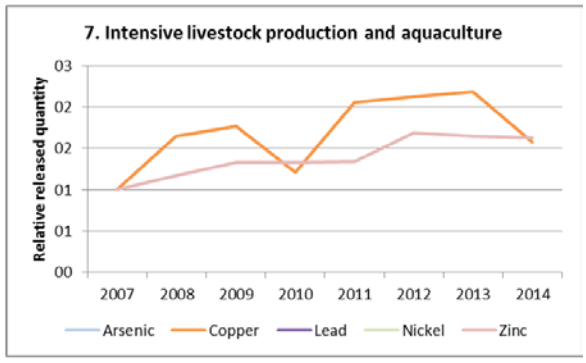

5. Waste and Wastewater management (excluding UWWTP)
Relative released quantity
2007 2008 2009 2010 2011 2012 2013 2014
Total nitrogen
Total phosphorus
Total organic carbon

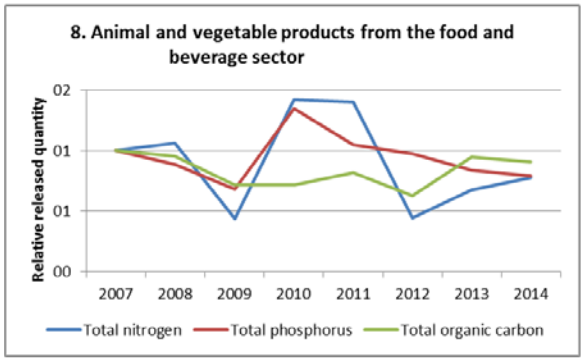

5. Waste and Wastewater management (excluding UWWTP)
Relative released quantity
2007 2008 2009 2010 2011 2012 2013 2014
Arsenic
Copper
Lead
Nickel
Zinc

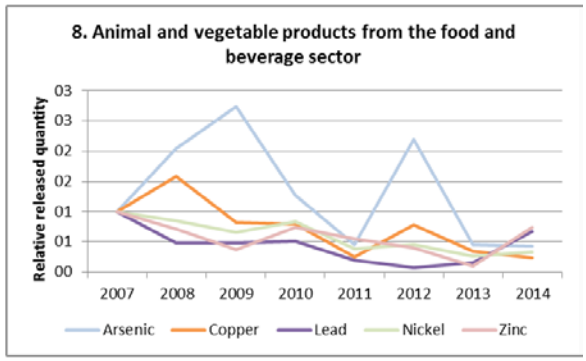

6. Paper and wood production and processing
Relative released quantity
2007 2008 2009 2010 2011 2012 2013 2014
Total nitrogen
Total phosphorus
Total organic carbon

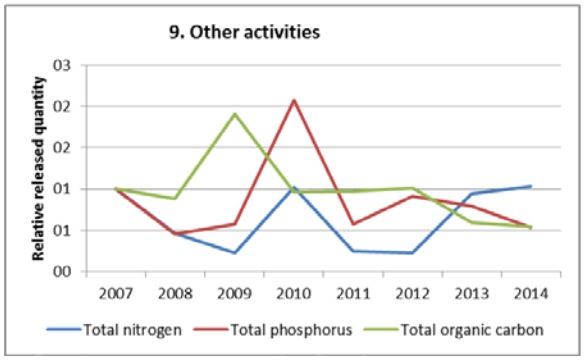

6. Paper and wood production and processing
Relative released quantity
2007 2008 2009 2010 2011 2012 2013 2014
Arsenic
Copper
Lead
Nickel
Zinc

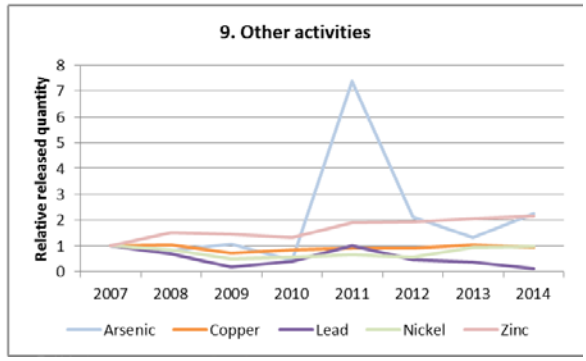

7. Intensive livestock production and aquaculture
Relative released quantity
2007 2008 2009 2010 2011 2012 2013 2014
Total nitrogen
Total phosphorus
Total organic carbon


7. Intensive livestock production and aquaculture
Relative released quantity
2007 2008 2009 2010 2011 2012 2013 2014
Arsenic
Copper
Lead
Nickel
Zinc


8. Animal and vegetable products from the food and beverage sector
Relative released quantity
2007 2008 2009 2010 2011 2012 2013 2014
Total nitrogen
Total phosphorus
Total organic carbon


8. Animal and vegetable products from the food and beverage sector
Relative released quantity
2007 2008 2009 2010 2011 2012 2013 2014
Arsenic
Copper
Lead
Nickel
Zinc


9. Other activities
Relative released quantity
2007 2008 2009 2010 2011 2012 2013 2014
Total nitrogen
Total phosphorus
Total organic carbon


9. Other activities
Relative released quantity
2007 2008 2009 2010 2011 2012 2013 2014
Arsenic
Copper
Lead
Nickel
Zinc

It can be expected these large fluctuations are related to the high contribution of releases of individual facilities to the total releases per sector (see Table 4.6) and the fluctuations in the releases of these facilities.

In Figure 4.9 and Figure 4.10 the relative trend is shown for the 8 pollutants from paragraph 4.1 for 2007, 2010 and 2014, indexed on 2007.

Figure 4.9 Relative trend of releases to surface water for total nitrogen, total phosphorus and TOC per E-PRTR activity sector, excluding activity 5.f: UWWTPs in 2007, 2010 and 2014 (2007 = 1)

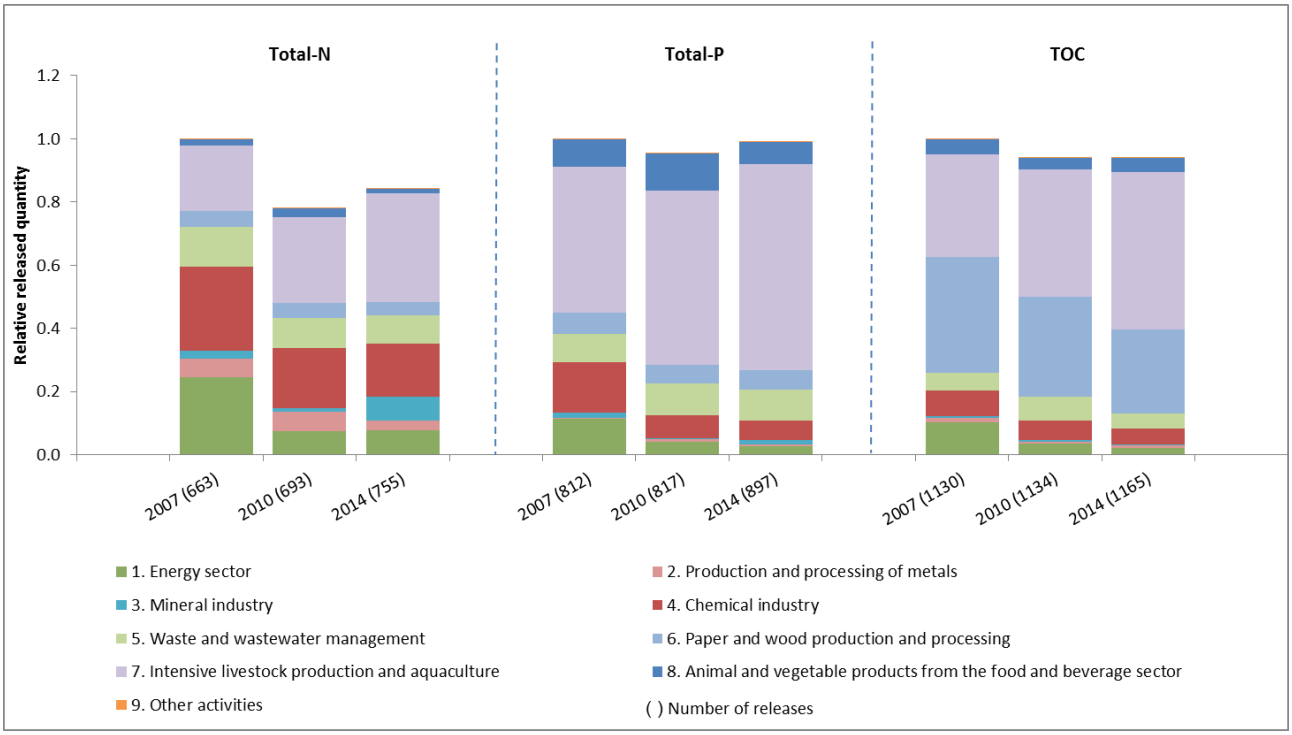


Figure 4.9 shows a decrease for the nutrients in the sectors energy and chemical industry, while the intensive aquaculture shows an increase. Within this assessment, also the releases per sector per country have been analysed. When relevant, it is referred to individual country releases.

Total nitrogen shows a decrease of about 20%. The *Energy sector* and the *Chemical industry* sector are the responsible activities for this decrease. Most countries show a decrease for both sectors. France has the biggest decrease for the *Energy sector* caused by only one facility. France reported 77% of the nitrogen releases in the *Energy sector* in 2007 and only 17% in 2014. For the sector *Chemical industry,* the UK shows the biggest decrease. In 2007 UK chemical facilities reported 22% of the total nitrogen releases, in 2014 Poland and the UK reported both 17% of the chemical releases.

The overall trend for total phosphorus is stable. There is a shift in the contribution of the different activities between 2007 and 2014. The sector *Intensive livestock production and aquaculture* is increasing, because of the higher releases from Norway in the Intensive aquaculture activity. The *Energy sector* and the *Chemical industry* are declining, caused by several countries. Like total nitrogen, half of the reduction of the released quantity in the *Energy sector* is from the same facility in France. The decrease of the release in the *Chemical industry* sector are caused by the UK and Italy, together reporting 56% of the chemical sector releases in 2007, in 2014 only 23% is left.

TOC shows the same trend for the sector *Intensive livestock production and aquaculture* as total nitrogen and total phosphorus. This is also mostly reported by Norway. The releases of the *Energy sector* are declining; half of the reduction is reported by France and Malta.
The metals are presented in Figure 4.10. Arsenic shows a fluctuating trend, mainly caused by the *Energy sector.* Serbia had reported for the first time in 2010. Their releases from the *Energy sector* are high compared with the other reporting countries; a decrease between 2010 and 2014 is mainly seen in the releases reported by Serbia (Paragraph 4.3.2).

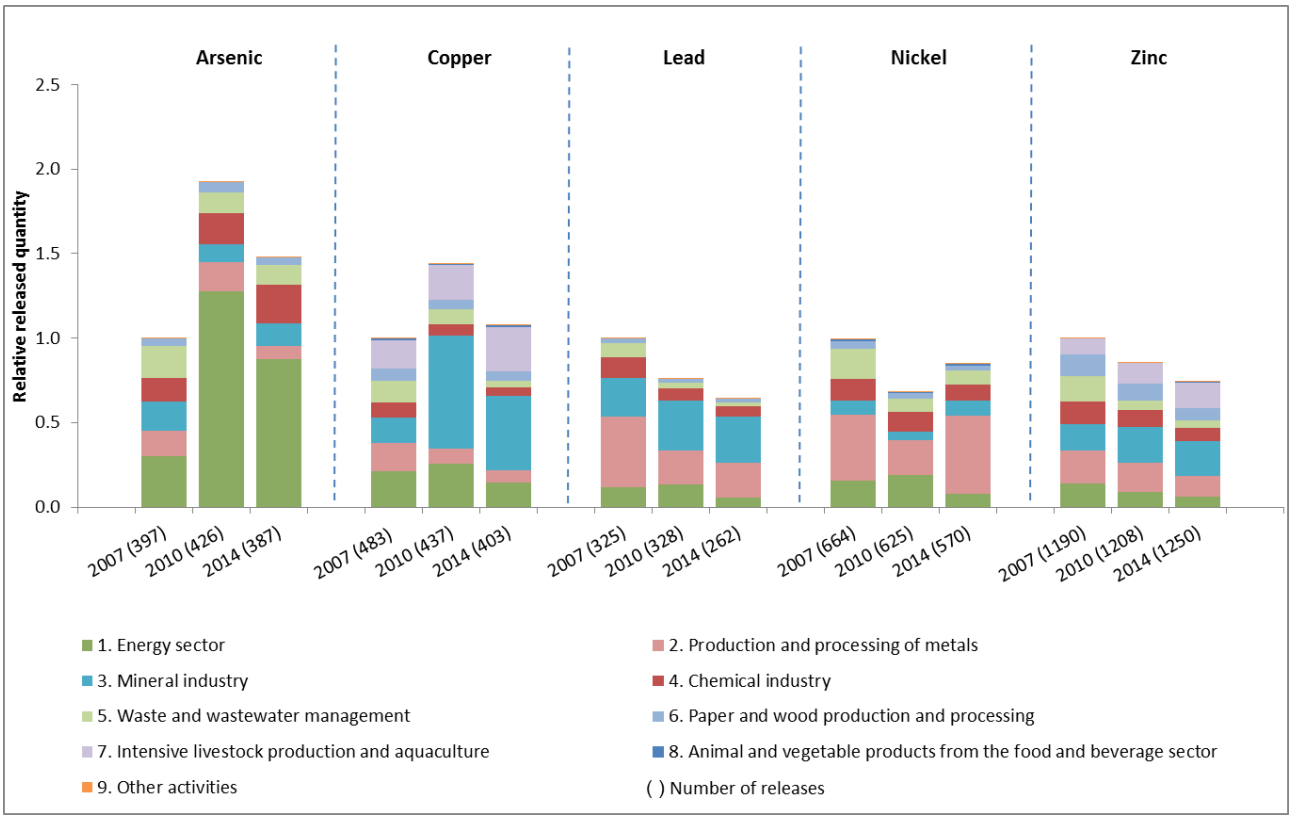
The same can be seen for copper by the sector *Mineral industry*. Fluctuations are especially seen in the reported releases of Serbia and Romania. Serbia reported for the first time in E-PRTR in 2010, so no releases by Serbia are available for 2007. The decrease of the *Mineral industry* between 2010 and 2014 is due to Romania. For the *Energy sector*, Serbia is reporting a peak in 2010. The UK is reporting an increasing trend in the sector *Intensive livestock production and aquaculture* between 2007 and 2014. Most other sectors show a decrease for copper.

For lead the trend is declining, the greatest decrease is caused by the sector *Production and processing of metals*. One facility in Bulgaria reported very high loads in 2007 (24% of the total E-PRTR release) but did not report similar peaks in later years.

Nickel shows an opposite fluctuating trend compared with the other metals for the sector *Production and processing of metals*. The high load in 2014 is due to a high release in Finland, this load is also marked as accidental release in E-PRTR. Italy and Serbia are responsible for the higher releases in 2010 for the *Energy sector*.

Zinc finally, shows an overall decrease in which the contributions of the different activities are rather stable.

Figure 4.10 Relative trend of releases to surface water for the 5 metals: arsenic, copper, lead, nickel and zinc per E-PRTR activity sector, excluding activity 5.f: UWWTPs in 2007, 2010 and 2014 (2007 = 1)

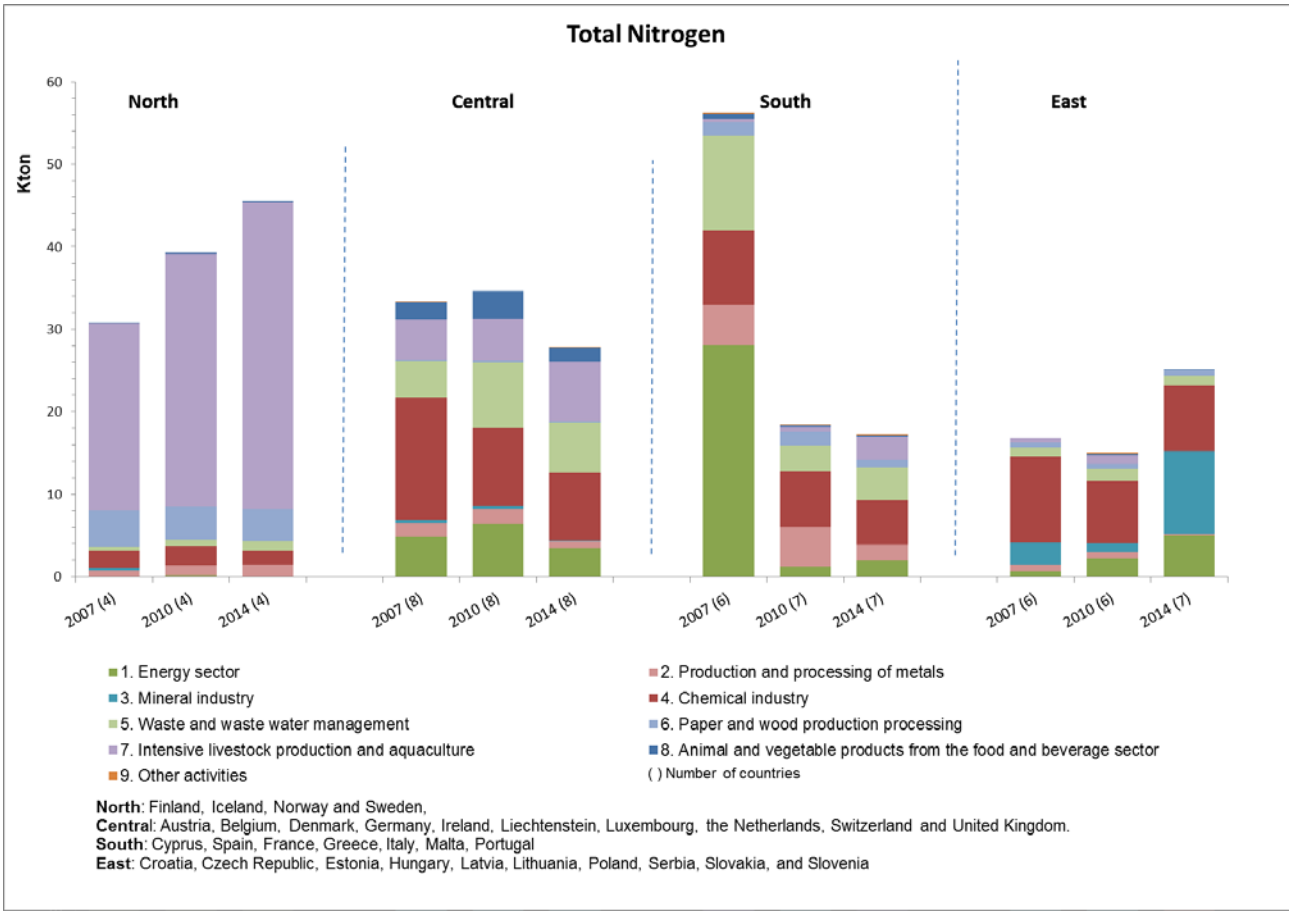


4.4 Regional differences within the EU

In this paragraph the regional differences within Europe are presented in graphs. Europe is divided into four regions: Northern, Central, Eastern and South-Eastern Europe. In Figure 4.11 to Figure 4.14 the activity sectors per pollutant per region are presented for the years 2007, 2010 and 2014 for four of the most reported pollutants.

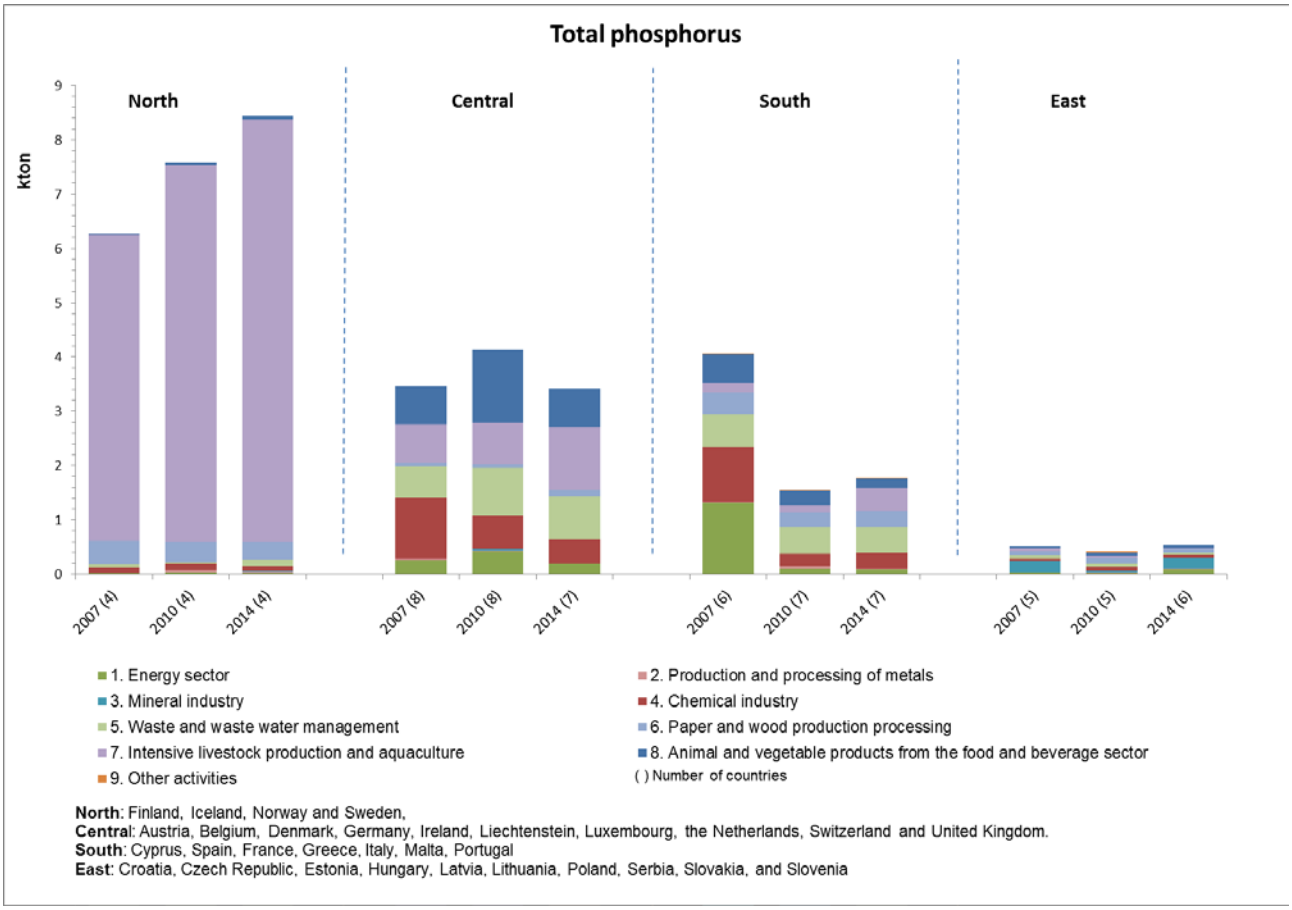
Total nitrogen (Figure 4.11) shows big differences between the different European regions. In the north, the *Intensive aquaculture* in Norway is the most important activity and increases between 2007 and 2014. Central and South Europe are slightly comparable and show a decrease. The releases in Central Europe are higher, but the activity sectors almost have the same distribution. The *Chemical industry* and the sector *Waste and waste management* (excluding the UWWTPs) are the most important activity sectors in both regions. The most important activity sectors in East Europe are the *Mineral industry* and the *Chemical industry*. The *Mineral industry* shows a big increase between 2010 and 2014.

Figure 4.11 Total nitrogen releases to surface water per activity sector for four European regions in 2007, 2010 and 2014 (kilo tonnes/year)



For total phosphorus there are huge differences between the releases in North Europe and the other regions, Figure 4.12. In North Europe 90% of the releases are caused by the activity *Intensive aquaculture* in Norway. Like nitrogen, the activity sectors in Central and South Europe almost have the same distribution. The releases are higher in central Europe. Both regions show a decrease between 2007 and 2014. East Europe has minor releases, but shows an increase between 2007 and 2014. The *Mineral industry* is the most important activity sector.

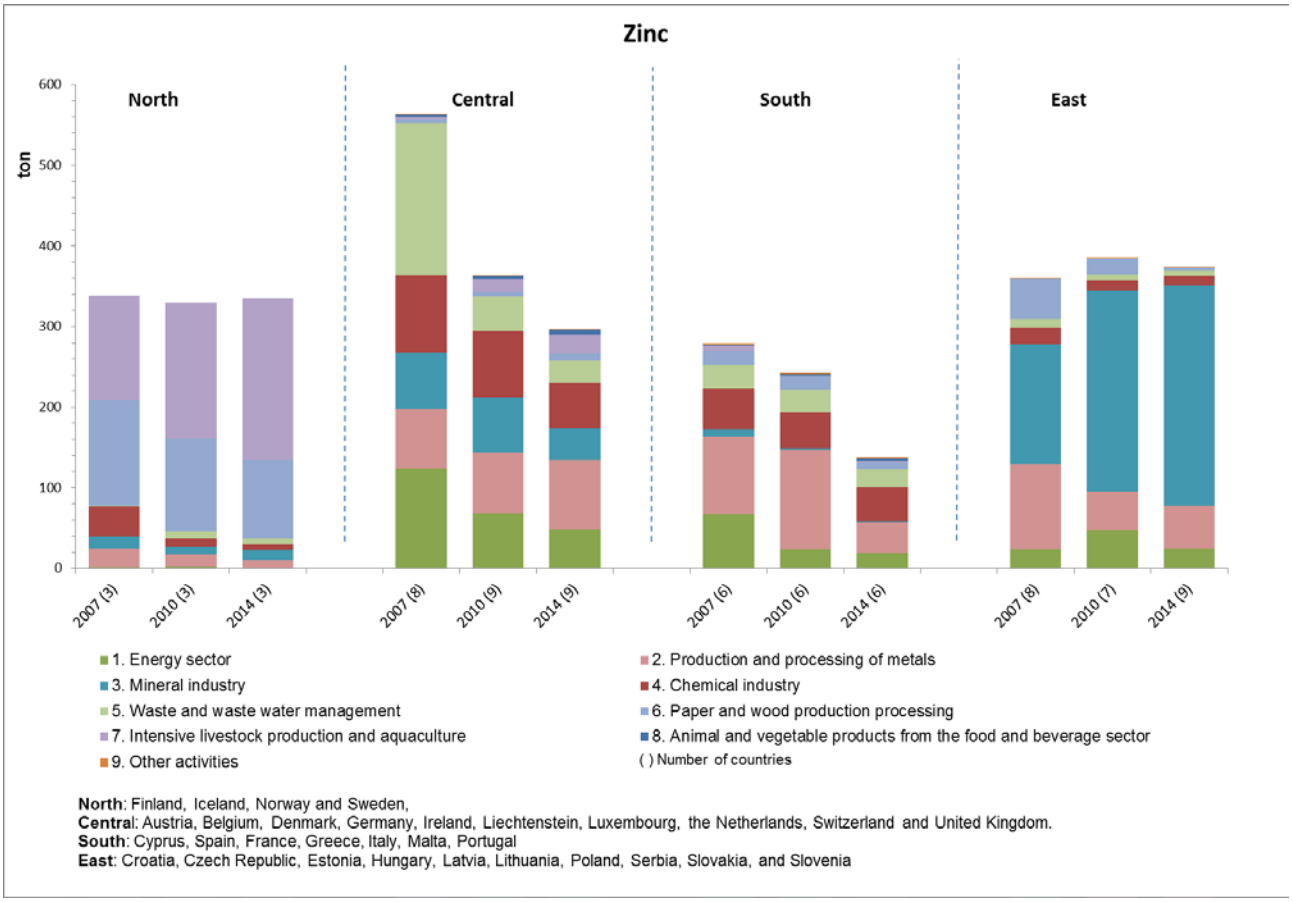
Figure 4.12 Total phosphorus releases to surface water per activity sector for four European regions in 2007, 2010 and 2014 (kilo tonnes/year)



The four regions in Europe (Figure 4.11) also differ for zinc (Figure 4.13). In the Northern part of Europe, the *Intensive aquaculture* in Norway and the industrial plants in activity *Industrial plants for the production of pulp from timber or similar fibrous materials* in Sweden are the most important activities. There is a slight decrease between 2007 and 2014. Like the nutrients the activity sectors in Central and South Europe almost have the same distribution, the releases in central Europe are much higher. Both regions show a decrease between 2007 and 2014, where the most important activity sectors are the *Chemical industry* and the *Production and processing of metals*. In Eastern Europe a slight increase is shown. The *Mineral industry* in Eastern Europe has the highest releases and increases since 2007. In 2014 mining was the biggest activity sector for zinc with 66%. Within this sector, Poland has with 71% of total zinc releases in the mining sector the highest release in the activity *Underground mining and related operations*, while Serbia has the highest release (26%) in the activity *Opencast mining and quarrying*.

Figure 4.14 shows an enormous increase of releases to surface water for copper in the Eastern part of Europe. The increase is caused by the Mineral industry. Poland and Serbia have the biggest releases to surface water (58% and 31% of all copper releases) in the activity *Opencast mining and quarrying*. While the *Intensive aquaculture* activity in Norway is important for nutrients and zinc, it is not for copper. In Central Europe the *Intensive aquaculture* in the UK is just as important for copper. Whereas the other activity sectors decrease in Central Europe since 2007, aquaculture increases. In North Europe the most important source is the *Paper and wood production and processing*. A high decrease can be seen in South Europe since 2007, with the *Production and processing of metals* in France and Italy and the *Energy sector* in Spain and France as the most important activity sectors.

Figure 4.13 Zinc releases to surface water per activity sector for four European regions in 2007, 2010 and 2014 (ton/year)



For the other four most reported substances not presented in the figures, a short description of the results is provided.

Nickel has the highest releases in the southern part of Europe. The *Production and processing of metals* is responsible for half of the releases. The *Paper and wood production and processing sector* is important in North Europe, the *Mineral industry* in Eastern Europe and in Central Europe the *Chemical industry*.

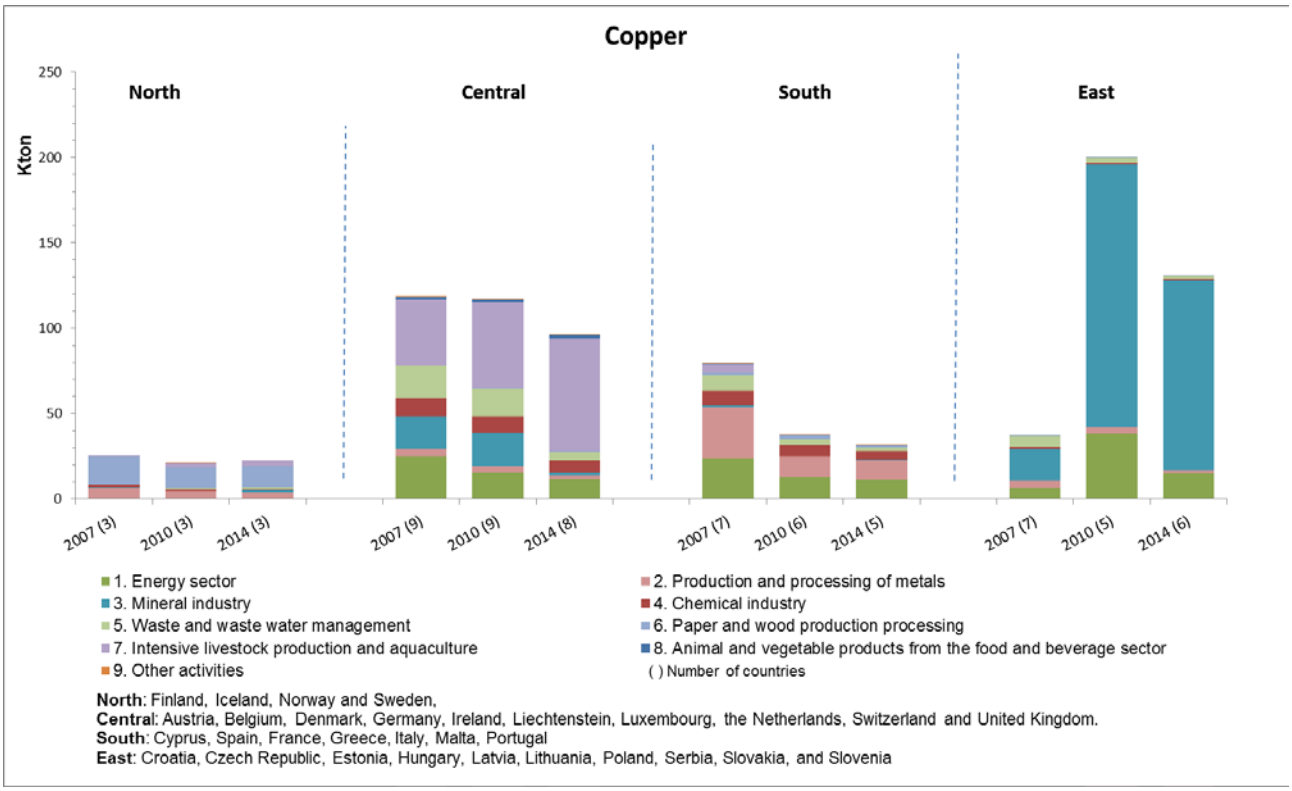
The *Energy sector* is the most important sector for arsenic in Central, South and East Europe. The releases in the different parts of Europe differ. They are by far the highest in Eastern Europe with 63% of the arsenic releases in the *Energy sector*, followed by South Europe with 28% and Central Europe with 9%.

For lead, almost 50% of the releases come from Eastern Europe. In that part of Europe, it is the *Mineral industry* which is responsible for the lead releases. The releases in Central and Southern Europe are much lower, whereas the *Production and processing of metals* is the most important sector. The releases in the North of Europe are minor in comparison with Eastern Europe.

Finally TOC, the Northern part of Europe is responsible for 64% of all TOC releases in 2014. The most important sector is the *Intensive aquaculture* in Norway, followed by the *Paper and wood production and processing* in Northern Europe. The trend for aquaculture is increasing in Northern Europe. In Central Europe aquaculture has TOC releases as well, but they are less important in comparison with Norway. In the rest of Europe The *Paper and wood production and processing* and the *Chemical industry* are important.

It can be concluded that large differences can be seen in the reported releases to water between the four distinguished European regions, not only in apportionment of the different sectors, but also in the trends.

Figure 4.14 Copper releases to surface water per activity sector for four European regions in 2007, 2010 and 2014 (ton/year)



4.5 Comparison WISE-SoE Emissions and E-PRTR

E-PRTR and WISE-SoE Emissions (SoE) both contain UWWTPs and industrial discharges; hence in theory the comparison could be prepared for both parts of emissions. As for the UWWTD and E-PRTR, urban discharges could be focused on category U24 only (equal or above 100.000 p.e.). Industrial discharges could be compared as industrial waste water treated (I3), industrial waste water untreated (I4) or industrial waste water total (1) with E-PRTR industrial facilities. A detailed analysis of the differences between E-PRTR and WISE-SoE Emissions data has been carried out in the ETC-report Prchalova et al. (2014) and will not be repeated here. Comparison of E-PRTR industrial emissions makes no sense now, because these emissions are aggregated and added to WISE-SoE Emissions by the ETC/ICM.

Differences between the reporting for WISE-SoE Emissions and E-PRTR that prevent a comparison of the data on a detailed level:

- E-PRTR contains only loads for E-PRTR sectors above threshold values, while WISE-SoE Emissions might contain E-PRTR and non-E-PRTR loads;
- There are 9 different industrial activity sectors in E-PRTR, with different activities per sector, in WISE-SoE Emissions just two: Industrial loads and UWWTP loads (4 categories);
- In WISE-SoE Emissions, different aggregations are possible to report, like total point sources and total industrial treated. In E-PRTR reporting at facility level is required;

- In WISE-SoE Emissions, the reporting is for inland waters (River Basin District level). In E-PRTR, the reporting is for all releases to water, including the coastal and transitional waters. The geographical coordinates have to be reported per facility.

Up to 2015, only 15 of the 31 Member Countries who report to WISE-SoE Emissions reported industrial releases.

4.6 Conclusions

The following conclusions can be drawn:

- About 1/3 of the number of release reports in E-PRTR refers to off-site transfers in water. Since it is not reported to which facility these releases are transferred to, no relation can be made with the final loads of the pollutants ending up in the surface water.
- Accidental releases are only a very small part of the total reported releases, both for the number of release reports and the amount of reported releases.
- The trend in number of release reports is rather stable over the period 2007–2014. Also the trends in reporting per country, per pollutant and per sector are quite stable, with the exception of an increase of the number of release reports of nutrients and zinc in the activity intensive aquaculture in Norway.
- A high percentage of the release reports relate to only a small set of pollutants. Most reported releases (74%) are from 8 pollutants: total nitrogen, total phosphorus, total organic carbon, arsenic, copper, lead, nickel and zinc. The other 26% of the release reports refer to the other 90 reported E-PRTR pollutants.
- A relatively large amount of pollutants is released by one or two sectors. Where the sectors *Intensive aquaculture*, *Paper and wood production and processing* and *Chemical industry* are leading for the nutrients, the *Energy sector*, *Production and processing of metals* and the *Mineral industry* are important for the 5 metals.
- It is remarkable that for all years a small percentage of the facilities is responsible for a large percentage of the releases of the 8 most reported pollutants. For three pollutants (arsenic, lead and nickel) more than half of the total EU wide release to surface water is reported by the top 10 facilities. Releases of individual facilities can cover up to 37% (lead and nickel in 2014) of the EU reported release for specific years.
- Large differences can be seen in the average release per facility per year for the different sectors. In particular, the sector *Mineral Industry* shows high releases of heavy metals per facility, as can be expected. A high number of reporting facilities in the sector *Intensive livestock production and aquaculture* (average of 600 per year) result in a high source apportionment of this sector for nutrients and zinc.
- Analysing the trends in E-PRTR reported data, it appears to be impossible to distinguish between a “real increase” of releases to water and one that owes to an increase in reporting as a result of greater knowledge or monitoring efforts. It is also possible that an increase in reported release is the result of a decrease of the performance of the waste water treatment of a facility. This question cannot be answered within this report because the background data is not available at an EU-wide scale.
- The trends in the period 2007–2014 of the releases to water of the 8 most reported pollutants have been shown to be stable, at least for the last 5 years, for total nitrogen, total phosphorus and TOC, are declining for lead, nickel and zinc (reduction of 15–40% in 2014 compared to 2007) and show large fluctuations for copper and arsenic.
- For 46 other pollutants the releases to water in 2007 and 2014 were compared, with 75% showing a decrease since 2007, 25% showing an increase. For most pollutants with an increasing

trend a very low number of releases is reported. Among the increasing pollutants are priority (hazardous) substances of the WFD.

- New reporting countries can have big influences in the E-PRTR trends. Serbia is a new added country to E-PRTR since 2010. Very high releases of a few facilities in Serbia influence the total trend for arsenic and copper in the period 2010–2014.
- The trends of the releases to water of the 8 most reported pollutants for the 9 E-PRTR sectors show a declining trend for most pollutants for most of the sectors (1, 2, 4, 5, 6, 8), although large differences between pollutants within one sector may exist and large fluctuations for a lot of pollutants in time do occur. An increasing trend, can be seen in sector *Mineral industry* (at least for a number of pollutants) and for all pollutants in sector *Intensive livestock production and aquaculture*. The trend in sector *Other activities* varies enormously between pollutants.
- Large regional differences exist between the releases to water of the four regions distinguished across Europe. Central and South Europe show similar releases per sector. Northern and Eastern Europe are totally different. While the *Intensive aquaculture* and *Paper and wood production and processing* are the most important sectors in Northern Europe, the *Mineral industry* and the *Energy sector* are the main sectors in Eastern Europe. It can be concluded that large differences can be seen in the reported releases to water between the four distinguished European regions, not only in apportionment of the different sectors, but also in the trends.
- Although the E-PRTR and WISE-SoE Emissions reporting both cover releases from industry, a detailed comparison cannot be made due to differences in thresholds, definitions of categories of pathways and the coverage of reporting in reported years and countries.

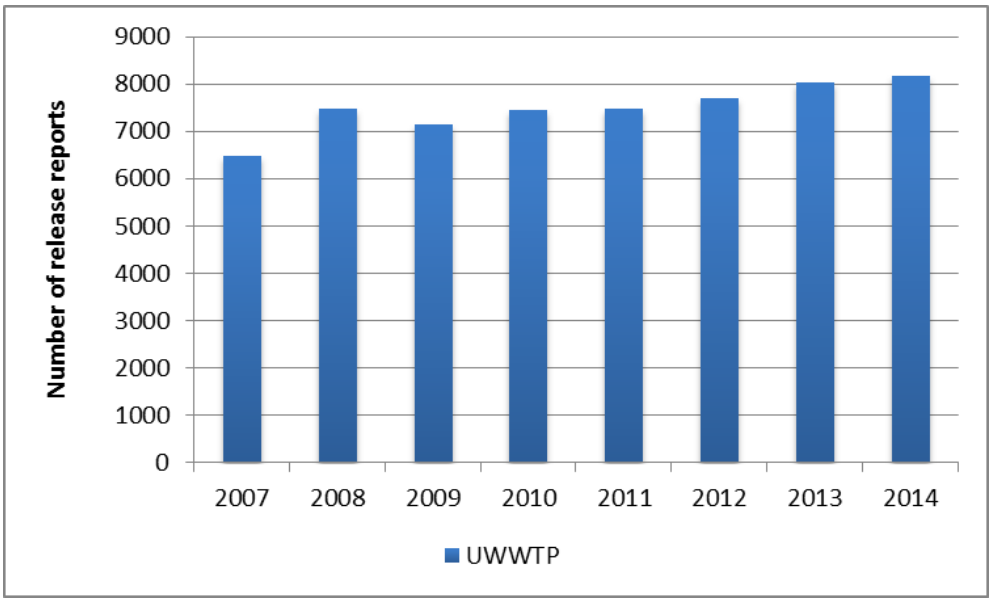
5 Emissions from Urban Waste Water Treatment Plants

Urban waste-water treatment plants (UWWTP) bigger than 100 000 p.e. are reported to E-PRTR in *activity 5.f: Urban waste water treatment plants*. For these UWWTPs this chapter describes the most reported pollutants and the corresponding sources are identified. The total trend and the trend in four different regions in Europe is described and a comparison between different datasets is made. Finally, conclusions about the UWWTP releases are described.

5.1 Pollutants

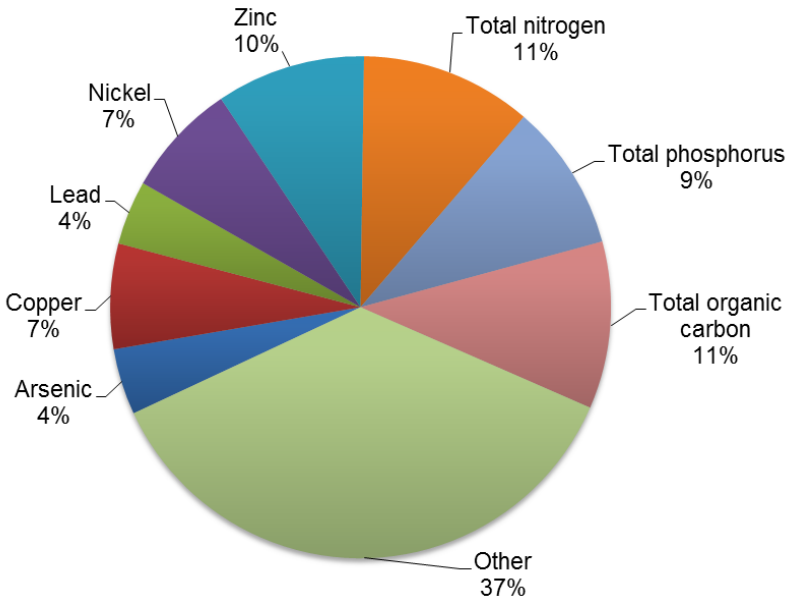
In E-PRTR the number of release reports from UWWTPs represents half of the total number of release reports to surface water. The other half of the reports refer to industrial facilities. Figure 5.1 shows the annual number of pollutants release reports in E-PRTR for UWWTPs. The number of reports slightly increases between 2007 and 2014.

Figure 5.1 Number of pollutant release reports to water per year in E-PRTR for activity 5.f: UWWTPs (2007–2014)



The most frequently reported pollutants in the E-PRTR database between 2007 and 2014 are shown in Figure 5.2. Like the most frequently reported pollutants of the industrial facilities, total organic carbon, zinc, total phosphorus and total nitrogen are the most reported pollutants in E-PRTR, followed by the heavy metals zinc, nickel, copper, arsenic and lead. The 37% other E-PRTR pollutants are included in Annex 2. The table in the annex shows the percentage of the number of release reports per pollutant of the total number of release reports per year. Heavy metals and inorganic substances are reported most frequently. Chlorinated substances, pesticides and other organic substances are the least reported pollutants. No large changes in the percentages of the number of release reports per pollutant are seen in the period 2007–2014.

Figure 5.2 **The pollutants with the largest number of release reports in E-PRTR for activity 5.f: UWWTPs (sum period 2007–2014)**



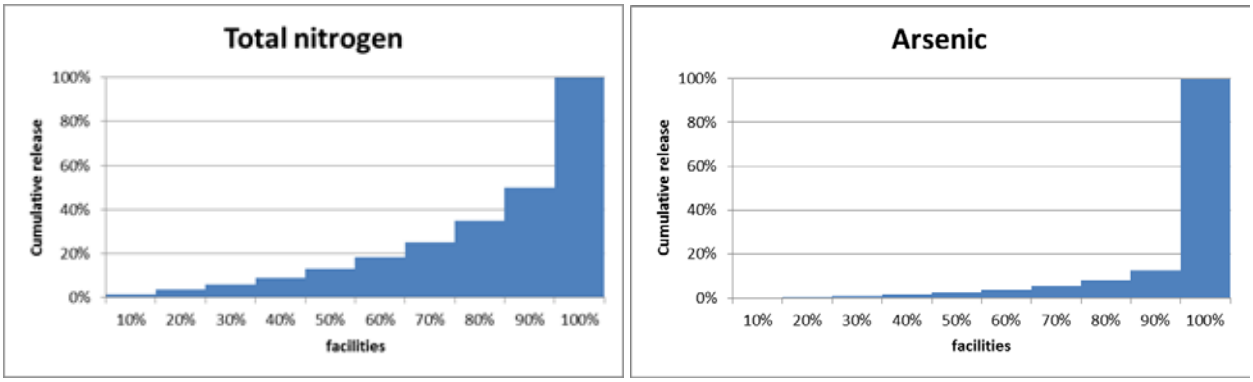
A small percentage of the facilities are responsible for a large amount of the releases for the 8 most reported pollutants (Table 5.1). Almost 80% of all arsenic releases of the UWWTPs are caused by 5 of the 340 reporting facilities in 2014. For lead it is more than 50% in 2007 and 2009.

Table 5.1 **Percentage of the total reported release in E-PRTR covered by the five UWWTPs with the highest releases for activity 5.f: UWWTPs (2007–2014).**

Pollutant	2007	2008	2009	2010	2011	2012	2013	2014
Total nitrogen	9%	13%	14%	13%	16%	11%	11%	11%
Total phosphorus	16%	15%	16%	18%	14%	14%	13%	12%
Total organic carbon	51%	15%	13%	14%	14%	13%	16%	14%
Arsenic	20%	35%	23%	21%	19%	27%	38%	75%
Copper	16%	12%	18%	21%	9%	12%	21%	17%
Lead	52%	27%	51%	25%	24%	28%	34%	36%
Nickel	40%	18%	26%	22%	27%	17%	24%	19%
Zinc	22%	20%	41%	32%	19%	22%	17%	22%
Red = > 50%, yellow betw een 25%-50%								

In Figure 5.3 the cumulative release is given for total nitrogen and arsenic. The facilities are ranked on the X-axis from low to high release. The figures indicate that a small percentage of the facilities produces the highest releases to surface water. For total nitrogen in 2014 the 10% largest facilities cause more than 50% of the UWWTP releases. For arsenic this percentage is even higher: 87%.

Figure 5.3 Cumulative releases for total nitrogen (kilo tonnes/year) and arsenic (ton/year) in E-PRTR for activity 5.f: UWWTPs in 2014



5.2 Sources

Emissions from urban areas include a mix of sources – mainly different waste waters: domestic waste water, industrial waste water discharged to the municipal sewage system – but also parts of diffuse sources: not connected households with or without treatment, storm water overflows and run-off from urban surfaces.

While the volume of waste water in municipal sewage systems and concentrations of prevalent pollutants are regularly measured and reported, the proportion of industrial waste water and/or storm overflows in the system is rarely known at EU level.

The off-site transfers to water releases, also reported in E-PRTR (see 4.1) are often transferred to an UWWTP. Because it is not reported to which UWWTP the waste water is transferred, no relation can be made with UWWTPs reported in E-PRTR.

5.3 Trends

The trends for the pollutants reported most often for the years 2007–2014 are described in this paragraph.

5.3.1 Trends of the number of reported UWWTPs

Table 5.2 shows the number of reported UWWTPs in E-PRTR per country from 2007–2014. The most frequently reported UWWTPs are from Germany, UK and Spain. The number of UWWTPs reported has increased since 2007. Most countries have reported since 2007 and the reporting of most countries is stable. Spain, Portugal, and Romania show an increase, no decrease is shown in the table. The total number of releases is increasing over the years.

The United Kingdom and Germany report the greatest number of UWWTPs over the years, followed by Italy, France, Spain, Poland and the Netherlands.

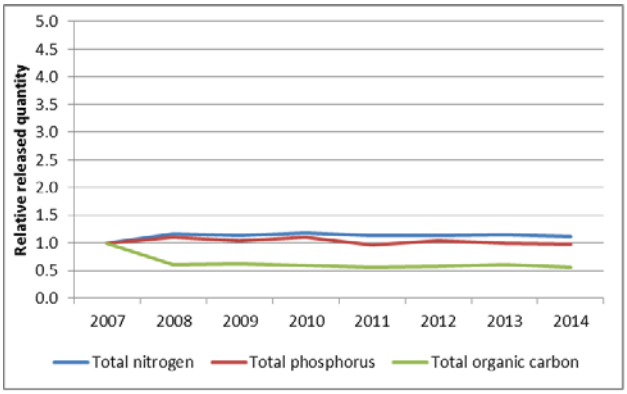
Table 5.2 Trends of the number of reported urban waste water treatment plants in E-PRTR for activity 5.f: UWWTPs (2007–2014)

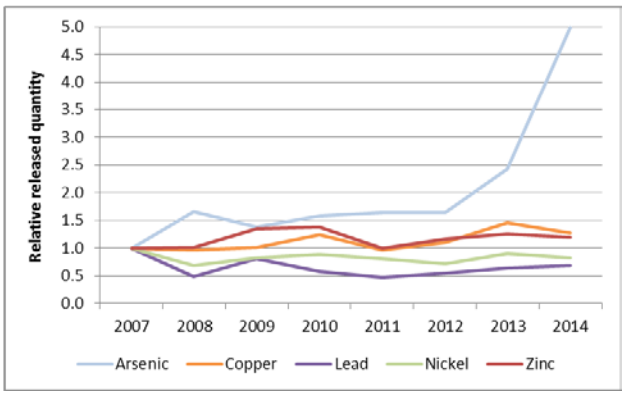
Country	2007	2008	2009	2010	2011	2012	2013	2014
Austria	26	25	29	27	25	27	27	20
Belgium	11	18	19	17	16	16	17	16
Bulgaria	7	13	14	14	11	12	12	13
Cyprus	1	0	1	1	1	2	2	2
Czech Republic	18	17	25	20	18	18	18	18
Denmark	23	36	27	16	18	18	17	15
Estonia	3	4	5	4	5	5	5	5
Finland	17	17	18	17	17	17	17	17
France	85	105	109	110	112	113	115	120
Germany	205	208	210	205	207	209	207	206
Greece	7	8	3	3	3	6	6	6
Hungary	24	22	20	22	20	20	20	20
Iceland	0	2	0	2	2	2	2	2
Ireland	5	5	6	7	7	8	8	7
Italy	85	88	91	101	96	93	98	99
Latvia	3	1	1	1	1	1	1	1
Lithuania	5	5	7	7	6	6	6	4
Luxembourg	1	2	2	2	2	2	2	2
Malta	0	0	0	0	1	1	1	1
Netherlands	34	42	49	50	51	50	50	53
Norway	7	7	7	6	6	6	7	8
Poland	66	71	74	74	73	75	76	72
Portugal	19	21	24	34	34	37	35	35
Romania	20	21	21	22	23	26	28	27
Serbia	0	0	0	0	1	2	5	5
Slovakia	5	5	8	8	8	7	7	7
Slovenia	4	5	5	5	5	3	3	3
Spain	73	80	98	105	109	119	123	140
Sweden	14	14	15	17	17	17	17	17
Switzerland	13	15	19	19	20	20	20	20
United Kingdom	137	150	145	142	141	156	143	144
Total	918	1007	1052	1058	1056	1094	1095	1105

5.3.2 Trends of released loads per pollutant

The trends of the reported loads for the 8 most reported pollutants is shown in Figure 5.4. For the nutrients and total organic carbon, the trend has been stable since 2008. On the other hand, the number of releases (Table 5.3) shows a slight increase. It can therefore be concluded the average reported release to water per facility is decreasing over time.

Figure 5.4 Trends of relative released loads to water (2007 =1) of nutrients, TOC and metals in E-PRTR for activity 5.f: UWWTPs (2007–2014)





Arsenic shows an enormous increase between 2012 and 2014. This is caused by two reported UWWTPs in Italy. In 2014 only one UWWTP in Italy is responsible for almost 70% of all UWWTP arsenic releases in E-PRTR. For the metals copper and zinc a slight increase is shown. Copper has higher releases in the UK in 2010 and in Italy and Serbia in 2013. These higher releases cause the peaks in Figure 5.4 for the concerning years. For zinc the higher peaks can be explained by higher releases in France in 2009, in Bulgaria in 2010 and in the UK and Italy in 2013 and 2014. Remarkable for lead is the increasing trend in Italy from 2007 to 2013. Italy reports the highest lead releases in Europe.

In Annex 4 a more detailed overview is given in which the trends of the loads per country are presented for the 8 most reported pollutants. The extreme releases of lead, copper and zinc from Poland in 2007 and France in 2009, high TOC releases from Serbia in 2007, as well as the relative high releases of total nitrogen, total phosphorus and copper from the UK and the increasing trend of the heavy metal releases from Italy are easy to spot. Less easy is to find an explanation of these incidental peaks. Without a time consuming assessment per UWWTP and further consultation of the countries, it remains unclear whether these extreme reported releases are realistic or might be the result of monitoring or reporting mistakes or specific accidents in the UWWTP processes.

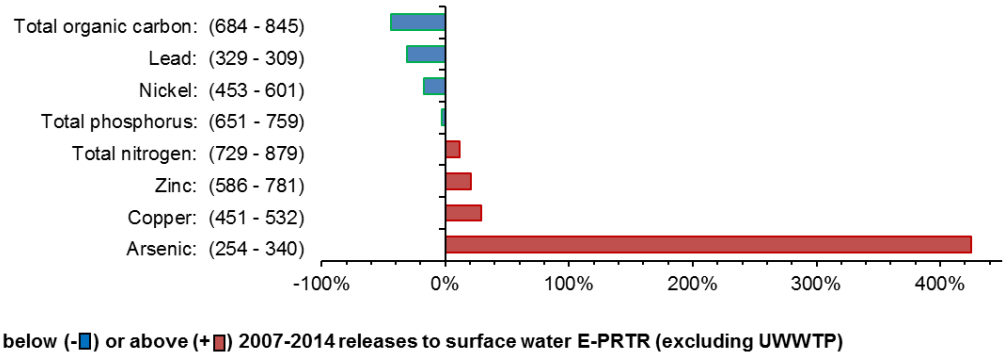
Table 5.3 Number of facilities per pollutant per year for the most reported pollutants for activity 5.f: UWWTPs (2007–2014)

PollutantName	2007	2008	2009	2010	2011	2012	2013	2014
Total nitrogen	729	811	824	866	835	871	892	879
Total phosphorus	651	715	715	734	704	722	739	759
Total organic carbon	684	779	785	814	815	853	876	845
Arsenic	254	314	313	328	327	341	342	340
Copper	451	494	493	513	519	535	542	532
Lead	329	333	297	296	301	286	313	309
Nickel	453	531	542	532	558	567	591	601
Zinc	586	700	728	712	727	760	771	781

5.3.3 Comparing 2007 and 2014

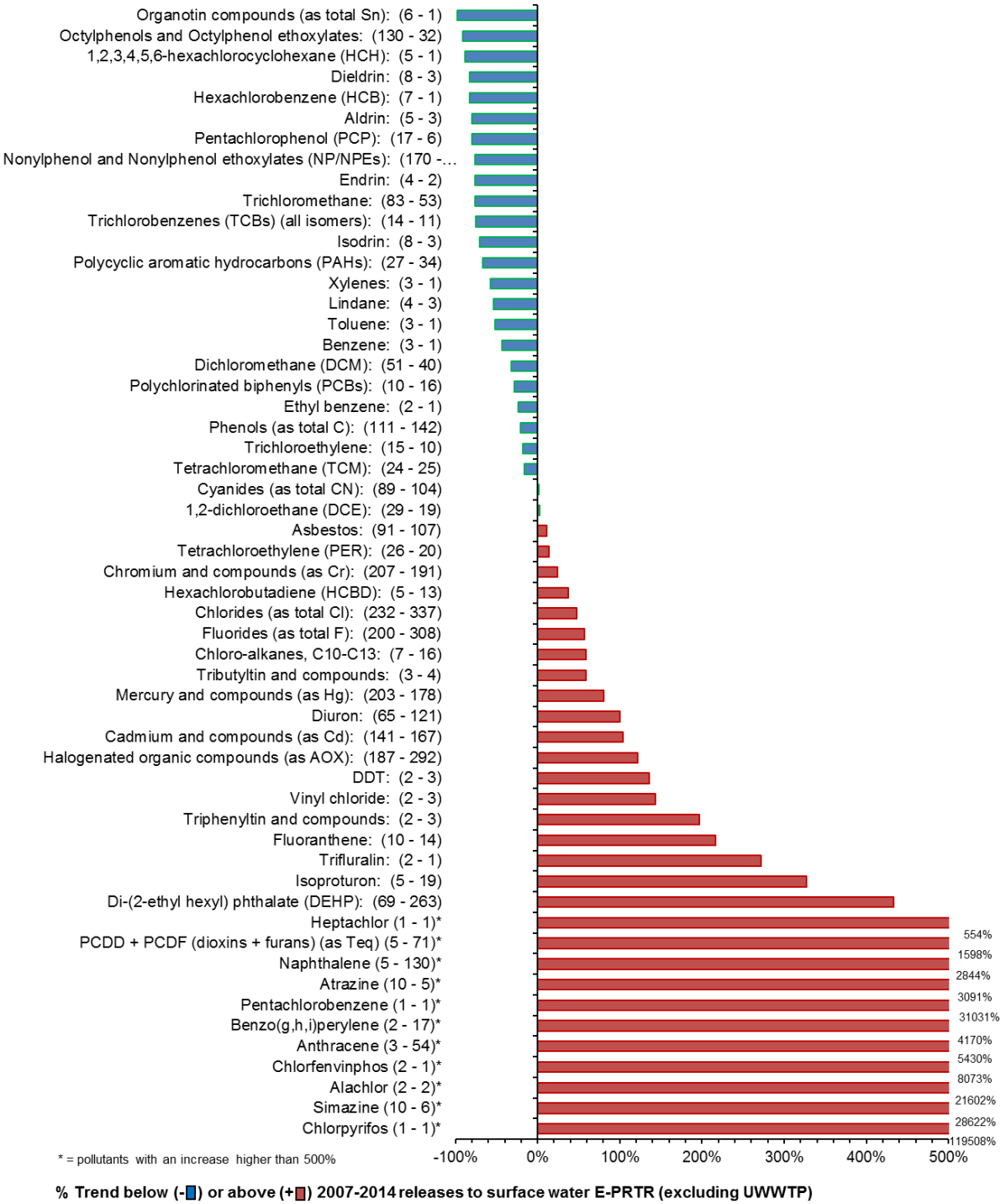
The absolute trends of reported loads of the 8 most reported pollutants between 2007 and 2014 are shown in Figure 5.5. The blue bars show the decrease, the red bars the increase. As showed already in Annex 4, arsenic has an enormous increase caused by one extreme release in Italy in 2014. The TOC reduction is the result of a large difference between the 2007 and 2008 releases. Since 2007 was the first reporting year for E-PRTR, this might be related to changes in reporting between 2007 and 2008.

Figure 5.5 Trend as % reduction (blue) or increase (red) of releases to surface water for the 8 most reported pollutants in 2014 compared to 2007 in E-PRTR for activity 5.f: UWWTPs. Between parentheses the number of releases, left: 2007, right: 2014



The trend for the other 55 pollutants is shown in Figure 5.6. Annex 5 shows the releases of all pollutants for all the years of the period 2007–2014. For 8 pollutants no trend was available because of missing releases in 2007 or 2014. More than half of the pollutants (30) show an increasing trend, among them are 17 priority substances of the Water Framework Directive.

Figure 5.6 Trend as % reduction (blue) or increase (red) of releases to surface water for the other pollutants in 2014 compared to 2007 in E-PRTR for activity 5.f: UWWTPs. Between parentheses the number of releases, left: 2007, right: 2014



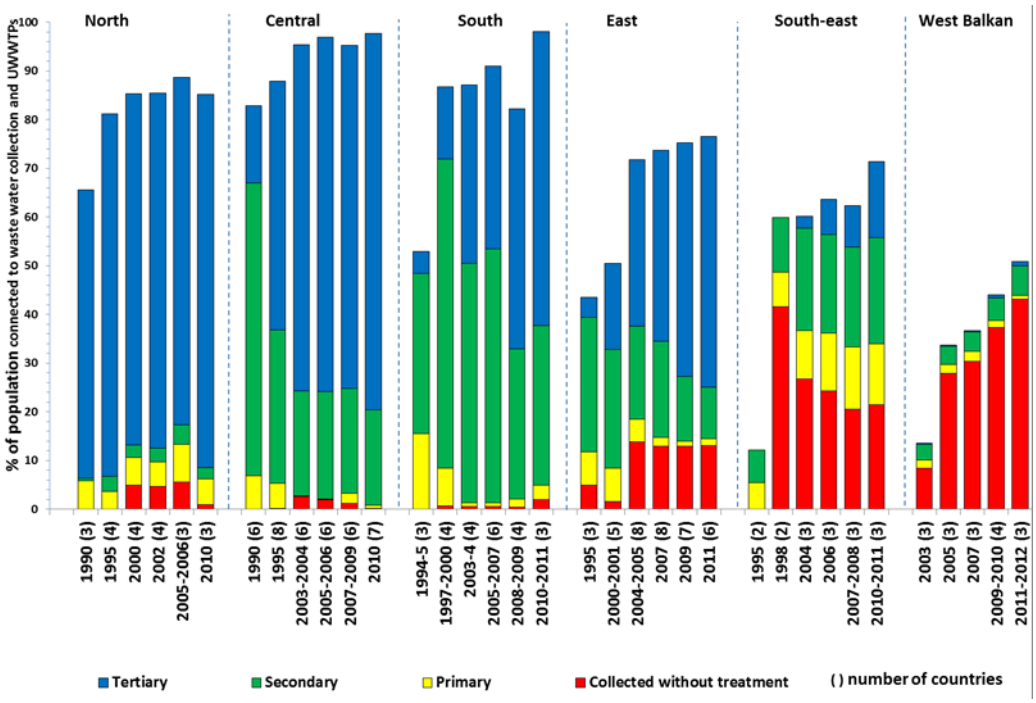
It cannot be concluded easily what causes the increase of releases of so many pollutants. In theory, it could be the result of a less successful treatment of the waste water.

This seems not to be expected and is further discussed in 5.4. Another possible explanation could be an increase of monitoring, resulting in a more realistic quantification and reporting of the releases for more pollutants. This could be the case for pollutants like naphthalene, AOX and dioxins. A third possibility is an overall increase of the number of households connected to a sewer system and a large UWWTP. This will also be discussed in the next paragraph.

5.4 Regional differences within the EU

During the last 15–25 years, in all parts of Europe the waste water treatment has improved. The percentage of the population connected to waste water treatment in Southern, South-Eastern and Eastern Europe has increased over the last ten years. Latest values of population connected to waste water treatment in the Southern countries are comparable to the values of Central and Northern countries, whereas the values of Eastern and South-Eastern Europe are still relatively low compared to Central and Northern Europe. Figure 5.7 shows a long trend of the % of the population connected to waste water collection and the level of waste water treatment for 6 EU-regions (EEA, 2015). We see both a steady increase of the % of waste water collected and the level of treatment (from primary to secondary to tertiary).

Figure 5.7 Changes in waste water treatment in regions of Europe between 1990 and 2012

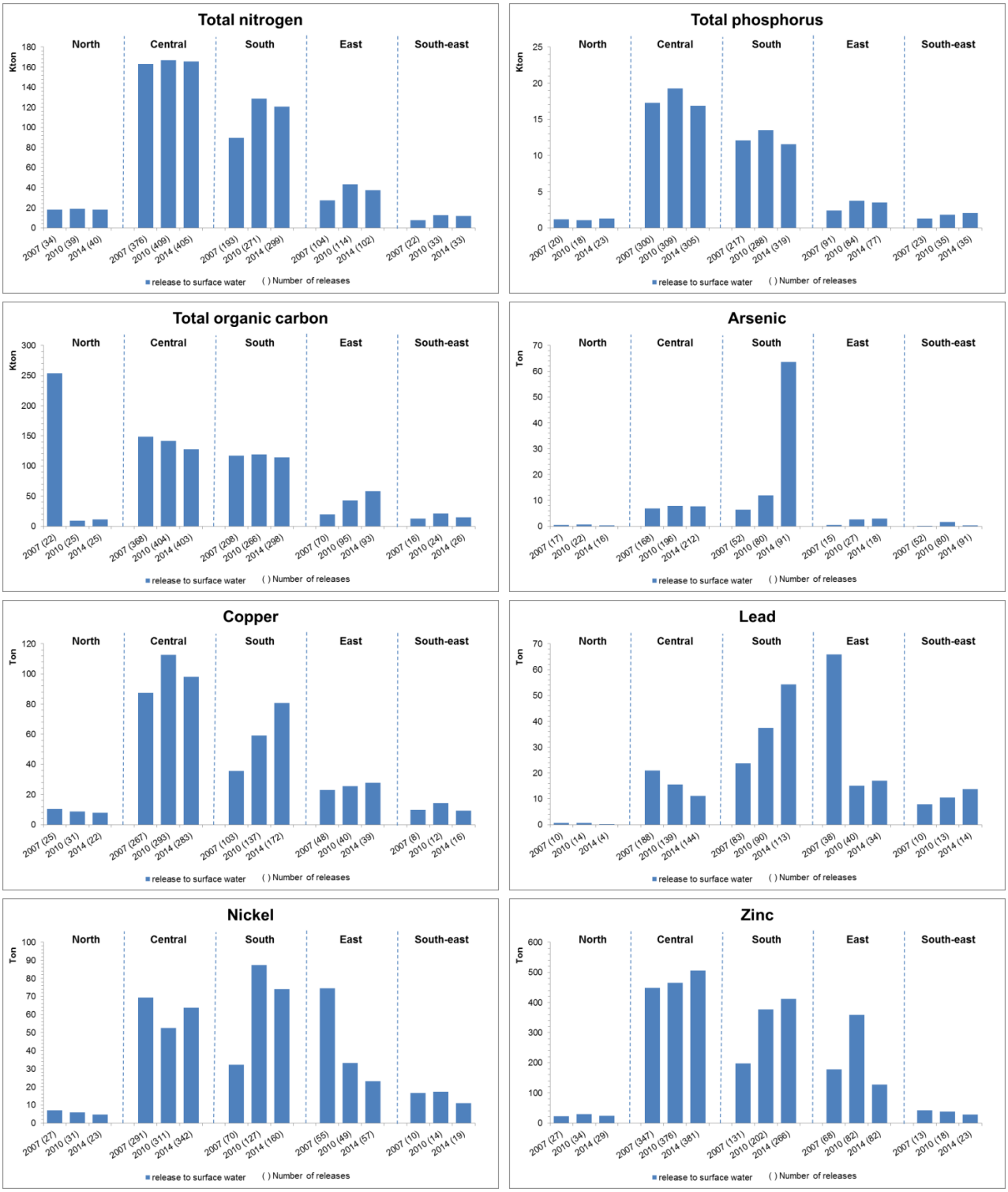


North: Norway, Sweden, Finland and Iceland;
Central: Austria, Denmark, United Kingdom, the Netherlands, Germany, Switzerland, Luxembourg and Ireland;
Southern: Cyprus, Greece, France, Malta, Spain and Portugal;
East: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia, Slovakia;
South East: Bulgaria, Romania and Turkey;
West Balkan: Albania, Bosnia and Herzegovina, Macedonia (FYR) and Serbia;
Only countries with data from (almost) all periods included the number of countries in parentheses.

Source: EEA, 2015

In E-PRTR (Figure 5.8) the highest releases to surface water of most pollutants are located in Central and South Europe, the result of a high population density, a high connection rate and a high level of treatment.

Figure 5.8 **Trend of releases of the most reported pollutants from UWWTPs in E-PRTR for five European regions in 2007, 2010 and 2014. Nutrients and Total organic carbon in kilo tonnes/year, metals in ton/year**



Central: Austria, Belgium, Denmark, Germany, Ireland, Liechtenstein, Luxembourg, Netherlands, Switzerland, United Kingdom
Eastern: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Serbia, Slovakia, Slovenia
North: Finland, Iceland, Norway, Sweden
South-East: Bulgaria, Romania
South: Cyprus, France, Greece, Italy, Malta, Portugal, Spain

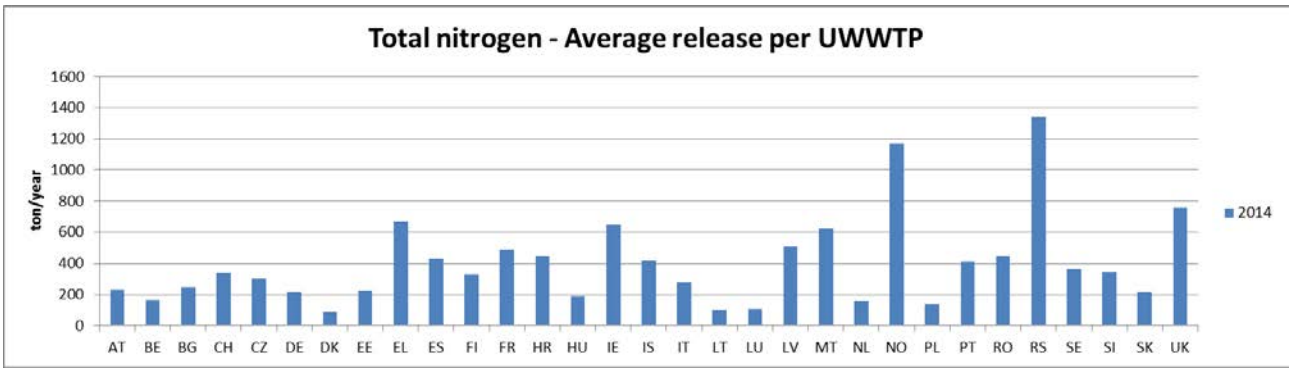
Relatively low releases can be seen in North Europe and will be the result of a low population density, combined with a high connection rate and a high level of treatment. In Eastern and South-eastern Europe a smaller percentage of the population is connected to waste water treatment plants. In combination with a relative low population density and a lower average treatment level of the UWWTPs, this results in rather low releases for most pollutants.

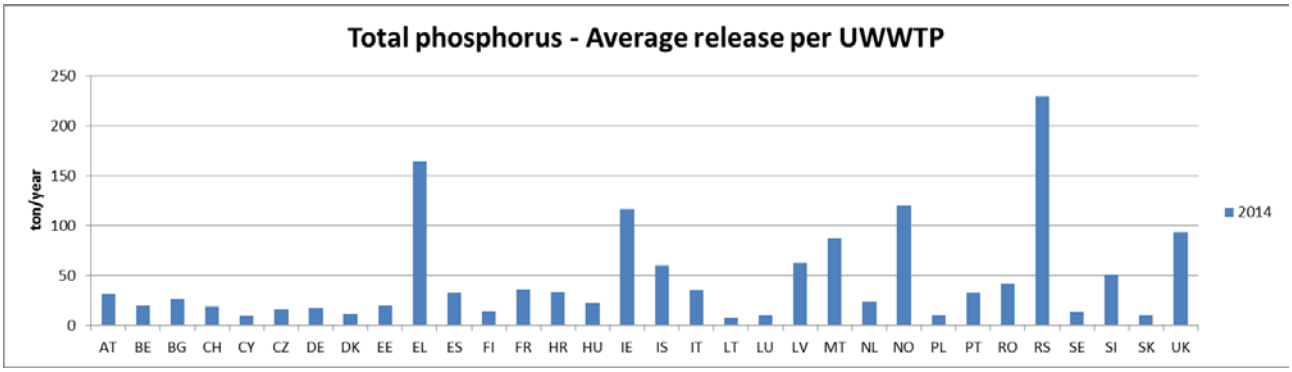
For most pollutants, the trends in the different regions are not very clear. This will probably be the result of the mix of different trends (increase of connection rate, increase of population numbers, increase of treatment processes), a general increase of monitoring in UWWTP effluent and "disturbance" of the trends by extreme releases from a limited number of UWWTPs.

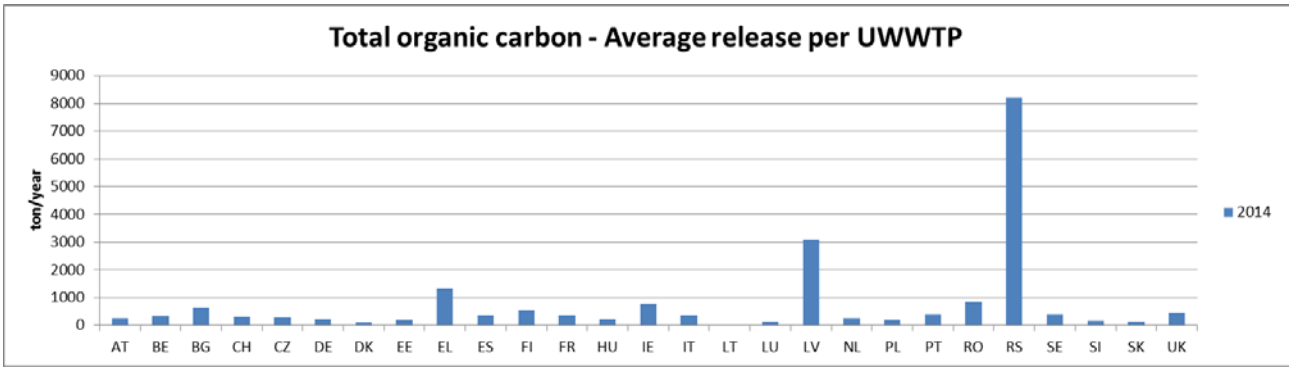
5.4.1 Average release per UWWTP per country

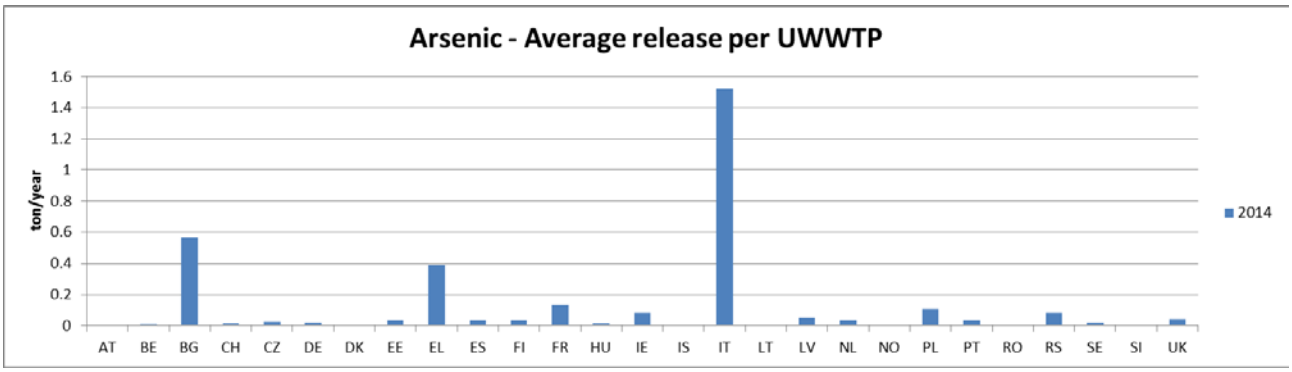
In Figure 5.9 the average releases per UWWTP for one year (2014) per country are shown, as reported under E-PRTR. Extreme (relative) high releases for specific pollutant-country combinations come forward in this way (like Greece-copper and Bulgaria-lead). Large differences between countries can also be the consequence of different average capacities of the reported UWWTPs per country.

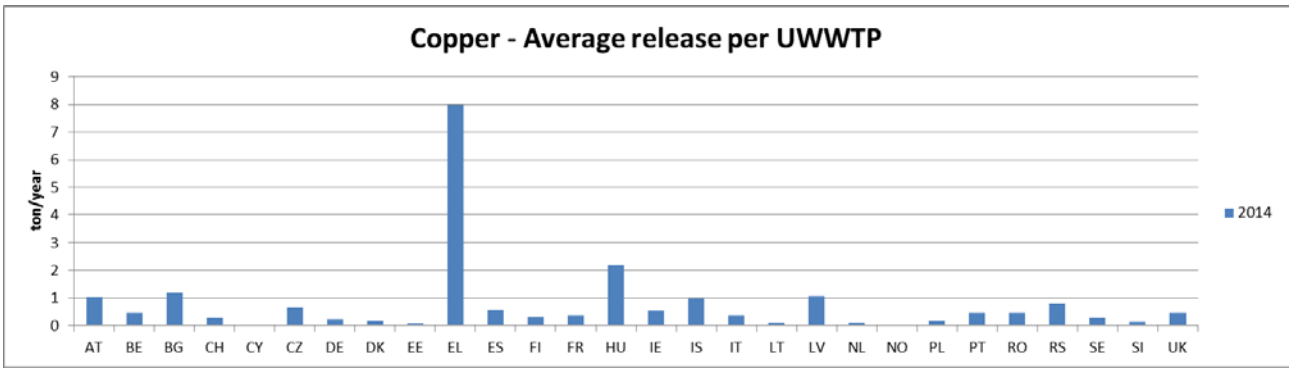
Figure 5.9 Average release per UWWTP per country for the 8 most reported pollutants in ton/year in 2014

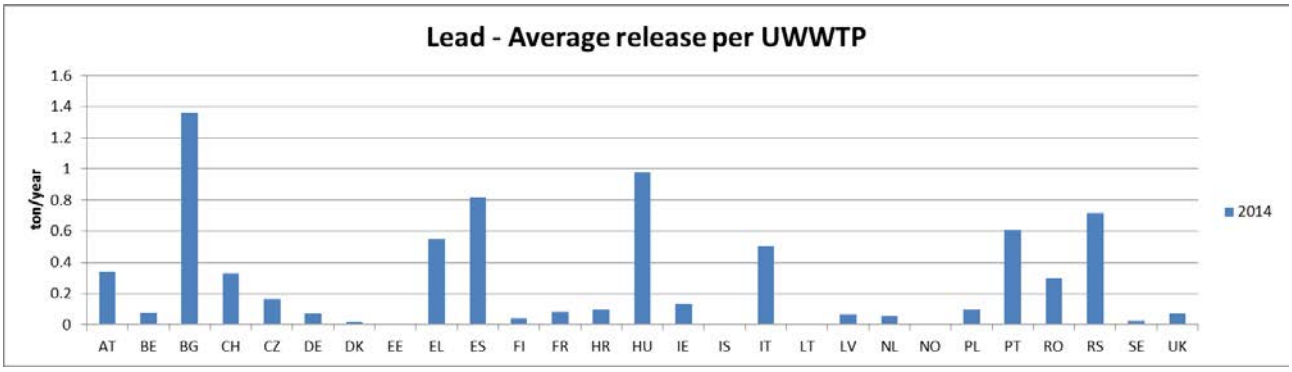


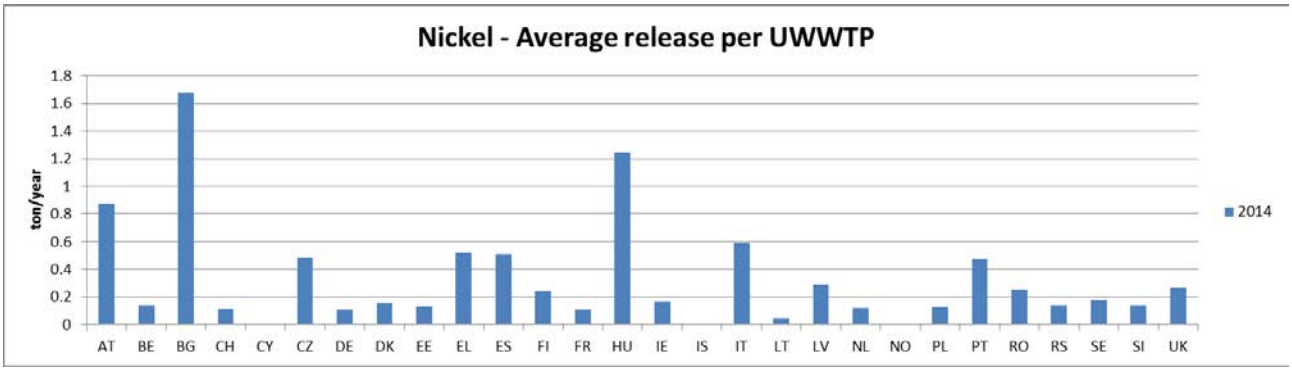


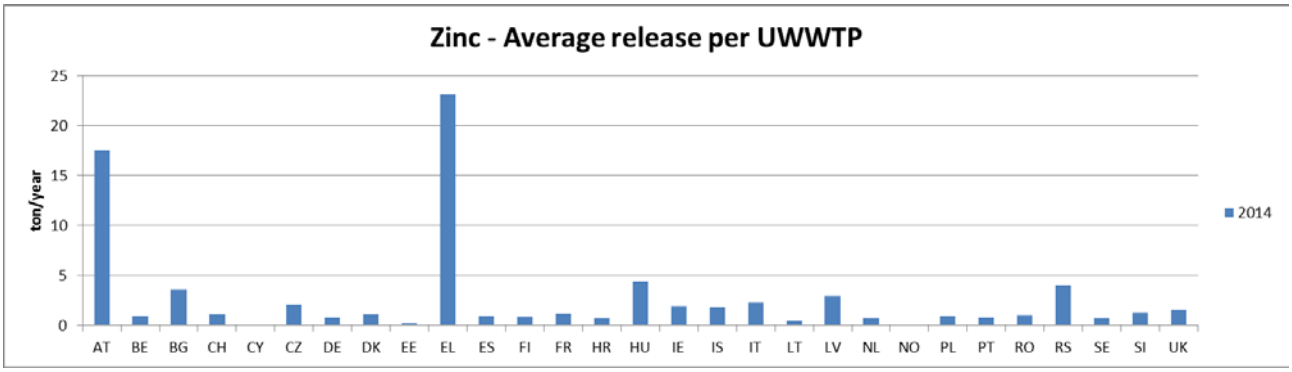



Arsenic - Average release per UWWTP
ton/year
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
AT BE BG CH CZ DE DK EE EL ES FI FR HU IE IS IT LT LV NL NO PL PT RO RS SE SI UK
2014


Copper - Average release per UWWTP
ton/year
9
8
7
6
5
4
3
2
1
0
AT BE BG CH CY CZ DE DK EE EL ES FI FR HU IE IS IT LT LV NL NO PL PT RO RS SE SI UK
2014


Lead - Average release per UWWTP
ton/year
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
AT BE BG CH CZ DE DK EE EL ES FI FR HR HU IE IS IT LT LV NL NO PL PT RO RS SE UK
2014


Nickel - Average release per UWWTP
ton/year
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
AT BE BG CH CY CZ DE DK EE EL ES FI FR HU IE IS IT LT LV NL NO PL PT RO RS SE SI UK
2014

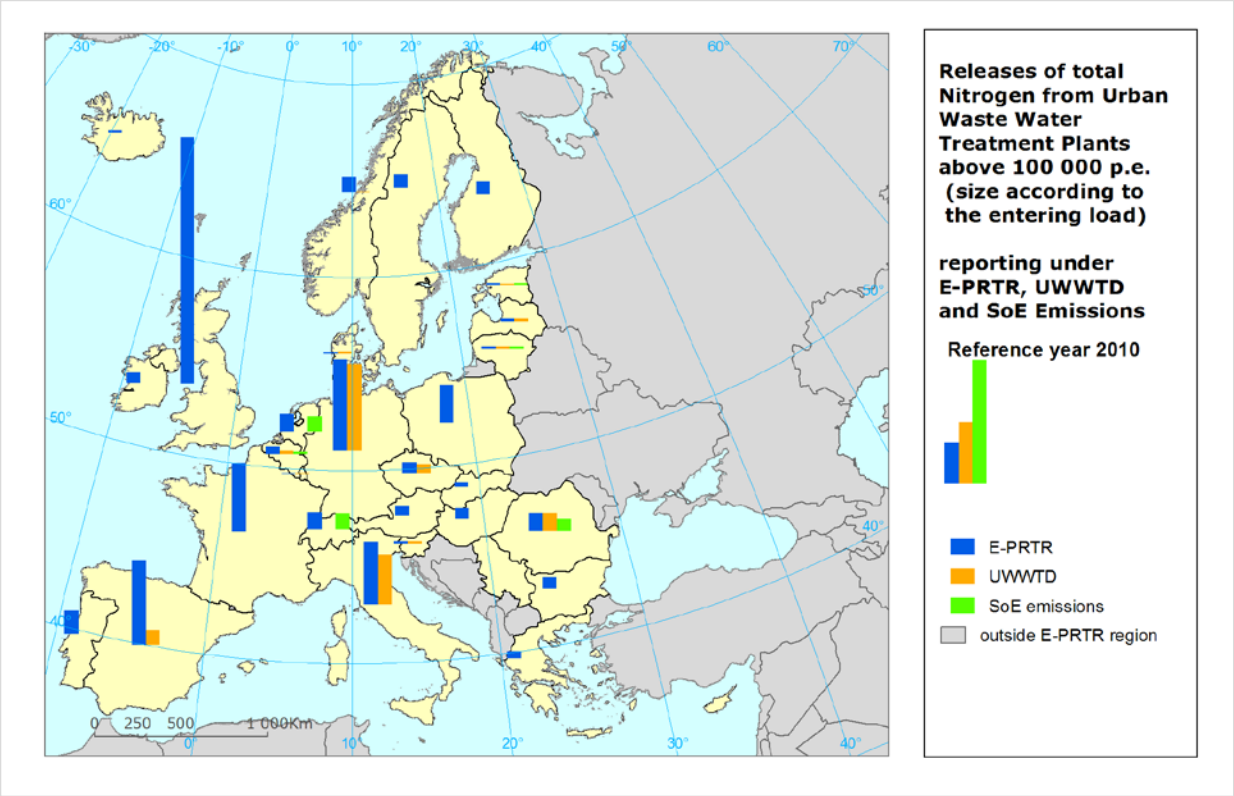

Zinc - Average release per UWWTP
ton/year
25
20
15
10
5
0
AT BE BG CH CY CZ DE DK EE EL ES FI FR HR HU IE IS IT LT LV NL NO PL PT RO RS SE SI UK
2014

5.5 Comparison E-PRTR, WISE-SoE Emissions and UWWTD

In 2014, a technical report of the ETC/ICM (Prchalova et al, 2014) compared the differences of the UWWTP releases reported under different obligations (Wise-SoE: Emissions, E-PRTR and UWWTD). The conclusion of the report was that to some extent these data can be compared with each other, as there are some areas where comparison is. Else it is difficult or not possible. The biggest possibility of streamlining and harmonisation of the different data flows is in the area of point sources.

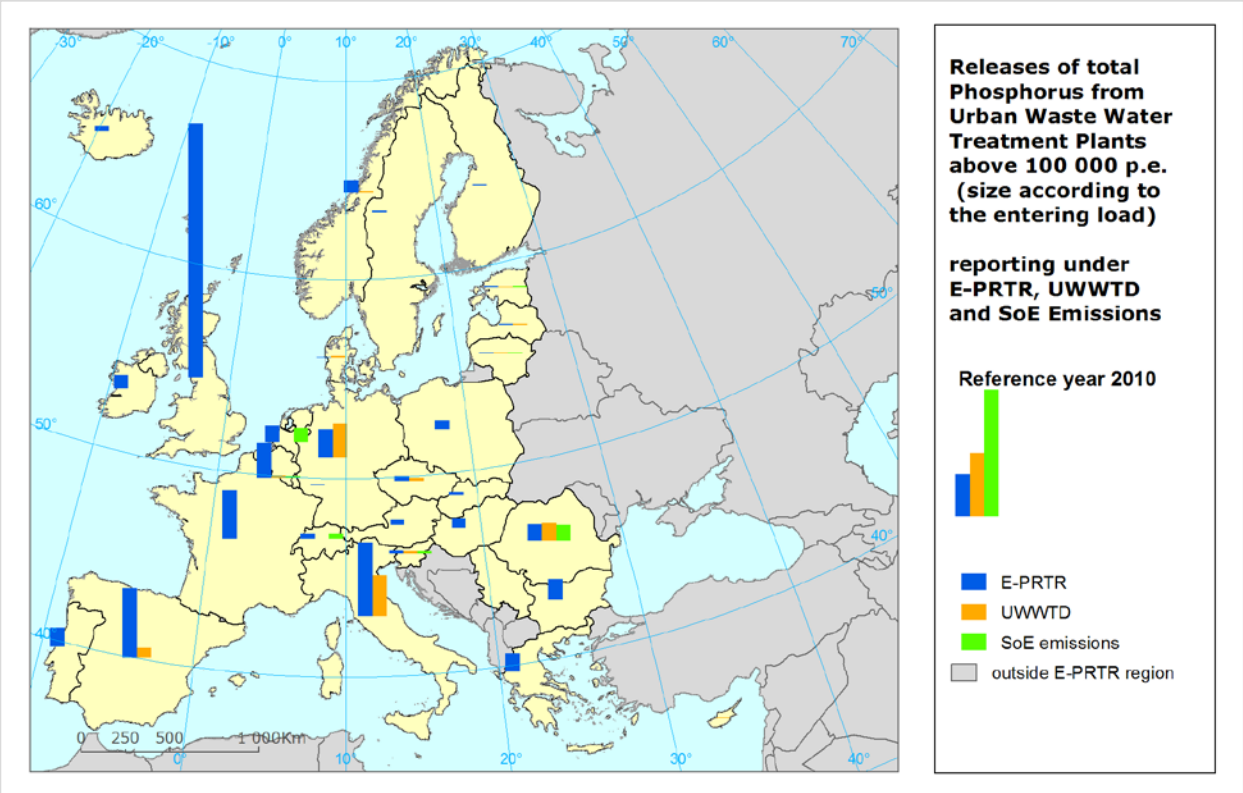
Figure 5.10 shows the comparison for the entering load for total nitrogen and total phosphorus (Figure 5.11) for UWWTPs above 100 000 p.e. for 3 different data sources in 2010: E-PRTR, UWWTD and Wise-SoE Emissions. Most countries only report releases to E-PRTR. Only 6 countries report UWWTP releases to WISE-SoE Emissions and 9 countries report to the UWWTD. The figures show it is hard to compare the three databases. Large differences are shown in both figures between the different reporting procedures for most countries, while you would expect the same releases per pollutant.

Figure 5.10 Proportion of total nitrogen emission loads from UWWTPs above 100.000 p.e. in E-PRTR, UWWTD and WISE-SoE Emissions



Source: Prchalova et al., 2014

Figure 5.11 Proportion of total phosphorus emission loads from UWWTPs above 100.000 p.e. in E-PRTR, UWWTD and WISE-SoE Emissions



Source: Prchalova et al., 2014

5.6 Completeness of reporting

Although information about emissions from UWWTPs are measured and collected, present reporting covers mainly large UWWTPs (above 100 000 p.e.) and TOC, phosphorus and nitrogen under E-PRTR. Detailed information about all UWWTPs above 2 000 p.e. are included in UWWTD reporting, but discharge data (BOD, COD, nitrogen and phosphorus) are not mandatory. WISE-SoE Emissions and WFD reporting obligations require aggregated data about pollutant discharges per River Basin Districts or sub-units and without existing data at facility level it is difficult to verify the completeness.

Priority and hazardous substances from UWWTPs are rarely reported (except heavy metals) and with low releases. It is not easy to say if this is the result of limited monitoring, what might be an indication for incomplete reporting, or if this reflects the real situation.

More details about the UWWTP reports can be found in Annex 6.

5.6.1 Check of completeness of reporting

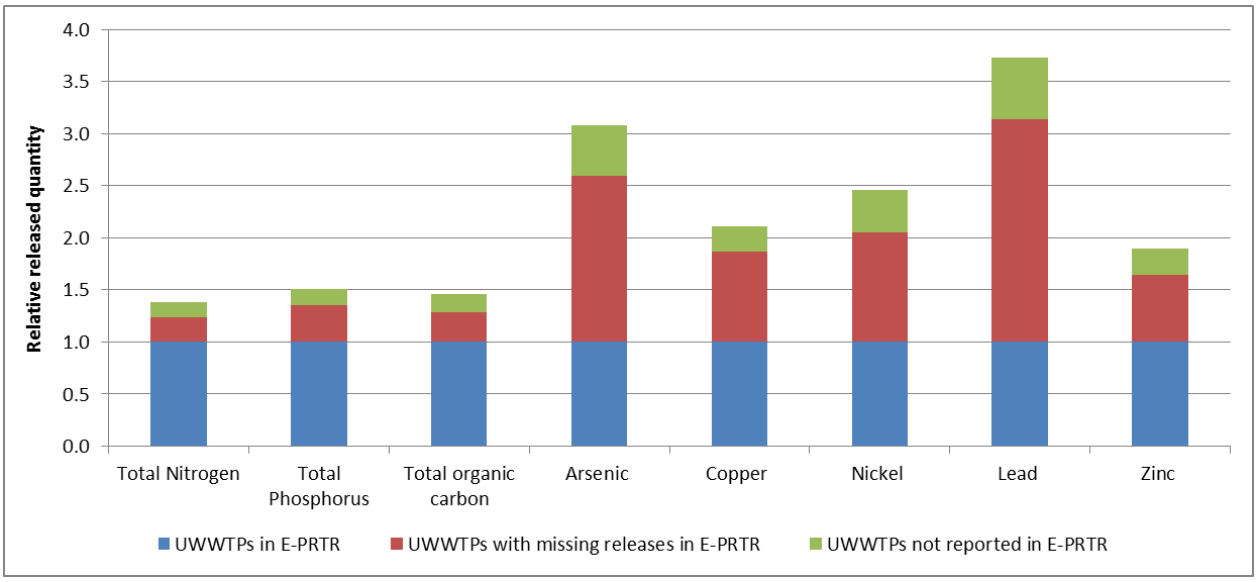
For the UWWTPs, a completeness check was carried out to see if the data reported provide full coverage (Roovaart et al, 2016). In this study, available data about capacities and treatment level of a large number of UWWTPs from the UWWTP database is combined with reported UWWTP releases in E-PRTR. This study shows two different potentially missing releases from UWWTPs larger than 100 000 p.e.:

- UWWTPs reporting under E-PRTR but not reporting a particular pollutant:
  For the completeness check, missing releases are calculated with a calculated country specific factor. All calculated releases above the threshold value are marked as potentially missing releases for E-PRTR.

- UWWTPs not reported in E-PRTR:
  UWWTPs which appear to be omitted in E-PRTR. Over the years an average of 16% of the total number of UWWTPs >100 000 p.e. in the UWWTP database have not reported any releases to E-PRTR. For these UWWTPs potentially missing releases are calculated.

For both, calculated missing releases above the threshold value are marked as potentially missing releases for E-PRTR and are shown in Figure 5.12. The total releases to surface water for the 8 most reported pollutants are indexed on 1.

Figure 5.12 Potentially missing releases for the most reported pollutants of UWWTPs > 100 000 p.e. in E-PRTR 2013 (reported E-PRTR releases = 1)



Source: Roovaart et al, 2016

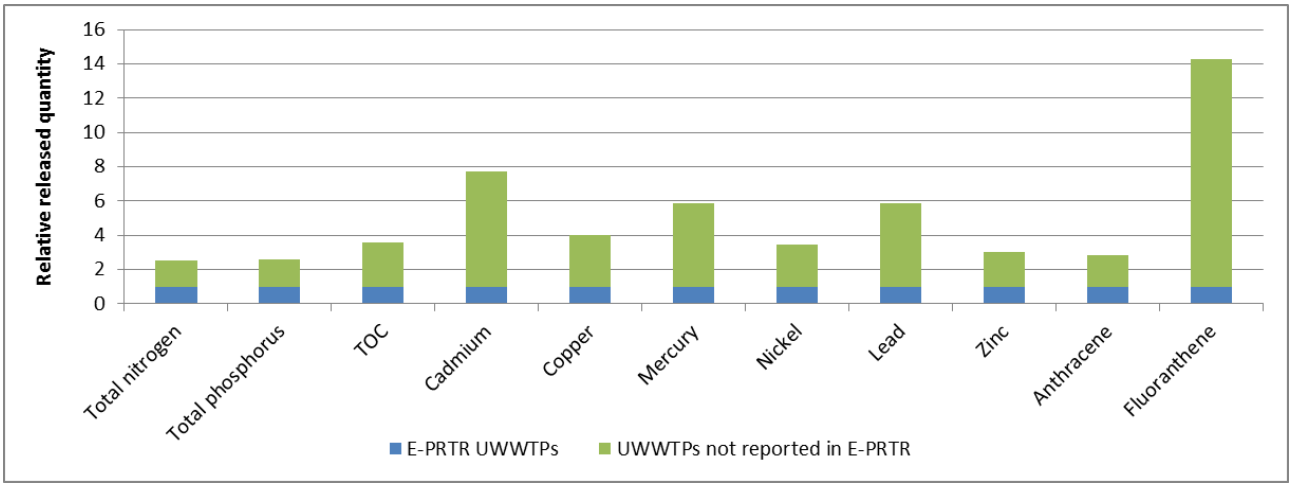
The results show a large amount of quantified potentially missing releases above the pollutant threshold values for all (the most reported) pollutants. For the heavy metals, potentially missing releases are quantified within a range of 1–3.5 times the reported UWWTP loads in E-PRTR. For total nitrogen, total phosphorus and TOC about half of the reported UWWTP loads in E-PRTR are quantified as potentially missing.

5.6.2 Contribution of smaller UWWTPs

A study carried out for the European Commission (Roovaart et al, 2013) quantified the releases for non-E-PRTR UWWTPs (< 100 000 p.e). Because these releases are below the E-PRTR capacity threshold of 100 000 p.e., they are not labelled as "potentially missing". The starting point of the E-PRTR Regulation was that about 90% of point source discharges would be covered by the definitions and thresholds included in the Regulation. The quantified releases of these non E-PRTR UWWTPs (<100 000 p.e.) together with the quantified potentially missing UWWTPs as described in the previous paragraph (and Figure 5.12), are presented in Figure 5.13 as "UWWTPs not reported in E-PRTR". They are compared with the releases of the large UWWTPs (> 100.000 p.e.) as reported in E-PRTR. The data in Figure 5.13 indicate that even for the well-known and relatively well measured substances like nutrients (TOC, total nitrogen and total phosphorus) E-PRTR seems to cover only less than half of the "real" UWWTP releases.

The calculated "real" UWWTP releases are the sum of the UWWTPs in E-PRTR and releases of the UWWTPs quantified as potentially missing together with the quantified releases of the smaller UWWTPs (<100 000 p.e.) in the project. For other substances this percentage of coverage seems even lower, with a lowest value of 7% for fluoranthene.

Figure 5.13 Releases of the UWWTPs not reported in E-PRTR (sum of quantified potentially missing releases of UWWTPs > 100 000 p.e. and quantified releases of smaller UWWTPs < 100 000 p.e. (Roovaart et al, 2013) compared with releases of UWWTPs reported under E-PRTR (reported E-PRTR releases = 1)



Source: Roovaart et al, 2013

5.7 Conclusions

The following conclusions can be drawn:

- About half of the E-PRTR release reports relate to UWWTPs which is a significant proportion. Between 2007 and 2014 the number of reports slightly increases for most countries and is quite stable for a small set of countries.
- As with the industrial releases in E-PRTR, a high percentage of the release reports relate to only a small set of pollutants for UWWTPs over 100 000 p.e. Most reported releases (63%) are from 8 pollutants: total nitrogen, total phosphorus, total organic carbon, arsenic, copper, lead, nickel and zinc. The other 37% of the release reports refer to the other 66 reported E-PRTR pollutants.
- Similar to the industrial releases, only a small percentage of the UWWTPs are responsible for a large amount of the releases of the 8 most reported pollutants. Almost 80% of all arsenic releases of the UWWTPs are caused by 5 of the 340 reporting facilities in 2014. For lead it is more than 50% in 2007 and 2009. Releases of individual facilities can cover up to 70% (arsenic in Italy in 2014) of the EU reported UWWTP release for specific years.
- For the nutrients and total organic carbon the trend has been stable since 2008. Arsenic shows an enormous increase between 2012 and 2014. For the metals copper and zinc a slight increase is shown. Copper, zinc and lead are rather stable over the last few years, but highly influenced by extreme releases of individual UWWTPs.
- More than half of the other 55 pollutants (30) show an increasing trend, among them are 17 priority substances of the Water Framework Directive, although it has to be stated most of these pollutants are only reported incidentally.

- It cannot be concluded easily what causes the increase of releases of so many pollutants. Trends we see could be the result of a less successful treatment of the waste water. Another possible explanation could be an increase of monitoring, resulting in a more realistic quantification and reporting of the releases for more pollutants. This could be the case for pollutants like naphthalene, AOX and dioxins. A third explanation is an overall increase of the number of households connected to a sewer system and an UWWTP.
- A long term trend of the % of the population connected to a sewer system and a UWWTP and the level of waste water treatment for 6 EU-regions is reported by EEA (2013), showing both a steady increase of the % waste water collected and the level of treatment (from primary to secondary to tertiary). Large differences between the EU regions can be seen.
- Also in the UWWTP releases in E-PRTR these regional differences can be noticed: relatively low releases can be seen in Northern Europe and will be the result of a low population density, combined with a high connection rate and a high level of treatment. In Eastern and South-eastern Europe a smaller percentage of the population is connected to waste water treatment plants. In combination with a relative low population density and a lower average treatment level of the UWWTPs, this results in rather low releases for most pollutants.
- For most pollutants, the trends in the different regions are not very clear. This will probably be the result of the mix of different trends (increase of connection rate, increase of population numbers, increase of treatment processes), a general increase of monitoring in UWWTP effluent and “disturbance” of the trends by very high releases from a limited number of UWWTPs.
- Calculated average releases per UWWTP for one year (2014) per country show extremely high releases for specific pollutant-country combinations. Large differences between countries can also be the consequence of different average capacities of the reported UWWTPs per country.
- A technical report of the EEA (Prchalova et all, 2014) compared the differences of the UWWTP releases reported under different obligations (WISE-SoE Emissions, E-PRTR and UWWTD), showing large differences between the different reporting procedures for most EU countries.
- The results of a recent study (Roovaart et al, 2016) show a large amount of quantified potentially missing UWWTP releases above the pollutant threshold values for all (the most reported) pollutants. For the heavy metals, potentially missing releases are quantified within a range of 1–3.5 times the reported UWWTP loads in E-PRTR. For total nitrogen, total phosphorus and TOC about half of the reported UWWTP loads in E-PRTR are quantified as potentially missing.
- Another study carried out for the European Commission (Roovaart et al, 2013) quantified the releases for non-E-PRTR UWWTPs (< 100 000 p.e). Summing up with the potentially missing releases mentioned in the bullet above, this results in a picture that even for the well-known and relatively well measured substances like nutrients (TOC, total nitrogen and total phosphorus) E-PRTR seems to cover only less than half of the “real” UWWTP releases. For other substances, this percentage of coverage seems even lower, with a lowest value of 7% for fluoranthene.

6 Emissions from diffuse sources

6.1 Definitions of diffuse sources

To analyse this type of emission, it is first necessary to define the term 'diffuse source'. Hereafter are some of the official definitions used in the context of reporting obligations.

Diffuse pollution (EEA): *Pollution from widespread activities with no one discrete source, e.g. acid rain, pesticides, urban run-off, etc*.

Diffuse source (E-PRTR): *Diffuse sources are defined as the many smaller or scattered sources from which pollutants may be released to water, whose combined impact may be significant and for which it is impractical to collect reports from each individual source.*

NOTE: in E-PRTR, only UWWTP above 100 000 p.e. are considered, all the other UWWTP which represent the vast majority, are considered in the diffuse sources.

Non-point source (Eurostat guide): *a source of one or more pollutant(s) that cannot be geographically located on a map as a point but originating from a certain area. Non-point sources cannot be assessed by monitoring. This is because there is no precise point where water can be sampled. Different quantification approaches (e.g. modelling, lysimetry, small monitored watershed) can be used and made comparable to obtain a reasonably reliable result.*

While diffuse sources would best be restricted to areal sources (an homogeneous area generating emission like an agriculture land), they are very often including small and scattered point sources including all UWWTP below 100 000 p.e. for the case of the E-PRTR, and this will be the definition used in this chapter.

Diffuse sources can have a significant collective impact on water quality and represent a significant share of the pollution problem.

6.2 Pollutants

As the control of regulated discharges from urban waste water and from industry and agriculture point sources has become increasingly effective in the last 20 years, the significance of other sources of emission has become more evident in the overall share of emission pressure. It is not an easy task to identify which pollutants are emitted by diffuse sources as the set of pollutant parameters and pathways is very wide, but this comprises organic pollution, nutrients or heavy metals or biocides and pesticides from household and small industry waste water, the same parameters (except biocides) and pesticides from agriculture, heavy metals and PAH from transport, some heavy metals, nitrogen and acidification substances from atmospheric deposition. Beyond these key pollutants, a wide set of individual substances and their degradation products can potentially be found, originating from use of household products (more than 100 substances classified at least in one EU or international priority list and used in household products in France, (Fribourg-Blanc et al, 2011) and transfer in waste water untreated or via sludge, of heavy metals, various hydrocarbons and other substances collected with dust washed by rainwater on impervious areas, of pesticides for infrastructure maintenance (cemetery, local roads, car parks).

Data on emissions from a set of parameters from diffuse sources of pollution are available from WISE-SoE Emissions and E-PRTR. For the moment, it is too soon to have data from the WFD inventory of PS/PHS emissions.

6.3 Quantification of diffuse sources

According to the E-PRTR Regulation the E-PRTR database must include releases of pollutants from diffuse sources where available. Article 8 of the Regulation establishes that the Commission will include data on releases from diffuse sources which have already been reported by Countries, and will disaggregate the information to an adequate geographical level whilst including information on the methodology used. When no data on releases from diffuse sources are available, the Commission is obliged to take actions to initiate reporting on diffuse sources.

Therefore, the European Commission launched a project on the quantification of diffuse sources (Roovaart et al, 2013a). In this project, available data on diffuse emissions to water was collected, estimation methods to quantify diffuse emissions were developed and forty maps prepared. The maps cover a selection of key sources and substances for the EU Member States and the 4 European Free Trade Association (EFTA) countries (Iceland, Liechtenstein, Norway and Switzerland) on a River Basin District sub-unit scale. The maps are available on the E-PRTR website of the European Commission and of the EEA.

Table 6.1 shows the releases of a number of diffuse key sources for a selection of pollutants quantified in the diffuse sources project, indicating that 11–55% of the total releases are covered by the E-PRTR. While the study does not cover the entire set of diffuse sources (in particular industrial emissions from non-E-PRTR industries), it is the first attempt of this nature with until now widest geographical coverage with a harmonised assessment methodology, but still a limited substance coverage.

In addition, data from other reporting streams strongly support the conclusion that for most key pollutants the contribution of the diffuse sources to the total releases to water greatly exceeds the contribution of the point sources, e.g. data reported under the North Sea Minister Conference (NSC, 2002), the WISE-SoE Emissions, the EU Water Framework Directive (WFD) and by International River Basin Commissions (e.g. ICPR 1999, 2003).

Table 6.1 Relative load per key source to surface water in Europe 2010 (EU27 + EFTA countries Iceland, Liechtenstein, Norway and Switzerland)

Substances	Emissions quantified in the project						Emissions already in E-PRTR		Total project + E-PRTR	Unit
	Atmospheric deposition	Agriculture	Inland navigation	un-connected households	Road transport	UWWTPs not in E-PRTR	E-PRTR industries	E-PRTR UWWTPs		
Total nitrogen	3%	77%	0,004%	0,004%	0%	10%	2%	8%	4 063	kton
Total phosphorus	0%	46%	0,01%	0,02%	0%	24%	11%	19%	196	kton
Total organic carbon	0%	0%	0,03%	0,1%	0%	44%	33%	22%	1 342	kton
Cadmium	5%	0%	0%	<0,1%	0,0%	69%	10%	16%	72	ton
Copper	0%	0%	0%	<0,1%	8,3%	48%	27%	16%	1 326	ton
Lead	17%	0%	0%	<0,1%	11%	47%	14%	10%	716	ton
Mercury	17%	0%	0%	<0,1%	0,0%	55%	16%	12%	15	ton
Nickel	0%	0%	0%	<0,1%	4,5%	57%	16%	23%	836	ton
Zinc	0%	0%	0%	<0,1%	1,0%	50%	25%	25%	5 082	ton
Anthracene	0%	0%	23%	<0,1%	0,7%	24%	39%	13%	0,48	ton
Fluoranthene	0%	0%	16%	0,1%	0,6%	54%	26%	4%	1,4	ton
blue < 10%, yellow between 10%-50% and red > 50%										

Source: Roovaart et al, 2013a

Another source of information is the WISE-SoE Emissions reporting. The data on diffuse pollution is divided into 7 possible sources of pollution, but some countries report only the total emission from diffuse sources as NP*.

NP1 Agriculture Emissions
NP2 Atmospheric Deposition
NP3 Emissions from Un-Connected Dwellings
NP4 Urban Diffuse Emissions
NP5 Emissions from Storm Overflows
NP6 Emissions from Abandoned Industrial Sites
NP7 Other Diffuse Emissions
NP8 Background Emissions
NP9 NP3 + NP5

NP* Total diffuse emissions to inland water

Compared to data on nutrients from point sources, data for organic pollution and nutrients emissions are available only to a limited extent as can be seen from the table below.

Table 6.2 Summary of available data on organic pollution and nutrient emissions from WISE-SoE Emissions reporting

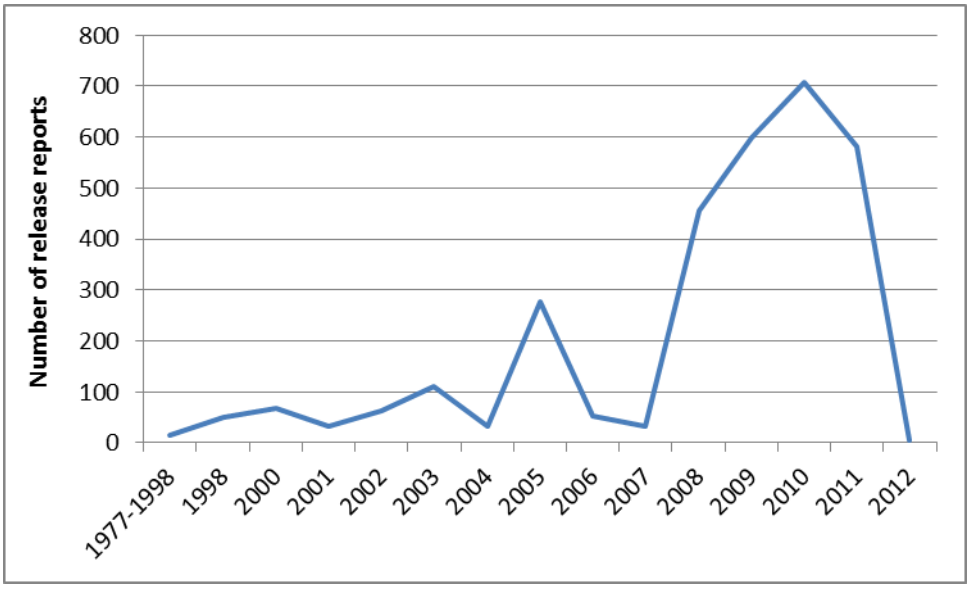
Substance	Point sources		Diffuse sources	
	Number of countries	Number of records	Number of countries	Number of records
Ammonium	10	1126	1	8
Biological oxygen demand	14	2758	2	52
Chemical oxygen demand	15	2884	1	42
Nitrate	8	702	1	47
Total nitrogen	18	3017	11	720
Total phosphorus	18	3252	11	650
Total organic carbon	9	1004	2	129

Concerning hazardous substances, it is not possible to compare emissions from different Member States due to a lack of data. As shown in the report 'Emission of pollutants to Europe's waters' (Prchalova et al., 2014), source apportionment of emissions differs greatly between countries. It seems to show more a differing level of knowledge than effective differences in size and apportionment of emission from diffuse sources. Only Belgium, Switzerland and particularly the Netherlands have reported data on emission of hazardous substances from diffuse sources; data was mainly reported in the period 2007–2011.

In the WISE-SoE emissions database, ten categories of diffuse sources are considered and reported, representing in total 3087 diffuse hazardous pollutant annual records (sum of all reported years in the period 1977–2012), see Figure 6.1.

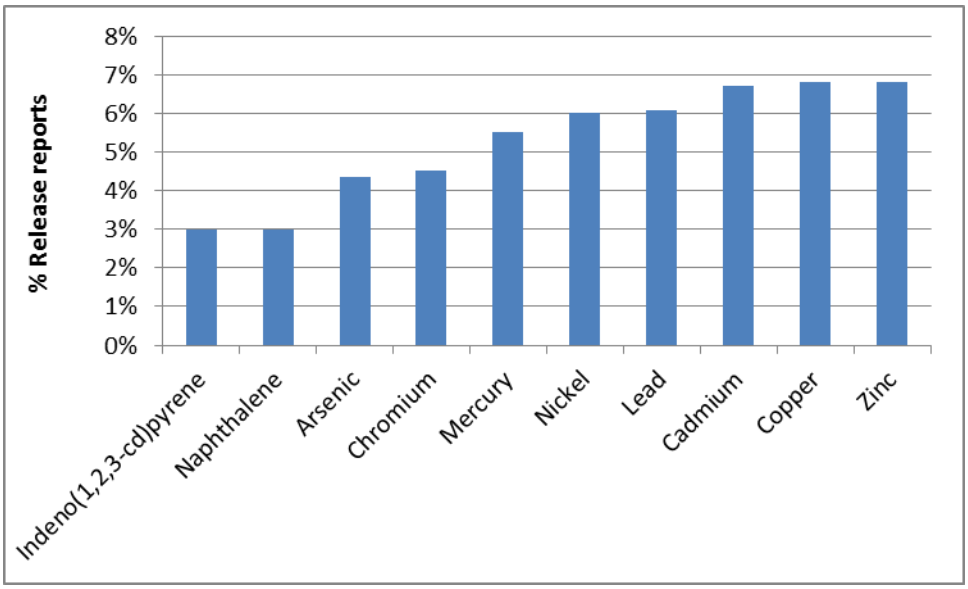
Under WISE-SoE Emission reporting for hazardous substances, 4 countries reported data on 6 to 38 substances. These are mostly heavy metals and PAHs, but also a variety of chlorinated compounds and some pesticides, originating from 4–7 different sources and with variable temporal coverage. The most reported pollutants in the WISE-SoE Emissions database between 1977 and 2012 are shown in Figure 6.2.

Figure 6.1 **Number of diffuse sources hazardous pollutant release reports to water per year in WISE-SoE Emissions**



Heavy metals and metalloids and two PAHs are the most reported pollutants in WISE-SoE Emissions with a relatively homogeneous number of reports. The other 30 WISE-SoE Emissions pollutants are reported less frequently (43% of reports).

Figure 6.2 **The 10 hazardous pollutants representing 57% of the total number of reported diffuse releases in WISE-SoE Emissions (sum for the period 1977–2012)**



6.4 Trends

Diffuse emissions are based on calculations or modelling, often using an emission factor and an activity rate (e.g. the area of a certain crop or the number of inhabitants). Both often have an un-measurable reliability. In addition, the calculations of emissions are based on models which are continuously improved, and they can be highly influenced by the weather conditions of the year: high or low precipitation, temperature or other characteristics.

Many research projects are underway to improve knowledge on diffuse emission and their trends as diffuse emissions represent an increasing share of emission and require actions at different levels of the DPSIR chain.

Therefore, trends are very difficult to establish for diffuse emissions. It is necessary to filter data from specific annual weather conditions, from changes in calculation method such as different models or different emission factors, and from changes of practices in land use. Nitrate from agricultural land, for instance, is typically influenced by the amount of precipitation with a typical pattern over a year. The use of pesticides depends on the crop, on changes in authorised substances as well as on marketing strategies of selling companies. The influence of weather and type of crop is recognised in the legislation, as Directive 2008/105 (EC, 2008c) allows for the inventory of emission from priority substances to use three years average for pesticides.

Some trends result from actions taken elsewhere, sometimes beyond the scope of water policy, for example through reduction of air emissions causing acid rain and associated reduction in acidification parameters to surface water; reduction of atmospheric lead emissions to water following development of lead-free petrol.

Large changes in pesticide use in the past 15 years have also lead to significant reductions of emission of some substances (banned substances like HCH or atrazine) or increased emissions of others (like Ampa, a degradation product of glyphosate).

To improve the analysis of trends, it would be desirable to have data on diffuse emissions of individual substances used and emitted in more than 3 countries for a sufficiently large temporal period as currently they cover only 1–4 years, which does not allow us to draw relevant conclusions.

6.5 Regional differences within the EU

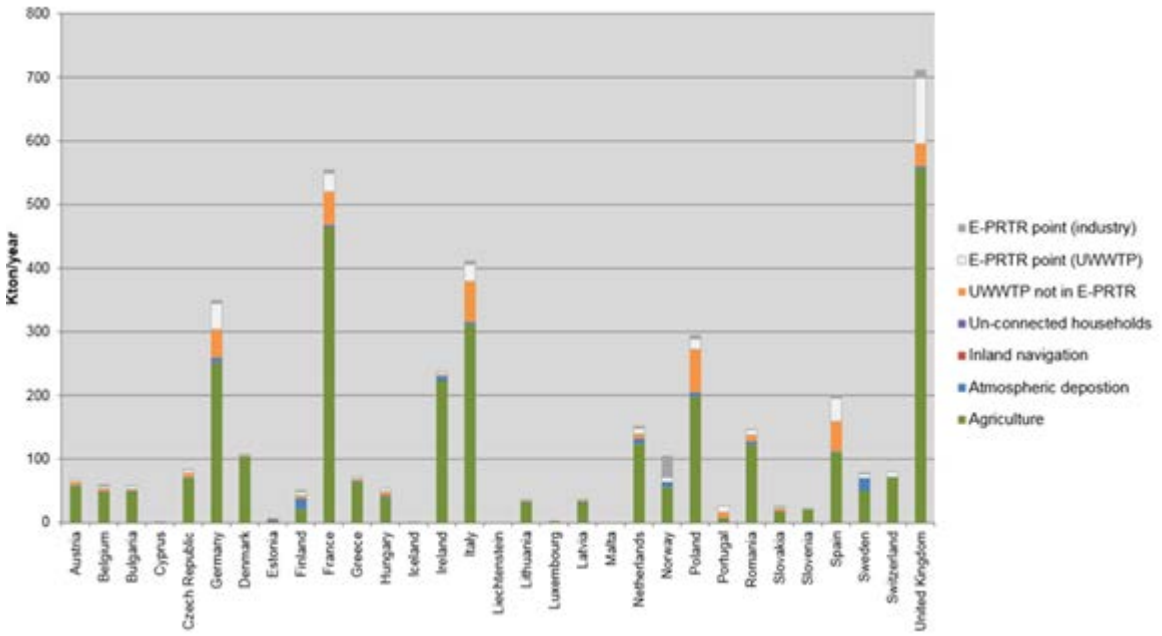
The available data does not allow identifying regional differences within Europe, except for the maps available in the report 'Diffuse Water Emissions in E-PRTR' (Roovaart et al, 2013a).

Figure 6.3 and Figure 6.4 show two examples of the release of total nitrogen and total phosphorus for selected diffuse sources (and the E-PRTR releases, both industry and UWWTP) per country as quantified in the project. Large regional differences can be seen as a result of factors such as the intensity of the processes causing the emissions, regional or national circumstances, the amount of surface water, land use or population density.

Figure 6.5 and Figure 6.6 show two examples of quantified diffuse sources of lead from atmospheric deposition and of total nitrogen from agriculture per River Basin District Sub Unit (RBDSU). Please note that the unit presented on the maps is kg/ha surface water. This results in different maps than when kg/ha RBSDU is used. The use of ha surface water links the emission to the hydrology of the RBSDU and therefore more closely with water quality than when ha RBDSU is used. More details can be found in the background document of the project (Roovaart et al, 2013b). This project shows a first rough estimation of the diffuse sources of a number of relevant pollutants that can be made within a limited time and budget.

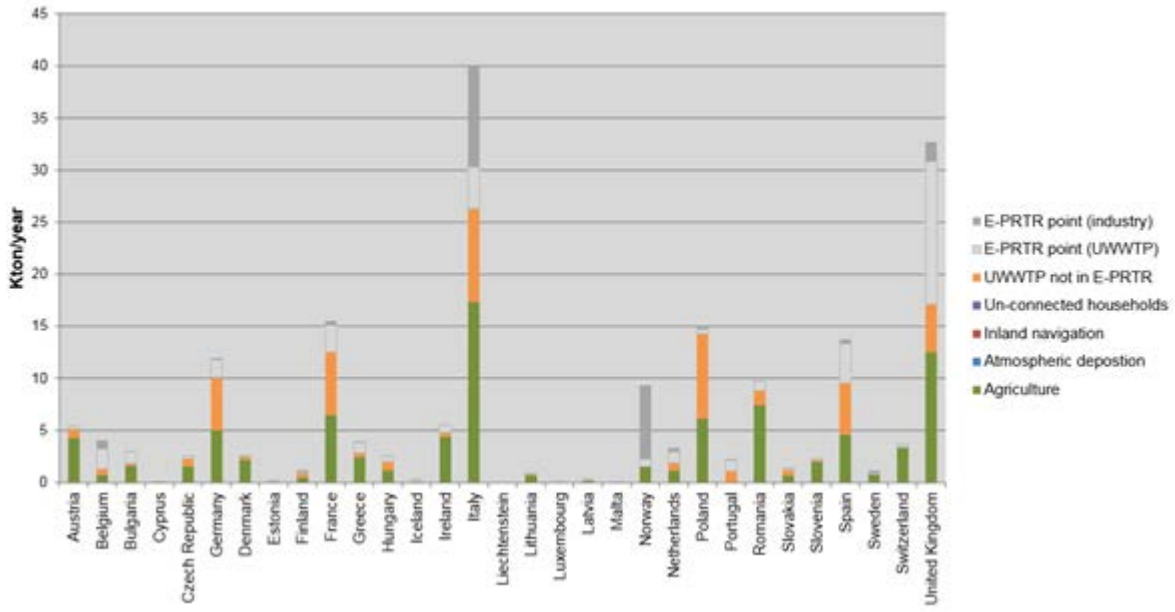
Another example are the maps developed for atmospheric re-deposition on land under the Convention on Long-range Transboundary Air Pollution (CLRTAP). The maps show that the long range air pollution transport leads to significant differences in the amount of atmospheric deposition per hectare of land. As many processes occur between atmospheric deposition and discharge in the aquatic environment, this information however only shows the size of the pressure.

Figure 6.3 **Loads to surface water of total nitrogen per source category and per country (EU+EFTA) in kilo tonnes/year in 2010**



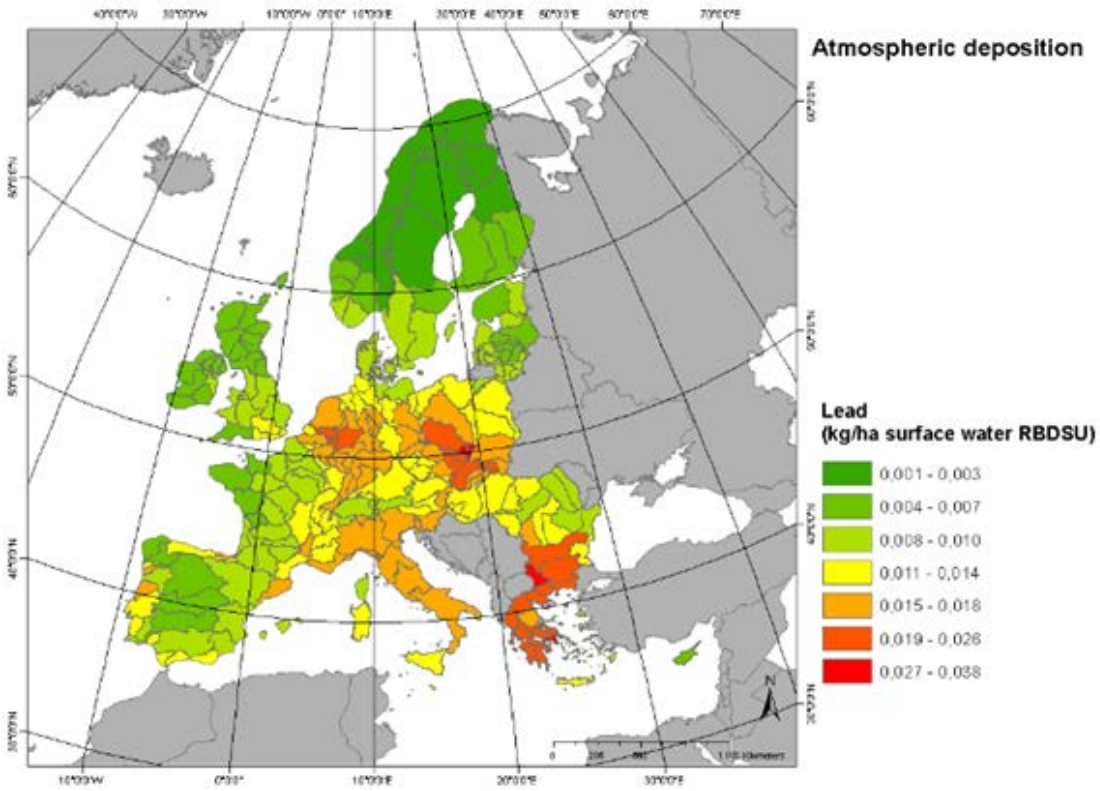
Source: Roovaart et al, 2013a

Figure 6.4 **Loads to surface water of total phosphorus per source category and per country (EU+EFTA) in kilo tonnes/year in 2010**



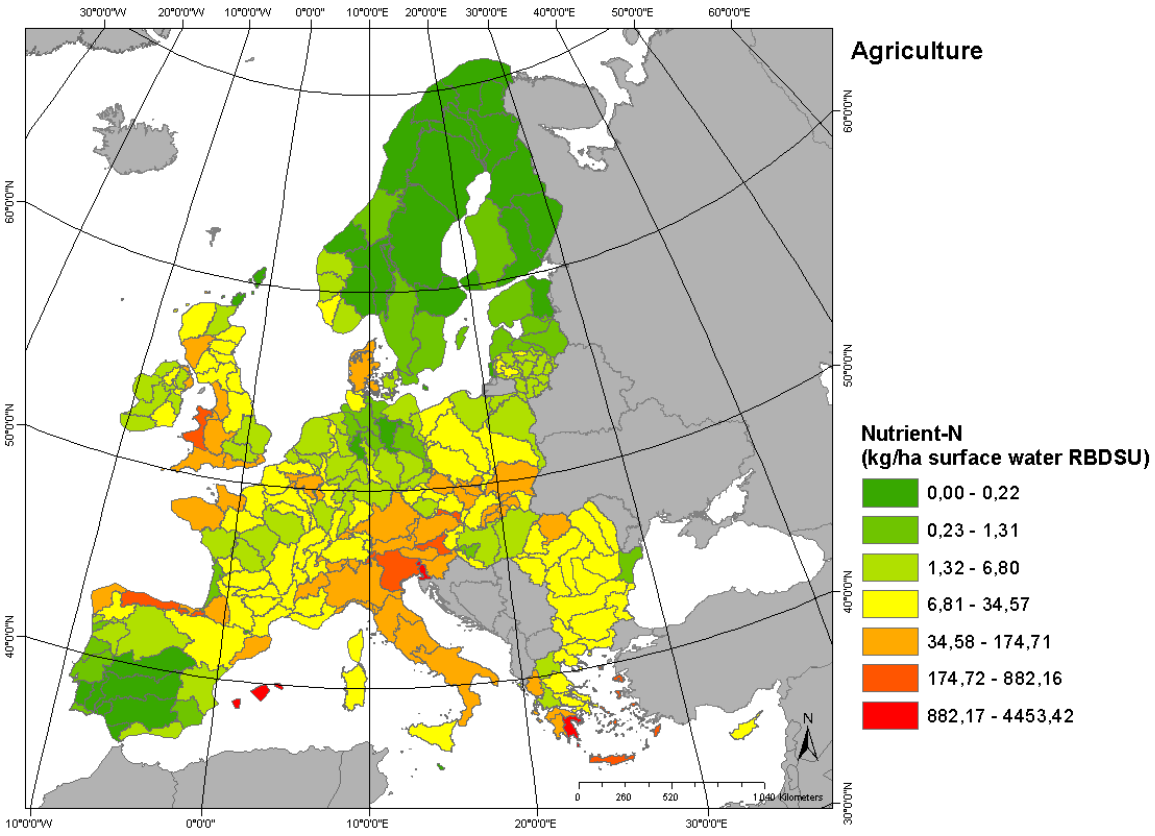
Source: Roovaart et al, 2013a

Figure 6.5 **Lead from atmospheric deposition per River basin district unit (RBDSU) in Europe per kg/hectare surface water RBDSU in 2010**



Source: Roovaart et al, 2013a

Figure 6.6 **Total nitrogen from agriculture per River basin district unit (RBDSU) in Europe per kg/hectare surface water RBDSU in 2010**



Source: Roovaart et al, 2013a

6.6 Sources and pathways

In the overall emission scheme (Figure 2.1), the sources and pathways are shown. All sources emitting substances to air are part of the diffuse sources, and the pathways for diffuse sources refer to re-deposition of pollution released by all sources to air on soil and impervious areas (roofs and transport infrastructures) and their transfer to water, the indirect emission. Direct emission and discharges from agricultural land, abandoned and historic mining, inland navigation and natural background, and from small point sources generally not monitored individually are also part of diffuse emissions.

The main sources and pathways of diffuse water pollution with a European coverage, and associated reported pollutant parameters are listed in Table 6.3. The table is structured according to the reporting requirements.

Table 6.3 Diffuse emission reports, their aggregation level and sources, pathways and pollutants covered (Note: WISE-SoE Emissions data with specific classification of diffuse sources)

Reporting	Aggregation	Sources or main step in pathway	Pollutants reported
UWWTD	disaggregated data	UWWTPs not in E-PRTR	BOD, COD, Suspended Solids, N-tot and P-tot
E-PRTR	Aggregated data per RBD and sub-unit - Detailed apportionment	Atmospheric deposition	Nutrient-N, Cd, Pb
		Agriculture	Nutrient-N, Nutrient-P
		Transport	Cd, Pb, Ni, Cu, Zn, Anthracene, Fluoranthene
		UWWTPs not in E-PRTR	TOC, Nutrient-N, Nutrient-P, Cd, Pb, Hg, Ni, Cu, Zn, Anthracene, Fluoranthene
		Un-connected households	TOC, Nutrient-N, Nutrient-P, Cd, Pb, Hg, Ni, Cu, Zn, Anthracene, Fluoranthene
		Inland navigation	TOC, Nutrient-N, Nutrient-P, Anthracene, Fluoranthene
WFD	Aggregated data per RBD and sub-unit	All significant diffuse sources discharges	45 priority substances among which 12 are hazardous
OECD/Eurostat JQ	Aggregated data per country and region	All non point sources discharges	BOD, COD, Suspended Solids, N-tot and P-tot for all years, Cu and Zn for 2012, As, Cd, Cu, Cr, Pb, Hg, Ni, Zn before 2012
SoE Emissions	Aggregated data per RBD or sub-unit - Detailed apportionment	Agriculture (NP1)	40 hazardous substances (metals, pesticides, POPs…), nutrients N and P, nitrate, ammonium, TOC, BOD, COD
		Atmospheric deposition (NP2)	
		Unconnected dwellings (NP3)	
		Urban diffuse (NP4)	
		Storm water overflows (NP5)	
		Abandoned industrial site (NP6)	
		Other: forestry, transport, mining and aquaculture	
		Background (NP8)	

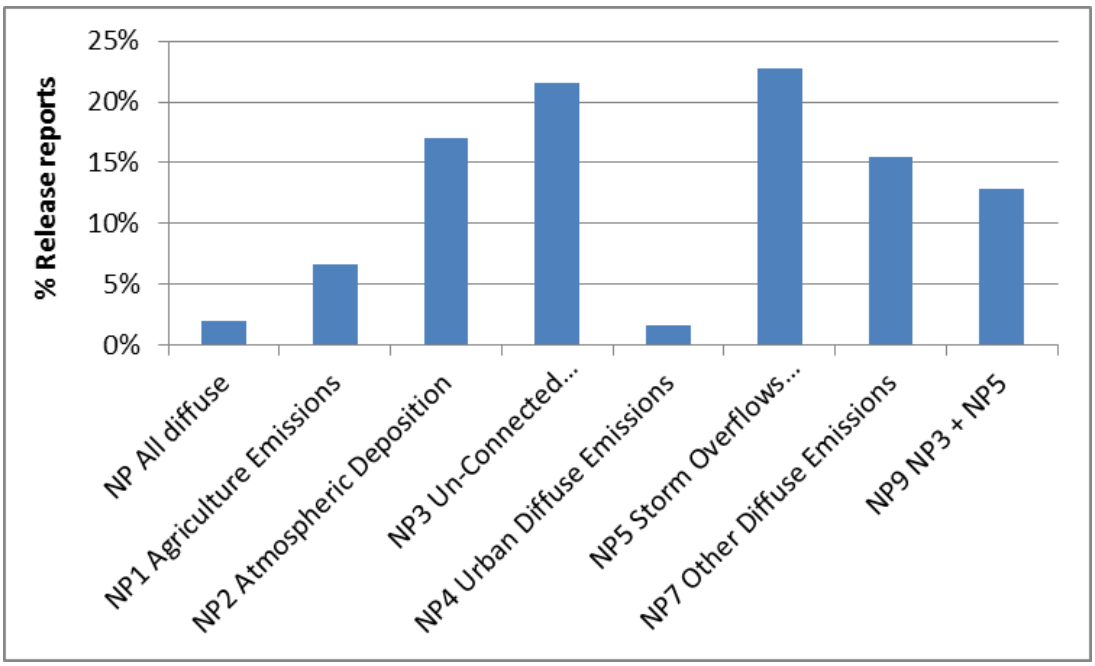
As can be seen in the above, the coverage of the sources, pathways and parameters is not the same in different reporting streams. Not all countries consider the all possible sources of diffuse pollution, some Member States report emissions only from one source (often agriculture – NP1) or from one set of data for total diffuse sources (reported as NP). Some countries are more advanced in their calculation of

diffuse pollution, e.g. the Netherlands with their PRTR. Due to these differences it is currently not possible to combine the datasets from different reporting streams on diffuse emissions to draw a complete and homogeneous picture of the situation in Europe.

Table 6.4 provides an overview of available data on organic pollution and nutrients based on WISE-SoE Emissions Reporting.

Figure 6.7 shows the percentage of reported hazardous pollutants per diffuse source between 1977 and 2012. Most pollutants are reported for four sources: unconnected dwellings, storm overflows, atmospheric deposition and other diffuse sources. In WISE-SoE Emissions, waste water from households and urban areas are not accounted as point sources.

Figure 6.7 Apportionment of number of release reports per category of diffuse sources of hazardous substances in WISE-SoE Emissions (1977–2012)



Scientific knowledge is still insufficient at the European level concerning diffuse source pollution, fate and transport of pollutants which could help Member States to better take into account non-point source pollution. An international harmonization and exchange of data and knowledge on (the quantification of) diffuse sources seems a necessary step for the improvement of the completeness of releases of key pollutants through diffuse pathways.

Table 6.4 Available data on organic pollution and nutrients by country and period covered, classified by type of diffuse sources from WISE-SoE Emissions Reporting

Pollutant	country	years	sources	number of RBDs	Note
COD	BE	2000 - 2010	NP3, NP5, NP7	2 RBD	RBDs VL only, CODCr
BOD	BE	2000 - 2010	NP3, NP5, NP7	2 RBD	RBDs VL only, BOD5
	LT	2008 - 2009	NP, NP1, NP3, NP8	4 RBD	BOD7
TOC	BE	2000 - 2012		2 RBD, 15 SU	RBDs VL only, SU - 2005 only
	CH	1977/1998, 2000 - 2010	NP	2 RBD, 9 SU	RBD 1977/1998 and 2010
Ammonium	CH	2006/2009	NP	2 SU	
NO3	CH	1977/1998, 2000 - 2010	NP	2 RBD, 10 SU	RBD 1977/1998 and 2010
N	AT	2004/2007, 2009/2011	NP, NP1, NP2, NP4	8 SU	
	BE	1998, 2000 - 2011	NP, NP1, NP3, NP4, NP5, NP7	2 RBD, 15 SU	RBDs VL only, SU - 2005 and 2010 only
	CZ	2006	NP1, NP2, NP3	3 RBD	
	DK	2010 - 2012	NP	4 RBD	
	FI	2000-2006	NP, NP1, NP2, NP5, NP7, NP8	8 RBD	
	FR	2007	NP1, NP2	33 SU	
	CH	1977/1998, 1985, 1995, 2000 - 2011	NP, NP1, NP2, NP3, NP4, NP5, NP7, NP8, NP9	4 RBD, 6 SU	RBD 1977/1998 and 2010
	IS	2008 - 2012	NP1, NP3	CC	
	NL	2008 - 2011	NP1, NP2, NP3, NP4, NP5, NP7, NP9	4 RBD	
	RO	2004	NP1, NP2, NP7, NP9	1 RBD	
	SE	1995, 2000, 2006, 2009	NP, NP1, NP2, NP3, NP4, NP7, NP8	5 RBD	
P	AT	2004/2007, 2009/2011	NP, NP1, NP2, NP4	8 SU	
	BE	1998, 2000 - 2011	NP, NP1, NP3, NP4, NP5, NP7	2 RBD, 15 SU	RBDs VL only, SU - 2005 and 2010 only
	CZ	2006	NP3, NP7	3 RBD	
	DK	2010 - 2012	NP	4 RBD	
	FI	2000-2006	NP1, NP2, NP5, NP7, NP8	8 RBD	
	CH	1977/1998, 1985, 1995, 2000 - 2011	NP, NP1, NP2, NP3, NP4, NP5, NP7, NP8, NP9	4 RBD, 6 SU	RBD 1977/1998 and 2010
	IS	2008 - 2012	NP1, NP3	CC	
	NL	2008 - 2011	NP1, NP3, NP5, NP7, NP9	4 RBD	
	RO	2004	NP1, NP2, NP7, NP8	1 RBD	
	SE	1995, 2000, 2006, 2009	NP, NP1, NP2, NP3, NP4, NP7, NP8	5 RBD	

RBD	River Basin District		**NP2**	Atmospheric Deposition
SU	Sub-Unit of RBD		**NP3**	Un-Connected Dwellings Emissions
VL	Flanders region of Belgium		**NP4**	Urban Diffuse Emissions
CC	The whole country		**NP5**	Storm Overflows Emissions
CW	Coastal water		**NP6**	Abandoned Industrial Sites Emissions
SWR	Surface water body		**NP7**	Other Diffuse Emissions
NP*	Total diffuse emissions to inland water		**NP8**	Background Emissions
NP1	Agriculture Emissions		**NP9**	NP3 + NP5

6.7 Conclusions

The following conclusions can be drawn:

- The recent study on diffuse emissions for E-PRTR (Roovaart, 2013a) clearly identifies a significant share of "diffuse" emissions owes to point sources not covered under E-PRTR. This should be separated from other diffuse emissions as these can be estimated with a transparent and acceptable unique approach for the whole of Europe. In particular, the UWWTD reporting collects data on each individual UWWTP above 2.000 p.e., which should allow calculations of loads for specific pollutants not covered by the current reporting. A similar situation probably will occur for all industrial facilities not covered by the E-PRTR.
- It would be advantageous to reach an EU agreement on a minimum set of sources, parameters and assessment methods for diffuse emissions relevant at EU level, considering the necessary subsidiarity, in order to allow for an improvement in knowledge, dataset reliability and subsequent identification of trends. This is important as many experts recognise that diffuse emissions represent a significant share of anthropogenic emissions to the aquatic environment. Appropriate measures need to take, and a strong political support is needed to tackle this. As detailed in the DPSIR figure in section 2.2, this political response can address different parts along the pathway, from sources to the receiving environment. Monitoring success will need relevant efficiency and effectiveness indicators.
- Diffuse emissions require the use of a large amount of data, information and expertise, and hence a cooperation with many different actors from research to technical operators to policy level is needed. Both require a reliable and transparent knowledge framework to allow reliable sharing of knowledge.
- The specificity of diffuse emissions to water, with difficulties for identifying the sources and significant pathways, and with a set of pathways from sources to the aquatic environment is clearly a complicating factor when it comes to reporting, because it requires a clear definition of the different components: parameters, calculation methods, sources and their groups, parameters and their groups, geographical aggregation level and temporal aggregation level. To allow reporting, and subsequent use of the datasets, a common framework including a set of unique lists, definitions and metrics, has to be established and used by all. This is currently not the case. The E-PRTR offers a good basis for this, because it provides a core framework which allows linking of diffuse and point source emissions.
- The main challenge remains the identification of the sources of pollution as they have generally neither unique geographical coordinate nor emission pattern and transformation of the polluting parameters along the various pathways can occur.
- The key in assessing temporal trends is therefore to define and store with the respective datasets in a transparent manner the methods used, the sources, the pathways, so as to be able to reapply the same methodology in the following years or to adjust it to the most recent knowledge and recalculate the entire time series.

7 Synthesis and outlook

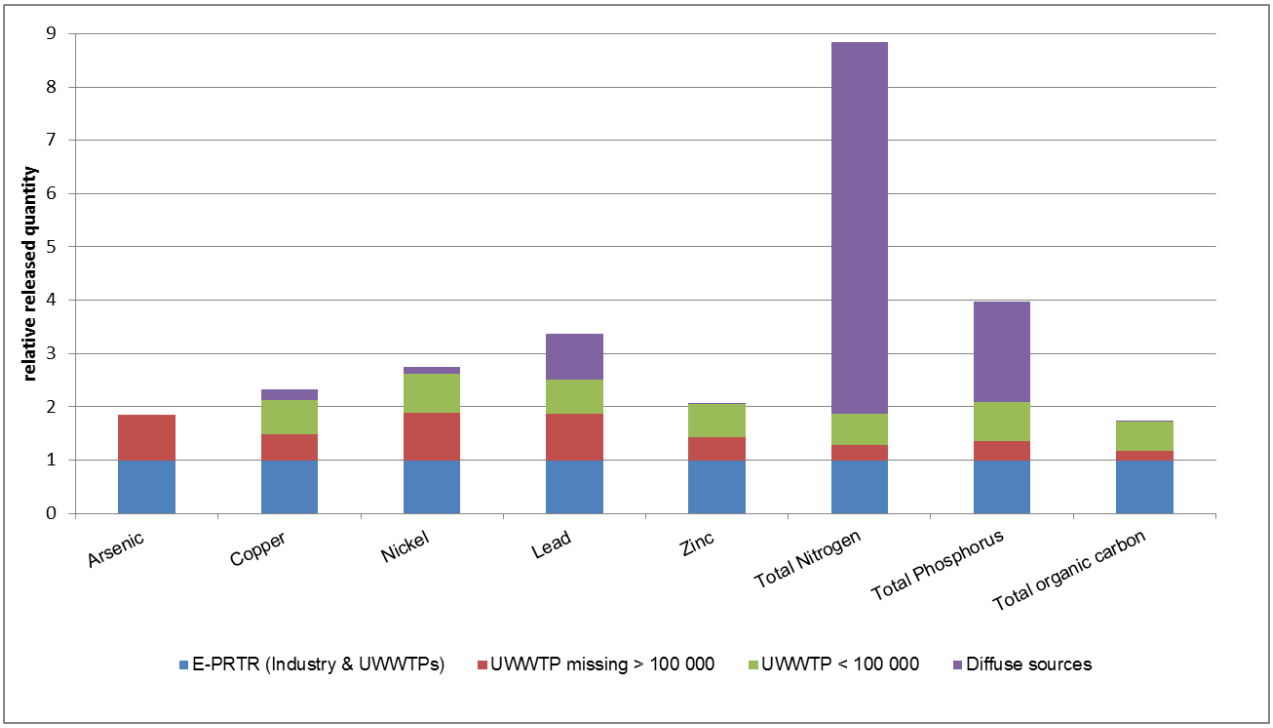
7.1 Synthesis

7.1.1 Overview of emissions

In this study, the most complete and harmonized data available have been collected and combined to get an impression of the contribution of the different emission sources to the total release to surface water in the EU. Figure 7.1. gives this overview for a selection of 8 most reported pollutants, combining:

- The E-PRTR data: sum industry and UWWTPs (average of 2007–2014);
- The potentially missing releases of the pollutants of both UWWTPs > 100 000 p.e. missing in E-PRTR, and missing releases of pollutants of UWWTPs > 100 000 p.e. included in E-PRTR, as quantified in Roovaart et al (2013a);
- The releases of UWWTPs < 100 000 p.e., as quantified in Roovaart et al (2013a), not available for Arsenic;
- The releases of a selection of a number of diffuse sources, as quantified in Roovaart et al (2013a), not for Arsenic and TOC.

Figure 7.1 Overview of a combination of releases from different reports for a selection of 8 most reported pollutants, compared with releases of Industry & UWWTPS reported under E-PRTR (reported E-PRTR releases = 1)



The presently available information regarding E-PRTR releases seems only to represent a limited part of the total releases to water for a set of 8 often reported pollutants. Although there is an uncertainty in the quantification of missing data and information, there is a strong indication that the existing data provide in some cases an incomplete picture of the total release to surface water.

A complete, detailed and reliable overview of water related emissions appeared impossible at this stage due to the incomparability and the incompleteness of the available information (see previous chapters).

7.1.2 *Gaps in emission data*

The main gaps in the reported emission data can be summarised as follows:

- One of the main obstacles to provide a clear overview of the completeness of the E-PRTR emission inventory is the lack of data regarding the production capacity (or real production data) of the facilities related to the different activities. For releases to water, only for activity 5.(f) UWWTPs, there is a rather complete database of capacities publicly available (the UWWTP database).
- The limited reporting received from a large number of countries for many sectors and pollutants in E-PRTR gives a strong indication of the extent of potentially missing releases.
- Missing UWWTPs > 100 000 p.e. in the E-PRTR and the pollutants from UWWTPs expected to be above the pollutant threshold that are not reported, appear to be a considerable and relevant gap.
- Although the smaller UWWTPs < 100 000 p.e. do not have to be reported for E-PRTR, their contribution to the total UWWTP releases is expected to be relevant. A quantification method based on emission factors is available.
- For most key pollutants, the contribution of the diffuse sources to the total release to water greatly exceeds the contribution of the point sources. Most countries do not report on diffuse sources, or only for a few sources and pollutants.

7.2 The way forward

Possible actions to improve the reporting of release to water are:

- **To communicate UWWTPs missing in EPRTR with Member States:**
  About 25% of the UWWTPs > 100 000 p.e. known in the UWWTP database are consequent not reported in E-PRTR. This results in a high level of possible incompleteness.
- **To encourage the use of emission factors in the calculation of releases to water from UWWTPs for non-monitored pollutants:**
  Many pollutants are not reported for UWWTPs by certain countries or not reported for specific facilities, although releases above the pollutant thresholds would be expected due to the known capacity threshold.
- **To organise a detailed analysis on a selected number of activities for which facilities and/or pollutants seem to be missing:**
  In the report "E-PRTR completeness checks" (Roovaart et al, 2016) a comparison has been made between the expected pollutants per activity in the E-PRTR Guidance document and eleven most reported pollutants. It shows a limited number of activity-pollutant combinations not reported but expected to be reported according the Guidance document, but mainly for activities with only a small number of reporting facilities. For example, the Polycyclic Aromatic Hydrocarbons (PAHs) are reported only to a very limited extent, which could be a signal of underreporting. The use of emission factors to quantify these releases instead of, or in combination with, regular monitoring could be considered.
- **Expanding diffuse sources in E-PRTR:**
  The reporting on diffuse sources under WISE-SoE Emissions and the WFD shows that an increasing number of countries succeed in reporting diffuse releases of a number of key pollutants. It might be a good moment to start including diffuse sources in E-PRTR, as is described in Article 8 of the Regulation, through a streamlining with the existing reporting obligations.
- **Revision of the UWWTP activity threshold:**
  For most EPRTR activities, no convincing arguments are available to increase or decrease the activity thresholds. For one activity however, a reduction of the activity threshold should be considered. For activity 5.(f) UWWTPs the existing capacity threshold of 100 000 p.e. seems not to

be consistent with the pollutant thresholds of the most reported pollutants namely total nitrogen, total phosphorus and total organic carbon (TOC). Even an average UWWTP with a high level of treatment (tertiary treatment), and thus relatively low releases, will release pollutants a factor 5 higher than the pollutant thresholds. So, if we take the pollutant thresholds as an amount of the pollutant we want to be reported, the capacity threshold for UWWTPs under E-PRTR could be reduced by a factor 5. This would result in a new capacity threshold of 20 000 p.e.

- **Quality check of reported loads of a selection of UWWTPs and other E-PRTR facilities:**
  This analysis show that extreme differences exist between countries and between UWWTPs and that extreme releases of individual facilities in a number of cases do exist. A detailed quality check in communication with the countries and the exchange between countries of methods and data could probably improve the quality of the releases in E-PRTR.
- **Combining of related reporting in UWWTD and E-PRTR:**
  It would be very useful to harmonize the identification parameters of UWWTPs in the UWWTP database and E-PRTR. That would make it easier to use the reported capacity data for assessments with the release data.
  It seems efficient to stop the reporting of releases in the UWWTP database, which seems no big problem since this data reporting is voluntary. This could be combined with lowering the capacity threshold of UWWTPs in E-PRTR to 20 000 p.e.
  It would be useful to add info in E-PRTR on the identification parameters of the receiving UWWTP for water transfers. That would make it possible to use the water transfer data in a wider context without the risk of double counting with the UWWTP releases in E-PRTR.
- **Streamlining reporting in WFD and E-PRTR:**
  Efforts to reduce the burden of reporting mean that E-PRTR releases now do not need to be reported under WFD. The frequency of reporting needs further discussion as the present 6-yearly reporting frequency under the WFD may be insufficient, while the annual reporting under EPRTR may be too burdensome. For diffuse sources, a two or three year reporting cycle could be considered.
- **Harmonization of quantification methods for releases from diffuse sources:**
  It is suggested to start a process of sharing knowledge, data and information on diffuse sources between the Countries to avoid doubling the amount of work and to make steps towards harmonising quantification methods for diffuse sources.
  It is suggested to the European Commission, to keep playing a facilitating and stimulating role in the process of the quantification of diffuse water emissions and to take additional initiatives under the umbrella of the CIS Working Group Chemical, like the establishment of a group on the harmonization and quantification of emissions of diffuse sources. Other actions the European Commission could undertake include:
  - Organize meetings for the quantification of diffuse water emissions and the harmonization of definitions and methods;
  - Stimulate involvement of European / international water organizations with specialist groups on diffuse water pollution;
  - Set up a database to exchange information concerning emission factors;
  - Create an online platform (website or social media) for sharing information, data and knowledge of the quantification of diffuse water emissions.

  To Member States, it is suggested to:
  - actively share information about projects, activities, data and methods about the quantification of emissions of diffuse sources
  - to participate in international working groups, River Basin Committees and discussions about diffuse water emissions and

- to report on diffuse water emissions in official requests, even when the emissions have a limited reliability.

- **Reducing the non-mandatory WISE-SoE Emissions reporting:**
  To reduce the reporting burden, voluntary WISE-SoE Emissions could be ceased with respect to diffuse sources and instead integrated into E-PRTR reporting. This would provide a more consistent and comparable high quality dataset on releases to water.

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Annex 1 Percentage of the number of release reports per pollutant per year in E-PRTR, excluding activity 5.f: UWWTPs (2007–2014)

In E-PRTR different pollutant groups are distinguished: chlorinated organic substances, heavy metals, inorganic substances, other gases, other organic substances and pesticides. Per group, for all the individual pollutants, the percentage of the number of release reports per year is shown. The percentage of the reported pollutants in the specific year is marked with different colours:

- Green: 1%–5% of all the release reports in the specific year
- Yellow: 5%–10% of all the release reports in the specific year
- Red: > 10% of all the release reports in the specific year

PollutantName	2007	2008	2009	2010	2011	2012	2013	2014
Chlorinated organic substances								
1,1,1-trichloroethane	0.04	0.01	0.01	0.05	0.01	0.11	0.00	0.03
1,2-dichloroethane (DCE)	0.44	0.42	0.35	0.41	0.31	0.32	0.30	0.30
Brominated diphenylethers (PBDE)	0.02	0.05	0.04	0.04	0.02	0.05	0.00	0.01
Chloro-alkanes, C10-C13	0.06	0.06	0.05	0.06	0.05	0.07	0.09	0.09
Dichloromethane (DCM)	0.45	0.50	0.48	0.49	0.43	0.43	0.41	0.40
Halogenated organic compounds (as AOX)	1.80	1.66	1.56	1.70	1.61	1.66	1.52	1.58
Hexabromobiphenyl	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00
Hexachlorobenzene (HCB)	0.05	0.02	0.01	0.00	0.00	0.02	0.02	0.03
Hexachlorobutadiene (HCBD)	0.04	0.05	0.05	0.05	0.07	0.06	0.04	0.05
PCDD + PCDF (dioxins + furans) (as Teq)	0.15	0.19	0.19	0.25	0.22	0.12	0.22	0.28
Pentachlorobenzene	0.05	0.04	0.04	0.05	0.02	0.02	0.01	0.04
Pentachlorophenol (PCP)	0.09	0.08	0.07	0.06	0.08	0.08	0.07	0.06
Polychlorinated biphenyls (PCBs)	0.09	0.10	0.06	0.08	0.11	0.12	0.06	0.12
Tetrachloroethylene (PER)	0.18	0.20	0.17	0.18	0.19	0.18	0.17	0.13
Tetrachloromethane (TCM)	0.22	0.26	0.20	0.17	0.25	0.22	0.19	0.19
Trichlorobenzenes (TCBs) (all isomers)	0.05	0.10	0.10	0.08	0.12	0.12	0.07	0.10
Trichloroethylene	0.24	0.24	0.22	0.18	0.14	0.17	0.16	0.13
Trichloromethane	0.50	0.59	0.56	0.65	0.56	0.60	0.62	0.66
Vinyl chloride	0.18	0.17	0.20	0.17	0.16	0.16	0.14	0.15
Heavy metals								
Arsenic and compounds (as As)	4.50	4.75	4.74	5.05	5.32	4.94	4.93	4.87
Cadmium and compounds (as Cd)	2.86	2.64	2.42	2.51	2.55	2.45	2.58	2.46
Chromium and compounds (as Cr)	2.97	2.61	2.59	2.72	2.59	2.47	2.41	2.33
Copper and compounds (as Cu)	5.74	5.79	5.36	5.12	5.24	5.46	5.43	5.05
Heavy metals	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
Lead and compounds (as Pb)	3.80	3.79	3.52	3.83	3.76	3.54	3.44	3.30
Mercury and compounds (as Hg)	2.78	2.67	2.63	2.70	2.37	2.46	2.25	2.30
Nickel and compounds (as Ni)	7.84	7.39	7.21	7.33	7.01	6.68	6.84	7.08
Zinc and compounds (as Zn)	14.25	14.65	15.10	14.31	14.51	14.72	15.04	15.85
Inorganic substances								
Asbestos	0.00	0.02	0.01	0.02	0.04	0.04	0.00	0.00
Chlorides (as total Cl)	3.40	3.43	3.29	3.42	3.43	3.15	3.26	3.46
Cyanides (as total CN)	1.17	1.09	1.19	1.24	1.21	1.22	1.10	1.03
Fluorides (as total F)	2.71	2.55	2.62	2.65	2.82	2.57	2.55	2.66
Inorganic substances	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
Particulate matter (PM10)	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total nitrogen	7.92	7.91	8.65	8.17	8.41	9.46	9.52	9.58
Total phosphorus	9.75	9.72	10.00	9.73	10.07	10.30	10.51	11.44
Other gases								
Ammonia (NH3)	0.01	0.02	0.06	0.02	0.02	0.02	0.02	0.03
Carbon monoxide (CO)	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Sulphur oxides (SOx/SO2)	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.03

PollutantName	2007	2008	2009	2010	2011	2012	2013	2014
Other organic substances								
Anthracene	0.43	0.32	0.32	0.41	0.41	0.38	0.51	0.45
Benzene	1.28	1.32	1.39	1.36	1.19	1.16	1.24	0.46
Benzo(g,h,i)perylene	0.16	0.19	0.17	0.20	0.22	0.31	0.28	0.24
Di-(2-ethyl hexyl) phthalate (DEHP)	0.30	0.44	0.37	0.48	0.55	0.30	0.32	0.36
Ethyl benzene	0.91	0.86	1.03	1.04	0.89	0.90	0.88	0.42
Ethylene oxide	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Fluoranthene	0.40	0.45	0.47	0.54	0.56	0.70	0.67	0.54
Naphthalene	0.82	0.83	0.78	0.86	0.77	0.76	0.72	0.72
Nonylphenol and Nonylphenol ethoxylates (NP/NPEs)	0.29	0.36	0.29	0.59	0.61	0.50	0.37	0.37
Octylphenols and Octylphenol ethoxylates	0.11	0.10	0.06	0.16	0.16	0.13	0.15	0.13
Organotin compounds (as total Sn)	0.04	0.04	0.01	0.01	0.00	0.01	0.00	0.00
Phenols (as total C)	3.49	3.47	3.50	3.62	3.40	3.52	3.24	4.09
Polycyclic aromatic hydrocarbons (PAHs)	0.63	0.62	0.56	0.47	0.49	0.44	0.51	0.39
Toluene	1.29	1.27	1.30	1.27	1.16	1.15	1.19	0.48
Total organic carbon (TOC) (as total C or COD/3)	13.51	13.75	13.92	13.41	13.84	13.85	14.07	14.76
Xylenes	1.18	1.18	1.24	1.21	1.09	1.04	1.05	0.46
Pesticides								
1,2,3,4,5,6-hexachlorocyclohexane (HCH)	0.06	0.07	0.06	0.05	0.05	0.05	0.05	0.04
Alachlor	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00
Aldrin	0.02	0.04	0.02	0.07	0.08	0.08	0.09	0.05
Atrazine	0.06	0.04	0.04	0.00	0.01	0.02	0.01	0.00
Chlordane	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Chlordecone	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Chlorfenvinphos	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Chlorpyrifos	0.02	0.02	0.01	0.00	0.01	0.00	0.00	0.00
DDT	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Dieldrin	0.02	0.04	0.02	0.07	0.08	0.08	0.07	0.05
Diuron	0.04	0.05	0.04	0.04	0.07	0.05	0.04	0.05
Endosulphan	0.01	0.04	0.01	0.01	0.00	0.00	0.00	0.00
Endrin	0.02	0.05	0.02	0.06	0.06	0.06	0.05	0.03
Heptachlor	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Isodrin	0.02	0.04	0.02	0.06	0.06	0.06	0.05	0.03
Isoproturon	0.40	0.40	0.42	0.40	0.42	0.38	0.38	0.01
Lindane	0.04	0.07	0.02	0.02	0.01	0.00	0.04	0.01
Mirex	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Simazine	0.01	0.02	0.01	0.01	0.00	0.02	0.01	0.01
Toxaphene	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Tributyltin and compounds	0.01	0.02	0.02	0.01	0.04	0.00	0.00	0.00
Trifluralin	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Triphenyltin and compounds	0.01	0.02	0.01	0.02	0.00	0.00	0.00	0.00

Annex 2 Percentage of the number of release reports per pollutant per year in E-PRTR for activity 5.f: UWWTPs (2007–2014)

In E-PRTR different pollutant groups are distinguished: chlorinated organic substances, heavy metals, inorganic substances, other gases, other organic substances and pesticides. Per group, for all the individual pollutants, the percentage of the number of release reports per year is shown. The percentage of the reported pollutants in the specific year is marked with different colours:

- Green: 1%–5% of all the release reports in the specific year
- Yellow: 5%–10% of all the release reports in the specific year
- Red: > 10% of all the release reports in the specific year

PollutantName	2007	2008	2009	2010	2011	2012	2013	2014
Chlorinated organic substances								
1,2-dichloroethane (DCE)	0.46	0.35	0.25	0.29	0.25	0.34	0.30	0.24
Brominated diphenylethers (PBDE)	0.06	0.04	0.14	0.12	0.16	0.16	0.00	0.00
Chloro-alkanes, C10-C13	0.10	0.08	0.14	0.16	0.16	0.15	0.16	0.19
Dichloromethane (DCM)	0.79	0.69	0.38	0.46	0.46	0.59	0.56	0.48
Halogenated organic compounds (as AOX)	2.91	2.97	2.98	3.12	3.30	3.71	3.56	3.57
Hexabromobiphenyl	0.00	0.03	0.03	0.03	0.05	0.01	0.02	0.04
Hexachlorobenzene (HCB)	0.12	0.04	0.04	0.03	0.08	0.03	0.01	0.01
Hexachlorobutadiene (HCBD)	0.07	0.09	0.15	0.12	0.10	0.11	0.13	0.16
PCDD + PCDF (dioxins + furans) (as Teq)	0.09	0.07	0.04	0.14	0.13	0.14	0.63	0.85
Pentachlorobenzene	0.01	0.04	0.03	0.05	0.03	0.05	0.02	0.02
Pentachlorophenol (PCP)	0.25	0.29	0.29	0.24	0.30	0.16	0.10	0.08
Polychlorinated biphenyls (PCBs)	0.15	0.30	0.27	0.29	0.14	0.16	0.18	0.19
Tetrachloroethylene (PER)	0.39	0.36	0.34	0.37	0.34	0.30	0.22	0.24
Tetrachloromethane (TCM)	0.39	0.33	0.30	0.28	0.30	0.40	0.32	0.30
Trichlorobenzenes (TCBs) (all isomers)	0.22	0.25	0.19	0.21	0.13	0.14	0.15	0.14
Trichloroethylene	0.24	0.20	0.19	0.24	0.29	0.18	0.21	0.13
Trichloromethane	1.30	1.12	0.70	0.64	0.74	0.70	0.64	0.68
Vinyl chloride	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.04
Heavy metals								
Arsenic	3.94	4.20	4.35	4.39	4.34	4.41	4.25	4.18
Cadmium and compounds (as Cd)	2.18	2.15	2.15	2.12	2.06	2.06	1.89	2.07
Chromium and compounds (as Cr)	3.27	2.74	2.75	2.68	2.61	2.35	2.56	2.39
Copper	6.92	6.61	6.85	6.88	6.92	6.89	6.68	6.51
Lead	5.11	4.49	4.16	4.01	4.06	3.73	3.92	3.78
Mercury and compounds (as Hg)	3.17	3.33	2.90	2.83	2.73	2.68	2.66	2.18
Nickel	7.08	7.19	7.60	7.19	7.50	7.44	7.41	7.44
Zinc	9.07	9.37	10.14	9.60	9.75	9.84	9.63	9.59
Inorganic substances								
Asbestos	1.36	1.39	1.17	1.31	1.31	1.42	1.24	1.28
Chlorides (as total Cl)	3.65	3.69	3.90	4.02	4.34	4.38	4.27	4.21
Cyanides (as total CN)	1.37	1.30	1.31	1.32	1.44	1.35	1.36	1.27
Fluorides (as total F)	3.14	3.24	3.11	3.23	3.42	3.77	3.68	3.78
Inorganic substances	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Total nitrogen	11.08	10.73	11.41	11.54	11.10	11.20	11.00	10.67
Total phosphorus	9.90	9.46	9.92	9.74	9.34	9.30	9.09	9.19

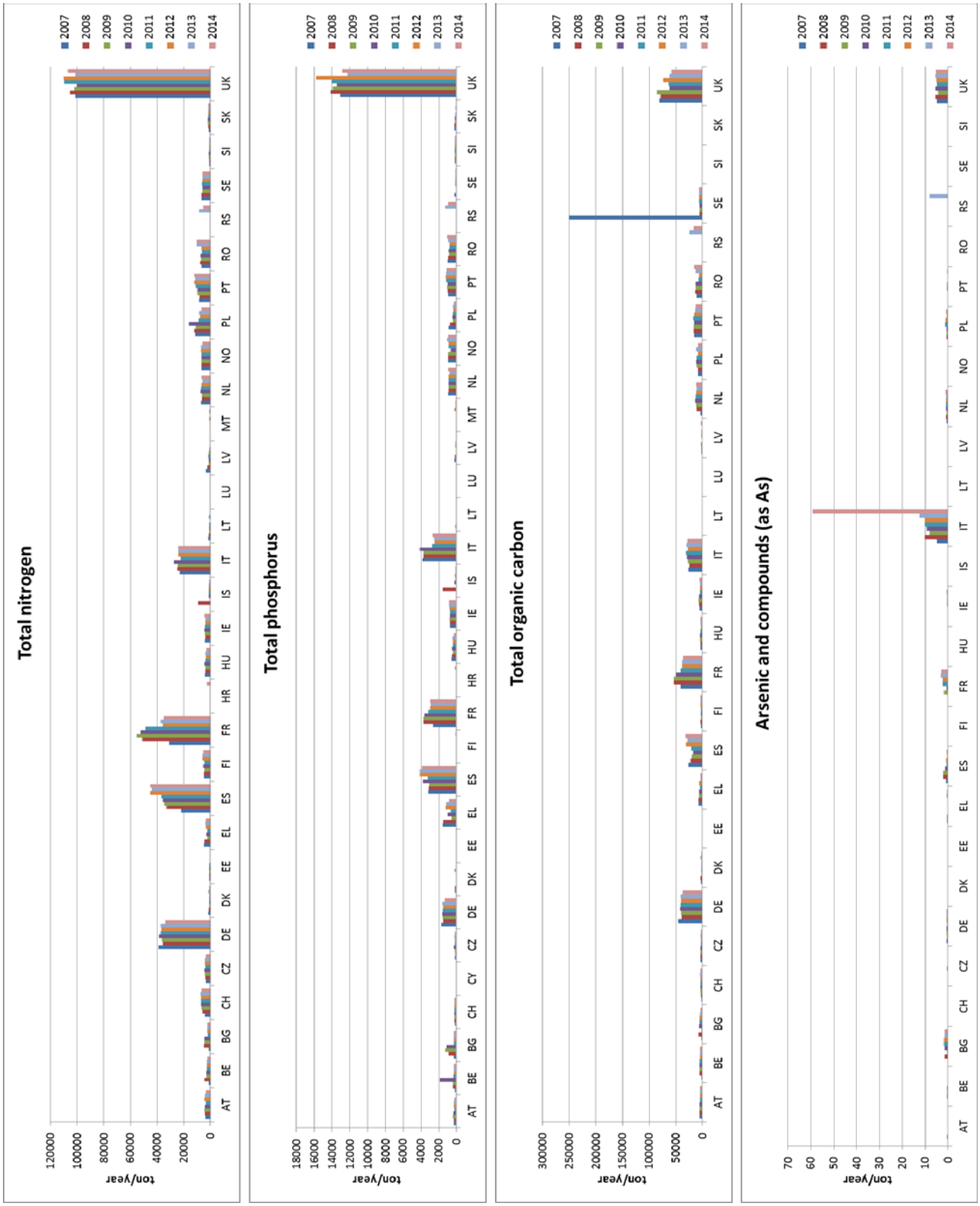
PollutantName	2007	2008	2009	2010	2011	2012	2013	2014
Other organic substances								
Anthracene	0.04	0.04	0.15	0.29	0.22	0.24	0.62	0.65
Benzene	0.06	0.07	0.07	0.08	0.04	0.01	0.01	0.01
Benzo(g,h,i)perylene	0.03	0.05	0.08	0.05	0.08	0.08	0.12	0.20
Di-(2-ethyl hexyl) phthalate (DEHP)	1.06	2.08	3.18	3.09	3.21	2.91	3.04	3.16
Ethyl benzene	0.03	0.03	0.07	0.07	0.03	0.01	0.01	0.01
Ethylene oxide	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Fluoranthene	0.16	0.20	0.18	0.22	0.13	0.13	0.12	0.18
Naphthalene	0.09	0.12	0.10	0.08	0.07	0.13	1.43	1.57
Nonylphenol and Nonylphenol ethoxylates (NP/NPEs)	2.55	3.08	2.47	2.89	2.85	2.86	2.85	3.02
Octylphenols and Octylphenol ethoxylates	1.94	2.16	0.56	0.68	0.46	0.47	0.32	0.38
Organotin compounds (as total Sn)	0.09	0.10	0.05	0.04	0.05	0.03	0.02	0.01
Phenols (as total C)	1.84	1.86	1.47	1.47	1.53	1.75	1.64	1.85
Polycyclic aromatic hydrocarbons (PAHs)	0.42	0.40	0.26	0.14	0.09	0.09	0.34	0.42
Toluene	0.06	0.07	0.10	0.10	0.05	0.05	0.02	0.01
Total organic carbon	10.55	10.44	11.01	10.94	10.92	11.07	10.90	10.35
Xylenes	0.06	0.04	0.05	0.09	0.07	0.03	0.01	0.01
Pesticides								
1,2,3,4,5,6-hexachlorocyclohexane (HCH)	0.07	0.04	0.03	0.03	0.01	0.03	0.01	0.01
Alachlor	0.03	0.01	0.04	0.04	0.00	0.01	0.01	0.02
Aldrin	0.09	0.05	0.04	0.07	0.07	0.05	0.05	0.04
Atrazine	0.15	0.07	0.11	0.07	0.08	0.06	0.05	0.06
Chlordecone	0.00	0.00	0.01	0.00	0.04	0.01	0.02	0.05
Chlorfenvinphos	0.03	0.03	0.00	0.01	0.03	0.00	0.00	0.01
Chlorpyrifos	0.01	0.00	0.03	0.00	0.01	0.00	0.00	0.01
DDT	0.03	0.03	0.04	0.03	0.01	0.04	0.01	0.04
Dieldrin	0.13	0.10	0.08	0.12	0.07	0.05	0.05	0.04
Diuron	0.97	1.18	1.05	1.10	1.38	1.28	1.00	1.45
Endosulphan	0.03	0.01	0.04	0.01	0.01	0.00	0.00	0.00
Endrin	0.07	0.07	0.05	0.05	0.07	0.04	0.04	0.02
Heptachlor	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01
Isodrin	0.13	0.08	0.08	0.12	0.07	0.05	0.05	0.04
Isoproturon	0.07	0.09	0.10	0.13	0.20	0.05	0.16	0.23
Lindane	0.06	0.08	0.04	0.09	0.03	0.06	0.04	0.04
Mirex	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Simazine	0.15	0.13	0.10	0.09	0.10	0.09	0.05	0.07
Toxaphene	0.00	0.00	0.03	0.03	0.03	0.00	0.00	0.01
Tributyltin and compounds	0.04	0.09	0.07	0.07	0.05	0.06	0.05	0.05
Trifluralin	0.03	0.03	0.01	0.01	0.00	0.01	0.01	0.01
Triphenyltin and compounds	0.03	0.04	0.01	0.04	0.05	0.03	0.02	0.04

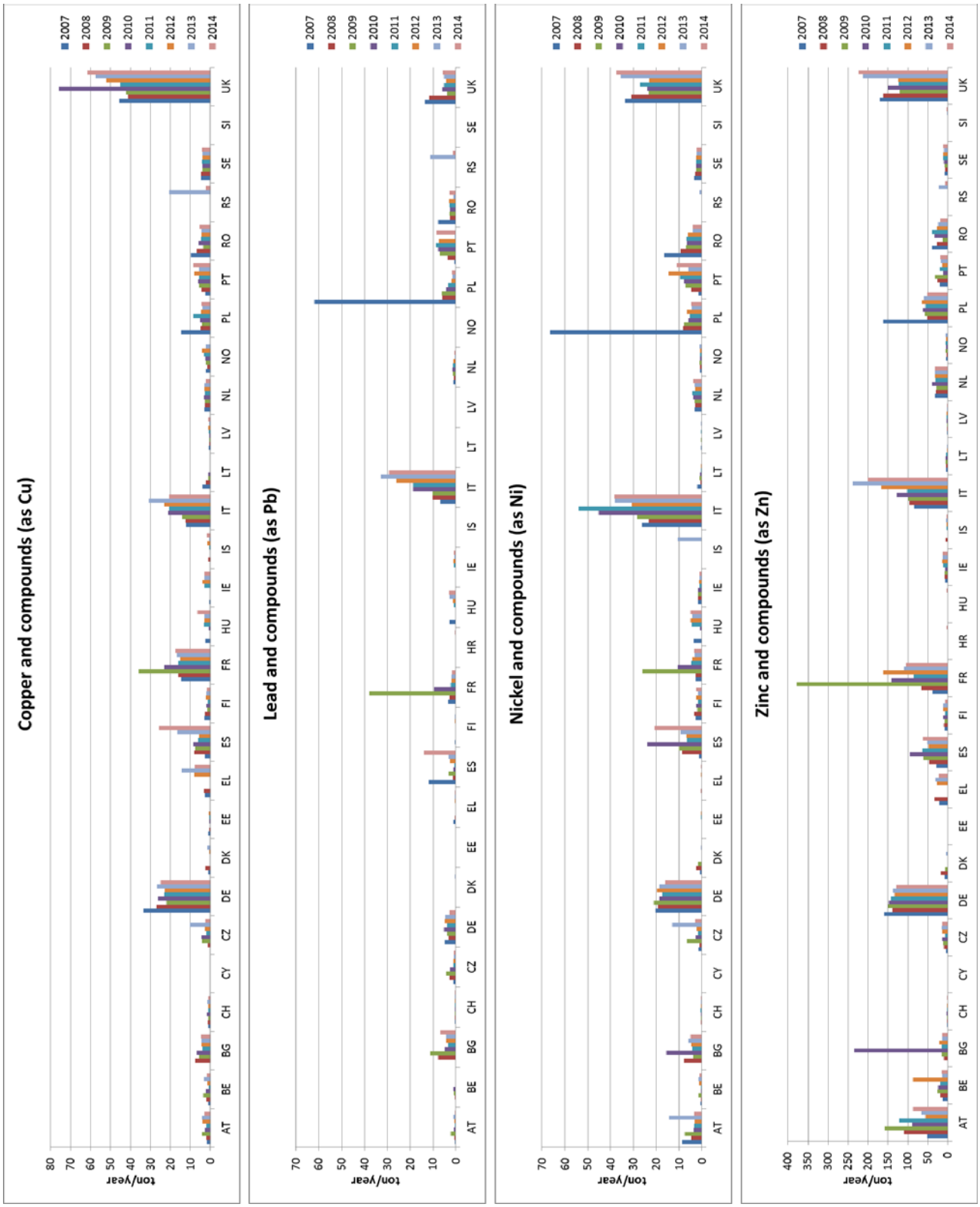
Annex 3 Trend of releases (kg/year) for all pollutants in E-PRTR, excluding activity 5.f: UWWTPs (2007–2014)

PollutantName	2007	2008	2009	2010	2011	2012	2013	2014
Chlorinated organic substances								
1,1,1-trichloroethane	0.01	0.00	0.00	0.00	0.00	0.00	0	0.05
1,2-dichloroethane (DCE)	8,976	9,718	30,616	5,328	4,418	4,268	3,837	2,442
Brominated diphenylethers (PBDE)	3.6	45	8.9	12	22	25		2.2
Chloro-alkanes, C10-C13	86	78	928	144	171	170	159	156
Dichloromethane (DCM)	41,117	9,647	13,809	7,678	5,838	7,859	12,520	10,663
Halogenated organic compounds (as AOX)	3,382,070	2,845,770	2,418,900	3,179,660	2,673,220	2,793,290	2,379,400	2,283,330
Hexabromobiphenyl	0	55	0	8.5	0.14	0	0	0
Hexachlorobenzene (HCB)	12	18	4.3	0	1.9	11	7.2	6.4
Hexachlorobutadiene (HCBD)	47	232	49	107	160	172	132	166
PCDD + PCDF (dioxins + furans) (as Teq)	0.01	0.02	14	0.29	0.03	0.06	0.03	0.23
Pentachlorobenzene	15	20	647	306	11	167	44	37
Pentachlorophenol (PCP)	84	170	42	37	30	23	24	43
Polychlorinated biphenyls (PCBs)	6.8	30	1.6	3.9	4.3	6.2	4.0	2.2
Tetrachloroethylene (PER)	2,433	1,702	1,109	1,032	1,612	1,093	1,042	763
Tetrachloromethane (TCM)	587	576	521	1,877	949	543	635	609
Trichlorobenzenes (TCBs) (all isomers)	1,717	1,172	661	375	650	464	328	262
Trichloroethylene	1,801	5,832	5,671	1,371	958	1,098	1,155	710
Trichloromethane	11,437	10,277	10,196	12,505	9,389	7,643	6,713	5,979
Vinyl chloride	2,120	1,486	2,084	2,441	1,811	1,906	1,197	1,104
Heavy metals								
Arsenic	37,800	32,604	33,044	72,690	78,587	64,120	48,326	55,940
Cadmium and compounds (as Cd)	11,364	9,061	6,770	7,479	10,098	12,250	14,189	10,782
Chromium and compounds (as Cr)	596,335	570,175	410,189	600,407	450,365	457,083	474,486	411,134
Copper	261,114	299,171	243,797	376,250	351,346	344,390	370,815	280,486
Heavy metals (not specified)	0	0	154	0	0	0	619	0
Lead	157,420	93,083	101,546	119,779	148,760	107,170	101,715	101,040
Mercury and compounds (as Hg)	8,308	2,775	3,768	2,596	2,775	3,400	2,876	2,448
Nickel	208,377	194,553	148,860	143,242	139,557	141,182	132,796	176,992
Zinc	1,542,277	1,141,803	1,285,870	1,320,152	1,178,775	1,109,026	1,220,665	1,142,945
Inorganic substances								
Asbestos		17	699	11	3.7	14	0	0
Chlorides (as total Cl)	17,492,330,000	15,190,810,000	11,907,470,000	14,436,890,000	17,329,010,000	15,503,980,000	16,257,460,000	15,329,810,000
Cyanides (as total CN)	170,279	147,699	145,578	161,448	121,260	129,629	106,970	85,375
Fluorides (as total F)	9,516,410	9,709,800	6,371,610	7,122,490	8,417,080	9,043,400	7,435,060	7,467,040
Inorganic substances (not specified)	0	0	56	0	0	0	104	0
Particulate matter (PM10)	52	0	0	0	0	0	0	0
Total nitrogen	137,169,500	111,474,000	97,885,800	107,372,900	102,735,100	113,675,700	113,911,500	115,735,400
Total phosphorus	14,299,200	13,565,970	13,341,850	13,664,660	12,948,290	14,958,940	14,138,210	14,151,440
Inorganic substances								
Ammonia (NH3)	100	74,350	15,131	15,227	15,430	14,981	19,024	23,845
Carbon monoxide (CO)	0	0.41	0	0	0	0	0	0
Sulphur oxides (SOx/SO2)	0	0	0	0	411,300	0	0	1,926,000
Other organic substances								
Anthracene	2,133	1,217	94	208	311	115	196	203
Benzene	2,575,713	2,638,188	2,310,696	2,275,322	1,870,342	1,870,765	3,388,252	856,242
Benzo(g,h,i)perylene	284	587	80	131	193	155	400	136
Di-(2-ethyl hexyl) phthalate (DEHP)	1,024	581	355	942	951	3,526	470	775
Ethyl benzene	116,490	123,925	147,015	171,353	104,569	135,904	148,370	41,594
Ethylene oxide				17				17
Fluoranthene	11,734	8,513	7,106	375	448	510	966	1,164
Naphthalene	75,796	186,057	123,505	155,869	82,155	93,321	164,875	140,207
Nonylphenol and Nonylphenol ethoxylates (NP/NPEs)	7,449	7,380	1,880	3,492	4,349	4,559	4,169	4,343
Octylphenols and Octylphenol ethoxylates	978	642	502	1,846	720	834	164	108
Organotin compounds (as total Sn)	377	752	437	111		88		
Phenols (as total C)	902,936	840,543	619,077	827,233	646,133	657,566	578,923	880,320
Polycyclic aromatic hydrocarbons (PAHs)	7,143	4,550	3,909	3,574	2,929	5,227	3,293	3,179
Toluene	1,943,028	1,891,502	1,753,417	1,712,148	1,635,018	1,567,738	1,894,533	793,138
Total organic carbon	492,391,400	552,388,900	480,754,900	462,506,300	478,959,900	499,944,200	485,433,000	462,557,000
Xylenes	504,679	479,511	589,950	581,752	502,962	539,099	576,695	151,407

PollutantName	2007	2008	2009	2010	2011	2012	2013	2014
Pesticides								
1,2,3,4,5,6-hexachlorocyclohexane (HCH)	227	911	128	19	4,599	42	59	19
Alachlor	7.8	31	1.00	0	0	0	0	0
Aldrin	19	45	16	58	49	42	34	13
Atrazine	36	36	8.5	0	3.9	9.1	5.7	0
Chlordane	0	55	0	0	0	0	0	0
Chlordecone	0	55	0	0	0	0	0	0
Chlorfenvinphos	0	55	0	0	0	0	0	0
Chlorpyrifos	81	56	2.6	0	6.7	0	0	0
DDT		28	0	0	0	0	0	0
Dieldrin	16	45	16	58	49	42	31	13
Diuron	27	64	16	18	28	22	4.2	27
Endosulphan	3.0	32	3.0	2.0	3.0	0	0	0
Endrin	16	21	20	24	20	15	11	8.4
Heptachlor	0	28	0	0	0	0	0	0
Isodrin	11	17	8.6	69	20	13	13	8.4
Isoproturon	246,231	234,599	265,751	243,964	210,621	251,886	275,669	8.4
Lindane	43	67	17	3.2	2.6	0	3.8	1.3
Mirex	0	55	0	0	0	0	0	0
Simazine	3.2	33	5.8	3.2	0	9.1	1.3	1.4
Toxaphene	0	0	0	14	0	0	0	2.4
Tributyltin and compounds	2.6	8.6	40,013	8.5	92	0	0	0
Trifluralin	0	28	0	0	0	0	0	0
Triphenyltin and compounds	2.6	5.2	2.0	17	0	0	0	0

Annex 4 Releases per pollutant per year per country for the UWWTPs reported under EPRTR*





* Although only UWWTPs > 100 000 p.e. are requested to report under E-PRTR, some countries also do report some releases of UWWTPs < 100 000 p.e. In this annex all the reported UWWTPs are included (also the releases of UWWTPs < 100 000 p.e.)

Annex 5 Trends of UWWTP releases reported under E-PRTR* in kg/year (2007–2014)

PollutantName	2007	2008	2009	2010	2011	2012	2013	2014
Chlorinated organic substances								
1,2-dichloroethane (DCE)	2,394	2,455	1,815	2,381	3,904	2,343	2,480	2,187
Brominated diphenylethers (PBDE)	107	106	20	19	23	27	0	0
Chloro-alkanes, C10-C13	204	55	143	176	444	137	311	324
Dichloromethane (DCM)	6,025	4,405	2,538	2,778	7,604	3,027	2,641	2,840
Halogenated organic compounds (as AOX)	1,012,010	1,127,410	1,109,740	1,262,130	1,213,630	1,665,770	1,658,880	1,956,660
Hexabromobiphenyl		4.4	1.9	0.32	4.1	0.17	0.38	0.46
Hexachlorobenzene (HCB)	110	75	63	73	85	78	18	19
Hexachlorobutadiene (HCBD)	101	36	72	70	55	119	132	139
PCDD + PCDF (dioxins + furans) (as Teq)	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03
Pentachlorobenzene	1.5	16	14	81	13	59	48	51
Pentachlorophenol (PCP)	610	159	134	552	285	155	39	126
Polychlorinated biphenyls (PCBs)	31	156	221	73	65	85	28	22
Tetrachloroethylene (PER)	3,163	3,252	2,071	2,832	2,892	1,877	2,000	3,593
Tetrachloromethane (TCM)	1,612	1,418	1,418	1,363	1,509	1,925	1,386	1,337
Trichlorobenzenes (TCBs) (all isomers)	482	132	150	240	129	129	167	122
Trichloroethylene	1,906	1,711	1,751	2,062	2,085	1,695	1,893	1,573
Trichloromethane	17,028	13,524	6,963	6,455	5,503	5,641	6,065	3,984
Vinyl chloride	28	38	39	44	268	82	90	69
Heavy metals								
Arsenic and compounds (as As)	15,172	25,249	20,963	24,034	24,841	24,850	36,954	75,669
Cadmium and compounds (as Cd)	8,426	12,345	18,129	11,425	10,295	11,139	28,638	16,806
Chromium and compounds (as Cr)	76,591	67,468	92,894	104,734	75,893	68,147	94,543	91,183
Copper and compounds (as Cu)	169,192	162,266	169,812	210,253	164,180	185,731	245,878	216,412
Lead and compounds (as Pb)	120,046	58,254	97,665	70,121	56,892	65,868	76,533	83,376
Mercury and compounds (as Hg)	3,211	3,057	2,814	1,855	2,170	3,021	1,784	5,428
Nickel and compounds (as Ni)	204,610	142,214	168,177	183,136	165,345	146,073	185,853	169,904
Zinc and compounds (as Zn)	905,526	919,446	1,229,285	1,252,436	903,273	1,062,134	1,135,329	1,085,733
Inorganic substances								
Asbestos	356	372	254	345	357	403	352	395
Chlorides (as total Cl)	2,347,220,000	2,570,030,000	3,387,030,000	2,964,500,000	3,494,640,000	3,516,330,000	3,605,790,000	3,376,330,000
Cyanides (as total CN)	34,958	35,401	25,349	45,146	31,638	49,055	40,111	34,783
Fluorides (as total F)	2,045,820	3,042,500	2,039,440	2,265,610	3,715,030	3,216,130	3,272,790	3,171,960
Inorganic substances			117,000					
Total nitrogen	307,257,400	358,717,700	347,965,100	359,762,100	347,036,900	346,502,700	350,916,300	344,246,800
Total phosphorus	34,431,460	38,162,560	35,531,830	37,933,340	33,261,200	36,058,500	34,186,600	33,602,020
Other organic substances								
Anthracene	5.8	12	20	61	43	51	144	322
Benzene	2,236	3,387	3,909	3,372	1,564	1,040	1,110	1,090
Benzo(g,h,i)perylene	4.8	26	83	24	95	78	31	205
Di-(2-ethyl hexyl) phthalate (DEHP)	5,325	21,099	22,752	26,013	30,926	26,796	20,343	27,687
Ethyl benzene	1,428	1,197	2,044	1,442	1,282	1,040	1,110	1,090
Ethylene oxide	0	0	18	0	0	0	0	0
Fluoranthene	86	48	84	66	109	92	29	211
Naphthalene	324	4,144	384	579	452	753	5,012	5,688
Nonylphenol and Nonylphenol ethoxylates (NP/NPEs)	89,014	108,642	21,285	22,776	26,787	26,548	20,529	21,018
Octylphenols and Octylphenol ethoxylates	1,539	2,123	1,531	638	613	333	77	142
Organotin compounds (as total Sn)	2,492	1,968	6,001	769	7,688	139	259	67
Phenols (as total C)	114,190	95,465	71,712	216,194	63,053	108,065	135,626	83,426
Polycyclic aromatic hydrocarbons (PAHs)	1,735	2,007	1,080	510	788	464	960	570
Toluene	2,456	7,137	10,982	3,889	1,529	9,513	1,790	1,090
Total organic carbon	565,288,700	347,434,500	355,482,100	330,794,200	316,855,800	328,149,900	340,000,000	318,364,600
Xylenes	2,767	2,009	33,038	2,998	2,750	1,706	1,110	1,090

PollutantName	2007	2008	2009	2010	2011	2012	2013	2014
Pesticides								
1,2,3,4,5,6-hexachlorocyclohexane (HCH)	23	9.1	61	26	5.8	22	1.5	2.8
Alachlor	9.4	1.7	4.3	15	0	8.0	9.0	2,040
Aldrin	140	159	106	179	126	125	94	27
Atrazine	123	81	85	87	184	79	14	3,916
Chlordecone	0	0	61		11	1.3	3.1	99
Chlorfenvinphos	6.1	3.6	0	23	3.9	0	0	501
Chlorpyrifos	1.5	0	32	0	4.0	0	0	1,830
DDT	3.1	2.9	99	14	2.4	92	2.6	7.4
Dieldrin	159	208	153	174	106	86	94	27
Diuron	282	489	455	775	1,121	433	275	565
Endosulphan	26	1.0	33	1.0	3.0	0	0	0
Endrin	102	116	42	33	32	25	27	22
Heptachlor	1.5	0	1.1	24	0	8.0	92	10.0
Isodrin	95	43	41	54	148	29	32	27
Isoproturon	21	83	90	115	298	90	68	89
Lindane	26	87	64	92	82	106	106	12
Mirex	0	0	0	0	1.2	0	0	0
Simazine	51	89	71	82	175	82	15	14,645
Toxaphene	0	0	2.9	5.5	38	0	0	1.7
Tributyltin and compounds	7.4	242	82	75	72	76	13	12
Trifluralin	2.7	4.5	1.1	12	0	8.0	9.0	10.0
Triphenyltin and compounds	3.4	68	59	72	69	71	9.0	10

* Although only UWWTPs > 100 000 p.e. are requested to report under E-PRTR, some countries also do report some releases of UWWTPs < 100 000 p.e. In this annex all the reported UWWTPs are included (also the releases of UWWTPs < 100 000 p.e.)

Annex 6 Number of reported UWWTPs

The comparison of emission load from UWWTPs among countries is difficult – as data availability depends on the number of inhabitants connected to UWWTPs with a capacity above 100 000 p.e. – some countries (as e.g. United Kingdom or Germany) have many of these UWWTPs, while e.g. Baltic countries have 3–5 of these, see Table 6.1. For most countries the percentage of the UWWTPs above 100 000 p.e. is between 3.5%–10%. For Bulgaria, Cyprus, Malta a higher percentage (25%–33%) of the UWWTPs is larger than 100 000 p.e.

Table A6.1 Number of reported UWWTPs above 2 000 p.e. and 100 000 p.e. (reporting under UWWTD)

Country	Number of reported UWWTPs above 2 000 p.e.	Number of reported UWWTPs above 100 000 p.e.	% reported UWWTPs above 100 000 p.e.
AT	615	33	5%
BE	355	16	4%
BG	52	17	25%
CY	13	5	28%
CZ	552	25	4%
DE	4003	229	5%
DK	372	26	7%
EE	42	5	11%
EL	159	12	7%
ES	1858	182	9%
FR	3443	133	4%
HR	67	5	7%
HU	484	29	6%
CH	396	21	5%
IE	153	7	4%
IT	2893	162	5%
LT	72	10	12%
LU	28	1	3%
LV	59	3	5%
MT	4	2	33%
NL	339	57	14%
NO	157	7	4%
PL	1405	98	7%
PT	436	41	9%
RO	331	40	11%
SE	373	24	6%
SI	66	4	6%
SK	194	16	8%
UK	1845	171	8%
Total	**20766**	**1381**	**6%**

Note: The numbers of UWWTPs are according to the reported capacity (reported years: 2011–2012)

A detailed overview of reported priority and hazardous substances is in the Table 6.2. The number of reported countries includes all reported years and the maximum of UWWTPs per country and year. However, the maximum of reported UWWTPs is by the specific campaign of the selected pollutants inventory in the United Kingdom (2013).

Table A6.2 Number of reported countries and maximum of reported UWWTPs for priority and hazardous substances during 2007–2013

Substance	Number of reported countries	Maximum of reported facilities per year
alachlor	4	1
aldrin	4	5
anthracene	8	52
atrazine	9	3
benzene	6	3
benzo(g,h,i)perylene	7	11
brominated diphenylethers (PBDE)	5	13
DDT	5	1
di-(2-ethyl hexyl) phthalate (DEHP)	18	142
dieldrin	5	5
1,2-dichloroethane (EDC)	13	15
dichloromethane (DCM)	15	33
diuron	12	72
endosulphan	4	1
endrin	4	4
fluoranthene	11	4
hexachlorobenzene (HCB)	6	2
hexachlorobutadiene (HCBD)	8	4
1,2,3,4,5,6-hexachlorocyclohexane(HCH)	6	2
chlorfenvinphos	4	2
chloro-alkanes, C10-C13	8	7
chlorpyrifos	3	1
isodrin	6	5
isoproturon	9	6
naphthalene	6	110
nonylphenol and nonylphenol ethoxylates (NP/NPEs)	16	143
octylphenols and octylphenol ethoxylates	13	130
pentachlorobenzene	2	4
pentachlorophenol (PCP)	10	9
polycyclic aromatic hydrocarbons (PAHs)	11	22
simazine	8	4
tetrachloroethylene (PER)	14	8
tetrachloromethane (TCM)	14	9
tributyltin and compounds	7	3
trifluralin	3	2
trichlorobenzenes (TCBs) (all isomers)	11	6
trichloroethylene	11	8
trichloromethane	16	44
cadmium and compounds (as Cd)	27	53
mercury and compounds (as Hg)	28	64
nickel and compounds (as Ni)	28	149
lead and compounds (as Pb)	26	106

In the following tables the reporting of the WFD substances is presented. Table 6.3 shows the number of UWWTPs with at least one priority or hazardous substance reported, except for the four heavy metals. Table 6.4 shows the number of reported UWWTPs which reported PAHs.

Table A6.3 Number of urban waste water treatment plants with at least one priority and hazardous substance reported except the four heavy metals Cd, Hg, Ni and Pb

Country	2007	2008	2009	2010	2011	2012	2013
AT	6	5	6	17	16	15	11
BE		4	1	4	6	4	6
BG							
CH	1						
CZ	2	3	5	7	5	5	6
DE	22	21	17	16	15	14	26
DK	1	33	25				
EL							
ES	18	31	24	23	29	35	46
FI	8	7	7	8	5	7	8
FR	9	16	19	20	42	40	37
HU							
IE	5	5	6	7	7	8	8
IT	15	21	20	19	21	17	15
LU							
MT							
NL	5	27	26	28	29	7	1
NO	4	3	7	5	6	6	7
PL	14	16	15	15	14	10	13
PT	7	12	14	18	21	21	21
RO	4	3	1			1	4
RS							
SE	7	9	9	8	7	6	6
SI	3	5	5	3	4	3	3
SK							
UK	132	144	116	133	119	148	143
Total	263	365	323	331	346	347	361

Table A6.4 Number of reported UWWTPs with PAH discharges

	2007	2008	2009	2010	2011	2012	2013
CZ				1			
DE	1			1			
ES	1	2	3				
IE	3	3	4	4			
IT	4	4	6	2	3	4	3
NO		2					
PL		1	1	1	1		
PT		3	4		1		2
RO	1	1				1	1
SE	2	1		1	1	1	1
UK	15	13					20

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