|  |  |
| --- | --- |
| **EEA/NSV/13/002 – ETC/ICM** |  |

Content review on existing WISE SoE data flows:   
Water Quality and Emissions

Version: 4.0

Date: 12.11.2015

EEA activity: 1.5.1.a (AP2014-2)

ETC/ICM task, Milestone: 1

Prepared by / compiled by:

Sandra Richter, Anita Künitzer (UFZ), Ursula Schmedtje (UBAD)

Peter Kristensen , Nihat Zahl , Bo Jacobsen (EEA)

Anne-Lyche Solheim, Kari Austnes, Jannicke Moe (NIVA)

Benoit Fribourg-Blanc (OIEau)

Hana Prchalova (CENIA)

Vit Kodes (CHMI)

EEA project manager: Peter Kristensen

Version history

| **Version** | **Date** | **Author** | **Status and description** | **Distribution** |
| --- | --- | --- | --- | --- |
| 1.0 | 18/02/2015 | SRI | First draft based on input from PKR plus content experts | FORUM |
| 2.0 | 25/02/2015 | SRI | Draft after comments from PKR | FORUM |
| 3.0 | 01/06/2015 | SRI, US | Final draft for EIONET workshop | FORUM, EEA |
| 4.0 | 12/11/2015 | US | Revised version after EIONET consultation | FORUM, EEA |

PKR: Peter Kristensen, EEA

SRI: Sandra Richter, UFZ

US: Ursula Schmedtje, UBAD

**Acronyms**

AEI – Agri-environmental indicator

BQE – biological quality element

CLIM – climate state and impact indicator

CSI – core set indicator

DWD – Drinking Water Directive

EEA – European Environment Agency

EQR – ecological quality ratio

ETC/ICM – European Topic Centre on inland, coastal and marine waters

GWD – Groundwater Directive

IPChem – Information Platform on Chemical Monitoring

PRTR – Pollutant Release and Transfer Register

RBD – River basin district

RBSP – river basin specific pollutant

SoE – state of the environment

SOER – State of Environment Report

UWWTD – Urban Waste Water Treatment Directive

WFD – Water Framework Directive

WHS2 – Indicator fact sheet / Hazardous substances in rivers

WISE – Water Information System for Europe

**Contents**

[1 Introduction 4](#_Toc434411565)

[2 Eionet priority data flows 5](#_Toc434411566)

[3 Content review of SoE determinands 6](#_Toc434411567)

[3.1 Data flow: Water quality 6](#_Toc434411568)

[3.1.1 Pollution from oxygen consuming substances 9](#_Toc434411569)

[3.1.2 Nutrient enrichment / eutrophication 11](#_Toc434411570)

[3.1.3 Hazardous substances and emerging chemicals 14](#_Toc434411571)

[3.1.4 Other pressures affecting water quality (salinisation, acidification,   
thermal pollution and climate change) 16](#_Toc434411572)

[3.2 Data flow: Emissions to water 19](#_Toc434411573)

[4 Conclusions 23](#_Toc434411574)

[5 Annex: Complete list of SoE determinands for data flows on water quality   
and emissions ..……………………………………………………………………. 24](#_Toc434411575)

# Introduction

It is the European Environment Agency’s (EEA) task to provide objective, reliable and comparable information on the environment in order to allow the European Commission, Member Countries and the general public to judge the effectiveness of environmental policy and the needs for policy development. This comprises ‘state of the environment’ assessments using indicators to assess current status, pressures and impacts as well as trends in the mid and long-term.

The next EEA assessment on the state of Europe’s water will be published in 2017 and will again cover a wide range of water related topics. The EEA is currently preparing the conceptual framework for these assessments. The analyses will be based on data reported by EU Member States to WISE WFD for the 2nd River Basin Management Plans as well as on data reported from EEA Member Countries under the State of Environment (SoE) Reporting.

To ensure that these assessments and analyses can be carried out, it is necessary to make the best possible use of the large amount of data and other information from the various European reporting streams on water. At the Eionet Workshop in 2014 the EEA presented the planned activities for streamlining the reporting pathways under WISE SoE and WFD[[1]](#footnote-1). This included

1) a quality review of the data reported by Member Countries using country quality fact sheets (for details see separate report), and

2) a content review of reported determinands to assess their relevance in producing high quality assessments including the possibility to derive key messages on water policies.

The aim of the content related review of SoE data flows was to:

* ensure EEA assessments to be carried out during 2016-2018;
* ensure a stable and well defined reporting of “high priority” determinands for EEA uses (European, pan-European and regional integrated environmental data and indicator sets, assessments and thematic analyses);
* improve integrated assessments with Water Framework Directive and other Water Directives;
* reduce the reporting burden for countries.

A review of the WISE SoE data flows has been performed from the second half of 2014 onwards. The activity focused on checking the relevance of the established SoE determinand lists for data flows on water quality and emissions to water. In parallel a review was carried out on the data flow on water quantity.

The proposed changes to the SoE data flows were presented and discussed with EEA Member Countries at the Freshwater Eionet Workshop in June 2015. After the workshop the documents were consulted with Member Countries in a written procedure. The document was modified accordingly. This document constitutes the final result of the SoE Content Review on the data flows on water quality and emissions.

# Eionet priority data flows

The EEA Eionet priority data flow identifies a set of agreed, stable, well-defined objectives to provide a focus for countries when they are putting procedures in place for regular reporting.

The European Environment Agency (EEA) collects inland data sets reported voluntarily by EEA Member Countries (water quality in groundwater, rivers, lakes; emissions of pollutants and water quantity). These data are a sub-set of national sampling. The data is transferred annually from the Member Countries to the EEA using electronic reporting and quality assurance tools. The data is stored in the Agency’s ‘Waterbase’[[2]](#footnote-2).

The WISE‑SoE data flows have successfully provided a solid basis of information for several of the EEA indicators and water assessments[[3]](#footnote-3):

* The current Waterbase data sets contain a vast amount of water quality information covering more than 15,000 river stations in 38 countries, 4,200 lake stations in 36 countries, and around 24,200 groundwater stations in 36 countries.
* For rivers, around 1000-1700 time series (dependent on the pollutant) are available, covering the period from 1992 to 2012 (with some longer time series and many shorter time series).
* The Waterbase data sets also include data on emissions and loads as well as on freshwater resource availability, abstraction and use. The data on water quantity and emissions have been collected annually since 2009. Data on emissions to water per river basin district, typically based on information from River Basin Management Plans or reporting to International River and Sea Conventions, has the potential to serve as the primary data source for EEA indicators in emission intensities provided reporting from more countries and full territory coverage.
* The data in Waterbase is the basis for the EEA's water quality indicators and the WISE interactive maps that provide European overviews.

All Waterbase data sets are available for download here: <http://www.eea.europa.eu/data-and-maps/data#c17=waterbase&c11=&c5=all&c0=5&b_start=0>

# Content review of SoE determinands

## Data flow: Water quality

European freshwaters are affected i.a. by the following water pollution and water quality problems:

* Pollution from oxygen consuming substances
* Nutrient enrichment resulting in eutrophication
* Hazardous substances and emerging chemicals
* Bacterial/faecal pollution
* Salinisation
* Acidification
* Sediments
* Thermal pressures e.g. impacts from cooling water
* Climate change

The current water quality Waterbase (rivers, lakes and groundwater) has been primarily used for providing European overviews of wide-spread European problems related to 1) pollution from oxygen consuming substances and 2) nutrient enrichment resulting in eutrophication.

EEA water indicators aim at presenting the following information:

* European overviews of concentration levels in the form of maps, diagrams and tables.
* Country or river basin comparison of concentration levels
* Illustrating of areas with higher and lower concentrations
* Comparison (current situation or trends) on other levels of aggregation (broad types, biogeographical regions, ecological status classes)
* Trend information
* (Policy) evaluation of concentration level in relation to certain factors affecting pollution (e.g. concentration levels in relation to percentage of agricultural land and population density) and trend in concentration in relation to change in pressures (e.g. nitrate in rivers in relation to nitrate surplus), and implementation of measures (e.g. upgrade of waste water treatment).

Table 1 lists both planned assessments/products and suggestions for new assessments. For existing indicators and maps, both determinands and data extraction/analysis procedures are in place, but discussions of possible additional determinands are listed. For the other planned assessments and suggested assessments there is a range of possibilities regarding selection of determinands, combinations of determinands and types of analysis/visualisation. The tables list examples of products, with different variants of the same product (same analysis, different determinands) and what they can be used for. The chosen examples are considered to be the most important ones, and they include the determinands that should be kept.

The two greatest benefits of the SoE data are the long time series and that they are “real” data on a continuous numeric scale, i.e. nutrient concentrations and EQRs rather than categorical status classes. The SoE data are also reported more frequently than e.g. WFD data. For the biology data most of the BQEs (macroinvertebrates, phytobenthos and phytoplankton) have been reported twice or more from many countries during the first two years of reporting (2011-2013), which will allow time series and trend analyses at EQR level in a few years. Another benefit with the SoE biology data compared to the WFD BQE data is that they are impact-specific (eutrophication, acidification, hydromorphological alterations) and can be combined with physico-chemical determinands such as SoE nutrients, pH, river flow or temperature. The SoE biology data can therefore be used to supplement and interpret WFD data, e.g. showing improvement of a BQE both within and across WFD status classes and within and between the RBMP cycles. However, better spatial coverage of stations reported is needed to ensure representativeness relative to the WFD status classes for each BQE, as well as geographically.

The long time series of SoE nutrients are used in indicators, but more in-depth assessments on different nutrients and biology determinands are possible when linking the data to other data sources, e.g.

* efficiency of WFD nutrient reduction measures using WFD data on measures in combination with SoE nutrients for the same water bodies,
* WFD status class versus nutrients, chlorophyll, Secchi depth or cyanobacteria,
* Eurostat data on nitrogen surplus versus nitrate concentration in rivers,
* UWWT or emissions versus concentration of phosphate,
* Ammonium and BOD in rivers.

Time series for nutrient determinands can also be used to explain current conditions for other determinands without long time series, i.e. showing the nutrient trends leading up to the current ecological status/BQE status/EQR.

The biological SoE data can also be further explored for links to ecosystem services and to biodiversity, using both the EQR data and the additional biological data in original scale (such as chlorophyll a). The Habitats Directive conservation status assessment includes several parts, such as the “structure and function” component, that could be explored for potential links to EQRs for selected BQEs or to additional biological data (chlorophyll, cyanobacteria, and macrophyte depth limit), using appropriate spatial scale (e.g. broad types matching HD freshwater habitats).

Table 1: Overview table of EEA topics and existing and planned products based on water quality databases

| **Topic** | **European overviews** | **Country comparisons** | **Trend analyses** | **Pressures-status-measures analyses** | **Used for**  **(indicators, reports, assessments)** |
| --- | --- | --- | --- | --- | --- |
| Oxygen consuming substances/organic pollution | X | (X) | X | X | – WISE maps  – CSI 019  – CSI 020  – EEA 2010: Freshwater quality - SOER 2010 thematic assessment.  – EEA ETC/ICM 2010: Freshwater Eutrophication Assessment - Background Report for EEA European Environment State and Outlook Report 2010.  – EEA, 2012 European waters - assessment of status and pressures, EEA Report No 8/2012  – EEA ETC/ICM 2012: Ecological and chemical status and pressures. Thematic assessment for EEA Water 2012  – EEA, 2015: SOER 2015 — The European environment — state and outlook 2015 |
| Nutrient enrichment / eutrophication | X | (X) | X | X |
| Hazardous substances and emerging chemicals | X | X | X | X | – WHS2  – AEI 27.2 Pesticide indicator  – EEA Technical Report no. 8 / 2011.  – ETC/ICM Technical Report no. 1 / 2013.  – ETC/ICM Technical Report no. 1 / 2015.  – PRTR-Viewer, Hazardous Substances Viewer |
| Salinisation | X | (X) | (X) | (X) | Assessment of trends in conductivity, European overview possible, but maybe more relevant for different climate regions (north - road salt, Mediterranean - irrigation etc), country comparison within regions.  Cyanides, fluorides, chlorides emission by (industrial) sector. |
| Acidification | X | (X) | (X) | (X) | Trends and current status in Europe and regions, country comparison within regions with issues. |
| Changes in hydromorphology and degradation of habitats | X | X | X |  | WISE map, trends and current status bar-plots, background for WFD 2024, SOER 2020, new HyMo assessment reports |
| Climate change | X |  | X |  | CLIM 019 and 020, trends in lake and river surface mean and max temperature, ice cover (on, off, duration). Background for climate assessments (coupling with information e.g. CLIM 001, 002 and 016, SoE Water quantity).  Time series diagrams showing temperature, river flow and SoE nutrients or SoE biology data. Bar-plots comparing change in temperature and river flow with change in SoE biology and or SoE nutrients data for the same stations. Input to new Climate change report or to SOER 2020. |
| Multiple pressures and their impacts in rivers and lakes | X |  |  |  | Pressure-status-measures report, input to SOER 2020, incl. ecological status, conservation status for freshwater habitats and species and ecosystem services of rivers and lakes. |

For the analysis the following categories were used for whether a determinand should be kept or dropped in future reporting: “must keep”, “should keep”, “could keep” and “drop”. These were defined as follows (see table below).

Table 2: Definition of Must keep, Should keep, Could keep and Drop

| **Step** | **Criteria** | **Value** | **Decision** |
| --- | --- | --- | --- |
| 1 | Priority Substance according to relevant Directive | Yes | Must keep |
|  |  | No | Go to 2 |
| 2 | Required for current EEA products (indicators, assessments, reports, etc.). | Yes | Must keep |
|  |  | No | Go to 3 |
| 3 | Required for future planned assessments (i.e. complementing WFD with relevant time series). | Yes | Must keep |
|  |  | No | Go to 4 |
| 4 | Frequently monitored and reported information. | Yes | Go to 5 |
|  |  | No | Go to 6 |
| 5 | Information that can be derived from other reliable data sources currently available to the EEA | Yes | Drop |
|  |  | No | Go to 6 |
| 6 | Useful and usable ancillary information for current EEA products, including Quality Control of other "Must" determinands. | Yes | Should keep |
|  |  | No | Go to 7 |
| 7 | Useful and usable ancillary information for planned EEA products. | Yes | Could keep |

The determinands are discussed by topics across water categories (rivers, lakes and groundwater) where applicable in order to enable a comparative analysis on some key topics. The full set of determinands with the proposed decision can be found in the Annex, which constitutes the final results after consultation with EEA Member Countries.

### Pollution from oxygen consuming substances

EEA has been using biochemical oxygen demand (BOD) and total ammonium as key indicators of organic pollution. Severe organic pollution may lead to rapid deoxygenating of the water, high concentrations of ammonia and the disappearance of fish and aquatic invertebrates. Organic pollution causing oxygen consumption is mainly a problem in rivers and is generally less relevant in lakes or in groundwater; therefore the following analysis will deal only with rivers.

Table 3: Overview table of EEA products on pollution from oxygen consuming substances

| **Name of product/ information displayed** | **European overviews** | **Country comparisons** | **Trend analyses** | **Pressures-status-measures analyses** | **Used for** |
| --- | --- | --- | --- | --- | --- |
| Oxygen consuming substances in rivers | X | X | X | -- | WISE maps, CSI 019, background for WFD, SOER and in-depth assessments |
| Ecological  status of macro-invertebrates in rivers | X | X | X | -- | WISE maps, trends on possible improvements towards good ecological status for invertebrates (also within single WFD classes), bar plots to compare invertebrate current status among broad types and biogeographic regions or grouped by WFD ecological status classes. |
| Oxygen consuming substances and ecological status/potential in rivers | X | -- | X | X | WFD, SOER and in-depth assessments. Trends or current status of oxygen consuming substances grouped by ecological status/potential. |
| Pressures-measures-status organic pollution rivers | X | -- | X | X | Assessments on organic pollution, background for WFD and SOER. Combining different determinands, coupling e.g. BOD or ammonium and macroinvertebrates EQR, dissolved oxygen and BOD, coupling to pressure and measures information |

In Waterbase “rivers” the determinands in Table 4 have been reported to describe pollution from oxygen consuming substances.

Table 4: Determinands to describe pollution from oxygen consuming substances in rivers (SoE data flows: Nutrients, Oxygen consuming substances in rivers and Biology in rivers)

| **Determinand** | **No. of reporting countries** | **Must keep** | **Should keep** | **Could keep** | **Drop** | **Used for existing EEA products** |
| --- | --- | --- | --- | --- | --- | --- |
| Ammonium  Total Ammonium | 18 27 | X  X |  |  |  | CSI 019, WISE maps |
| BOD5 BOD7 | 28 5 | X  X |  |  |  | CSI 019, WISE maps |
| CODCr CODMn | 23  14 |  | X (rivers)  X (rivers) | X (lakes)  X (lakes) |  | CSI 019 |
| Total Organic Carbon (TOC) | 25 | X |  |  |  |  |
| Dissolved Organic Carbon (DOC) | 12 |  |  | X |  |  |
| Dissolved Oxygen Oxygen saturation | 31   26 |  | X | X |  |  |
| Non-ionised  Ammonia | 9 |  |  |  | X |  |
| Invertebrate EQR\_G | 18 | X (rivers) |  |  | X (lakes) |  |

Arguments to keep or drop a determinand

* Currently, the CSI 019 includes the determinands BOD5/BOD7 and ammonium in rivers. They are the main indicators of oxygenation status of water bodies in European rivers.

There are, however, other determinands available in WISE-SoE which can be used to understand the oxygenation conditions in European freshwaters. Ammonium and total ammonium are the same and should be merged.

* TOC can be used for countries which are not reporting BOD, but is not necessarily a good indicator for oxygen pollution. In humic rivers, TOC is not an adequate measure of oxygen-consuming substances – much of it is rather recalcitrant. On the other hand, the BOD indicator is less significant for the Scandinavian region due to low freshwater temperatures and consecutive lower microbiological activity. CODCr is frequently reported and can be included in assessments of organic pollution (or possibly in CSI 019). CODMn can be used if more data is available than for CODCr. DOC is not very frequently reported, but is useful for other assessments such as the bioavailability of heavy metals or climate change impacts.
* Dissolved oxygen and oxygen saturation are frequently reported and can be used in QA for other determinands. Because of reporting only annual values to Waterbase, they are not good indicators for overall oxygen conditions. Oxygen saturation is a more general determinand than dissolved oxygen as 100% depends on salinity and temperature. It is useful for comparisons across Member States. Instead of annual values it would be better to report monthly values.
* Non-ionised Ammonia is less frequently reported and not a good indicator.
* Invertebrate EQR\_G (general impacts) is reported by most countries and is mainly sensitive to organic pollution. So it is easy to use in assessments and relevant for WFD reporting. Countries suggested to change the reporting frequency from every year to every 3-6 years.

### Nutrient enrichment / eutrophication

EEA has been using groundwater and river nitrate (NO3), river orthophosphate (o-PO4) and lake total phosphorus (TP) as the key indicators of nutrient enrichment, which is a relevant problem for rivers, lakes and groundwater. Nutrient enrichment leads to eutrophication in many rivers and lakes in Europe. Table 5 provides an overview of already existing and planned products on pollution from nutrient enrichment / eutrophication.

Table 5: Overview table of EEA products on pollution from nutrient enrichment / eutrophication

| **Name of product/ information displayed** | **European overviews** | **Country comparisons** | **Trend analyses** | **Pressures-status-measures analyses** | **Used for** |
| --- | --- | --- | --- | --- | --- |
| Nutrient concentrations in rivers / lakes | X | X | X | -- | WISE maps; CSI 020, AEI 27.1, EEA agricultural indicator; background for WFD, SOER and in-depth assessments |
| Nitrate concentrations in groundwater | X | X | X | X | WISE maps; CSI 020, AEI 27.1, EEA agricultural indicator |
| Eutrophication of lakes: Ecological status of phytoplankton and macrophytes / of phytobenthos in rivers | X | X | X | -- | WISE maps; trends on possible improvements towards good ecological status for each of the determinands (also within single WFD classes); bar plots to compare status among broad types and biogeographic regions or grouped by WFD ecological status |
| Nutrient concentrations and ecological status/potential in rivers / in lakes | X | -- | X | X | WFD, SOER and in-depth assessments. Trends or current status of nutrient concentrations grouped by WFD ecological status/potential |
| Pressures-measures-status eutrophication rivers/lakes | X | -- | X | X | Assessments on eutrophication and agriculture, background for WFD and SOER. Combining different determinands, coupling e.g. nutrients vs BQE-EQR (trends for the same stations), river and groundwater nitrate, river total phosphorus and orthophosphates (trend in ratio, to analyse the contribution from waste water), lake chlorophyll a and total phosphorus and dissolved oxygen (trends for the same stations), coupling to pressure and measures information |

Currently, the CSI 020 includes the determinands total phosphorus, orthophosphates and nitrate in rivers, lakes and groundwater. There are, however, other determinands available in WISE-SoE, which can be used to understand the nutrient conditions and impacts resulting from nutrient inputs. In Waterbase the determinands shown in Table 6 are reported for pollution from nutrient enrichment.

Table 6: Determinands to describe pollution from nutrient enrichment and eutrophication (SoE data flows: Nutrients, Oxygen consuming substances in rivers, lakes, groundwater and Biology in rivers and lakes)

| **Determinand** | **No. of reporting countries** | | | **Must keep** | **Should keep** | **Could keep** | **Drop** | **Used for existing EEA product** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Nutrients in rivers, lakes, groundwater** | rivers | lakes | GW |  |  |  |  |  |
| Total Phosphorus Phosphate | 33  32 | 32  29 | 6 11 | X (SW) X (SW) |  | X (GW) X (GW) |  | CSI 020, WISE maps |
| Nitrate | 34 | 34 | 31 | X |  |  |  | CSI 020, WISE maps |
| Ammonium  Total Ammonium | 18  27 | 17  17 | 31 | X  X |  |  |  | CSI 020, WISE maps |
| Nitrite |  |  | 27 | X (GW) |  | X (SW) |  | WISE map |
| Total Oxidised Nitrogen | 14 | 13 |  | X (SW) |  |  |  | CSI 020, WISE maps |
| Total Nitrogen | 28 | 25 | 7 | X (SW) |  |  | X (GW) |  |
| Kjeldahl nitrogen | 13 | 14 |  |  |  | X (SW) |  |  |
| Total inorganic nitrogen  Total organic nitrogen | 12  11 | 6  6 |  |  |  |  | X (SW)  X (SW) |  |
| Dissolved Inorganic Nitrogen Non-ionised Ammonia Particulate Organic Nitrogen | 3   9 0 | 1   5 0 |  |  |  |  | X (SW)  X (SW)  X (SW) |  |
| Dissolved Oxygen Oxygen saturation | 31  26 | 28 25 | 25 | X (GW) |  | X (SW) | X (SW) |  |
| Secchi depth |  | 25 |  |  | X  (lakes) |  | X (rivers) |  |
| Chlorophyll\_a | 18 | 27 |  | X |  |  |  |  |
| **Biology in rivers and lakes** | rivers | lakes | GW |  |  |  |  |  |
| PhytobenthosEQR\_E PhytoplanktonEQR\_E MacrophyteEQR\_E | 10 | 16 8 |  | X X | X |  |  |  |
| Cyanobacteria Biomass |  | 5 |  |  | X |  |  |  |

Arguments to keep or drop a determinand

Data flows on nutrients in rivers, lakes and groundwater:

* Total phosphorus and phosphate (previously orthophosphates) as well as nitrate are the main relevant determinands for indicator CSI 020 on nutrients in freshwaters. There is good reporting from countries and long-time series are available. For groundwater total phosphorus and orthophosphates are of less importance but they could be kept.
* Nitrite is a metastabile form of nitrogen occuring rarely in groundwater. Nevertheless due to an amendent of the Groundwater Directive nitrite must be kept.
* Total oxidised nitrogen is used in CSI 020 whenever nitrate data are not available or only available for a few years. Total nitrogen is frequently reported and highly relevant for future assessments in rivers and lakes (including CSI 020 and the WFD assessment). It indicates the total nutrient load, to rivers and to the sea. There are good time series available for total nitrogen, especially for rivers. For groundwater total nitrogen can be dropped.
* Kjeldahl nitrogen: Frequently reported by some countries, can be used to supplement time series on total nitrogen. Countries already reporting Kjeldahl N that do not report total nitrogen should continue reporting, otherwise there is no need to report this determinand.
* Total inorganic nitrogen can be derived from the individual nitrogen species (although it is more correct to calculate the sum for individual samples). Total organic nitrogen is frequently reported in quite a few countries, but is currently not used in indicators and they can be dropped from reporting.
* Dissolved inorganic nitrogen is rarely reported and it can be derived from the individual nitrogen species (although more correct to calculate the sum for individual samples). Non-ionised Ammonia is less frequently reported and unstable. So it is not a very good indicator. For particulate organic nitrogen there are no records available. Therefore these determinands do not have to be reported in the future.
* Dissolved oxygen and oxygen saturation are frequently reported in rivers and lakes and used in quality assurance for other determinands, but only annual values are reported, which are not meaningful for eutrophication assessments. It would be better to report monthly or seasonal values. Oxygenation conditions are to be reported under the WFD, so maybe they will become useful in this context. Oxygen saturation generally is a vaguer determinand than dissolved oxygen as 100% depends on salinity and temperature. Therefore, only dissolved oxygen should be reported for rivers and lakes. For groundwater dissolved oxygen is a core determinand according to WFD Annex II and therefore must be kept.
* Secchi depths are frequently reported and a good indicator of general light conditions. They are a useful supplement in the assessment of nutrients and eutrophication status, e.g. Secchi depth and DOC/TOC can supplement the interpretation of relationships between nutrient concentrations and chlorophyll a.

Data flows on biology in rivers and lakes:

* PhytobenthosEQR\_E (eutrophication impact) in rivers has been reported by ten countries. Phytobenthos is highly sensitive to nutrient enrichment and is very relevant to use in eutrophication assessments.
* PhytoplanktonEQR\_E (eutrophication impact) in lakes has been reported by most countries (16) and is regarded as the most sensitive BQE to eutrophication in lakes. It is easy to use in assessments. Most countries include both biomass (chlorophyll a and/or biovolume) and species composition into their national assessment methods. Therefore, this delivers more informative than chlorophyll a alone.
* MacrophyteEQR\_E (eutrophication impact) in lakes: This is reported by eight countries. The determinand is based on intercalibrated metrics used by many countries. More countries may report this determinand in the coming years. Macrophytes are highly sensitive to nutrient enrichment in lakes and they are an important indicator in very shallow lakes. EQRs can give more precise assessments than the WFD status class. It may be possible to link macrophytes status with conservation status under the Habitats Directive. However, the monitoring and reporting is less frequently reported than for the other BQEs. Therefore, time series are more difficult to construct compared to other BQEs.
* Cyanobacteria Biomass is a new metric requested only in 2013. It has been reported by only five countries so far. The determinand can be linked to ecosystem services (drinking water, bathing water) and is negatively correlated to biodiversity in lakes. Data from other countries can be calculated by multiplying CyanobacteriaProportion with TotalPhytoplanktonBiomass.
* Chlorophyll\_a is an essential determinand for assessing lake eutrophication (for WFD assessments or independent assessments) and is a valuable supplement to the biology, particularly WFD phytoplankton data, as it provides time series. Chlorophyll\_a is frequently reported.

### Hazardous substances and emerging chemicals

The EEA will use the information to develop indicators for the assessment of the state and trend of hazardous substances and monitor progress in reaching European policy objectives. There are estimated to be between 20,000 to 70,000 different chemicals on the market. Many of these will end up in the aquatic environment and in many cases have potentially harmful effects on aquatic biota and human health. Many hazardous substances degrade only slowly and can accumulate in the environment and along food chains. Therefore, it is important that the levels of these potentially harmful substances are monitored in the environment.

Hazardous substances data in Waterbase are also used by other stakeholders, e.g.:

* Extracts of disaggregated data on hazardous substances have been shared with JRC for the ongoing review of the list of Priority Substances
* Hazardous substances can function as source data for the new Information Platform on Chemical Monitoring (IPCheM)
* Hazardous substances data has been used and has further potential for use by the technical/scientific community for reference scenarios as well as for European level projects.

The following table provides an overview of existing and planned EEA products on hazardous substances.

Table 7: Overview table of EEA products on pollution from hazardous substances and emerging chemicals

| **Topic** | **Name of product/ information displayed** | **European overviews** | **Country comparisons** | **Trend analyses** | **Pressures-status-measures analyses** | **Used for** |
| --- | --- | --- | --- | --- | --- | --- |
| Hazardous substances and emerging chemicals | Concentration of Hazardous Substances in the aquatic environment | X | X | X | X | WHS2 Hazardous substances in rivers, PRTR viewer. Hazardous substances in the European marine environment: Trends in metals and persistent organic; pollutants (topic report 2/2003). EEA and ETC/ICM Technical Reports (8/2011; and 1/2013 + 1/2015 respectively). Hazardous Substances viewer and/or IPCHEM, maybe for WFD 2016 assessment and 2017 SoW assessment |
| Pesticides groundwater | X | X | X | X | AEI 27.2 Pesticide indicator |
| Hazardous substances in surface and groundwater | X | X | X | -- | Technical reports on hazardous substances in Europe’s fresh and marine waters |
|  | Emerging pollutants in surface and groundwater | X | X | -- | -- | Future extension of hazardous substances technical report |

Therefore, it is useful to use groups to ease the identification of priority determinands and to allow future development. Four grouping criteria are relevant for hazardous substances: the chemical families, the uses of the substances, European legislation and the properties of the substances. For each criterion a set of groups can be defined and each individual substance can be linked to these groups. The combination of these grouping criteria allows defining 6 key groups of hazardous substances as described in the following table. Table 8 provides an overview of hazardous substances by groups. Hazardous substances determinands cover a wide range. Some substances can belong to more than one group, for instance some metals are also covered by EU legislation. A full list of hazardous substances determinands is given in the Annex.

Table 8: Groups of determinands to describe pollution from hazardous substances and emerging chemicals (SoE data flows: Hazardous substances in rivers, lakes and groundwater)

| **Group name** | **Must keep** | **Should keep** | **Could keep** | **Drop** | **Used for existing EEA product** |
| --- | --- | --- | --- | --- | --- |
| EU-Legislation | X | X |  |  | EEA assessments (currently SoE, WFD in the future) |
| RBD specific pollutants |  | X | X | X | EEA assessments (currently SoE, WFD in the future) |
| Pesticides | X | X |  |  | EEA assessments (SoE, WFD), AEI 27.2 on pesticides |
| Metals and metalloids | X | X | X | X | EEA assessments (currently SoE, WFD in the future) |
| Other Organics | X | X | X | X | EEA assessments (currently SoE, WFD in the future) |
| Supportive and inorganic determinands | X | X | X | X | EEA assessments (currently SoE, WFD in the future) |

Arguments to keep or drop a determinand/ a group of determinands

In general, the substances in the groups may be discarded for one of the water categories if the substance is not relevant due to its environmental properties (in particular for groundwater). It should be noted also that this does not preclude the matrix (water, sediment, biota) in which the substance is monitored, which should be specified in reporting.

* Legislation: All substances covered under relevant EU legislation (WFD, GWD, DWD) should be reported in the future unless the compound is not relevant for the given water category (e.g. groundwater) due to its environmental properties.
* River Basin Specific Pollutants (RBSP) should be kept, because their relevance has been proven by monitoring and they may be candidates for inclusion into EU legislation if monitored in more than one RBD. They are particularly important in international RBDs.
* Pesticides should be reported if they are required by relevant EU legislation (in case of groundwater all pesticides are covered by the Groundwater Directive). It is hard to predict which active compounds are used in the countries in a given year. That is the reason why so many pesticides remain on the list for groundwater as required by the GWD. Selected pesticides (currently used in EEA products) must be reported, the others should be reported when available. Only obsolete (legacy) pesticides can be dropped from reporting if they have not been used for a long time and they do not occur in the relevant water category(ies) anymore. In any case and in particular if these are mentioned in EU legislation (such as DDT), a reason for not reporting these has to be given.
* Metals and metalloids must be reported if they are required by relevant EU legislation. Those not covered by legislation should be reported if this is justified based on expert knowledge (especially if the substances are on a watch list or national RBSP list).
* Other organics must be reported if they are required by relevant EU legislation and currently covered by EEA products. They should be reported if covered by EU legislation or justified by expert knowledge. They could be reported if only expert knowledge is available. They are dropped from reporting if they are not useful due to their environmental properties, due to scarce data or because they are inappropriate for an assessment.
* Supportive and inorganic determinands must be reported if required by relevant EU legislation and necessary for an assessment of hazardous substances. They should be reported if they are important for an assessment. They could be reported if they are useful for an assessment. They are dropped from reporting if they are not useful. When assessing heavy metals, these determinands are essential for assessing the potential effects of the substances monitored. This goes beyond substances such as pH or hardness.

### Other pressures affecting water quality (salinisation, acidification, thermal pollution and climate change)

A number of other pressures can affect water quality that have not been addressed above such as bacterial/faecal pollution, salinisation, acidification, sediments as well as thermal pressures (e.g. from cooling water) or climate change. Table 9 provides an overview of possible additional EEA products on such pressures.

Table 9: Overview table of EEA products on different pressures affecting the water quality

| **Topic** | **Name of product/ information displayed** | **European overviews** | **Country comparisons** | **Trend analyses** | **Pressures-status-measures analyses** | **Used for** |
| --- | --- | --- | --- | --- | --- | --- |
| Salinisation | River and lake salinisation | X | (X) | (X) | (X) | Trends in conductivity; European overview possible, but maybe more relevant for different climate regions (Northern Europe: e.g. road salt, Mediterranean: e.g. irrigation). Country comparison within regions.  Cyanides, fluorides, chlorides emission by (industrial) sector. |
| Acidification | Lake and river acidification | X | (X) | (X) | (X) | Trends and current status in Europe and regions; country comparison within regions with issues. |
| Changes in hydro-morphology and degradation of habitats | Ecological status of fish in rivers | X | X | X | X | WISE map; trends and current status bar-plots; background for WFD 2024 (after 3rd RBMPs), SOER 2020; new assessment reports. |
| Climate change | Climate change and lake and river temperature and river flow | X | -- | X | -- | CLIM 019 and 020, trends in lake and river surface mean and max. temperature, ice cover (on, off, duration). Background for climate assessments (coupling with information e.g. CLIM 001, 002 and 016, SoE Water quantity). |
| Climate change impacts on water quality and biodiversity | X | -- | X | X | Time series diagrams showing temperature, river flow and SoE nutrients or SoE biology data. Bar-plots comparing change in temperature and river flow with change in SoE biology and or SoE nutrients data for the same stations. Input to new Climate Change eport or to SOER 2020. |
| Multiple pressures and their impacts in rivers and lakes | Impacts of multiple pressures on ecological status and ecosystem services of rivers and lakes | X | -- | -- | X | Diagrams (chained relations) combining information from several data flows. Pressure-status-measures report, input to SOER 2020, incl. ecological status, conservation status for freshwater habitats and species and ecosystem services of rivers and lakes |

An overview of the determinands to describe these pressures is given in Table 10.

Table 10: Determinands to describe pollution from different pressures (SoE data flows: Nutrients, Oxygen consuming substances in rivers and lakes)

| **Topic/**  **Determinand** | **No. of reporting countries** | | | **Must keep** | **Should keep** | **Could keep** | **Drop** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Salinisation** | **rivers** | **lakes** | **GW** |  |  |  |  |
| Electrical Conductivity | 29 | 29 | 20 | X (GW) | X (SW) |  |  |
| **Acidification** |  |  |  |  |  |  |  |
| pH | 31 | 30 | 19 | X (GW) | X (SW) |  |  |
| Acid neutralising capacity | 16 | 19 |  |  | X |  |  |
| Fish EQR\_A[[4]](#footnote-4) | 0 | 0 |  |  |  | X |  |
| **Thermal pollution and climate change impacts** |  |  |  |  |  |  |  |
| BOD5/ BOD7  Total Nitrogen  TOC Total Phosphorus | 28/5  28  25  33 | 22/3  25  18  32 |  | X (SW)  X (SW)  X (SW)  X (SW) |  |  |  |
| all SoE BQEs incl. fish EQR4 | <18 | <18 |  | X (SW) |  |  |  |
| Cyanobacteria biomass | 5 | 5 |  |  | X |  |  |
| Secchi depth | 3 | 25 |  |  | X (lakes) |  | X (rivers) |
| Temperature (water) | 32 | 29 |  |  |  | X |  |
| **Changes in hydromorphology/ degradation of habitats** |  |  |  |  |  |  |  |
| Fish EQR\_G4  Fish EQR\_H4 | 0  0 | 0  0 |  |  | X  X |  |  |

Arguments to keep or drop a determinand

Topic: Salinisation

* Electrical conductivity is used in quality assurance of other determinands and is a useful background determinand which is frequently reported. For rivers and lakes it could be kept. For groundwater electrical conductivity is a core determinand according to WFD Annex II and therefore must be kept.

Topic: Acidification

* pH is an important determinand for acidification assessments and is frequently reported. For rivers and lakes it should be kept, for groundwater it is a “must”.
* Acid neutralising capacity (formerly alkalinity) is a useful background determinand especially for acidification assessments. It is fairly frequently reported in many countries, but does not show full coverage of Member Countries.
* Fish EQR\_A (acidification impact) is the most sensitive BQE to acidification and should be reported in the future, if possible.

Topic: Thermal pollution including climate change impacts

* BOD5/ BOD7, Total Nitrogen, TOC, Total Phosphorus as well as all SoE BQEs incl. fish EQR, and Cyanobacteria biomass are relevant determinands to give an indication of thermal pollution including climate change impacts. They are fairly frequently reported both for rivers and for lakes.
* Water temperature is frequently reported and very relevant for future climate change assessments. The analysis of water temperature data requires more information on how it was monitored in the past (e.g. time and frequency of measurement, water depth). Consistency of the dat is very important in temperature monitoring. As annual values the data can be used for the assessment of long-term trends and for this purpose they should be reported. Temperature is also required in WFD reporting (as part of the thermal conditions).

Topic: Changes in hydromorphology/degradation of habitats

* Fish EQR\_G (general impacts) and Fish EQR\_H (impacts from hydromorphology) is sensitive to degradation of habitats and this should be reported in the future, if possible.

## Data flow: Emissions to water

The data in Waterbase is the basis for the EEA’s water quality indicators and the WISE interactive maps. The specific data used in the indicators is also available for viewing and download separately. Emissions to water are an important for describing pollution pressures in the SoE assessments. This database contains data on emissions of nutrients and hazardous substances to water, aggregated within river basin districts in the EEA Member Countries.

The WFD emission reporting includes two levels of emission data – total point and diffuse emission load per RBD or sub-unit and a more detailed source or pathway emission load (also per RBD or sub-unit). In order to obtain comparable source apportionment, it is recommended to revise the SoE emission source categories to match the WFD pressure list (when the latter has sub-categories) and also to sub-divide the SoE direct discharges to sea to allow a summation of the sector categories at country level, which is not possible with the current data model. An estimation of emission loads to the sea depends on the type of emission load: net emission load from RBD area could be used from riverine load; rough emission input (discharges without losses in water bodies) could be counted from all related RBD emission loads. Specific information is necessary about direct discharges to coastal waters and atmospheric deposition directly to sea surface – these emissions to coastal waters should be included in SoE data (but not for marine waters).

In its State of the Environment Reports and other thematic reports on water EEA has presented results on the sectoral contribution particularly of nutrient pollution to the aquatic environment. Source apportionment is the estimation of the contribution by different sectors to water pollution. In the coming years the EEA aims at updating this information on the source apportionment of the load of pollutants to the aquatic environment on a large scale: country, WFD river basins districts and sub-units, and sea areas.

Emissions to water are an important element - describing the pressure - in the assessment of the state of Europe’s environment (SoE). The extent to which products relating to non-EQS-Directive substances can be developed will depend upon the extent of reporting. The extent to which products relating to trends can be produced will depend upon the provision of data for more than one year.

Table 11: Overview table of EEA products based on water emissions database

| **Topic** | **Name of product/ information displayed** | **European overviews** | **Country comparisons** | **Trend analyses** | **Pressures-status-measures analyses** | **SoE determinands (or groups of determinands) needed for assessment** | **Used for** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Oxygen consuming substances/ organic pollution | Total point and/or diffuse emission load value; Total point/diffuse emission load value per source; Point/diffuse emission load values – detailed apportionment according to the size (tonnes/year) | -- | X | (X) | X | COD, BOD, TOC | tables, figures, maps - RBD or country level (other aggregation is also possible - e.g. regions; new proposed indicator |
| Nutrient enrichment / eutro-phication | Total point and/or diffuse emission load value; Total point/diffuse emission load value per source; Point/diffuse emission load values – detailed apportionment according to the size (tonnes/year) | -- | X | (X) | X | N tot, P tot | tables, figures, maps - RBD or country level (other aggregation is also possible - e.g. regions; new proposed indicator |
| Hazardous substances and emerging chemicals | Total point and/or diffuse emission load value; Total point/diffuse emission load value per source; Point/diffuse emission load values – detailed apportionment according to the size (tonnes/year) | -- | X | (X) | X | Priority substances (Annex I) | tables, figures, maps - RBD or country level (other aggregation is also possible - e.g. regions; new proposed indicator |

The list of emission determinands was checked whether they must be kept, should be kept, could be kept or should be dropped. The criteria applied for water quality (see Table 2) were adapted in a similar way for emissions to water.

An overview on the determinands to describe emission pressures is given in Table 12.

Table 12: Determinands to describe emission pressures (SoE data flow: Emissions to water)

| **Name** | **No. of countries reporting[[5]](#footnote-5)** | | **Must keep** | **Should keep** | **Could keep** | **Drop** |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Diffuse sources** | **Point sources** |  |  |  |  |
| **Nutrients** |  |  |  |  |  |  |
| Total Organic Carbon (TOC) | 2 | 30 |  | X |  |  |
| CODMn  CODCr | -  1 | 4  11 |  | X X |  |  |
| BOD5  BOD7 | 1  - | 9  4 |  | X X |  |  |
| Total Nitrogen  Total Phosphorus | 6  6 | 31  31 |  | X X |  |  |
| Nitrate  Ammonium | 1  - | 8  7 |  |  | X | X |
| Total suspended solids | 2 | 7 |  |  |  | X |
| **Hazardous substances (groups)** |  |  |  |  |  |  |
| Priority substances (EQS, Annex I) |  |  | X |  |  |  |
| Pollutants in E-PRTR releases (not included in priority substances) |  |  |  |  | X |  |
| Other substances (RBSP), mentioned in WFD products |  |  |  |  | X |  |
| Non priority substances, non RBSPs and non pollutants in E-PRTR releases |  |  |  |  |  | X |

Arguments to keep or drop a determinand

* CODMn/CODCr, BOD5/BOD7: These determinands can be used for country comparisons of total diffuse and total point source pollution for WFD related assessments5. Diffuse sources pollution is not reported annually and some countries do not report them. But these determinands are reported very often (when diffuse sources are provided).
* Total nitrogen, Total phosphorus, TOC: These determinands can be used for country comparisons of total point and diffuse source pollution for WFD related assessments[[6]](#footnote-6) and should be reported. Nitrates could be reported as diffuse source pollution, but total nitrogen is preferred. Diffuse source pollution is not reported annually and some countries do not report them all. When diffuse source emission is reported, then these determinands are reported very often.
* Priority substances (EQS, Annex I), River Basin Specific Pollutants (RBSP) can be used for country comparison of total point and diffuse source pollution for WFD related assessments5. Pollutants in E-PRTR water releases can be used for completeness E-PRTR data and for country comparisons of total point and diffuse sources. Priority substances, pollutants in E-PRTR and relevant RBSPs should be reported.
* Non priority substances, non River Basin Specific Substances (RBSP) and non pollutants in E-PRTR water releases can be dropped from reporting. They are not relevant for emissions reporting.
* Total suspended solids and ammonium are not very relevant for reporting of emissions and they are only rarely reported, so they can be dropped from future reporting. Nitrate emissions have not been reported by many countries but they are important for assessing pressures from diffuse sources.

# Conclusions

The activity focused on checking the relevance of the established SoE determinand lists for the data flows on water quality and emissions to water. The review resulted in a number of determinands being dropped mainly due to low added value in comparison to other determinands, often coupled with low reporting frequencies by Member Countries. Consultation with Member Countries generally confirmed the previous assessments.

The Annex contains a complete list of all SoE determinands on water quality and emissions and includes the final results of the review with regard to their relevance for future WISE SoE reporting as “must keep”, “should keep”, “could keep” and “drop”. The results are given per data flow:

T1 – Water quality: Physico-chemical conditions in rivers and lakes (formerly oxygen consuming substances and nutrients)

T2 – Water quality: Biology in rivers and lakes

T3 – Water quality: Hazardous substances in rivers and lakes

T4 – Water quality: Physico-chemical conditions and hazardous substances in groundwater (formerly nutrients and hazardous substances in groundwater)

T6 – Emission to water

All determinands in the categories “must keep”, “should keep” and “could keep” will be kept for future reporting; determinands in the “drop” category will no longer be used.

In summary, the review has resulted in streamlining SoE reporting, thereby reducing the reporting burden for Member States and making EEA’s state of waters assessments more focussed. At the same time options are kept open for new developments.

In future, water quality determinands “oxygen consuming substances and nutrients” will be described more broadly as “Water quality - Physico-chemical conditions in rivers and lakes” since some of the determinands listed also refer to impacts from acidification, salinisation, thermal pollution or climate change. This is a logical step as WFD reporting also uses these categories.

The results of the SoE content review are being used to prepare the new SoE data model, which will be valid for the next SoE data requests from 2015 onwards.

# Annex: Complete list of SoE determinands for data flows on water quality and emissions

See file:

<http://forum.eionet.europa.eu/nrc-eionet-freshwater/library/eionet-workshops/copenhagen-freshwater-eionet-workshop-2015/copenhagen-freshwater-eionet-workshop-2015/background-documents/soe-content-review-document-and-annex-20151115_final-after-country-consultation/codelists_qualityelementsanddeterminands>

1. For more information see background note on content related WISE-SoE review: <http://forum.eionet.europa.eu/nrc-eionet-freshwater/library/copenhagen-eionet-freshwater-workshop-2014/freshwater-eionet-workshop-2014/background-documents/content-related-soe-review> [↑](#footnote-ref-1)
2. Waterbase is the generic name given to the EEA's databases on the status and quality of Europe's rivers, lakes, groundwater bodies and transitional, coastal and marine waters, and on the emissions to and on the quantity of Europe's water resources. [↑](#footnote-ref-2)
3. See also background note on content related WISE-SoE review: <http://forum.eionet.europa.eu/nrc-eionet-freshwater/library/copenhagen-eionet-freshwater-workshop-2014/freshwater-eionet-workshop-2014/background-documents/content-related-soe-review> [↑](#footnote-ref-3)
4. Fish EQR will not be included in the 2015 data call. [↑](#footnote-ref-4)
5. Diffuse sources pollution is not required and not reported annually. Therefore, the number of countries is low. [↑](#footnote-ref-5)
6. See chapter 9.3.2.1 and 9.3.3.2 in WFD Reporting Guidance 2016: <http://cdr.eionet.europa.eu/help/WFD/WFD_521_2016/Guidance/WFD_ReportingGuidance.pdf> [↑](#footnote-ref-6)