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COVER NOTE

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COMMISSION STAFF WORKING DOCUMENT

Towards a monitoring and outlook framework for the zero pollution ambition

Accompanying the document

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions

Pathway to a Healthy Planet for All
EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil'

{COM(2021) 400 final} - {SWD(2021) 140 final}

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1. INTRODUCTION

Pollution has major negative impacts: it affects human health and puts pressure on the species, ecosystems and their services that we want to protect. For several decades, the EU and its Member States have been monitoring different types of pollution[1] in relation to their presence (concentration) in the environment (*state*), their *impacts*, the amounts entering the environment (*pressures*) and the sources from which the pollution originates (*drivers*). And then the most effective actions to be taken are identified (*response*)[2]. Such a holistic and integrated monitoring framework already exists for greenhouse gas (GHG) emissions, for air pollution affecting human health, for marine oil spill detection and monitoring[3] and several other environment policy areas[4], where it is possible not only to determine the past and current pollution levels (monitoring), but also to predict, through modelling systems, possible sources of pollution and future trends based on various scenarios or assumptions (outlook).

However, pollution monitoring framework at the EU level or beyond is not as connected and integrated across media, pollutants or sectors as it could be. It is often a set of independent pollution monitoring systems covering the various pollution domains covered by EU environmental policy. For many pollution types, only certain elements of such a monitoring framework are well developed. But all this has been changing for some time now and there is an opportunity to use the zero pollution ambition to take monitoring and outlook efforts to the next level.

Due to stronger legally binding frameworks, EU level monitoring for air and water pollution has been more advanced than for soil but efforts are underway to close the gap. Furthermore, land-based and marine pollution or cross-media (air, water[5], soil) transfers of pollution can be further integrated. Data gathering or developing models necessary for policy making is becoming easier and more sophisticated, e.g. by reducing technical and administrative obstacles in accessing up-to-date data and using new technologies and thereby reducing the costs associated with the collection and assessment of data. Reliable fit-for-purpose data are at the base of all assessments, a good strategy and efficient set-up is needed in order to be cost effective. New approaches will allow progress (target screening, etc.), while previously costs have been prohibitive.

Once data have been collected at EU level, there are many different assessments addressing pollution issues and messages stemming from a variety of pollution-related analysis can sometimes be confusing (see chapter 4). They are mainly based on indicators related to specific types of pollution across the various domains covered by EU

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1 See Article 3(2) Industrial Emissions Directive 2010/75/EU: "*Pollution means the direct or indirect introduction, as a result of human activity, of substances, vibrations, heat or noise into air, water or land which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment*".

2 This DPSIR (drivers-pressures-state-impact-response) conceptual monitoring framework developed and used by the European Environment Agency (EEA) (and used increasingly by other bodies, e.g. the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)) frames the reality in a simplified way.

3 CleanSeaNet service of the European Maritime Safety Agency (EMSA)

4 An illustrative example is the Circular Economy Monitoring Framework (COM(2018) 29 and SWD(2018) 17)

5 In most instances throughout the document, 'water' is mentioned in the sense of freshwater and marine water.

laws (air, noise, water, marine, nature and biodiversity, soils, chemicals, nutrients, waste, plastic, industrial emissions etc.). They were developed and implemented 'from the bottom up', focussing on the needs and obligations of the particular pieces of legislation. The European Green Deal can help create the momentum to extract and communicate pollution-related issues in a more integrated narrative, giving a coherent policy message or create synergies for actions where root causes are similar.

Hence, the Zero Pollution ambition for a non-toxic environment announced in the European Green Deal[6] provides the impetus and mandate to improve knowledge on the presence, effects and flows of pollutants in the environment and to integrate this knowledge into a coherent and holistic framework. Moreover, the use of a variety of data sources and their integration will result in comparative advantages by cohesively merging and dynamically visualizing complex environmental data together with other data (e.g. economic, social or health-related data). This can be achieved by adhering to fully open data policies and enabling the discovery of, access to, licensing and use of environmental data originating from different data custodians and regimes, in full respect of the existing data protection rules[7]. Similarly, scenarios and modelling used for outlook analyses as well as the underlying data need to be transparent and open to review. Building on these data and other information sources, it will be ultimately important better link the policy debate and the assessment debate and to improve the science-policy interface.

The Zero Pollution Action Plan for air, water and soil offers the opportunity for the development and regular application of such an integrated monitoring and outlook framework, complementing the monitoring framework for greenhouse gases set up to monitor the EU's climate reduction and carbon neutrality targets[8] and the monitoring frameworks which aim to track the targets set out in the Biodiversity Strategy[9] and the Farm to Fork Strategy[10]. Together with the Monitoring Framework for the Circular Economy[11] and the indicator framework on chemicals[12], these elements can build the core pillars for a newly developed environmental monitoring framework foreseen under the 8th Environment Action Programme (8th EAP)[13].

The monitoring framework will also be compatible with the Better Regulation Guidelines[14] and make best use of the European Environment Agency's (EEA) and IPBES's DPSIR frameworks[15]. Moreover, it can ultimately help also to underpin the Commission's performance framework for the European Green Deal and other monitoring efforts, e.g. under the European Semester and the EU's Sustainable Development Goals (SDGs) monitoring framework.

Consequently, the purpose of this document is to

6 COM(2019) 640
7 Set out by the General Data Protection Regulation (GDPR)
8 The monitoring, reporting and outlook framework for greenhouse gas emissions and its link to air monitoring and outlook serves as an inspiration for the zero pollution monitoring and outlook framework. Consistency and complementarity will be ensured but it is excluded from the scope of this paper.
9 COM(2020) 380
10 COM(2020) 381
11 SWD(2018) 17
12 COM(2020) 667
13 COM(2020) 652
14 COM(2017)350, in particular section V on monitoring
15 see footnote 1

- initiate a consultation with experts from Member States, international organisations and other stakeholders with the aim to develop a common understanding and ownership;

- scope and frame an initial outline and content for a zero pollution monitoring and outlook framework (as contribution to the wider 8th EAP monitoring);

- plan the work ahead and identify actions where further efforts are needed to ensure that the monitoring and outlook generate timely and policy relevant information.

The outcome of the consultation will be taken into account for the preparation of the first Zero Pollution Monitoring and Outlook Report in 2022 and to further develop the coherent/policy-relevant zero pollution monitoring and outlook framework until 2024 as an input to wider monitoring frameworks such as the 8th Environment Action Programme, the Sustainable Development Goals and the EEA's regular reports on 'The European Environment: State and Outlook'[16].

2. PURPOSE, OBJECTIVES AND TARGETS

The overall purpose and objective(s) for the zero pollution monitoring and outlook framework are set out in the Action Plan[17]. They build on the overall (Article 2.1) and specific (Article 2.2 (d), (e) and (f)) objectives set out in the Commission Proposal for an 8th Environment Action Programme[18] (8th EAP). This monitoring framework is implementing the 'zero pollution' part of the overarching monitoring set out in Article 4 of that Proposal.

Building on these overarching objectives, the specific purposes of the monitoring and outlook framework are to be:

- A knowledge system driving the zero pollution ambition towards 2050 and a means for communication, allowing for accountability and engagement of citizens;

- A contribution to defining wellbeing[19] and planetary boundaries linked to pollution including the ambition to have (at some point) an integrated assessment of the total pollution load (exposure) on human health and (impact) on species and ecosystems;

- A tool to measure the progress of the zero pollution ambition including the illustration of some successful or challenging policy and implementation progress and effectiveness illustrated through a few telling examples as well as identifying synergies and strengthening coherence with related policy areas;

- A driver for change towards a more streamlined, simplified, modern, digital monitoring and reporting as well as the uptake of new digital and earth observation technologies resulting in real-near time data flows presented in an accessible way, while reducing administrative burden.

16 https://www.eea.europa.eu/soer
17 COM(2021) 400
18 COM(2020) 652
19 The wellbeing framework is rather broad (see e.g. OECD), in the context of this document it focuses on the health dimension which is an integral part of the wellbeing framework.

The approach is also designed to create an overarching, integrated monitoring that satisfies the Better Regulation Guidelines, in particular Section V. Hence, the monitoring and outlook framework will cover the entire scope of the zero pollution ambition including the monitoring systems developed under Chemicals Strategy for Sustainability, the pollution dimension of the upcoming EU Soil Strategy and the upcoming Integrated Nutrient Management Action Plan. In terms of scope, the definitions of pollution and pollutants as set out in EU legislation[20] provide for a wide coverage of releases to the environment. Moreover, the pollution of soil[21] will include land in the wider sense where this is relevant.

The Zero Pollution Action Plan[22] has set out an overarching vision for 2050 some illustrative targets for 2030 in addition to a number of objectives and targets set out in other Green Deal initiatives (namely the Farm to Fork Strategy and the Chemicals Strategy). These policy targets are complemented by a set of specific legally binding objectives in key pieces of legislation for air, noise, water, marine protection and soil as well as a number of sources specific EU law (see Annex 1 for details).

The monitoring framework will provide an assessment for the achievement of the targets as well as a regular 'snapshot' of the state of environment as regards the key challenges caused by the pollution. It will ideally give an answer to the question of whether the existing objectives have been achieved and, if not (yet), what the 'distance to target' is and in what areas (pollution types, sources, sectors, countries,…) pollution challenges remain. To this end, the monitoring will look at the pollution situation at local and regional level across the EU but focus on the assessment per Member States, the cross-border dimension of pollution and the EU-wide an inter-continental aspects, to the extent possible. For the existing targets (e.g. those listed in Annex 1), a **baseline[23] or reference year** against which progress will be measured is already established. However, for other pollution types (e.g. soil pollution), this baseline still needs to be established. If possible, the aim is to establish such a baseline on the latest available, representative data[24] when publishing the monitoring part of the **first Zero Pollution Monitoring and Outlook in 2022**.

Moreover, the **planned revision of some laws** will look at the **updating of the ambition level or the widening of the scope** in their particular area, which may result in additional or updated targets following an impact assessment. These updateds will have to be factored into the future iterations of the zero pollution monitoring.

In any case, **the approach will be iterative** given the diversity and the wide scope of pollution. In the first round (2022), the approach will focus on a limited number of impacts or pollutants based on readily available data. At the same time, the planning for the next iteration (2024) and the identification for key work areas to improve the

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20 In particular, Article 3(2) Industrial Emissions Directive 2010/75/EU, Article 2 (10) and (12) of the Taxonomy Regulation (EU) 2020/852, point 8 of Article 3 of Directive 2008/56/EC and point 33 of Article 2 of Directive 2000/60/EC are the most relevant in this context.

21 Soil means the top layer of the Earth's crust situated between the bedrock and the surface, which is composed of mineral particles, organic matter, water, air and living organisms (see Article 2 (11) of Regulation (EU) 2020/852).

22 COM(2021) 400

23 Not to be confused with a baseline that represents a business-as-usual scenario in modelling terms.

24 Annual indicators should ideally have a reference year between 2018-2021 bearing in mind that 2020 and maybe also 2021 will not be representative in terms of pollution because of the pandemic. However, this needs to be decided on a case-by-case basis.

framework at each iteration will be identified. In this context, it will be necessary to fill data and knowledge gaps if they are identified as relevant and important for better policy making. Administrative burdens can be minimised by using modern digital solutions and complementary data sources (e.g. Copernicus[25] or citizen science) and applying a more modern data management approach (see section 6 below). Guiding these developments are the established or developing policies for data, namely the European Data Strategy[26] and the one substance, one assessment approach for chemicals, building on the principles of openness, transparency and accountability.

To guide these developments, a consultative process and a regular review mechanism will be foreseen to ensure that the developments are on the right track and are coordinated with all relevant actors and initiatives.

Complementary to this, the outlook part of the **Zero Pollution Monitoring and Outlook Report** (also to be published in 2022 together with the monitoring report) will project into the future trend expected if no action is taken ('baseline') and compares it with the scenarios for a planned or agreed set of measures. It will try to anticipate whether actions at international, EU, national, regional or local level are sufficient to close the "gaps" identified by the monitoring. Already now, the Commission publishes a Clean Air Outlook[27], which is complementary to the reports published in the context of the Regulation on the Governance of the Energy Union and Climate Action[28]. In other words, this framework and the climate and energy reporting under the governance regulation are distinct but mutually reinforcing. In addition, work is ongoing to present a Clean Water and Marine Outlook in 2022 and outlook work in other areas, such as soil, could also be added, once available. The aim is to combine these into an overarching zero pollution outlook which can also help to include cross-sector and cross-media analysis (e.g. for nutrients) and help improve monitoring consistency and streamlining of assessment efforts. The **foresight or horizon scanning capacities** will also be developed (see section 5 for details).

3. BACKGROUND

3.1. A short history of pollution monitoring

Pollution was one of the earliest environmental concerns that was addressed by the EU (then the European Economic Community-EEC) in 1973 as part of the 1st Environment Action Programme[29]. It was an essential element of European cooperation because of its cross-border dimension and its effects on the single market. In fact, the internal market legal base was used to regulate pollution to waters and air already since the early Seventies in order to ensure a high level of protection of the environment and a level

[25] A wealth of Copernicus information products to monitor the status of the air quality, water and soil are provided for on a full, free and open basis by the Copernicus Atmosphere monitoring service, the Copernicus Marine Environment Service, the Copernicus Land Monitoring service, the Copernicus Climate Change service, the Copernicus Emergency Management service and the Copernicus Security services.

[26] COM(2020) 66

[27] The first Clean Air Outlook was published in 2018 (COM(2020) 446) and the second in 2021 (COM(2021) 3)

[28] COM(2020) 564 and related reports

[29] Declaration of the Council on the programme of action of the European Communities on the Environment (OJ C112, 20/12/1973, p. 1)

playing field for the economic operators who were responsible for the pollution. Even before that, chemicals legislation[30] was introduced which addressed the hazardous properties of chemical substances.

However, pollution did not only transfer between countries but also between air, water and soil. In 1996, the Integrated Pollution Prevention and Control (IPPC) Directive[31] was an important milestone that recognised that the protection of human health and the environment required a holistic vision and integrated approach. Since then, pollution is defined in EU law[32] as:

'the direct or indirect introduction, as a result of human activity, of substances, vibrations, heat or noise into air, water or land which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment'

This definition has been largely replicated in many EU laws[33], it stood the test of time, and now we can build the zero pollution ambition on it.

The idea that we need a long-term vision towards a 'zero pollution world' is also not new. It was already entertained since the late 1990s when the Ministerial Meeting of the North Sea countries and later the OSPAR Commission adopted the marine protection objective to achieve the *'cessation or phase out of discharges, emissions or losses of hazardous substances'* until 2020. They realised that through air, water (rivers) and soil (sediments), our seas and ocean are becoming the sink (*'dump'*)[34] of all the pollution that enters our environment. This policy drive for marine protection ultimately found its way into the Water Framework Directive (WFD)[35], influenced the definition of restrictions for PBT[36] substances in the chemicals legislation[37] and eventually in the Marine Strategy Framework Directive (MSFD)[38].

Building on these, and many other pieces of legislation, the EU has made significant progress in pollution reduction, which resulted in a number of success stories, e.g.:

- Bathing and drinking waters is generally of high quality in Europe[39];
- Air pollution, in particular from industry, has been significantly reduced[40];
- Heavy metal pollution in water and air was substantially cut since the 1970s[41];

30 The first rules on classification, labelling and packaging of substances were established by Directive 67/548/EEC

31 Directive 96/61/EC

32 See article 3 (2) of the Industrial Emissions Directive 2010/75/EU which is the successor of Directive 96/61/EC

33 E.g. Directive 2000/60/EC (point 33 of Article 2), Directive 2008/56/EC (point 8 of Article 3) or Regulation (EU) 2020/852 (points 10 and 12 of Article 2)

34 And this is not the only sink, soil is also storing a lot of pollution.

35 See articles 1 (c), 4 (a) (iv) and 16 of Directive 2000/60/EC

36 persistent, bioaccumulative and toxic

37 E.g. REACH Regulation

38 Directive 2008/56/EC, Article 1 and 2b

39 https://www.eea.europa.eu/publications/public-health-and-environmental-protection

40 https://ec.europa.eu/environment/industry/stationary/ied/evaluation.htm

41 https://www.eea.europa.eu/data-and-maps/indicators/eea32-heavy-metal-hm-emissions-1/assessment-10

- Many hazardous substances and pesticides were banned or their use was drastically restricted[42];
- Acid rain strongly decreased thanks also to the actions of the EU in the frame of the UNECE Convention on Long Range Transboundary Air Pollution.

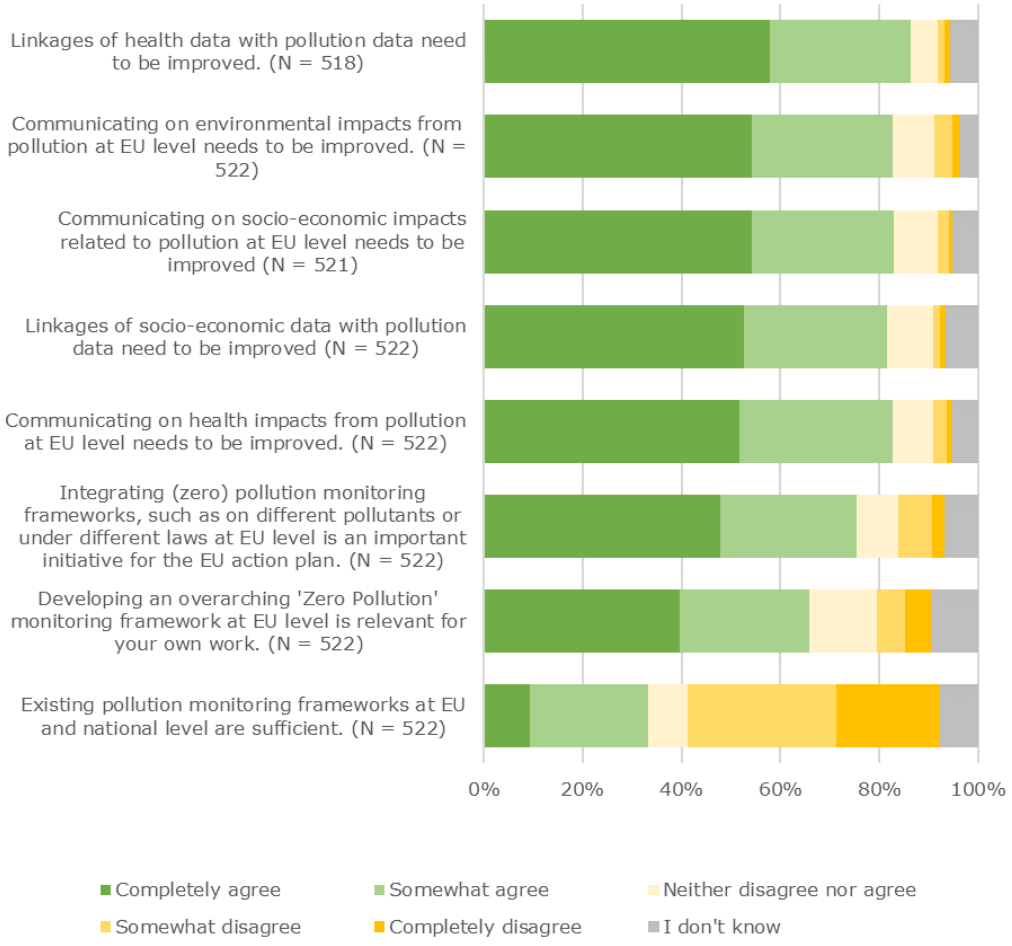
Nevertheless, some of the most pressing pollution issues at the time are solved, other persisted and proved more difficult to tackle. In particular, nutrient pollution was causing huge environment and health impacts (e.g. through eutrophication effects such as 'dead zones') already 50 years ago and we cannot claim that the situation has much improved despite various directives in place (nitrates, sewage sludge, urban waste water, air emission ceilings, etc.), in particular in some marine areas. In addition, new pollution issues emerged that we were either not aware of (e.g. in relation to PFAS, pharmaceuticals, or the transition of particulate from some sources to nano-level sizes) or that we underestimated, such as the marine pollution from plastics, as well as the aquatic and terrestrial pollution from microplastics. Moreover, combined effects of all types of pollution mixtures turned out to be of a far greater concern to our health and environment than just looking at the individual substance. In addition, the pollution is not emitted into a pristine environment, but added to chemicals and effects on health that have accumulated over time due to human activities.

It is therefore high time to define a 'zero pollution world' that we want to live in, and to aspire to move in this direction as quickly as we can, with ingenuity and creativity. The zero pollution ambition for a toxic free environment does exactly that[43]. Consequently, we also need to agree on how to measure whether we have reached our policy objectives, and to modernise and integrate our existing monitoring and outlook frameworks accordingly. This will help guide us and measure the progress towards achieving the zero pollution ambition.

42 E.g. SWD(2020) 87
43 COM(2021) 400

Feedback from the online public consultation on monitoring[44]

The open public consultation for the preparation of the Zero Pollution Action Plan included an expert section on the pollution monitoring frameworks. Overall, the majority of respondents (50% or more) completely or somewhat agree with the statements relating to the needed improvements of the various aspects to pollution policies. 58% of the respondents completely agree that linkages of health data with pollution data need to improved, while just over a third of the respondents (33%) consider the existing monitoring frameworks for pollution at the EU and national level to be sufficient (see figure below). With respect to the opinions of respondents on the main purpose for a zero pollution monitoring and outlook at EU level, 60% or more somewhat agree with all of the suggested options. Respondents seem most uncertain about the "*being 'a driver for change' through better communication with and engagement of citizens*" option, where 23% answered that they neither disagree nor agree. With respect to the pollutants that should be addressed as a priority at EU level and therefore included in the monitoring framework, 60% or more of the respondents completely or somewhat agree with the listed categories of pollution, except the two options related to other pollution not listed. Pesticides / biocides are ranked first with 72% of the respondents completely agreeing they should be addressed as a priority, followed by marine litter (68%), heavy metals (64%), pharmaceuticals (62%), and particulate matter (62%). Respondents are less certain about addressing noise as a priority, where 20% of the respondents neither disagree nor agree. Overall, 71% of respondents fully or somewhat agree that '*developing an overarching MF at EU level is relevant for their work'*.



[44] Ecorys (2021): "Consultations on the EU Action Plan towards a zero pollution ambition for air, water and soil", Synopsis Report (see 'Have your say' portal').

3.2. Achievement and challenges of existing pollution monitoring

Pollution monitoring is as old as the EU's pollution control policy. It is probably one of the most comprehensive and advanced sources for the evidence base that we have in the various environmental domains. For instance, EU air quality and bathing water monitoring regularly features in the news and its annual reports by the European Environment Agency generate a high interest and visibility indicating the continued interest and concern in such issues by the public and policymakers.

The main source of EU level data and information stems from legal obligations in environmental laws. The Fitness Check of environmental monitoring and reporting[45] provided, for the first time, a comprehensive overview of these monitoring and reporting based on environment legislation. Sixty-four pieces of legislation were analysed which include a total of 181 reporting obligations. Approximately 20% of these obligations include data and information on pollution, ranging from concentrations in the environment, exceedances of limit values to sources of pollution or measures to tackle it. In addition, Commission services[46] and various EU agencies[47] are collecting relevant information either on specific legal basis or on a voluntary basis. Furthermore, projects from different EU programmes have provided *ad hoc* input to the evidence base. More recently, citizen's science has become an increasingly relevant source of complementary information/knowledge[48]. Approximately 220 pollution related indicators have been counted as those being used in one or the other EU policy context, although the actual number is likely to be higher. It is important to note that certain aspects such as the monitoring of soil pollution are mainly covered at national level, which results in different approaches, methodologies and gaps.

As a result, some very successful monitoring products are published, like e.g.:

- The European Air Quality Index and the regular Air Quality Reports of the EEA[49];
- The annual EEA Bathing Water Report[50];
- The European Pollutant Release and Transfer Register (E-PRTR)[51];

There are many other implementation reports on all pollution-related legislation. In addition, information systems collect, disseminate and share pollution related data, e.g. the regionally aggregated data on heavy metals, pesticide residues and nutrients in EU soils (LUCAS Soils) or chemical monitoring data in all media (environment, humans, food/feed and products) in the Information Platform on Chemical Monitoring (IPCHEM), to name just a few. Also the THETIS-EU[52] platform to monitor and report implementation of environmental laws applicable to maritime transport is a good

45 SWD(2017) 230

46 Including Eurostat, the Joint Research Centre and the services working with the Copernicus programme

47 Including the European Environment Agency (EEA), the European Chemicals Agency (ECHA), the European Food Safety Agency (EFSA) and the European Maritime Safety Agency (EMSA)

48 SWD(2020) 149

49 https://www.eea.europa.eu/themes/air/air-quality-index/index

50 https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water

51 https://prtr.eea.europa.eu/

52 https://portal.emsa.europa.eu/web/thetis-eu described in the European Maritime Transport Environmental report

example for a successful information system. It combines record and exchange information with compliance and verifications efforts.

Complementary to national and specific monitoring, the Commission Copernicus earth observation Programme operational since 2014 operates dedicated full, free and open data and information services for environmental monitoring of planet health. The atmosphere monitoring service, the marine environment monitoring service, the maritime surveillance service are delivering daily routine observation of some pollutants and offering in some cases forecasts of such pollutants. The atmosphere monitoring service delivers observations to contribute to the air quality reporting[53]. These observation are fully, freely and openly available and are advantageously harmonised and quality-controlled across countries at pan-European level and at global scale. Reporting and analysis are published annually for example through the Copernicus ocean state report[54] (monthly ocean monitoring indicators). Data are made openly and digitally available for additional analysis in support to policies implementation.As regards to forward-looking outlooks, the situation is somewhat less advanced. Similar to the projections of climate policy, the regular Clean Air Outlook[55] provides a perspective on air emission trends based on a number of scenarios, which allows for a discussion on the most effective way to achieve our EU air quality objectives. As for other pollution aspects, work is ongoing, in particular in relation to water and marine pollution (see section 5).

Despite this impressive and comprehensive evidence base, there are still shortcomings which prevent a more robust basis for policy evaluations and impact assessment. The following findings feature regularly in the Commission's REFIT evaluations, in particular:

- Data are incomplete, are not monitored and/or reported by Member States or information is late or outdated;
- The quality of the data varies and lacks comparability;
- The frequency of data collection or transmission is not adequate for policy indicators (which are needed on an annual or, at least, biannual basis);
- The granularity (disaggregation of parameters or geographic levels, e.g. regional) is not sufficient to allow meaningful policy analysis;
- The format and structure of monitored/reported data makes it time consuming to aggregate and integrate them;
- The access to the data is difficult or restrictions hinder their use for different purposes, in particular from (past) research projects;
- Data are not well documented or difficult to interpret and re-use;
- Data are not easily findable, accessible and interoperable;
- For emerging pollution issues, it is often difficult to get robust, EU-wide data;

53 https://atmosphere.copernicus.eu/copernicus-contributes-european-environment-agencys-2020-air-quality-europe-report

54 https://marine.copernicus.eu/access-data/ocean-state-report and https://marine.copernicus.eu/access-data/ocean-monitoring-indicators

55 Second Clean Air Outlook: COM(2021) 3

- There is multiple reporting and collection of the same data and they do not benefit from technological progress in digital technologies;
- Data cannot be reused for other purposes.

Moreover, there is no thematic overview on pollution that brings all these individual pieces of information together and provides for an integrated picture. This is reflected in the lack of indicators for the combined exposure to mixtures of chemicals, and of their impact on human and ecosystem health.

3.3. Other existing and foreseen policy monitoring frameworks

In addition to the thematic monitoring described above, there are a number of overarching monitoring frameworks including the pollution dimension, either existing or under development. The efforts towards a zero pollution monitoring and outlook framework are directed towards using what exists and contributing to improving the deficiencies in the current frameworks. This section provides a short, non-exhaustive overview on the most relevant wider EU monitoring frameworks and the relationship with the one on zero pollution.

Monitoring sustainable development goals (SDGs)

The Commission (Eurostat) publishes annually a monitoring report on progress towards the SDGs in an EU context[56]. Currently, the report includes a number of pollution-related indicators. In total, eight out of the 100 indicators are used for directly monitoring pollution (some of them to monitor two Goals) under the SDGs 6 (water pollution), 11 (air and noise pollution), 12 (toxic chemicals), 14 (marine pollution) and 15 (water pollution affecting terrestrial ecosystems). In addition also indicators for the SDGs 3 (health) or 7 (energy) are relevant. These indicators are currently the best indicators available for the purposes of SDG monitoring however there is still scope to more comprehensively cover some important pollution aspects (e.g. in case of indicators used for SDGs 3, 12, 14 and 15). The zero pollution monitoring framework can help identify and develop further indicators to complement those that already exist.

The EEA's report on 'The European Environment: State and Outlook' (SOER)

The flagship report of the European Environment Agency presents the latest knowledge and data on the environment in Europe every five years[57]. The overview dashboard (table ES1 in the 2020 edition of the report) contains 35 themes out of which 14 assessments of the past trends and outlook are pollution-related. Looking at the detailed maps and indicators, approximately 30 are used throughout the report. Together, they already provide a very comprehensive overview.

Furthermore, the EEA possess additional information and data which are also published as part of both thematic-specific reports, as well as cross-cutting reports, e.g. recently on the 'Healthy Environment, Healthy Lives' report[58]. There remain, however, opportunities to further integrate pollution-related issues and in the future to ensure its relevance to the European Green Deal. Some of the 'shortcomings' are also linked to the overall

56 https://ec.europa.eu/eurostat/web/products-statistical-books/-/KS-02-20-202
57 https://www.eea.europa.eu/soer
58 EEA Report 21/2019

shortcomings in the EU's environmental monitoring and reporting system (as identified, e.g. in the Commission's Fitness Check[59] and in the Chemicals Strategy for Sustainability[60]), e.g. the lack of robust and reliable data and indicators on environmental status and impacts for certain issues such as the impact of chemicals and chemical mixtures on health and the environment, soil pollution and the better use of modern technologies to complement traditional reporting of information by Member States.

The Zero Pollution framework can help address these shortcomings and assist the EEA's efforts to further develop their evidence base and aligning it with the zero pollution ambition in the European Green Deal. Hence, all efforts will be done in close collaboration with the EEA and the EIONET[61] network of European countries so that these developments can also benefit the preparation of the next SOER.

Measuring progress towards the 8th Environment Action Programme objectives

The Commission's proposal for an 8th Environment Action Programme (8th EAP)[62] includes a provision on measuring progress (Article 4). This provision will trigger an overarching discussion on developing an 'umbrella' monitoring framework that builds on specific work streams to monitor environmental priorities, such as circular economy biodiversity protection and the zero pollution ambition. The aim is to provide **coherence between different monitoring exercises** by selecting a limited number of key high-level indicators that are most appropriate for the purpose of strategic communication towards the EU's 2030 and 2050 environment and climate goals. The work on the zero pollution monitoring and outlook framework is closely coordinated with the 8th EAP work and the aim is to achieve a fully coherent and integrated outcome, e.g. in terms of approach and indicators[63].

Meeting the objectives of EU environmental laws and policies: the overview provided by the Environmental Implementation Review

The Commission and the Member States must ensure that environmental policies and legislation are enforced and deliver effectively. The Environmental Implementation Review (EIR) maps the performance of each Member State. To date, two Environmental Implementation reviews (EIR) have been carried out in 2017 and 2019. The next review, due in 2022, is expected to highlight further actions required from each Member State in order to make sure that the EU remains on track to meet its environmental objectives. In accordance with the mandate given by the European Green Deal Investment Plan[64], the EIR will also identify the investment needs of each Member State in the key sectors of environmental policy and practice. The zero pollution monitoring will generate a comprehensive set of data, indicators and assessments that can help inform the next EIR.

59 COM(2017)312 and SWD(2017)230
60 COM(2020) 667 final
61 European Environment Information and Observation Network
62 https://ec.europa.eu/environment/strategy/environment-action-programme-2030_en
63 Consultative paper on the proposed approach and architecture for the 8th EAP monitoring framework
64 COM(2020) 21

Monitoring under thematic strategies

- *Circular Economy*

The monitoring framework developed as part of the first Circular Economy Action Plan is an inspiration for an integrated and policy-relevant approach. It identified 10 headline indicators (with 23 sub-indicators) which describe the economic cycle from production, consumption, waste management to secondary raw materials as well as competitiveness and innovation. This concept is a useful example to illustrate how complex relationships and systemic challenges can be captured with a relatively small number of indicators. However, it does not include any pollution related indicators although the release of emissions to air, water or soil is one sign of an inefficient economy where resources are wasted at the expense of affecting our health or our ecosystems. The new Circular Economy Action Plan announces a revision of the monitoring framework, with new indicators that will take account of the focus areas in the action plan and of the interlinkages between circularity, climate neutrality and the zero pollution ambition. The zero pollution monitoring framework can therefore complement the existing indicators and this ambition with a measure on how clean we can develop our circular economy. Coherence between the monitoring frameworks will be ensured to, support this transition towards a cleaner, climate-neutral, circular economy by 2050.

- *Biodiversity*

Section 2.2.9 of the Biodiversity Strategy[65] sets out the ambition level and actions for reducing pollution in relation to the objectives of that Strategy:

"Pollution is a key driver of biodiversity loss and has a harmful impact on our health and environment. While the EU has a solid legal framework in place to reduce pollution, greater efforts are still required. Biodiversity is suffering from the release of nutrients, chemical pesticides, pharmaceuticals, hazardous chemicals, urban and industrial wastewater, and other waste including litter and plastics. All of these pressures must be reduced. […] The Commission will develop a set of indicators for the progressive reduction of pollution, and will establish baselines to help monitor progress. Pressures from marine litter and underwater noise are being addressed under the Marine Strategy Framework Directive."

The zero pollution monitoring framework will help implement this action. At the same time, there are ongoing discussions on biodiversity targets and monitoring under Convention for Biological Diversity (CBD)[66] which include pollution aspects. These discussions build on the IPBES global assessment[67] and the IPBES regional assessment report on biodiversity and ecosystem services for Europe and Central Asia (ECA)[68] and other work in the area of biodiversity and ecosystem assessment[69]. The aim is to ensure consistency and synergies between the biodiversity and zero pollution efforts, which then can also help for the monitoring under the 8th EAP. To achieve this, further work will be needed to align conceptual approaches and coordinate the variety of ongoing processes.

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65 COM(2020) 380

66 see pollution-related proposals in recent SBSTTA-24 document or the UNEP thought starter on the linkages between biodiversity and chemicals & waste/ pollution

67 https://ipbes.net/global-assessment

68 https://ipbes.net/assessment-reports/eca

69 E.g. State of knowledge of soil biodiversity - Status, challenges and potentialities

As foreseen in the Biodiversity Strategy for 2030, the Commission will also revise the Soil Thematic Strategy and address soil degradation due to pollution as one of the key pressures affecting ecosystem services including the capacity of soil to function as a habitat.

- *Farm to Fork*

The Farm to Fork Strategy[70] sets a number of important high-level targets that will contribute to reduce pollution (some of them being common with the Biodiversity Strategy), namely from nutrients, pesticides and substances with associated antimicrobial resistance. Monitoring of these targets will be achieved through indicators, which reflect the use of these products or, in case of fertilisers, the nutrient balance. These indicators will be an important component of the zero pollution monitoring, but they will not give an indication in how far the reduction of use results in concentrations in air, water or soil, which do not cause harm to human health or the environment. The zero pollution monitoring can inform about these aspects and add to the efforts towards achieving the agreed goals.

- *Bioeconomy*

The EU Bioeconomy Monitoring System[71], pursuant to the EU Bioeconomy Strategy Action Plan[72] monitors progress towards the EU Bioeconomy Strategy Objectives at both EU and Member State level:

- Ensuring food and nutrition security;
- Managing Natural Resources Sustainably;
- Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad;
- Mitigating and adapting to climate change;
- Strengthening European competitiveness and creating jobs.

It builds on existing data from official sources, thus limiting administrative burden on countries. The monitoring system's conceptual framework is compatible with International Bioeconomy Monitoring Guidelines and cuts across the five objectives of the EU Bioeconomy Strategy, the three dimensions of sustainability (environment, society and economy) and the steps of the value chain, from the underlying ecosystems to primary production systems, to production, uses and end-of-life. Each indicator in the EU Bioeconomy Monitoring System is mapped to Green Deal Priorities. Those that are mapped to the ' a zero pollution ambition for a toxic-free environment' priority are relating to quality of life in urban areas and the indicator 'environmental impacts' based on product-based life-cycle assessment (LCA) and basket of representative products of the bioeconomy. Although pollution is not a major focus of the EU Bioeconomy Monitoring System, it does contain indicators about air and water quality under the heading of ecosystem services.

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70 COM(2020) 381

71 https://knowledge4policy.ec.europa.eu/bioeconomy/monitoring_en

72 COM(2018) 673

- *Chemicals Strategy for Sustainability*

The Chemicals Strategy for Sustainability[73], in line with the European Green Deal, strives for a toxic-free environment, where chemicals are produced and used in a way that maximises their contribution to society including achieving the green and digital transition, while avoiding harm to the planet and to current and future generations. The strategy sets actions to ensure that all chemicals are used more safely and sustainably, to promote that chemicals having a chronic effect for human health and the environment - substances of concern[74] – are minimised and substituted as far as possible, and to phase out the most harmful ones for non-essential societal use, in particular in consumer products. The industrial transition towards the production and use of safe and sustainable chemicals a key requisite to achieve a toxic-free environment.

Notwithstanding the EU's world-class knowledge on chemicals' properties and risks, there is room for improving the knowledgeon the intrinsic properties of a vast majority of chemicals, and knowledge on uses of hazardous chemicals and exposure of humans and the environment is fragmented. The Strategy recognises the importance of further improving the scientific understanding of the impacts of chemicals on health and the environment, including by monitoring the presence of chemicals in humans and ecosystems. The Strategy announces that a framework of indicators will be developed, as part of a wider zero pollution monitoring and outlook framework, in the context of the 8th Environment Action Programme, to monitor the drivers and impacts of chemical pollution and to measure the effectiveness of chemicals legislation. The Commission will also establish Key Performance Indicators to measure the industrial transition towards the production of safe and sustainable chemicals.

In addition, the Strategy – as part of the 'one substance, one assessment' approach – sets out a number of important actions in relation to chemical monitoring data, in particular:

- making all chemical monitoring data available via the Information Platform for Chemical Monitoring to ensure their findability, accessibility and interoperability;
- making a legislative proposal to removing legislative obstacles for the re-use of data and better streamlining the flow of chemical data between EU and national authorities;
- extending the principle of open data and the relevant transparency principles from the EU food safety sector to other pieces of legislation dealing with chemicals;
- rationalising the use of expertise and resources by proposing the reattribution of technical and scientific work on chemicals performed under the relevant pieces of legislation to European agencies, including work of the relevant scientific committees;
- enabling EU and national authorities to commission testing and monitoring of substances as part of the regulatory framework when further information is considered necessary.

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73 COM(2020) 667

74 These include substances having a chronic effect for human health or the environment (Candidate list in REACH and Annex VI to the CLP Regulation) but also those which hamper recycling for safe and high quality secondary raw materials.

Further, the toxicity and use data on chemicals will be consolideted across Agencies and made availbale for re-use through the open data portal on chemicals. Developing a zero pollution monitoring will rely strongly on the successful implementation of these actions. Close coordination with these efforts will be necessary.

Comparison of these existing monitoring frameworks

The purpose and structure of these various monitoring frameworks is different and therefore it is not surprising that the number and type of indicator varies. For example, the Green City Accord is working to building on forward indicators for cities to assess their progress in five environmental areas. However, when extracting the pollution-related parts of the analysis, it may give the impression that the situation and progress is somewhat different depending on which framework you look at. For example, Eurostat's SDG monitoring indicates a positive or very positive trend for all pollution parameters, the EEA's SOER gives a much bleaker picture with a mix or negative outlook putting in doubt that many pollution related policy objectives will be met. These apparently different findings are the result of methodological choices and availability of relevant data which in themselves are perfectly logic and justifiable but not necessarily helpful in the EU's policy debates. The zero pollution monitoring framework will not be able to resolve all these divergences but may help to create a common reference point, a platform for coordination and a process towards convergence.

4. ZERO POLLUTION MONITORING

4.1. Concept

The monitoring framework can draw lessons from many past and ongoing initiatives that develop a similar concept for an overarching policy. In particular, the climate monitoring mechanism[75], the Circular Economy monitoring[76] or the Digital Economy and Society Index (DESI)[77] have been sources of inspiration. Amongst the existing pollution monitoring frameworks, probably the one for air policy is most advanced but many other areas can also provide lessons for this overarching approach.

Monitoring pollution can be organised in several layers and dimensions given the large number of pollutants, sources and endpoints (i.e. affecting different aspects of health or the environment). To this end, the **hierarchy** set out in the pyramid below (figure 1) is showing the different levels of granularity of monitoring frameworks.

75 https://ec.europa.eu/clima/policies/strategies/progress/monitoring_en
76 https://ec.europa.eu/environment/circular-economy/first_circular_economy_action_plan.html
77 https://ec.europa.eu/digital-single-market/en/desi

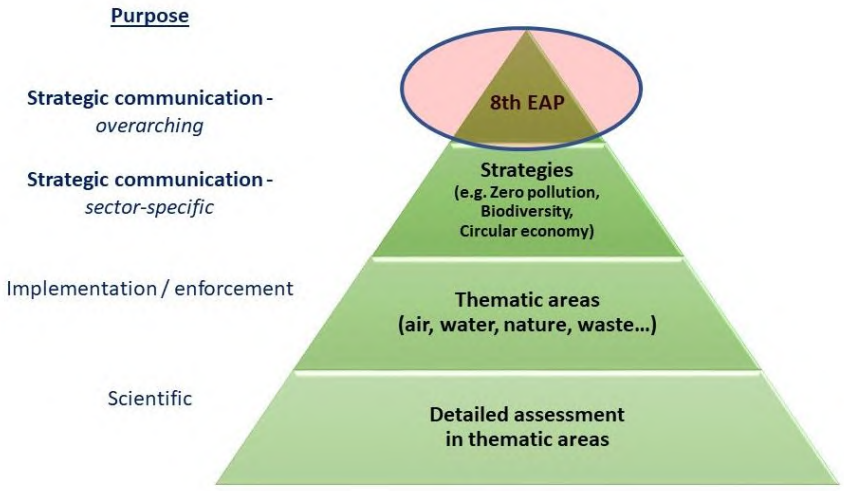

Figure 1: Pyramid of levels for different degree of granularity of a monitoring framework based on indicators, with the 8th EAP monitoring (under development) as an "umbrella framework".[78]

The **headline set of indicators for zero pollution** feeding into the 8th Environment Action Programme monitoring should not exceed a small number of indicators for pollution. These few indicators should merely provide a sense of the scale of the pollution problems that need to be solved. In addition, the ambition is to start building a zero pollution monitoring and outlook framework on the available data and evidence which provides a more comprehensive, yet succinct and integrated overview and monitoring of progress for the zero pollution ambition. A more detailed and specific set of indicators and assessment is needed for the implementation and enforcement of legislation and yet more indicators are emerging from research. All of these different levels of granularity need to be interconnected and logically built on one another.

A **conceptual representation for the zero pollution monitoring framework** is set out in figure 2. This illustration looks at the concept more from the perspective of the 'receptor', such as humans, biota or various environmental media. The systemic perspective of the sources and pressures (pollution levels) is discussed in chapter 4.3. Moreover, the economic and social dimension, including the possible impacts of pollution on vulnerable groups or productivity, is desirable to assess.

The identification and monitoring of key impacts (or causing harm) on health and the environment are a central element in assessing progress towards achieving the vision for the zero pollution ambition by 2050. Based on this overarching conceptual approach, a set of initial impact indicator has been proposed in Annex 2 as a starting point to identify the best indicators for strategic communication as set out above.

78 Consultative paper on the proposed approach and architecture for the 8th EAP monitoring framework

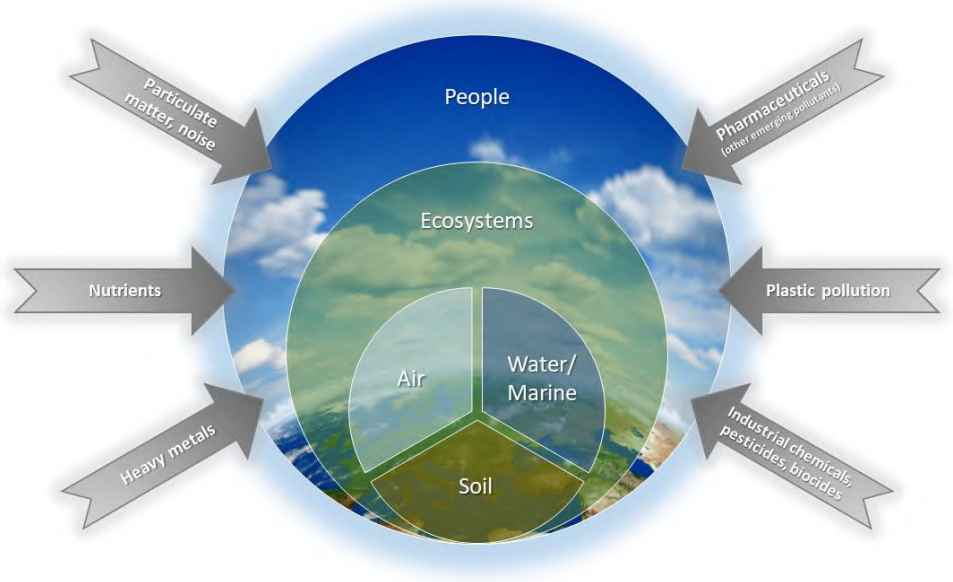

Figure 2: Conceptual representation of the Zero Pollution Monitoring Framework

There is certainly no shortage of indicators and the existing indicator libraries[79] can be a starting point for discussion. However, it is likely that new indicators may also need to be developed. The **selection of indicators** will be based on a clear set of criteria, which uses best available data in the context of the policy objective that is being monitored (see Annex 2).

- They should cover the scope of the zero pollution ambition as set out in the Green Deal, i.e. address **air/noise, water/marine, soil and consumer products**, when possible. For each of these four categories, the most relevant ones should be identified on the basis on either **impact (harm) for human health or impact (harm) for biodiversity and ecosystems**. A mechanism to identifying the pollutants with the highest impacts will need to be discussed[80].

- The **most important pollutant pressures** (or emissions) to air, water and soil should be identified.

- Some important **emerging pollutants** should be added, again differentiated by air, water and soil, if possible.

- A number of general quality criteria need to be fulfilled, such as timelines, regularity and the 'RACER' (relevance, acceptability, credibility, easiness and robustness)[81] criteria (see Annex 2 for details).

The selection of indicators can be based on the approximately 200 available pollution indicators at EU level. This document makes a number of suggestions and identifies possible indicators. The rationale for this selection is set out in the subsequent sections and proposed initial indicators based on the available, most relevant ones has been

79 https://ec.europa.eu/eurostat/web/environment/environmental-indicator-catalogue

80 E.g. building on examples and experiences from international organisations (e.g. WHO and IPBES) and relevant research (e.g. Lancet Commission on pollution and health).

81 See Better Regulation Toolbox, Tool#41

included in Annex 2. However, the final selection will only be done later in 2021 following a consultation and after the work on the 8th EAP monitoring are more advanced.

At the same time, the weaknesses and shortcomings of the initial indicator set should be considered from the outset in order to identify actions that will improve existing or develop new indicators to fit the political need. As a result, Annex 3 provides the starting point for developing a work programme that will start in 2021 with the aim of delivering improvements to support the 2024 update of zero pollution monitoring.

The indicators identified for the zero pollution monitoring may be complement with qualitative analyses derived from available data that may be limited in terms of temporal and geographical coverage. Dimensions that could be covered by qualitative case studies include for example indoor air pollution, light pollution or soil pollution and the integrated impacts of pollution on human and ecosystems health.

The current set of indicators may only address certain pollution types, pathways or sources. Ideally, more integrated environmental impact indicators should be used such as the total pollution exposure level on human health, the reduction of human sperm quality or the decline in insects or pollinators (see section 4.5). Such integrated, composite indicators already exist to a certain extent for certain types of ecosystems (e.g. good status as set out below) but they are often not only affected by pollution but also by other pressures. Further work may be needed to develop such integrated or composite indicators (see section 7).

It is clear that the conceptual framework will need to evolve with time. Indeed, the ongoing efforts to standardize natural capital accounting practices at corporate, project, and government level as well as the related reporting and disclosure schemes that are being developed in the context of greening the capital markets union could provide valuable contributions which can be integrated in time.

Finally, the aim is not to increase the administrative burden or to keep it limited for Member States or even, after some initial investment (e.g. in digital technology, modelling or processes), to reduce it. At the same time, the weaknesses and shortcomings should be identified and a gradual process for improvement is started against an overarching and common ambition level. Where observational monitoring data are insufficient or not available, a cost-effective way is to use modelling to interpolate or extrapolate on the basis of the available monitoring results[82]. This aspect is not explored further here, but it is an area where digital solutions can help (e.g. big data, artificial intelligence, remote sensing, earth system modelling)[83].

This will require some additional investments, in particular initially, but it will be assessed against the benefits that it results in, or synergies with other policies like climate. In many cases, such investment will be part of improvements of implementation because many data gaps are a result of incomplete implementation of existing provisions. This can create synergies and new opportunities, e.g. by introducing better use of available space-based earth observation data and more advance digital technologies and processes.

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82 E.g. https://onlinelibrary.wiley.com/doi/10.1111/gcb.15504 or https://www.nature.com/articles/s41598-017-00324-3

83 See SWD (2021) 140

4.2. Monitoring key impacts / harm

Based on available indicators linked to air, water and soil, there are two important impacts that the monitoring framework needs to capture:

1. key pathways through which air, water (e.g. through drinking water or bathing water) or soil as well as food and product pollution affect our daily lives and thereby our health ('**environmental health & wellbeing indicators**');

2. the wider impact of pollution (and other pressures) on our surface and ground waters, marine and land ecosystems ('**planetary boundaries indicators**').

4.2.1. Pollution, human health and well-being

The most relevant known impacts on human health result from air, noise and water pollution as well as through consumer products. This is encapsulated by SDG 3.9 targets which aim at the substantial reduction in the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

For **impacts from air pollution**, the relevant indicators (e.g. on Years of Life Lived with Disability or Lost (YLD- YLL) and/or premature deaths) are already widely used.

In addition, the impact of **noise pollution on human health** has been widely proven, with a range of indicators available to measure and communicate impacts on health[84]. Detailed data on citizens' exposure and health effects are available at the level of the EU but because of their complexity they are only updated every five years. Similarly, data from several water-related directives provide an additional insight to the potential effects of noise pollution on human health and wellbeing but they are only collected every four to six years. These initially proposed indicators can be used for a wider assessment and will, as far as possible, be included in the 'baseline' for the first zero pollution monitoring report. Some of them could be included in other monitoring frameworks (see chapter 3.3) because these data are collected more regularly by Member States but currently not transmitted annually to the EU level.

As regards water, the water-related Sustainable Development Goal (SDG6) puts emphasis on the **access to safe drinking water and sanitation**, which are globally still affecting health conditions (e.g. compliance with drinking water standards). Data for these indicators are, in theory, available on an annual or biannual basis but further arrangements with the Member States are needed (in particular on water indicators) to ensure that the aggregated indicators can be published annually.

Moreover, the **impact of chemicals through products** including food (in addition to the exposure of the same chemicals through air, water or soil) is relevant but difficult to quantify given the large variety of chemicals and products. The same is true for air, water or soil. For instance, there is a variety of water masses with different spatial / temporal conditions, as well as a variety of chemicals to quantify. Work is ongoing in the context of developing indicators for the Chemicals Strategy. **Other indicators** may also be discussed (e.g. contaminants in seafood or soil pollution and health) but would need to be at the same level of relevance, importance and availability as the above-mentioned ones.

[84] Health risks caused by environmental noise in Europe — European Environment Agency (europa.eu); Environmental noise in Europe — 2020 — European Environment Agency (europa.eu)

When using and assessing these indicators, it will be important to also analyse the exposure of such pollution to different population groups. This can be achieved by disaggregating the pollution levels data (as well as measuring key pressures) not only along geographic criteria but also by population groups, including according to income distribution[85].

4.2.2. Pollution, ecosystems and planetary boundaries

The SDGs set out a number of targets linked to pollution, e.g.:

- By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally (SDG target 6.3).
- By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution (SDG 14.1);

Many indicators describing the pollution impacts on the environment and ecosystems are available but many are not collected or updated on an annual basis.

On **water and marine ecosystems**, data are transferred to the EU level under the WFD and MSFD every six years. They are reported into the Water Information System for Europe (WISE and WISE-Marine), mostly as "compliance" or "failure" (with some additional information), but the underlying data are not. Some monthly ocean monitoring data (e.g. on acidification, nitrates, eutrophication, primary production anomalies) which are available through the Copernicus marine environment service, even if not all pollution-specific, can be used as proxies. Most countries also report data separately (as concentrations in the case of chemicals) into the EIONET Reportnet[86] system to inform the regular update of the EEA indicators and which are in turn used to inform assessments such as the (five-yearly) State and Outlook of the Environment Report (SOER) of the EEA. From this data flow, a number of indicators are available mainly, linked to nutrients, but they do not always provide the best indicator for policy purposes. This annual, voluntary dataflow could be improved and used more effectively for the purpose of gathering available data to calculate annual updates of key headline indicators for the zero pollution monitoring framework. Moreover, the evidence base on several aspects of water and marine pollution is not only temporally scarce, but can also be spatially incomplete, e.g. with large gaps in spatial data distribution especially in the southern parts of Europe's seas[87]. In addition, in some instances not all pathways are included, especially sea-based pollutants.

Beyond these annual indicators, assessing pollution effects on ecosystems has been encapsulated in EU laws in an integrated way with the help of complex assessments which look at the 'status' of the different ecosystems.

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85 See e.g. EEA Report 22/2018

86 https://www.eionet.europa.eu/reportnet

87 See EEA report on 'Contaminants in Europe's Seas'

The objectives are to:

- avoid negative impacts on land through the favourable conservation status of protected areas on land;
- avoid negative impacts on surface and ground waters as defined by the Water Framework Directive (WFD) through 'good status' of coastal, transitional (estuarine), rivers, lakes as well as aquifers and
- avoid negative impacts on seas and the ocean as defined by the Marine Strategy Framework Directive (MSFD), through the 'good environmental status'[88].

The indicators attached to these objectives are mostly linked to impacts but some also to state or pressures. They are important composite indicators aggregating a larger number of specific indicators based on explicit legal requirements. They are essential to monitor the ecosystem health and promote the long-term development of ecosystems towards a sustainable state. However, they go beyond pollution-related issues, as they are the result of many pressures on the environment. In some cases, it would be possible to extract those elements of the composite indicators which are directly linked to pollution pressures. For example, for the marine environment only use data for the descriptors 5 (nutrients), 8 (hazardous substances), 10 (marine litter) and 11 (underwater noise); for surface and ground waters use only chemical status). Future use of big data may help to extract the fraction of impact caused by chemical pollution, as is already done to assess impacts of chemicals on human health.

As regards **soil pollution**, no ecosystem-related impact indicator exists yet, but the concentration of certain contaminants (e.g. heavy metals, some pesticides) in the soil is monitored in a harmonized way across the EU by the **Land Use Cover Area Survey (LUCAS SOIL)**[89]. The progress in the management of contaminated sites is also reported by EEA-39 countries on an ad-hoc basis in the context of the EIONET. Also for soil indicators, it should be considered how soil pollution data collected under LUCAS and EIONET could be further enhanced and developed into one or more indicators. Ideally, these should also reflect the combined levels of chemical pollutants in soil, and impacts on soil ecosystems including microbiota. To capture these opportunities, EEA and EIONET have prepared a soil indicator and threshold framework, while the Joint Research Centre has launched the EU Soil Observatory[90], which hosts pan-EU datasets on diffuse soil pollution. Under the umbrella of the EU Soil Observatory, the Joint Research Centre (JRC) is developing a soil pollution dashboard. Both EEA and JRC cooperate closely in the EIONET National Reference Centres (NRC) on Soil.

These initially proposed indicators can be used for a wider assessment and will, as far as possible, be included in the 'baseline' for the first zero pollution monitoring report based on the WFD and MSFD reporting in 2022 as well as the latest LUCAS SOIL results. For updates afterwards some additional efforts will be made to access those data in Member States which are collected more regularly and by further development of a targeted pollution module in LUCAS Soil, which is integrated with MS monitoring programmes.

88 SWD(2020) 62
89 https://esdac.jrc.ec.europa.eu/
90 https://ec.europa.eu/jrc/en/eu-soil-observatory

A process for improving data availability and quality of water and marine data will be started through a supporting project[91].

In addition, the mission Soil Health and Food will be instrumental in view of developing and harmonising soil monitoring systems in Europe, based on a set of commonly agreed set of soil health indicators, one of them being "presence of pollutants, excess nutrients and salt".

In addition, the National Emission reduction Commitments Directive 2016/2284 requires the monitoring and reporting of **ecosystem impacts of air pollution**, on a four-year basis. Reported data provide information on air pollution impacts through acidification, eutrophication and ozone damages on a representative network of terrestrial ecosystems (including freshwater ones).

Increasingly, the potential of using **complementary data source**, in particular from Earth observation, e.g. hyperspectral data from the EU Copernicus Hyperspectral Imaging Mission for the Environment (CHIME) mission, offer a potential to overcome these shortcomings for many datasets. Moreover, the Information Platform for Chemical Monitoring (IPCHEM)[92] aims to provide access to all available in-situ chemical monitoring data directly from the sources (e.g. Member States), including some steps to ensure quality control when combining datasets. IPCHEM provides access to chemical monitoring data across media, i.e. in environmental media (waters, sediments, soil, biota), humans, food and feed and products. More investment in IPCHEM, especially to finalise consolidation of all chemical monitoring data flows through this platform in least aggregated form, will help deliver new data and indicators useful for the zero pollution monitoring. In particular, monitoring results may be combined with effect and impact data on humans (e.g. diseases) and environment (e.g. status of biodiversity and ecosystem health), hence providing a holistic view of the impact of combined exposure to chemicals through various routes on humans and the environment. The monitoring data may be also used for the back-calculation of pollutant emissions to water and other environmental compartments, hence for the monitoring of progress on the control and phasing out of pollutants of concern[93]. The activities of the IPCHEM should be streamlined with the European Marine Observation and Data Network (EMODnet)[94] and with the Copernicus Marine Environment Monitoring Service[95], not only to pursue more frequent update of indicators but also to achieve integration of the pollution data with all the other available information and data on the marine environment. EMODNET and Copernicus Marine already include a wealth of data regarding the state of the marine environment and of multiple pollutants, and the responsible coordinators are in constant collaboration with MSFD actors and the EEA to increase this knowledge base and make more data openly available. In order to have more regular updated indicators, these sources may need to be used to update existing indicators more regularly or develop new indicators (or proxies for the key indicators) that can be published on a more frequent basis.

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91 A project on 'Streamlining & digitalisation of water and marine monitoring & reporting' is about to be launched.

92 https://ipchem.jrc.ec.europa.eu/

93 E.g. https://www.sciencedirect.com/science/article/pii/S0048969718352471

94 https://emodnet.eu/en

95 https://marine.copernicus.eu/

Many pollutants **travel from the soil to air and/or water or accumulate in plants and animals**, including marine waters and ecosystems (biota). Transfers of such pollution can travel long distances even in remote areas. It will be increasingly important to develop indicators that consider these cross-media transfers and assess impacts in an integrated and holistic way, and that also consider its economic and other impacts ('co-benefits' or cross media relevance).

4.3. Monitoring key pressures and sources

Pollution pressure indicators complement the above-mentioned set of key impact indicators by including all point sources, which result in emissions to air, discharges to water or contamination of soil. Moreover, they account for losses or diffuse pollution which affect air, water or soil in the absence of an identified single point of pollution as they rather affect an area (e.g. spraying of pesticides, nitrates). They are based on a wider set of pollution source-related indicators, which give a measure of how the pressures from certain types of pollution evolve.

Overall, there are a **large number of pollution types, groups or individual pollutants**[96] which can theoretically be covered. Such point and diffuse pollution pressures may be collected through inventories or registers (e.g. the E-PRTR)[97] although many are not captured by the current databases and require to step up efforts to ensure better knowledge is available[98]. In addition to such legally-recorded sources of pollution, unknown pollution also occurs, such as illegal dumping or unrecognised pollutants.

For an integrated pollution monitoring, it will be important to capture emissions, discharges and losses across the media and link them to the sources of the pressures. Knowing the sources allows to better understand the drivers and develop measures to eliminate or reduce pollution. Such a systemic approach has been proven very useful in the context of the climate and energy policy[99] or the material flows in the circular economy. However, despite many years of monitoring and aiming to address this issue, our knowledge is still somewhat poor for some questions linked to pollution[100].

Figure 3 illustrates the ineffectiveness of our material flows and how a circular economy is essential to reduce or even eliminate emissions into air, water and waste (see losses in the top right of the diagram). A similar Sankey diagram exists for nitrogen flows along the EU food system[101].

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96 Greenhouse gas emissions are not covered by this monitoring framework. However, some pollutants have climate and other pollution effects, e.g. methane, so they may be covered here as well whilst ensuring consistency and complementarity with the climate monitoring.

97 European Pollutant Release and Transfer Register

98 E.g. on pesticides: https://ec.europa.eu/jrc/en/publication/estimating-pesticide-use-across-eu

99 See example of energy flows

100 E.g. https://www.eea.europa.eu/publications/chemicals-in-european-waters

101 https://www.sciencedirect.com/science/article/pii/S2211912420300213

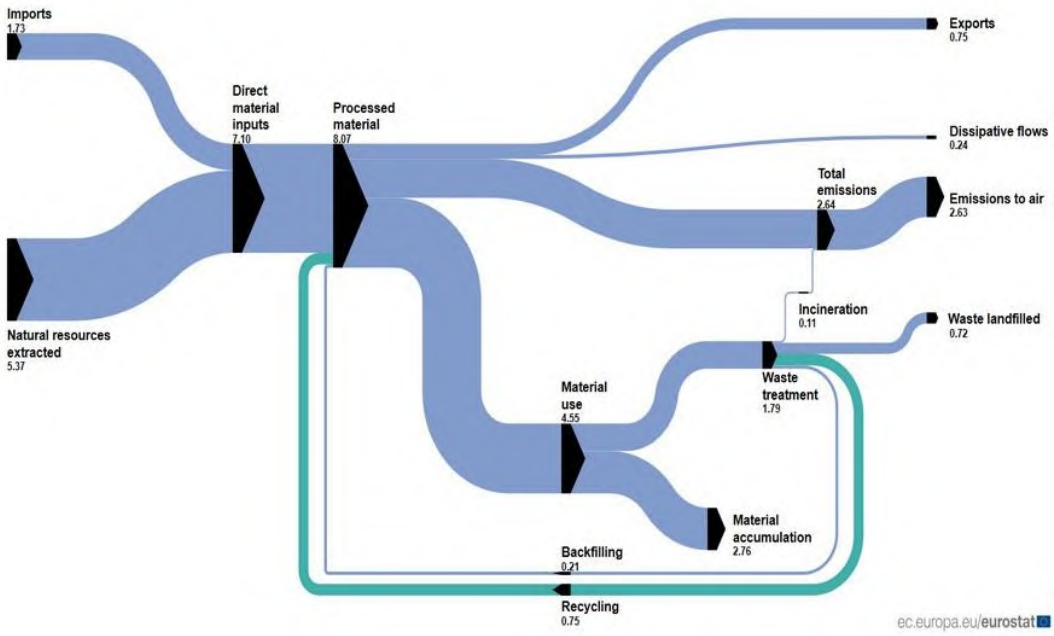

Figure 3: Material flows in the EU economy – Sankey diagram (EU-27, 2018) [102]

Monitoring pressures is also important to assess trends and, if desirable, setting pollution reduction targets. At the moment, only few such targets can actually be set and more efforts are needed to assess, comprehensively, all pollution pressures.

Initially, the focus could be a limited number of pollutants to concentrate efforts and showcase the benefits of such an integrated approach. The first round(s) of the zero pollution monitoring exercise(s) focus on:

- Nitrogen (including its specific emissions of NO_x, NH_4^+, etc.) & Phosphorus (linked to the fertiliser, air emissions and eutrophication targets);
- Selected active substances used in pesticide or their metabolites (linked to the pesticides targets);
- Particulate matter (linked to the air emission targets);
- Heavy metals (e.g. mercury linked to the Minamata Convention, lead or copper as fungicide)
- A subset of industrial chemicals (linked to hazardous chemicals)[103];
- Coastline / beach litter (linked to single use plastics).

In particular, the inventories are advanced and complete as regards air pollution. For pollutants from industrial installations a detailed system of activities and a longer list of pollutants exist, but targeting only some phased out substances of very high concern. This will further improve with the revision of the related legal instruments (mainly IED and EPRTR). For nutrients, a large number of data exist, although they are not always integrated or available for the whole of the EU (e.g. the total nutrient discharges of rivers

102 https://ec.europa.eu/eurostat/web/circular-economy/material-flow-diagram

103 Building on the efforts under the Chemicals Strategy for Sustainability

into the sea exist for the Baltic and the North-East Atlantic but not the others). Less information on pollutants may be available at EU level for other media (water, soil) or as regards pollution transfers across other sectors. But work is ongoing in several areas.

Building on these prioritised pollutants, an initial proposal of indicators would be made and updated regularly. In parallel, a process for improving data availability and quality will be started. In addition, it will be important to develop pressure indicators for other types of pollutants, such as pharmaceuticals (in particular antibiotics used in animal production and those to be developed in the context of water policy, see Annex 2, Part E) or ammonia, and to take into consideration initiatives such as the EU Methane Strategy[104]. More generally, there will need to be a reflection on which pollutants can be added at this stage and for which pollutants work is needed to develop new indicators. This should include identifying where further research will be needed in cases where the relevance is not proven yet and the available data or evidence is not yet sufficient for including these indicators in the zero pollution monitoring framework.

One essential aspect is to improve the availability of data and indicators including the collection of additional data. The feasibility of establishing reduction targets will need to be analysed for each pollutant group. In particular, for pesticides and industrial chemicals (i.e. those covered by REACH) this will be challenging given the several hundreds or thousands of individual substances, respectively, that would need to be considered. Alternatively, focus on emblematic and exemplary pollutants (e.g. PFAS)[105] could be explored. Once a baseline for the total EU emissions has been set for one particular pollutant type, it should be possible to break it down per country or per sector[106]. If not, this should be a desirable action to complete in the coming years. This can help to give an indication whether in a particular country or sector is reducing pollution in general or only for some pollutants. This will be essential information to focus actions and investments in a country- and/or sector-specific way. Overall, the more granular the data are (e.g. also for regional level), the better for policymaking.

4.4. Monitoring key drivers and responses

Once the pressure (or result) and impact indicators are established, it will be important to identify which inputs (e.g. financing, resource needs, etc.) and outputs (e.g. plans, programmes, measures, actions, policy options, etc.) are most effective to achieve the agreed targets and objectives. In other words, administrations at EU and national level need to reflect on the direction of public investment, the application of certain legal and non-regulatory tools and the incentivisation (e.g. through taxes and financial taxonomy for sustainable investments) to achieve pollution prevention or reduction. Such assessment would also take into account socio-economic impacts of pollution reductions, either in terms of productivity gains or losses or impacts on jobs, prices, taxes, etc. At the same time, instruments can be analysed which would result in achieving the zero pollution ambition most effectively, e.g. environmental taxes, cuts of harmful subsidies or application of the polluters pays principle. Such information is also useful to define need for action by the private sector, for example in partnership with public authorities in

[104] COM(2020) 663

[105] Work is already ongoing in the context of the Chemicals Strategy for Sustainability to address these questions.

[106] Examples already exist for some pollutants (e.g. the work on reactive nitrogen through the UNECE task force).

the context of sustainable finance activities including the ongoing work on the taxonomy for sustainable finance[107].

Such assessments typically feature in Commission's impact assessments for a particular piece of law. However, a systematic, integrated approach for such evidence or even the development of specific input and output indicators is not well developed. If analysed per Member State (e.g. through the Environmental Implementation Review) it would allow for a tailor-made political dialogue with Member States to identify gaps and delays and discuss practical solutions on how the EU could help overcome them. For example, if the investment in pollution reduction infrastructure is not sufficient, available Cohesion Policy Funds, the Common Agriculture Policy or European Investment Bank (EIB) loans could be used. In addition, the Recovery and Resilience Facility could further support Member States to improve the pollution reduction infrastructure provided that they included relevant investments and reforms in their respective national plans.

The EU Regulation on the Governance of the Energy Union and Climate Action[108] has introduced a mechanism for a systematic approach for assessing actions (outputs) taken by Member States and providing recommendations on how to address remaining implementation gaps. In the context of this regulation, recommendations and guidance were issued to Member States as to ensure a strong environmental dimension of the national energy and climate plans (NECPs). In particular, Member States were asked to reinforce the links with national, regional or local plans for air pollution reduction, such as the National Air Pollution Control Programme (NAPCP), and relevant air quality management plans. A similar approach is envisaged for governance under the Biodiversity Strategy. Building on existing requirements under the Governance Regulation, further discussions are needed to identify and further develop a synergic and cross-cutting zero pollution approach also taking into account reflections in the context of the 8th EAP. In order to widen the approach taken under energy and climate laws and build on the ongoing reporting and implementation efforts (e.g. under the Environment Implementation Review–EIR), further reflections for the development of an "Environmental Implementation Indicator Framework" should take place to improve the systematic assessment of input and output indicators. Until now, no indicators linked to policy actions or drivers has been identified. They should be considered in the future as they react faster to change than the impacts and pressures.

4.5. Innovative research initiatives monitoring pollution in an integrated way

Beyond these media specific indicators (and exposure routes), research efforts are underway to develop a more integrated assessment of pollution affecting the environment and our health. In particular, the following initiatives are worth mentioning:

- The **European Human Exposome Network**[109]: nine projects funded by Horizon 2020, the EU Framework for Research and Innovation (2014-2020), created a network in 2020, to address issues such as exposure to air pollution, noise, chemicals, light, urban stressors etc. and study the related health impacts. The projects will provide new evidence for better preventive policies and a

[107] In the context of Regulation (EU) 2019/2088
[108] Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action
[109] https://www.humanexposome.eu/

toolbox for policy makers to work with collected data and use it for evidence based decision-making.

- The European **Human Biomonitoring initiative** (HBM4EU)[110]: This initiative, co-funded by Horizon 2020, is coordinating and advancing human biomonitoring in Europe and generating evidence on the actual exposure of citizens to a number of priority chemicals[111], identified by EU regulators, agencies and member state stakeholders for their regulatory relevance. Building on this initiative, the **Partnership for the Assessment of Risk from Chemicals** (PARC) will continue the work under Horizon Europe. It aims to be an EU-wide research and innovation programme to support EU and national chemical risk assessment and risk management bodies with new data, knowledge, methods, networks and skills to address current, emerging and novel chemical safety challenges. It will facilitate innovation in chemical risk assessment to better protect human health and the environment.

- The EU funded **SOLUTIONS[112] (Solutions for present and future emerging pollutants in land and water resources management)** project addressed the challenges related to the contamination with complex mixtures of environmental pollutants and provided consistent solutions for the large number of legacy, present and future emerging chemicals posing a risk to European water bodies with respect to ecosystems and human health. In addition, it provided a large number of improved tools, models, and methods to support decisions in environmental and water policies. For instance, a data infrastructure to compile and exchange environmental screening data on a European scale was established, as well as, an integrated effect-based method for diagnosis and monitoring of water quality that allows to better characterise the likelihood that complex mixtures of chemicals affect water quality.

In addition, there are other ongoing research networks which look at urban health, testing and screening endocrine disruptors and human exposure to micro- and nano-plastics[113]. Moreover, Horizon Europe Work Programme 2021-2022 includes dedicated research and innovation actions to support filling knowledge and modelling gaps in the integrated assessment of pollution and research will cover many different pollutants[114].

All these initiatives are ongoing and can contribute to the first zero pollution monitoring and outlook report to complement the indicator-based assessment. Ideally, these initiatives will result in a more harmonised data generation allowing for the better use and re-use of data for indicator generation.

Information on the environmental burden of disease provides an integrated measure of the impact of pollution on health, in terms of specific disease outcomes, DALYs and premature deaths, with high communication potential. A number of initiatives are underway at international level to calculate the environmental burden of disease[115], with

110 https://www.hbm4eu.eu/

111 Substances currently prioritised are: Aniline family, Bisphenols, Cadmium and chromium VI, Chemical mixtures, Emerging substances, Flame retardants, Polycyclic Aromatic Hydrocarbons (PAHs), Per-/poly-fluorinated compounds, Phthalates and Hexamoll® DINCH, Acrylamide, Aprotic solvents, Arsenic, Diisocyanates, Lead, Mercury, Mycotoxins, Pesticides and Benzophenones.

112 https://www.solutions-project.eu/

113 https://ec.europa.eu/info/research-and-innovation/research-area/health-research-and-innovation_en

114 https://ec.europa.eu/info/research-and-innovation/research-area/environment_en

115 Global Burden of Disease (GBD 2019) | Institute for Health Metrics and Evaluation (healthdata.org); The Lancet Commission on pollution and health - The Lancet

both pollutant and country-specific data held by the World Health Organization and subject to update[116].

Another integrated assessment of human and ecosystem health is increasingly mature is the '**Consumption Footprint' project**. The Joint Research Centre (JRC) developed the Domestic Footprint indicator that addresses such environmental impacts from a territorial and a consumption perspective at the Member State and EU level for the period 2000-2018 and the Consumption Footprint indicator addressing consumption-based impacts at the Member State and EU level for the period 2010-2018. These indicators are available on the **Consumption Footprint Platform**[117].

The establishment of **planetary boundaries for pollution** may be an effective and appealing way to select a limited number of headline indicators and translate the capacity of the planet into indicators that can drive change and monitor progress. The original research by *Rockstroem et al*.[118] has included several pollution-related boundaries (other than climate change), in particular those linked to interference with the global phosphorus and nitrogen cycles, aerosol loading and 'introduction of novel entities' which includes chemical pollution. The latest update by the group of scholars[119] has developed the concept further and re-defined some of the planetary boundaries. Since then, the EEA[120] and the JRC[121] have worked extensively to explore on how this concept can be applied in the EU policy context and within Horizon Europe there will be research opportunities to develop and trial "Regional nitrogen and phosphorus load reduction approach within safe ecological boundaries. In particular for nutrients, it should already be possible to determine a 'planetary boundary' indicator which could be used in the EU context, e.g. in the Integrated Nutrient Management Action Plan. Also the above-mentioned JRC work on environmental footprinting of EU production (Domestic Footprint) and consumption (Consumer Footprint and Consumption Footprint)[122] uses the planetary boundaries as absolute sustainability reference and shows significant promise. This could result in the identification of some headline indicators (e.g. on nutrients) for a high-level assessment of pollution. Moreover, this could also help developing indicators for assessing the spill-over of pollution through imports of goods from outside the EU, another important dimension in a holistic and integrated pollution monitoring approach.

There are a number of established or emerging monitoring systems that could be used even more for the determination of an integrated and combined impact of pollution on the ecosystem. On the one hand, the regular **LUCAS monitoring** (Land Use/Land Coverage Area Frame Survey) includes the only harmonised soil assessment of the EU. It covers all land cover types at same time at the currently 22,000 location of soil data collection (41,000 in 2022). In addition to heavy metals, the JRC also has performed a first pilot of harmonised survey of certain pesticides in EU soils (over 100 active

116 Public health and environment (who.int)

117 https://eplca.jrc.ec.europa.eu/sustainableConsumption.html

118 Rockström, W. Steffen, et al. (2009): 'Planetary boundaries: Exploring the safe operating space for humanity. Ecol. Soc. 14, 32. http://www.ecologyandsociety.org/vol14/iss2/art32/

119 Steffen et al. (2017) : 'Planetary boundaries: Guiding human development on a changing planet'. https://science.sciencemag.org/content/347/6223/1259855

120 2020 EEA report 'Is Europe living within the limits of our planet?'

121 E.g. 'Environmental sustainability of European production and consumption assessed against planetary boundaries' (https://www.sciencedirect.com/science/article/pii/S0301479720306186)

122 2019 JRC report: 'Indicators and assessment of the environmental impact of EU consumption'

substances and metabolites from 3,300 sites). Other pollutants may be monitored (e.g. POPs ((N)PAHs, dioxins and furans, PCB, HCB), PFAS, microplastics) if additional budget would become available. This monitoring certainly provides a valuable input to zero pollution monitoring. However, further discussion is needed on the continuation, expansion of the scope, timing and funding of the survey so that it can feature regularly in zero pollution monitoring and address the knowledge gaps (see section 4.2.2). A proper legal basis at EU level for the LUCAS survey could secure the future of the survey in the long term. The JRC is also using LUCAS samples to characterise the soil microbiome through genetic analysis as a tool to define soil health (e.g. response to pollutants).

An emerging source of pollution-related data is the **monitoring of pollinators** (e.g. bees). A number of research and preparatory projects are ongoing that collect data on pollutants that are accumulating on honeybee bodies or in honeybee products (honey, pollen, wax etc.). The Commission is currently implementing a pilot project INSIGNIA[123], which is developing protocols for monitoring pesticides in the environment using honeybees. A follow-up preparatory action is planned for 2021, which will look to expand the monitoring scope (heavy metals, air pollutants and other pollutants but also microplastics[124]) and roll out the protocol across the EU. This action will help to set up a regular monitoring and indicator system, which could be integrated into the zero pollution monitoring framework.

Other monitoring initiatives that can help to link the state of terrestrial ecosystems and pollution pressures are **EMBAL (European Monitoring of Biodiversity in Agricultural Landscapes) and EU Pollinator Monitoring Scheme**[125]. The former is in pilot phase, while the latter is the subject of discussions between the Commission and Member States in the context of the implementation of the EU Pollinators Initiative[126]. Once fully implemented, these monitoring initiatives would provide data on the state of biodiversity in agricultural landscapes and the state of pollinator populations, which could be linked to land management and potential current and future sources of pollution (in particular the use of pesticides and the surplus of fertilisers). Similarly, the IPBES pollinators assessment[127] provides input to such an approach.

Finally, the **analytical framework proposed by IPBES** (theory of change) could be explored further. It focusses on the outcomes, i.e. healthy environment (ecosystems) and healthy people, and then identify the target actions needed to reduce the impact of pollution, which will be in terms of reducing air pollutants emissions and deposition (across media), and improvement of the condition of terrestrial (forest, agroecosystems, soil, urban), freshwater and marine ecosystems.

Another element is the **impact on the ecosystem services** (i.e. eutrophication is impacting water quality with a cost associated). Also the first **EU-wide ecosystem assessment**[128] is a milestone assessment and has many indicators and assessment ideas

123 https://www.insignia-bee.eu/
124 https://doi.org/10.1016/j.scitotenv.2020.144481
125 https://wikis.ec.europa.eu/display/EUPKH/Data+and+information
126 EU Pollinators Initiative (COM(2018) 395)
127 https://ipbes.net/assessment-reports/pollinators
128 https://publications.jrc.ec.europa.eu/repository/handle/JRC120383

which could be factored into a more integrated approach. Together with the advances in **Natural Capital Accounting**[129], this would help to combine the overall effects of pollution with the consequences for the different economic sectors, in particular through the condition accounts. This would allow to use these accounts to monitor the decline or recovery of ecosystem services hence the economic effects of pollution. The Commission (Eurostat) is currently working on legislation on ecosystem accounts. Similarly, efforts to further develop the application of the System of Environmental Economic Accounting to the ocean environment[130].

With all these initiatives and projects, the question is on how to make them operational for the purpose of zero pollution monitoring. This will be discussed in the next stage of the work.

5. ZERO POLLUTION OUTLOOK AND FORESIGHT

In addition to the monitoring framework which covers the current observations and past trends, a forward-looking or foresight dimension is valuable for policy making[131]. For this, a number of methods are available as illustrated in the figure 4. In relation to the zero pollution ambition, applying an outlook and a foresight method is particularly interesting. Both will be further explored. .

These two methods and related outputs will be different in nature and purpose. The **Zero Pollution Outlook** will project the observed pollution trends into the future by using modelling tools. It may develop scenarios which compare different situations, such as where no further actions are taken (‘**baseline’ or ‘business-as-usua**l’ scenario) are compared to alternatives, or specific **policy scenarios** with additional or more stringent/ambitious measures, under different socio-economic or climate mitigation and adaptation backgrounds. Such outlook reporting is already common in the climate and energy policies. In particular, Member States produce their own outlooks which are then shaping their national and EU policies in the context of the Regulation on the Governance of the Energy Union and Climate Action[132].

129 https://ec.europa.eu/environment/nature/capital_accounting/index_en.htm
130 Technical Guidance on Ocean Accounting (oceanaccounts.org)
131 COM(2020) 493
132 https://ec.europa.eu/energy/topics/energy-strategy/national-energy-climate-plans_en

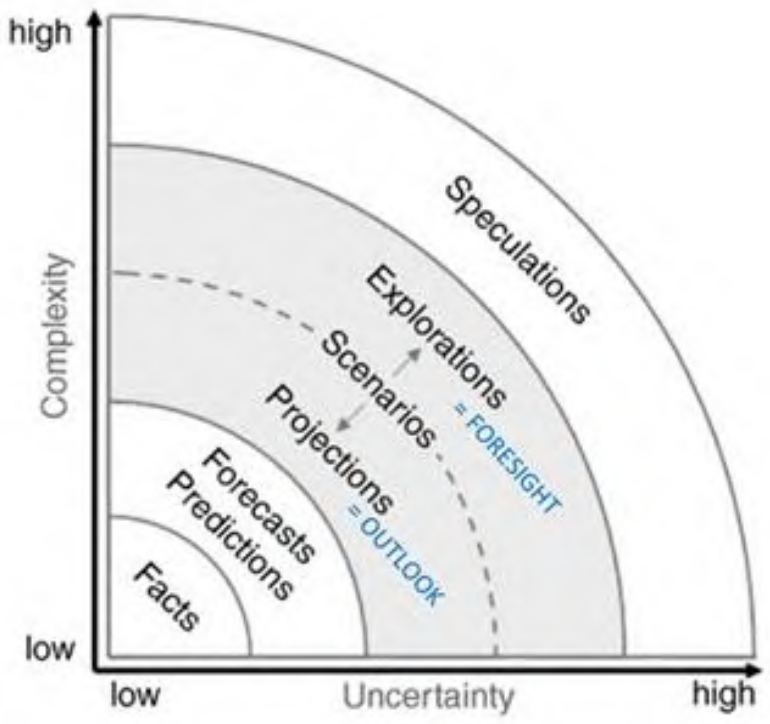

Figure 4: Definition of different types of forward looking analysis [133]

When developing any model-based scenarios, it is important to highlight that they represent a different approach than just forecasting the monitoring results. Models are based on assumptions and have limitations. Uncertainty associated to the output of the models is also essential. They have to be communicated clearly and the underlying data and computation must be open and transparent.

Already in 2005, the EEA produced a 'European environment outlook' report[134] which provided a combined forward-looking and scenario-based assessment of climate change, air pollution and water pollution. Since then, the EEA developed these approaches further and presented the latest evidence in their 2020 State and Outlook of the Environment Report[135]. Other tools such as online viewers[136] can provide additional information (the wider public included) and complement forward-looking analyses. For instance, a floods viewer juxtaposed with maps of industrial installations and sensitive ecosystems can help in identifying points with a chance for pollution episodes where additional measures might be needed to avert flooding.

Since 2018, there is also a **Clean Air Outlook**[137] building on the work undertaken in the preparation (impact assessment) for the NEC Directive[138]. The intention for a Zero Pollution Outlook report (to be published first in 2022) is to build fully on this Clean Air Outlook but go beyond air pollution.

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133 Based on Zurek, M., Henrichs, T. (2007). Linking scenarios across geographical scales in international environmental assessments. Technological Forecasting & Societal Change 74, 1282-1295.

134 EEA Report No. 4/2005

135 https://www.eea.europa.eu/soer/2020

136 https://www.eea.europa.eu/data-and-maps/explore-interactive-maps#c0=5&c5=&b_start=0

137 COM(2018)466 and COM(2020)3

138 https://ec.europa.eu/environment/air/clean_air/review.htm

In 2022, the intention is to publish also a **Clean Water and Marine Outlook**'. Modelling work is already ongoing for many years mainly in collaboration with the Joint Research Centre. The Blue2 project has developed some interesting results, which we can build upon[139]. Since 2020, the Blue2.2 project is ongoing which aims at defining the business-as-usual scenario and further more ambitious policy scenarios, in particular in relation to nutrient pollution, contaminants and litter[140] in rivers, lakes, coastal and marine waters. Some alignment of parameters with the air pollution modelling will be made. The results of this project will directly feed the Impact Assessment for the revision of the UWWTD, the review of the MSFD and form the basis for a first 'Clean Water and Marine Outlook' report in 2022.

The development of a **Clean Soils Outlook** could complement the implementation of the Soil, Biodiversity and Farm to Fork Strategies. While it may be too early to have a comprehensive soil dimension by 2022, discussions are ongoing about how existing instruments and initiatives (e.g. the ongoing European Soil Condition Assessment, LUCAS Soil) can support an outlook assessment for soils.

In addition to the modelling and integrated assessment tools discussed above, the **strategic foresight** is becoming increasingly important. The Commission has published its first **Strategic Foresight Report**[141] in 2020 focussing on resilience. An important contribution of this report is that it provides a definition of resilience, i.e. the ability to not only withstand and cope with challenges, but also to transform our Union in a sustainable, fair and democratic manner. The report identifies how major trends are evolving, and seeks opportunities for change that will help Europe rebound from the crisis. Overall, it encourages the use of foresight more systematically in all policy areas and announces a Strategic Foresight Agenda with a regularly updated Work Programme.

In line with this agenda, a systematic, cross cutting **foresight capacity for zero pollution** could be developed in the areas of air quality, water, marine, soil, chemicals, ecosystems policies etc. Such exploratory foresight activity would try to explore trends and developments (and breaks in current trends and developments) in a more qualitative way using longer term prospective tools (often referred to also as 'horizon scanning'). Such foresight can help strengthen the ability to deal with 'unexpected' developments and foster 'thinking outside the box'.

A foresight methodology[142] has been developed in the context of the 'foresight for the environment' (FORENV) activities in the context of the Environment Knowledge Community (EKC)[143]. For the third FORENV cycle, the Commission services have launched a dedicated '**Zero Pollution Foresight activity**' as part of the wider Commission's Strategic Foresight agenda (see Annex 3 for details) and will report on its findings as part of the 2022 Zero Pollution Monitoring and Outlook report.

In addition, several Commission services are engaged in some specific initiatives. Moreover, the 'Chemicals Strategy for Sustainability' announced that intention to

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139 E.g. JRC report (2019): "Water quality in Europe: effects of the Urban Wastewater Treatment Directive"

140 An interesting and inspiring example on marine litter and plastics are available at: https://www.pewtrusts.org/en/research-and-analysis/articles/2020/07/23/breaking-the-plastic-wave-top-findings

141 COM(2020) 493

142 https://ec.europa.eu/environment/risks/pdf/emerging_issues_methodological_framework.pdf

143 https://ec.europa.eu/environment/integration/research/environment_knowledge_en.htm

increase the EU's strategic foresight on chemicals in the context of key value chains and dependencies (where chemicals are important building blocks) as well as the development of an 'EU early *warning and action system for chemicals to ensure that EU policies address emerging chemical risks as soon as identified by monitoring and research*'.

6. DATA, KNOWLEDGE NEEDS AND DATA MANAGEMENT

Overall, data technologies have evolved significantly and there are many new, digital solutions which can and will allow for more efficient and effective data generation and management. The general trends and emerging technologies are explored in the related document on 'Digital Solutions for Zero Pollution'[144].

As mentioned earlier, the development of the monitoring framework will initially be based on the available data and indicators. In most cases, making better use of other data sources using modern digital technologies will be sufficient and no new or more frequent data will need to be collected. However, in some cases no data will have actually been collected and **further efforts will be needed to underpin policy making**. In addition, some of the monitoring data suffer of shortcomings in the findability, accessibility, interoperability and sometimes too restrictive use rights and some reporting and collection flows are multiplicative[145]. The exercise will therefore provide an opportunity to identify and coordinate the data and knowledge needs and take coordinated steps to meet them.

The uptake of **new digital technologies** (e.g. wireless on-chip fluid sensors) is an accelerator for cost-effective monitoring of surface water, groundwater and domestic wastewater. Leveraging on such (networked) sensor technologies new (revolutionised) continuous water quality monitoring system can be introduced in Member States over the coming years. Other innovative monitoring technologies, e.g. consisting of satellite data and automated monitoring technologies that collect and measure environmental DNA (e-DNA), also have great potential to improve data collection, reduce the costs of monitoring and enhance confidence in water status classification. In combination such modern (digital) water management technologies would e.g. allow water managers to better: a) monitor the quality of their water reserves in real time; b) predict the evolutions of the water reserves; c) act proactively to better align water reserves with demands.

One underexploited resource is the harvesting of **available data that are held with national authorities but are not used for EU level policy making** (yet) (e.g. some data are available at farm level but not collected in most Member States and generally not accessible or data from national contaminated sites registers)[146]. In this respect, the INSPIRE Directive offers the opportunity to request and use data ad hoc by using the Data Sharing Regulation (No. 2010/268)[147] and to further promote the active dissemination of environmental geospatial data through data services. The availability for public reuse and the accessibility of environmental data and earth observation data will

144 SWD(2021) 140

145 Therefore the application of the FAIR principles (findable, accessible, interoperable and reusable) to all environmental data is promoted.

146 To address this, the Commission proposes to collect annual statistics on the use of pesticides in agriculture, based on the professional use records held by farmers under Regulation (EC) 1107/2009 (see COM(2021)37).

147 See procedural guide for data request using Commission Implementing Regulation No. 2010/268

be accelerated by the Implementing Act on High Value datasets under the Open Data Directive[148] that is planned for adoption in 2021. The European Marine Observation and Data network (EMODnet) operates with this as one of its main priorities and further actions are taken at the level of the Member States to further support it.

Moreover, in the Data Strategy[149] and the Digital Europe Programme as well as the EU Open Data Portal, there are opportunities to use modern technologies to tap into available data sources but this has still to be exploited. These initiatives will help improve data availability in general terms and promote the effective use and application of artificial intelligence. The key initiative is the creation of a "European Data Space", through Common European data spaces in strategic sectors and domains of public interest. In this context, the Commission will support the establishment of a **Common European Green Deal data space**, to use the major potential of data in support of the Green Deal priority actionsand the zero pollution ambition is listed as an area for developing dedicated pilot exercises. The Copernicus program already transitioned to cloud technologies to make all satellite data and information products available digitally[150]. Embedding the zero pollution monitoring framework within a larger commitment to digital cooperation may help further capitalise on the opportunities provided by the adoption of an environmental governance digitalization strategy based upon a range of contributions and collaboration between national governments, the private sector and civil society.

In this context, the UN's "Global Commitment for Digital Cooperation" offers also wide scope for improved environmental data governance. One relevant initiative is related to the implementation of a "Digital Ecosystem for the Environment", a robust architecture and governance framework consisting of four elements: a) raw data, b) a supporting technological infrastructure, c) algorithms and analytics; d) insights and applications[151]. Another initiative is UNEP's World Environment Situation Room (WESR)[152] - a one-stop digital platform to access environmental data and information. The WESR platform on pollution will help address knowledge and implementation capacity gaps by aggregating such tools and assessments, and empowers policy makers, partners, and stakeholders to address pollution in a responsible and environmentally sound manner.

Furthermore, the use of **Earth observation** (e.g. by using Copernicus data[153] or the 'Destination Earth' initiative) is critical to address and overcome data gaps. The specific use of Copernicus services data and information in the context of a regular monitoring and forecast initiative will support in the different domains of air, water, marine and soil ecosystem. The Copernicus is an operational programme since 2014 and it will continue to provide data and products for routine daily or sub-daily environmental monitoring for next decades. The space component will enhance its observational capacities with new Earth Observation missions[154] and the six services will continue and evolve operationally

148 http://data.europa.eu/eli/dir/2019/1024/oj
149 COM(2020)66
150 Data and Access Information Service (DIAS)
151 https://un-spbf.org/wp-content/uploads/2019/03/Digital-Ecosystem-final-2.pdf
152 https://wesr.unep.org/
153 E.g. through the Data and Access Information Service (DIAS)
154 The Copernicus Carbon Dioxide Monitoring mission is one of Europe's new high-priority satellite missions and will help to measure how much carbon dioxide is released into the atmosphere specifically through human activity.

to provide value added products, observations and forecasts, in the years to come adapting to new requirements arising from the zero pollution goals.

'Destination Earth' initiative (a "digital twin for the planet") may be adopted as planning and sustainability optimisation tools which may support the assessment of environmental state and pollution impact for both the "human health" and "ecosystems" domains. A digital twin of the ocean is contemplated on the basis of proposals made by the Horizon Mission "Healthy Oceans and Waters". Local Digital Twins are also powerful means to improve the resource management and decision-making of cities and communities in order to, for example, pursue their zero pollution ambitions. The forthcoming Digital Europe Programme will support the creation of an EU toolbox for deployment of Local Digital Twins, the piloting and validation of the data space on climate-neutral and smart communities (as part of the Green Deal Dataspace) and to implement concrete activities for the massive adoption of AI-enabled solutions in cities and communities.

The key value of the **"digital twins"** approach is its ability to combine real-time data, models and intelligence from different platforms to simulate, predict and improve decision-making – critical elements for the "outlook and foresight" exercises. "Digital twins" should cover land-based pollution as well as the marine/maritime component, and their impacts on the atmosphere, terrestrial ecosystems, freshwaters and the marine environment. The project is going to start in 2021 but will only be a tangible support to the zero pollution monitoring and outlook after 2022.

In the context of the Chemicals Strategy for Sustainability, the actions under the 'one substance, one assessment' process will further facilitate and consolidate access to available data on chemicals monitoring. The **Information Platform for Chemical Monitoring** (IPCHEM) has been developed to become a single access point for the chemical occurrence data in all media across the EU. It is a decentralised platform, providing remote access to existing information systems and data providers. Several EU authorities are sharing their data already through this portal and increasingly, national authorities connect their national databases. The IPCHEM and its governance will be further developed as part of the work on Common Open Data Portal on Chemicals to ensure that all chemical monitoring data are made accessible through the platform. In addition, a proposal will be made to streamline the flow of chemical monitoring data in the environment through the relevant EU Agencies and to accelerate move from data reporting to data harvesting. Further, obstacles for the re-use and sharing of monitoring data will be removed to ensure that once data are provided to EU institutions they can be re-used for multiple purposes and no repetitive reporting/collections occur. IPCHEM can be also used to connect data that are also requested under the above-mentioned INSPIRE mechanism (see Annex 4). Meanwhile to ensure data quality and representativeness, resources need to be allocated to take the necessary quality control steps when bringing data sets together.

Two dedicated projects also offer opportunities to facilitate access to available data in a particular domain. Regarding **marine pollution, the EMODnet** provides data and data products on all the relevant descriptors, related to the marine environment, free of access and strictly follow INSPIRE standards. EMODnet and the Copernicus Marine Environment Monitoring Service (CMEMS), the Commission's long-term initiatives regarding marine observation (in-situ and satellite plus modelling respectively) are going

to provide the basis for the development of a Digital Ocean Twin and will participate actively in the activities of 'Destination Earth'[155]. In this context, the integration of the marine component is an important element to be considered from the outset. In addition, cooperation on marine data with international partners could also help fill the knowledge gaps, as demonstrated by the operational and scientific collaboration between EMODnet and the National Marine Data and Information Service (NMDIS) supported by the EU's Partnership Instrument[156].

Finally, the use of citizen science in the context of the zero pollution monitoring should also be further explored. Citizen science data has the potential to sensibly contribute to the implementation of the monitoring framework. However, while they can fill the increasing demand for high-resolution spatial and temporal data, work is still needed to build acceptance for this non-traditional data source. To this end, concrete recommendations and actions to facilitate the uptake of citizen science data are provided in the Commission's Staff Working Document 'Best practices in citizen science for environmental monitoring'[157], which also includes examples (best practices) of citizen science for different types of pollution.

7. GOVERNANCE, MILESTONES AND DELIVERABLES

The implementation of this Zero Pollution monitoring and outlook framework will require a clear and effective governance of all partners at EU level involved in the preparation of the outputs as well as all partners in the Member States who are data owners and users at the same time. Such a governance will build work of other existing governance systems[158] and establish close coordination, as necessary, to create synergies.

Following the adoption of the Zero Pollution Action Plan, a dedicated outreach and consultation with partners outside the EU institutions and bodies will be organised in 2021, mainly with Member State experts but also international organisations and other interested parties.

This Staff Working Document provides a starting point and suggestions for the concept and the indicators for a zero pollution monitoring and outlook framework. Consultations will take place throughout 2021. This will result in a decision on the indicators and evidence base to be used for the preparation of the first report in 2022. This will also feed into the finalisation of the zero pollution contribution to the 8th EAP monitoring.

In parallel, Commission services and key partner agencies[159] will establish a coordination mechanism that brings together the best competences and expertise and ensure the cooperation towards the combined efforts to establish the monitoring and outlook framework step-by-step.

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155 See details in SWD(2021) 140

156 Supported by the EU-funded *International Ocean Governance: Strengthening international ocean data through the EU's ocean diplomacy* project. See https://www.emodnet.eu/en/eu-china-partnership-sets-pace-international-marine-data-sharing

157 SWD(2020) 149

158 E.g. under the Energy Union Governance or the Biodiversity Strategy

159 in particular the European Environment Agency (EEA), the European Chemicals Agency (ECHA), the European Food Safety Agency (EFSA) and the European Maritime Safety Agency (EMSA) as well as others

The key milestones and deliverables are:

For 2022

The first **'Zero Pollution Monitoring and Outlook' report** will be published by the European Commission. It will provide a synthesis of the findings of various data sources and 'thematic' reports, in particular the following which will be an integral part of the report:

- **Zero Pollution Monitoring:** 'Pollution affecting Health and Biodiversity' (working title) presenting the results of the indicators and assessment listed in this SWD.
- **Zero Pollution Outlook including:**
    - **Clean Air Outlook**
    - **Clean Water and Marine Outlook**
    - **Clean Soil Outlook**[160]
- **Zero Pollution Foresight** (i.e. the outcome of the FORENV project).

A number of stand-alone 'thematic' or 'technical' reports can and should be published around the same time by the knowledge partners directly. The list can evolve during the consultation process but some examples are already given here, in particular:

- **Zero pollution monitoring by Copernicus**
- Key results of **pollution-related research linked to health and ecosystems** based on the reports including pollutants of emerging concern (e.g. ultrafine particles or light pollution) from EU-funded R&I projects;
- Key results from the **assessment of the final National Energy and Climate Plans** (as published in 2020) including on issues such as biodiversity and air quality.

Other relevant reports published by other international organisations will also be considered, e.g. the UNEP pollution summary report as a deliverable of the Implementation Plan "Towards a Pollution-Free Plan".

In addition to these reports, a **Zero Pollution online portal** will present selected indicators which can be regularly updated by the European Environment Agency. The nature and set up will depend on the decision taken regarding the European Green Deal Dashboard and the 8EAP monitoring system which could ideally integrate the zero pollution dimension in these wider communication tools. Finally, a joined up communication strategy will be developed through the zero pollution website[161] will be proposed.

2023

Follow-up on gaps identified to improve 2024 assessment and update indicators, if possible.

[160] Including state of play including trends in heavy metals and nutrients in agricultural soil and contaminated sites

[161] https://ec.europa.eu/environment/strategy/zero-pollution-action-plan_en

For 2024 and beyond

It will be important to identify shortcomings and develop new indicators or data flows already now so that they are ideally ready for use in 2024. Hence, a preliminary, non-exhaustive list of new elements for the further development of the zero pollution monitoring and outlook framework is listed in Annex 2, Part E.

Once the indicator set for the monitoring framework has been agreed, the question of aggregating or simplifying the available indicators, at least for communication purposes, may arise. It is attractive to consider the development of a 'zero pollution index' or 'composite indicator' as is the case for many other policy areas[162]. Alternatively, a simplified 'zero pollution scoreboard'[163] compiling and classifying the various indicators.

8. CONCLUSIONS AND NEXT STEPS

The development of a zero pollution monitoring and outlook framework is a challenging but worthwhile undertaking. It is clear that a more integrated approach offers the opportunity to get a more holistic and overarching view on the scale of the pollution crisis and the pathways towards solving it successfully. It also calls for joining forces and making best use of the available competencies and efforts as well as share good practices across policy domains. The interactive and cooperative preparation of this document has already highlight the needs, the potential and the opportunities that can be harvest from the overarching approach but also in driving and inspiring specific developments and improvements in certain policy domains (e.g. on soil or under the Water Framework Directive).

This document is, however, only a starting point which intends to initiate a wider discussion, a dedicated consultation and collaborative process that involves all actors and partners. It combines the joint thinking of all Commission services and associated agencies and reaches out to experts from Member States, social partners, industry, academia and civil society to contribute to these efforts. Moreover, dedicated dialogue with international organisations and partners working on similar initiatives based on the global ambition of the Sustainable Development Goals and the related international agreements will take place, in particular with UN organisations, multilateral environmental agreements and regional organisations (such as UNECE or the regional sea conventions).

The Commission services will collect feedback and input to the ideas presented in this document through dedicated workshops linked to the Zero Pollution Stakeholder Platform and the wider consultations for the development of the monitoring framework for the 8th Environment Action Programme[164]. Moreover, the various work strands will be developed further between the Commission services and the associated agencies to have a rolling work programme with the first milestone in 2022, the presentation of the first set of Zero Pollution Monitoring and Outlook reports. Building on these experiences and closely linked to the policy needs and wider efforts under the European Green Deal, this framework will evolve and aim at contributing towards achieving the zero pollution ambition.

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[162] E.g. the Digital Economy and Society Index (DESI)

[163] E.g. EU Justice Scoreboard

[164] Consultative paper on the proposed approach and architecture for the 8th EAP monitoring framework

ANNEX 1: NON-EXHAUSTIVE OVERVIEW OF RELEVANT TARGETS AND OBJECTIVES FOR POLLUTION SET OUT IN EU POLICIES AND LAWS

1. OBJECTIVES AND TARGETS SET OUT IN THE ZERO POLLUTION ACTION PLAN (SEE DETAILS IN COM(2021) 400)

2. OVERVIEW OF OBJECTIVES AND TARGETS IN OTHER GREEN DEAL INITIATIVES WITH RELEVANCE FOR THE ZERO POLLUTION AMBITION

a. FARM TO FORK STRATEGY (COM(2020) 381) AND BIODIVERSITY STRATEGY (COM(2020) 380)

Nutrients: 50% reduction of nutrient losses by 2030. The target shall ensure that there is no deterioration in soil fertility and will lead to 20% reduction of the use of fertilisers.

Pesticides: By 2030, 50% reduction of the overall use and risk of chemical pesticides and 50% reduction of the use of more hazardous pesticides.

Anti-microbial Resistant (AMR) substances: 50% reduction of overall EU sales of antimicrobials for farmed animals and in aquaculture by 2030.

b. CHEMICALS STRATEGY FOR SUSTAINABILITY (COM(2020) 667)

- Safe and sustainable production and use of hazardous chemicals
- Industrial transition to safe and sustainable chemicals
- Substitute and minimise the presence of substances of concern
- Phase out the most harmful substances, particularly in products and for vulnerable groups
- High level of protection of human health and the environment

In addition, the reduction of pollution by unit of use is set out in the wider product policy (in addition to REACH) including Directives on Eco-Design or EU Eco-label.

3. OVERVIEW OF KEY ENVIRONMENTAL QUALITY OBJECTIVES IN EU LAWS FOR AIR, NOISE, WATER, MARINE AND SOIL

Pollution type	Target / Objective	Deadline	EU policy / law	Comment
Air Quality	Compliance with EU air quality standards for several air pollutants	Several deadlines depending on the air pollutant	Ambient Air Quality Directives	EU air quality standards cover both highest concentration and average exposure levels for human health
Noise pollution	Reduction of harmful noise levels	Ongoing	Environmental Noise Directive, Outdoor Noise Directive, MSFD	
Water Quality – nutrients	Compliance with limit value for nitrates in groundwater, phosphate threshold value required in MS for groundwater; surface water, eutrophication objective	Several deadlines depending on legislation	Nitrates Directive, Groundwater Directive, WFD, MSFD	
Water Quality – biological quality elements	Status compared with undisturbed conditions	2015 (extensions to 2021 and 2027 possible)	Water Framework Directive (WFD)	
Water Quality – chemical pollutants	Compliance with environmental quality standards (EU level for PS; MS level for RBSPs, groundwater quality standards)	2015 (extensions to 2021 and 2027 possible, beyond that for more recent PS)	Water Framework, EQS, and Groundwater Directives.	
Marine environment	Achievement of good environment status for several pollutants	2020 (exceptions possible)	Marine Strategy Framework Directive	nutrients, contaminants, marine litter, energy including underwater noise
Species and ecosystems	Reach favourable conservation status for species and habitats of EU importance	No deadline	Habitats & Birds Directives	One important pressure is pollution
Soil Pollution	Reduce soil pollution and make progress in the identification and remediation of contaminated sites	No deadline	7th EAP, Soil Thematic Strategy, EU Biodiversity Strategy towards 2030	No specific target to date

Pollution type	Target / Objective	Deadline	EU policy / law	Comment
Soil pollution	Limits on the concentration of heavy metals in agricultural soil to which sewage sludge is applied.	No deadline	Sewage Sludge Directive	Several baselines for heavy metals exist (aggregated and modelled LUCAS Soil, GEMAS, ICP Forests, country-level), however, data cannot be separated for sites where sludge is applied. LUCAS Soil is carried out periodically every 3-4 years, continued, evaluated and expanded according to policy needs, e.g. possibly to cover more pesticides residues and/or metabolites thereof and other substances of concern.
Soil pollution	Pesticide residues and other substances of concern	No deadline	Sustainable Use of Pesticides Directive	JRC is currently exploring the potential of LUCAS soil to develop a baseline of pesticide residues for agricultural soils. LUCAS could be easily adapted to assess other substances of concern.

4. OVERVIEW OF KEY OBJECTIVES FOR SPECIFIC POLLUTION SOURCES IN EU LAWS

Pollution type	Target / Objective	Deadline	EU policy / law	Comment
Air Polluting Emissions	Percentage reductions for several pollutants	2020-29 and 2030 onwards	National Emission reduction Commitment Directive	
Emissions to Water	Compliance with emission limit values for urban waste water		Urban Waste Water Treatment Directive Water Framework Directive	The environmental objectives of certain waterbodies may be such that the emission limit values required for urban waste water agglomerations are more stringent than those under the UWWTD
Industrial emissions	Minimising industrial emissions by applying BAT and contributing to water and air quality standards			Emissions to air, water, soil as well as waste
Emissions from the maritime transport sector	Compliance with sulphur in maritime fuel requirements Reduction of sulphur content in non-SECA areas Accelerate rate of reduction of NOx emissions from ships	Ongoing 2030	Sulphur Directive	Emissions to air Extension of SECA areas to all EU areas Amendment of Sulphur Directive

ANNEX 2: INDICATIVE LIST OF PROPOSED INDICATORS TO BE EXPLORED FOR THE ZERO POLLUTION MONITORING FRAMEWORK

STATUS OF THE ANNEX

This annex presents an initial proposal for the selection criteria as well as some selected candidate indicators to be used in the context of the first zero pollution monitoring framework. Further discussions will be needed before finalising the selection. After each cycle, further improvements and developments can be made in the light of the lessons learnt and the evolution as regards indicators and assessments in the various policy areas.

INTRODUCTION

An indicator is a characteristic or attribute that is measured regularly in order to help assess to what extent an objective has been met.

- Impact indicators measure global or long-term effects of the Commission's interventions.
- Result indicators measure the initial or intermediate effects of the DG's interventions.

The proposed list of indicators is indicative and aims at triggering a discussion to identify the best list illustrating the most important dimensions of the zero pollution agenda. It will need to be 'fixed' in the end of 2021 to allow preparation of the first Zero Pollution Monitoring Report. However, it will be reviewed and constantly improved with the intention to update the list for the second round of preparing the zero pollution monitoring in 2024.

SELECTION CRITERIA

Building on the Better Regulation Guidelines, two criteria are particularly relevant for this exercise:

- **Frequency** – the indicators should be updated annually, or at least every two years (although exceptions are possible for very relevant indicators)
- **Timeliness** – the data should refer to recent periods, so that the results of action taken under this Commission can be demonstrated (as much as possible, and with all reservations linked to the long-term impact of environmental action).

This is currently not necessarily the case for all available indicators, in particular as regards water and marine pollution. In addition, the selected indicators should be, to the extent possible, 'RACER'[165], i.e.:

(1) **Relevant**, i.e. closely linked to the objectives to be reached. They should not be overambitious and should measure the right thing (e.g. a target indicator for health care could be to reduce waiting times but without jeopardising the quality of care provided).

(2) **Accepted** (e.g. by staff, stakeholders). The role and responsibilities for the indicator need to be well defined (e.g. if the indicator is the handling time for a grant application and the administrative process is partly controlled by Member States and partly by the EU then both sides would assume only partial responsibility).

(3) **Credible** for non-experts, unambiguous and easy to interpret. Indicators should be simple and robust as possible. If necessary, composite indicators might need to be used

[165] See Better Regulation Toolbox, Tool#41

instead – such as country ratings, well-being indicators, but also ratings of financial institutions and instruments. These often consist of aggregated data using predetermined fixed weight values. As they may be difficult to interpret, they should be used to assess broad context only.

(4) **Easy to monitor** (e.g. data collection should be possible at low cost).

(5) **Robust** against manipulation (e.g. administrative burden: If the target is to reduce administrative burdens to businesses, the burdens might not be reduced, but just shifted from businesses to public administration).

Moreover, **data quality** and **completeness** are important. Quantitative indicators should be used whenever possible (*e.g. amounts, averages, percentages, rates, ratios or indexes*). Where qualitative indicators are used, they should be objectively verifiable.

For some pollution aspects, there are also **different type of data** available, not all with the same quality, accuracy and granularity. Building on the rather advanced system of data tiers established within the climate monitoring mechanism[166], it may be meaningful to develop such a **tiered approach on data quality and robustness** across all pollution monitoring to allow the use of different types of data, from qualitative (lowest tier), to high quality quantitative data (highest tier) with a mechanism to improve data quality towards the highest tier. To illustrate the approach, the definition of three tiers in the IPCC guidelines[167] is set out below in table 1.

Table 1: Illustration for definitions for different tier data, based on IPCC

Tier	Definition
1	Simple first order approach–spatially coarse default data based on globally available data –large uncertainties –methods involving several simplifying assumptions
2	A more accurate approach–country or region specific values for the general defaults – more disaggregated activity data –relatively smaller uncertainties
3	Higher order methods–detailed modelling and/or inventory measurement systems –data at a greater resolution –lower uncertainties than the previous two method

USE OF THE INDICATOR LIST

The selected indicators can be used in the two main products namely:

- A **Zero Pollution online portal** (which can be part of a wider dashboard for the 8th EAP or the Green Deal) presenting and visualising online in a user-friendly way the indicators in Part A.
- A **Zero Pollution Monitoring Assessment** (which can also be embedded in wider reports under the 8th EAP progress monitoring or the SOER) using indicators in Part A, and C the indicators and assessments mentioned in Part D (which are not available annually).

It is also important to establish a baseline, ideally with data from the year 2020, allowing an assessment of the progress made in the run up to 2030.

166 See Commission Implementing Regulation 2018/2066
167 https://www.ipcc.ch/

Finally, Part E includes a list of indicators and improvements to develop in the future, which will be translated into work programme coordinated across all zero pollution dimensions.

PART A: MONITORING TARGETS

As set out earlier, the Zero Pollution Acton Plan and other European Green Deal initiatives have identified a number of targets for 2030 and many additional targets and objectives exist in EU law (see Annex 1). The monitoring of these targets is one main purposes of the monitoring framework. These targets are associated to indicators for impacts or pressures. The available indicators linked to the established targets have been included below.

PART B: KEY HEADLINE INDICATORS ON IMPACTS / HARM

	KEY HEADLINE INDICATOR	SUB- INDICATOR (TO EXPLORE)	REFERENCE (DATA SOURCE)	COMMENTS
Impacts on human health				
1	Health impact from **air** pollution	a) Years of Life Lost (YLL) due to PM2.5 (or premature deaths) b) Exposure to PM2.5 concentration in exceedance of the standards set in clean air legislation	EEA (?) EEA (CSI004)	Linking to socio-economic status, if possible, building of ESTAT and EEA work
2	Health impact from **water** pollution	a) Proportion of population using drinking water which does not meet requirements of the Directive b) Bathing sites with excellent water quality c) Proportion of urban waste water which does not meet requirements of the Directive (collection/ secondary treatment)	COM / EEA EEA (CSI022/ WAT004) EEA	Available annually only from 2023 onwards (new Directive), in 2022, data from current Directive if critical. Explore analysis of specific pollutants (e.g. PFAS, pesticides, nitrates) See also EEA Report 21/2019 and 2020 Bathing Water Report Data on urban waste water not collected or which does not meet the requirements of the Directive for biological treatment Linking to socio-economic status will be made, if possible
3	Health impacts from soil pollution	To be identified (see part C)		

	KEY HEADLINE INDICATOR	SUB- INDICATOR (TO EXPLORE)	REFERENCE (DATA SOURCE)	COMMENTS
4	Health impacts from industrial chemicals	To be identified (see Part C)		No indicator available at the moment. Linking to socio-economic status
Impacts on biodiversity and ecosystems				
5	Biodiversity and ecosystem impacts from **air** pollution	Impact of air pollution on ecosystems through acidification, eutrophication and ozone	EEA	Available every four years under NEC Directive or existing EEA indicators on exceedances of ozone, eutrophication and acidification thresholds based on LRTAP (updated annually/biannually)
6	Biodiversity and ecosystem impacts from **water** pollution	a) Exceedances[168] of nitrates concentrations above the threshold for drinking waters in groundwater	EEA (WISE-4/CSI020) / Eurostat (sdg_06_40)	Annual WISE SoE data collection; EEA report, link to exceedances under Nitrates Directive to be discussed.
		b) Nitrogen/phosphorus in rivers/ phosphorus in lakes or Nutrients in freshwater	EEA (WISE-4) or EEA (CSI020)	Annual WISE SoE data collection, EEA report
7	Biodiversity and ecosystem impacts from **marine** pollution	a) Nutrients in transitional, coastal and marine waters	EEA (CSI 021/ MAR 005)	Annual WISE SoE data collection, EEA report
		b) Chlorophyll concentrations coastal waters (Either sub-indicator 1: percentage of MS EEZ with chlorophyll-a deviations on a monthly basis or sub-indicator 2 chlorophyll-a anomalies monthly of MS EEZ)	EEA (building on UN Environment)	Combination of in situ data and Copernicus MEMS or better link to SDG14.1.1 work, see also EEA report
		c) Hazardous substances in marine organisms	EEA	Annual WISE SoE data collection, EEA Report
8	Biodiversity and ecosystem impacts from **soil** pollution	To be identified (see Part C)		No annual indicator available at the moment.

[168] https://www.eea.europa.eu/data-and-maps/daviz/nitrate-in-groundwater-2#tab-chart_2

	KEY HEADLINE INDICATOR	SUB- INDICATOR (TO EXPLORE)	REFERENCE (DATA SOURCE)	COMMENTS
9	Environment impact from industrial chemicals	To be identified (see Part C)		No annual indicator available at the moment.

Pollution of emerging concern				
10	Air pollution	to be identified		
11	Water pollution	to be identified		
12	Marine pollution-litter	Environmental status – coastline (macro) litter (Descriptor 10)	JRC/EEA	Annual update using EEA's marine litter watch and MSFD data collected by EMODNET
13	Soil pollution	to be identified		

PART C: KEY HEADLINE INDICATORS FOR EMISSIONS AND OTHER POLLUTION PRESSURES ON THE ENVIRONMENT (FOR TREND ANALYSIS)[169]

	POLLUTION TOPIC OR SECTOR	KEY HEADLINE INDICATOR	REFERENCE (DATA SOURCE)	COMMENTS
1	Air emissions	$PM_{2.5}$ emissions per MS	EEA (CSI040)	
2	Air emissions	NOx and NH3 emissions per MS (in kt)		EEA (CSI040)
3	Marine pollution	Nutrient emissions from rivers into the marine environment	HELCOM/ OSPAR/ BARCON/ ICPDR	Annual emissions data published by international organisations (to be checked)
4	Hazardous chemicals	Aggregated total production and consumption of hazardous chemicals (hazardous for human health and environment)	Eurostat (sdg_12_10)	Derived from PRODCOM To be further developed in line with objectives of the Chemicals Strategy

[169] Linking to socio-economic status will be made, where possible

	POLLUTION TOPIC OR SECTOR	KEY HEADLINE INDICATOR	REFERENCE (DATA SOURCE)	COMMENTS
5	Agriculture-fertiliser	Gross nutrient balance (N and P)	ESTAT (aei_pr_gnb) .	Indicator link to nutrient reduction target in the Farm to Fork Strategy and CAP Communication[170]. The Commission proposes to collect Gross Nutrient Balances[171].
6	Pesticides	Use and risk of chemical pesticides (Risk Indicator (HRI1))	ESTAT (aei_hri)	Indicator link to pesticides reduction target in the Farm to Fork Strategy
7	Pesticides	Use of the more hazardous pesticides	ESTAT	Indicator link to pesticides reduction target in the Farm to Fork Strategy and the CAP Communication[172].
8	Industry	Industrial pollution intensity	EEA (see CSI055 indicator)/ ESTAT	Based on E-PRTR or air emissions account as included in SDG 9
9	Maritime transport	Air emissions from vessels (SOx, NOx, $PM_{2.5}$)	EMSA	Emission model available from 2022
10	Maritime transport	Vessel discharges (discharges related to nitrates from sewage, but also heavy metals and PAH from wash water discharges from scrubbers, etc.)	EMSA	Emission/discharge model available from 2024.
11	Consumption and Production	Pollution Footprint indicator for EU	JRC	https://eplca.jrc.ec.europa.eu/sustainableConsumption.html

[170] Annexes to COM(2020) 846
[171] COM(2021) 37
[172] Annexes to COM(2020) 846

PART D: KEY HEADLINE INDICATORS FOR REGULAR ASSESSMENT (AVAILABILITY OF EVERY 3-6 YEARS)[173]

	POLLUTION TOPIC	KEY HEADLINE INDICATOR	REFERENCE (DATA SOURCE)	COMMENTS
Impacts on human health				
a	Noise pollution	DALY (Disability Adjusted Life Years)	EEA	Only available every five years – explore higher frequency
b	Noise pollution[174]	Number of people at high noise levels (above 55 dB Lden)	EEA	Only available every five years – explore higher frequency
c	Water – chemicals in surface and groundwater	Exceedances of EQS for PS relevant to human health (surface waters) and exceedances of quality standards for nitrates and pesticides in groundwater.	ENV / EEA	Available every six years under WFD – explore more regular data harvesting
d	Water quality-drinking water (optional)	Share of population with access to drinking water	ENV	Available every six years only with new Drinking Water Directive from 2028 onwards (new Article 18(1)a)
Impacts on biodiversity and ecosystems				
e	Water quality-surface waters (fresh and coastal)	Ecological status – relevant quality element for pollution (benthic invertebrates)	ENV / EEA	Available every six years, update available in 2022
f	Water quality-surface and groundwaters	Chemicals status - pesticides in water indicator	ENV / EEA	WISE SoE reporting - currently under development
g	Water quality-groundwaters	Chemical status of groundwater (exceedance of QS for nitrates and pesticides)	ENV / EEA	Available every six years, update available in 2022
h	Water quality-marine pollution	Environmental status - nutrients (Descriptor 5)	ENV / EEA	Available every six years, update available in 2024
i	Water quality-marine pollution	Environmental status – contaminants (Descriptor 8)	ENV / EEA	Available every six years, update available in 2024, indicator to be defined consistent with freshwater

[173] Linking to socio-economic status, where possible.

[174] Check alternative indicator: 'Population living in households considering that they suffer from noise, by poverty status (sdg_11_20)'

	Pollution Topic	Key Headline Indicator	Reference (data source)	Comments
j	Soil pollution (local)	Number of contaminated sites and progress in the management of contaminated sites	EEA (LSI003/ CSI 015)	No regular updating process, but a strategy to improve the reporting is prepared and being discussed
k	Soil pollution	LUCAS Soil indicators of metals, antibiotics and pesticides, nutrients	JRC	Regular update on the current status of these parameters in topsoils. Development of indicators and thresholds to be clarified.
l	Chemicals/Food	Exceedances of limit values of hazardous chemicals for food safety Or Hazardous chemical (residues) and content of heavy metals in food	EFSA	Build on Chemical contaminants occurrence data, can be updated every 2-3 years

Part E: Indicators to be developed

	Pollution Topic	Key Headline Indicator	Lead	Comments
	By 2022			
1	Water and marine pollution	Chemical pollution of groups of priority substances	EEA / ECHA	In situ data (using INSPIRE mechanism and link to IPCHEM), link to POPs Regulation, define groups (e.g. PFAS)
2	River and Marine Pollution	Microplastics		Explore possibilities
3	Marine pollution	Number of "significant oil spills"	EMSA	Starting with CleanSeaNet data for HELCOM/OSPAR, extension of coverage later
4	Marine pollution	Floating macro litter	tbc	Copernicus, link to SDG14.1.1b work and reflections in TG litter
5	Industrial chemicals	Industrial transition to safe and sustainable chemicals	tbc	
6	Integrated - Health and environment	Development of a European Environment and Health Quality Index Atlas	EEA	Provides a vehicle into which further health-based indicators might be used, supplementing other indicators

	POLLUTION TOPIC	KEY HEADLINE INDICATOR	LEAD	COMMENTS
	By 2024 or beyond			
7	Integrated health assessment			Building on Exposome and HB4EU/PARC projects
8	Integrated Ecosystem assessment of pollution	Ecosystem Accounting Pollinator monitoring	ESTAT COM	follow up of KIP-INCA project EMBAL and other projects
9	Chemicals	Hazardous chemicals/Substances of concern in products	ECHA	Links to Circular Economy and Chemicals Strategy
10	Chemicals	Exposure/impact on humans and the environment	tbc	To monitor progress on the objectives of the Chemicals Strategy
11	Chemicals	Safe and sustainable production/use of hazardous chemicals	tbc	To monitor progress on the objectives of the Chemicals Strategy
12	Air pollution	Nanoparticles/ultrafine particles, Black Carbon (NOx from shipping)		New indicator on PM much smaller than 2.5 increasingly relevant for air pollution from transport
13	Water pollution	Integrated assessment of chemical risks	EEA	Building on EEA Report 18/2018, link to IPCHEM
14	Water pollution	Pharmaceuticals in water	EEA / JRC	Building on WFD watchlist, link to IPCHEM
15	Marine pollution	Integrated ecosystem health-pollution part	EEA	Building on EEA Report 17/2019, link to IPCHEM
16	Marine pollution	Underwater Noise indicator		Building on monitoring (observation & modelling) and work of TG Noise
17	Soil pollution	Soil genomics indicator to assess impact of pollution on microorganisms Soil pollution and health Soil pesticide indicator	JRC	Build on watchlist EEA and JRC prepare initial indicator application on diffuse pollution for the ongoing European soil condition assessment
18	Integrated - Health and environment	Health and Biodiversity and ecosystem impacts from **soil** pollution and from industrial chemicals	tbc	

ANNEX 3: OVERVIEW OF POSSIBLE POLLUTANTS TO BE COVERED BY THE ZERO POLLUTION OUTLOOK REPORT

CLEAN AIR OUTLOOK[175]

First Clean Air Outlook published in 2018[176], second Clean Air Outlook in January 2021[177].

Pollutants currently covered are:

- Ammonia (NH_3)
- Nitrogen oxides (NO_x)
- Fine particular matter ($PM_{2.5}$)
- Sulphur dioxide (SO_2)
- Non-Methane Volatile organic compounds (NMVOC)
- Methane (CH_4)
- Black carbon, directly emitted ultrafine

This work will now also be further developed including the link to water and marine outlook mainly through ecosystem assessment under National Emissions Reduction Directive (NEC), in particular as regards nitrogen emissions. Moreover, the air pollution emissions from vessels (maritime transport) are currently assessed within the first European Maritime Transport Environmental Report (EMTER). This work could also be closer associated in the future.

CLEAN WATER AND MARINE OUTLOOK

No Clean Water and Marine Outlook is available yet. Ongoing work in the context of the BLUE2 project of the JRC will form the basis.

Pollutant categories currently covered by various JRC projects for which baselines have been or will be produced:

- nutrients (N, P)
- pesticides (ca. 400 chemical active substances)
- coliforms (possibly limited to human sources)
- biodegradable organic matter (BOD)
- pharmaceuticals in waste water
- diffuse pollution associated with urban runoff and indirect industrial discharges (e.g. metals, PAH)
- microplastics from waste water (e.g. fibers) and from urban runoff (e.g. tyre wear)
- veterinary antimicrobials
- Water Framework Directive (WFD) priority substances.
- Marine Litter (including loss of containers as emerging issue)

[175] https://ec.europa.eu/environment/air/clean_air/outlook.htm
[176] COM(2018) 446
[177] COM(2021) 3

Pollutant categories currently not addressed are industrial chemicals, contaminated sites and persistent organic pollutants (POPs) and based litter modelling from source (to be addressed under Blue2.2).

The first results will feed the Zero Pollution Outlook in 2022 and the Integrated Nutrient Management Action Plan. Further improvements of the Clean Water and Marine Outlook will be identified then as well. Thereafter, the work will be developed further possibly also including other areas, pollutants or sectors such as marine pollution from maritime transport.

CLEAN SOIL OUTLOOK

There is no EU Clean Soil Outlook available yet. The outcomes of LUCAS Soil, JRC modelling and EEA Assessments and the Agriculture Outlook[178] could be used to provide an initial baseline in 2022 for:

- nutrients (N, P)
- pesticides
- metals pollution (and other diffuse pollution)
- veterinary antimicrobials (tentatively)
- contaminated sites

Pollutant categories currently not addressed are industrial chemicals and persistent organic pollutants (POPs) and plastics. A roadmap to further develop the Clean Soil Outlook will be identified.

ZERO POLLUTION FORESIGHT

Priority Objective 5 of the 7th Environmental Action Programme (7th EAP)[179] established the need to improve the knowledge and evidence base for Union environment policy, to ensure, inter-alia, 'that (by 2020) the understanding of, and the ability to evaluate and manage, emerging environmental and climate risks are greatly improved'.

Accordingly, in 2015 the Environment Knowledge Community (EKC[180]) decided to jointly 'strengthen the Commission's capacity to anticipate emerging issues, including through foresight tools as well as to monitor and identify opportunities and complex risks and foresee their impact on environment and society'.

Capitalising and bringing together existing knowledge, expertise and practices, in 2017 the EKC partners have established FORENV, the EU foresight system for the systematic identification of emerging environmental issues, whose overall aim is:

To identify, characterise and assess emerging issues that may represent risks or opportunities to Europe's environment, and to communicate these results *to policy-makers and other stakeholders, encouraging appropriate and timely action to be taken.*

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178 https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/agricultural-outlook-2019-report_en.pdf

179 Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet'

180 The Environment Knowledge Community (EKC) is an informal platform of 6 EU actors (ENV, CLIMA, RTD, JRC, ESTAT and EEA) that was set up in 2015 with the objective to improve the generation and sharing of environmental knowledge for EU policies

Following the adoption of the Commission´s **first Strategic Foresight Report in September 2020**, FORENV will be further developed and contribute to the Commission's approach to foresight and the strategic work programme on foresight.

FORENV runs in annual cycles, where around **10 emerging issues and related risks and/or opportunities and benefits for environment and society** are identified, characterised and communicated. This cycle will be dedicated to the **zero pollution ambition**.

The **European Green Deal** has set out a zero pollution ambition for a toxic free environment. This long-term vision needs to be seen as part of the overall green (and digital) transformation that the Commission foresees for the EU towards becoming a climate-neutral, circular, clean and biodiverse region in the world.

The Commission has announced the presentation of a **Zero Pollution Action Plan** for air, water and soil in the second quarter of 2021[181]. In this context, the identification of emerging trends, and future opportunities, benefits and risks will be important.

The overarching objective of this specific FORENV exercise is to:

- Identify and analyse potentially emerging issues and benefits related to the zero pollution ambition;
- Feed into the establishment of the zero pollution monitoring and outlook framework and the EU early warning and action system for chemicals;
- Provide an initial input for a wider stakeholder engagement (e.g. with first results feeding into at the Green Week 2021) and a Zero Pollution Stakeholder Forum from 2022 onwards.
- Make strategic foresight an integral part of future zero pollution policy making.

This third annual FORENV cycle has started and will finish by the end of 2021. The cycle will focus on the **Zero Pollution ambition for a toxic-free environment**, contributing to the launch and the implementation of the Zero Pollution Action Plan for air, water and soil and feed into related reflections on 'early warning mechanism' under the Chemicals Strategy for Sustainability. The FORENV contribution will be part of the outlook activities in the context of the integrated Zero Pollution monitoring that is under development. Preliminary first results can inform stakeholder engagement at Green Week 2021 and thereafter, the final results can then feed into the first Zero Pollution Monitoring and Outlook report which is scheduled for the end of 2022.

Pollution has been at the centre stage of EU environment policy *for many decades but all too often the specific policies (on air, water, soil) have been reactive and not proactive. The* ***precautionary principle*** *and the desire for* ***prevention,*** *rather than control or remediation, has been long expressed but not always been successfully applied*[182]*. The European Green Deal and the Strategic Foresight agenda now offer an opportunity to start a* ***more systematic and regular process which ultimately helps to identify the context (trends, drivers). This will contribute to the identification of pathway(s) towards a zero pollution world and identify benefits, opportunities and risks early on in the policy discussions****. In this respect, the pollutants of emerging concern for human*

[181] See Roadmap

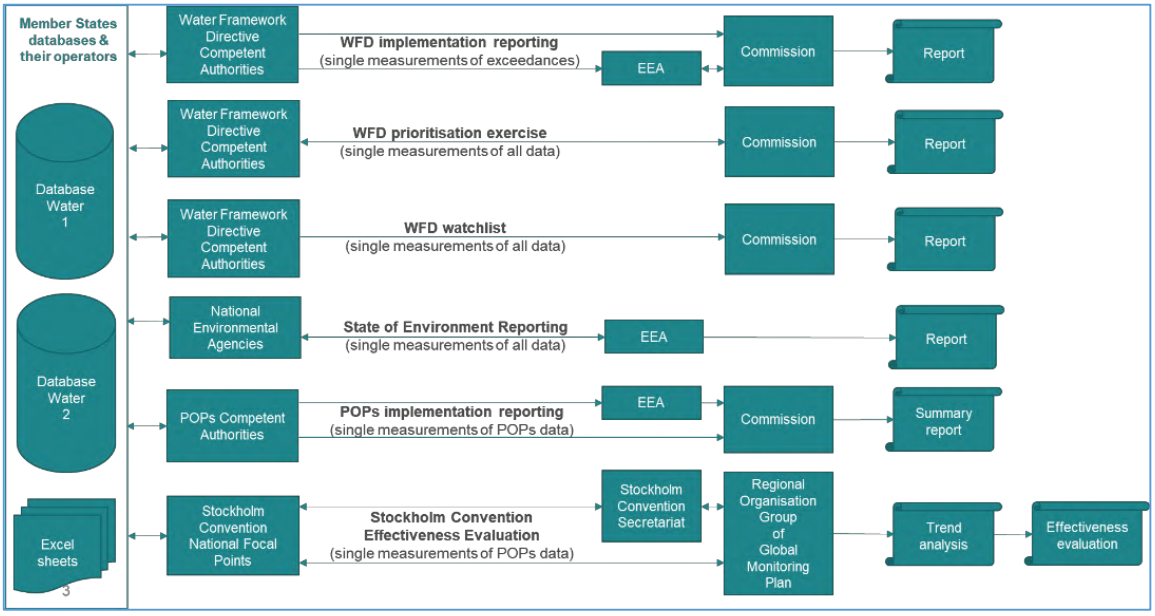
[182] See EEA reports on 'Late lessons from early warnings' (1st: 22/2001 and 2nd: 1/2013) for many pollution related examples

health or the environment (biodiversity) are of relevance. Moreover, economic and societal issues and trends will have an influence on our 'polluting' behaviours and patterns. But we don't necessarily know which trends have the most beneficial, which ones the most detrimental effect. One such example of a trend is the link to the digital transition which could be explored. This would then also allow for a contribution to one of the key topics in the Commission's foresight agenda, namely: 'Deepening the twinning of the digital and green transitions'. As overall orientations for the elaboration of the concrete issues, the following are proposed:

Which emerging societal, economic or environmental issues (i.e. benefits, opportunities and/or threats) will impact our ability to deliver a zero-pollution ambition for a toxic-free environment by 2050?

ANNEX 4: ILLUSTRATIVE EXAMPLE ON HANDLING OF CHEMICAL MONITORING DATA IN ENVIRONMENT

The reporting practices and handling of chemical monitoring data in environment could be improved to a large degree. There is some multiple reporting of the same data to the Commission, EEA or international organisations and some have very restrictive use rights so they cannot be reused for other purposes. Typical example is a multiple reporting of monitoring data of persistent organic pollutants in water environment that takes place as part of the implementation reporting of the POPs regulation, Stockholm Convention effectiveness evaluation and as part of a bigger set of data under WFD implementation reporting, WFD prioritisation exercise and a state of environment reporting (see figure below). Further, some chemical monitoring data are not appropriately stored and there are challenges in knowing what data exist and in accessing them, such as *e.g.* data collected for the WFD prioritisation exercise, WFD watchlist or LUCAS soil survey. In addition, there are some parallel initiatives to improve the situation without sufficient coordination, such as developments of IPCHEM, Reportnet 2.0 and WISE.



Inefficiency and ineffectiveness in providing chemical monitoring data in environment is caused, among other, by very fragmented data flows that when established, did not fully consider the possible re-use of data (silo approach) or organisational and technological developments (such as that chemical monitoring data were made machine readable under INSPIRE obligations and Member States make them usually publically available). Other factors include differences in legal requirements or lack of technical and financial resources to collect the data and handle them in a more centralised way.

Solution

Making chemical monitoring data available via IPCHEM combined with the legislative changes to remove obstacles for reuse of data and to better stream the data (as set by the Chemicals Strategy for Sustainability) provides a solution to rationalise data flows, improve accessibility and interoperability of data and significantly improve efficiency and effectiveness of the provision of chemical monitoring data in the environment. Databases that are used by National Authorities to report the monitoring data could be

dynamically connected to the Information Platform for Chemical Monitoring (IPCHEM) and harmonized within the IPCHEM infrastructure. Those Member States wishing to store their data directly in the IPCHEM could do so through IPCHEM cloud service (either because of saving of resources, because of non-existence of national databases or because of joint work (e.g. watchlist)).

The responsibility for maintaining the connections between IPCHEM and national databases and for hosting the data, both organisationally and technically, would lie with the IPCHEM module coordinator, which would be one of the EU Agencies. Any quality control of data would be done when connecting or uploading the databases to IPCHEM or when performing a certain analysis. Any discrepancies on data quality would be solved directly with the national data holders and would be reflected through the updated of national database(s).

National Authorities would not report the monitoring data to EU Agencies, Commission or international organisations, as there would be dynamic link established between their databases and IPCHEM. Instead, EU Agencies, Commission or International Organisations would access the data through IPCHEM and could facilitate the preparation of the necessary analyses and reports. National Authorities would remain involved in the design and validation of the analysis.