European Commission

Scientific Committee on Health, Environmental and Emerging Risks

SCHEER

Statement on emerging health and environmental issues (2026)

Scientific Committees
on Consumer Safety
on Health, Environmental and Emerging Risks

The SCHEER adopted this document by written procedure on 24 June 2026

ABSTRACT

The purpose of this SCHEER statement on emerging issues in the non-food area is to draw the attention of EU Commission Services to these issues identified by the SCHEER members as having the potential to impact human health and /or the environment in the future. The Secretariat will use this list when discussing potential new mandates with relevant Commission services.

Keywords:
SCHEER, emerging issues, emerging risks, newly identified health risks, health, environment, impacts

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About the Scientific Committees (2022-2026)
Two independent non-food Scientific Committees provide the Commission with the scientific advice it needs when preparing policy and proposals relating to consumer safety, public health and the environment. The Committees also draw the Commission's attention to the new or emerging problems which may pose an actual or potential threat.
These committees are the Scientific Committee on Consumer Safety (SCCS) and the Scientific Committee on Health, Environmental and Emerging Risks (SCHEER). The Scientific Committees review and evaluate relevant scientific data and assess potential risks. Each Committee has top independent scientists from all over the world who are committed to work in the public interest. In addition, the Commission relies upon the work of other Union bodies, such as the European Food Safety Authority (EFSA), the European Medicines Agency (EMA), the European Centre for Disease prevention and Control (ECDC) and the European Chemicals Agency (ECHA).

SCHEER
This Committee, on request of Commission services, provides Opinions on questions concerning health, environmental and emerging risks. The Committees addresses questions on:
- health and environmental risks related to pollutants in the environmental media and other biological and physical factors in relation to air quality, water, waste and soils.
- complex or multidisciplinary issues requiring a comprehensive assessment of risks to consumer safety or public health, for example antimicrobial resistance, nanotechnologies, medical devices and physical hazards such as noise and electromagnetic fields.

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1. INTRODUCTION

The primary purpose of this position statement is to draw the attention of the EU Commission Services to emerging issues in the non-food area that have been identified by the SCHEER members as having the potential to significantly impact human health and / or the environment in the future.

The Committee provides Opinions on questions concerning emerging or newly identified health and environmental risks and on broad, complex or multidisciplinary issues that require a comprehensive assessment of risks to consumer safety or public health and related issues not covered by other European Union risk assessment bodies.
Examples of areas of activity include potential risks associated with: antimicrobial resistance; new technologies such as nanotechnologies; medical devices including those incorporating substances of animal and/or human origin; tissue engineering; blood products; fertility reduction; physical hazards such as noise and electromagnetic fields; the interaction, synergic effects and cumulative effects of risk factors and methodologies for assessing new risks.

It may also be invited to address risks related to public health determinants and non-transmissible diseases.

There are generally considered to be three categories of emerging risks (IRM, 2020):
1. A new risk in a known context
2. A known risk in a new context
3. A new risk in a new context

The SCHEER considers all three in their statement.

UNEP Foresight programme considers an "Emerging Issue" as:

1. An environmental or environmental-related issue that is not yet generally recognised but could have major impact on human wellbeing and the environment.

2. An issue that is recognized as very important by the scientific community but is not yet receiving adequate attention from the policy community.

3. The issue could be positive or negative. Significant opportunities may be lost, or undesired effects may occur in future, if not addressed.

4. Recognized as 'emerging' based on 'newness' but not necessarily issues that are unheard of or that come as a surprise.

Early identification of emerging issues is of great potential value to ensure a high level of public safety and environmental protection. However, by the very fact that they are emerging issues, there is usually very limited data available that would make it possible to correctly identify them and their impact. It is therefore important that each issue that is identified is regularly reviewed. It is the aim of the SCHEER, therefore, to regularly review any relevant new developments and to produce an updated position statement twice during the term of the Scientific Committees (this term January 2022 - December 2026). The first SCHEER statement was published in 2018: Statement on emerging health and environmental issues, adopted on 20 December 2018). The second was published in 2022. Earlier, the preceding Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) also issued a position statement: Position Statement on emerging and newly identified health risks to be drawn to the attention of the European Commission, adopted on 20 November 2014; see Annex I for issues identified earlier by SCENIHR and SCHEER. The Committee can submit an urgent issue at any time to the

Commission. In considering emerging issues, the SCHEER wishes to work closely with other EU scientific advisory committees that are also mandated to look at emerging issues. The SCHEER focuses on non-food risks, and so primarily looks at emerging issues in this area. It therefore seeks to work in cooperation with the European Food Safety Agency when issues are related to emerging food risks. Statements on emerging issues on cosmetic ingredients are prepared in cooperation with the Scientific Committee for Consumer Safety, the SCCS.

The SCHEER is also aware of a number of other fore-sighting activities led by other international bodies, including UNEP and ISC (Global environmental outlook global foresight report 2024), EEA (Foresighting for sustainability, 2025), World economic forum (WEF, global risks report 2024), OECD (Management of emerging critical risks, 2025) and of course the EU FORENV process which the SCHEER has contributed to. At the same time, there are also a number of academic 'horizon scanning' publications that provide a synthesis of various, diverse issues.

The SCHEER recognised the need to establish a very flexible framework to identify emerging issues and their potential impacts (see document 'Emerging Issues and the Role of the SCHEER, Position Paper', SCHEER, 2018).

The SCHEER approach is to promote the discussion among its members, in dedicated 'brainstorming sessions', to identify emerging/relevant issues that they think should be flagged for the Commission Services. A dedicated working group then oversees the scientific discussion of these identified issues and brings additional issues of concern to the Commission's attention. The SCHEER members are also able to identify relevant publications and reports to inform the prioritisation of the identified issues. The list of issues is not exhaustive, as it is a composite list to which individual experts contribute. Each issue's description provides some justifications for the issue's being considered as emerging, but is not a full scientific evaluation of the topic. Previously identified issues are also re-evaluated and updated as required.

Example of criteria in identifying emerging issues used in other contexts include:

Policy relevance – the issue is recognized as important but has not yet had adequate policy attention

Urgency – requires immediate action by policy makers or other stakeholders

Evidence-based – including scientific and traditional knowledge

Newness – as a result of new knowledge, new technologies, new scale of impact, heightened awareness, new solution found

The specific SCHEER criteria used in addition to identify an emerging issue are as follows:

Uniqueness or novelty: what is the potential novelty (familiar risk with new exposure scenario or new risk?). Has the issue been addressed before?

Soundness: data verifiability, what is the potential for verifiability (trusted source, more than one source, are reliable data available for prioritisation purposes?)

Urgency/imminence: estimated rate of change (what is the potential for rapid increases, how soon is it estimated that the potential hazard will manifest?)

Scale: What is the spatial scale for potential exposure (local, regional, global, particularly vulnerable community/group)?

Severity: Estimated severity for individual organisms or next generations (what is the potential to be life threatening?)

Interactions: What potential is there for interaction, consequences, and knock-on effects, with other stressors?

A standardised template has been used to describe the issues and the approach used to categorise them. It is acknowledged that further consideration of some of the issues that have been identified should be led by other scientific committees.

2. FORMAT FOR DESCRIBING AN EMERGING ISSUE

A common format was proposed to describe emerging issues. It was agreed to use a table, in which the committee members have been asked to complete the following:

- The topic proposed
- Sources (one or more selected items from those mentioned under point 2.1 between 1-14)
- Causative factors (one or more selected items from those mentioned under point 2.2 between a and i)
- Preliminary ranking of the hazard (*, 1, 2 or 3 where * = uncertain and 3 is high for uniqueness, soundness, severity, spatial scale, urgency, interactions)
- Preliminary Estimation of importance (*, 1, 2 or 3 where * = uncertain and 3 is high)
- Description / background

2.1 Sources

The identified risk is placed into one of the broad categories below, while recognising that a risk may fit into more than one category:

1) Buildings and infrastructure
2) Energy and electronic communications
3) Disease evolution e.g. due to pathogen changes
4) Industrial and related activities
5) Waste processing and utilization
6) Use of natural resources
7) Transport and storage
8) Human behaviour (socioeconomic, lifestyle, perception)
9) Medical developments (technology, pharmaceuticals)
10) Environmental change
11) Product use/misuse
12) Agriculture and food
13) New materials
14) Other sources

2.2 Causes / Contributing factors

The causative or contributing factors have been similarly broadly categorised so that any risk can be associated with one of more of the factors:

a) Technical advances opening up the prospect of new products and/or processes and/or raising concerns about waste treatment safety

b) A consequence of changes in the natural environment or a more comprehensive (global) scale of the issue

c) Changes resulting from alterations in price, supply of materials and commodities

d) Changes due to alterations in legislation or public welfare measures

e) Other socio-cultural or demographic elements

f) Outcomes of research

g) Large-scale illegal activities

h) Public/political concern

i) Other causes

2.3 Exposure and hazard

Each issue is then ranked from 1 to 3 by the SCHEER experts, with 1 being the lowest in terms of how they meet each criteria point.

2.4 Prioritisation

The next step in the process requires the SCHEER WG members to rank each issue which they initiated (from 1 to 3) in terms of priority.

2.5 Ratification of prioritisation

The final step in the process asks all SCHEER members to prioritise each issue. The median score is then calculated from the scores provided by all the SCHEER members and provides the consensus prioritisation. This exercise is typically undertaken at a plenary meeting of the full SCHEER Committee or by written procedure.

3. NEXT STEPS

The list will be used internally by the Secretariat for discussion of potential new mandates with the relevant Commission services.

4. NEW ISSUES

Twelve issues have been identified by the SCHEER and are described below. Each issue has been described, and the sources and exposures/hazards categorised according to the agreed list in sections 2.1 and 2.2.

4.1. Chemicals in 4D injectable gels

Topic 1	**Chemicals in 4D Injectable Gels**
Sources (see section 2)	5) Waste processing and utilization 8) Human behaviour (socioeconomic, lifestyle, perception) 9) Medical developments (technology, pharmaceuticals) 11) Product use/misuse 13) New materials
Causative factors (see section 2)	As of 2026, 4D gels primary health hazards are potential issues with biocompatibility and material degradation of the synthetic gels in case of the unintentional release of residual chemicals to the environment. 2.2 (a); (b); (c); (d); (f)
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	 3 (human health) – 2 (environment) 3 (human health) – 2 (environment) 1 (human health) – 1 (environment) 2 (human health) – 1 (environment) 1 (human health) – 3 (environment) 2 (human health) – 2 (environment)
Parallels with past emerging issues **Potential interactions with other stressors**	Nanomaterials in medical devices Synthetic biology Surgical meshes Cytotoxicity and Systemic Toxicity
Preliminary estimation of prioritisation (see section 2)	A known risk in a new context (2): the topic is recognised as very important by the scientific community but needs to be adequately analysed by the policy community and risk assessors to take care of unexpected interactions between nature and newly synthesized materials in case of leakage.
Background including reliability of data, a key reference, if possible, any other reasons for concern	The limitations and challenges posed by static 3D materials necessitated a new era of 4D shape-morphing constructs for wide applications in diverse fields of science. 4D injectable gels for all applications are made from various natural and synthetic polymers (Markhart J. *et al.*, 2026) often blended with therapeutic agents and crosslinking materials to create "smart" hydrogels that can change shape or properties in response to stimuli like temperature, pH, or light. Natural Polymers are widely used due to their excellent biocompatibility (Chitosan, Collagen, Gelatine (often functionalized as GelMA), Hyaluronic acid (HA), Silk fibroin.

	Synthetic Polymers examples include: Poly(N-isopropylacrylamide) - temperature-sensitive, poly(glycolic acid) - biodegradable. Four dimensionally (4D) based hydrogels can be used to fabricate promising candidates for biomedical applications, such as targeted therapy, non-invasive diagnosis (Budur N. Alanazi *et al.*, 2025). Recent generation of ground-breaking complex 3D-bioprinted Neural Guidance Conduits and minimally invasive injectable hydrogels with 4D-responsive, antifibrotic, anti-inflammatory and antimicrobial properties to promote effective tissue regeneration of peripheral nerve injuries has become a topic of research (Li *et al.*, 2024; Stapleton *et al.*, 2024) and implementation (Murphy, Ralph N.A. *et al.*, 2023). The new 4D materials are expected to be produced within the SSbD EC framework. The 'safe and sustainable by design' (SSbD framework) is **a voluntary approach to guide the innovation process for chemicals and materials**, announced on 8 December 2022 in a Commission Recommendation, revised on 16 December 2025 in JRC143022 and includes a new structure of the contents of the safety and sustainable assessment sections. While such gels have been widely used in controlled medical applications, this issue considers their use in non-controlled situations and their potential degradation and release to the environment. It is necessary to evaluate the potential release to the environment and human exposure to substances during the lifetime of the 4D materials on a regular basis. In principle, the 4D materials should change their properties as functions of time in response to external environmental stimuli in a controllable way. It is necessary to evaluate the potential release to the environment and human exposure to substances during the manufacturing and use stages to identify, quantify and analyse the potential risks (qualitative, semi-quantitative, and quantitative) associated with each product. **References:** Budur N. Alanazi *et al.* (2025). Exploring 4D printing of smart materials for regenerative medicine applications. RSC Adv. 2025 Sep 5;15(39):32155–32171. https://pubs.rsc.org/en/content/articlelanding/2025/ra/d5ra04410c Doi 10.1039/d5ra04410c EU (European Union) (2022). Commission Recommendation (EU) 2022/2510 of 8 December 2022 establishing a European assessment framework for 'safe and sustainable by design' chemicals and materials. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H2510 Li X., Xing D., Bai Y., Du Y., Lang S., Li K., Xiang J., Liu G., Liu S. (2024). Injectable hydrogel with antimicrobial and anti-inflammatory properties for postoperative tumor wound care. Biomed Mater. 2024 Feb 8;19(2). doi: 10.1088/1748-605X/ad2408 Markhart J., Mainik P., Klee P.S. and Blasco E. (2026). 4D Printing of Self-Immolative Polymers. Adv. Funct. Mater.36, no. 23 (2026): e20642. https://doi.org/10.1002/adfm.202520642 Ralph N.A. Murphy, Camille de Schoulepnikoff, Jacky H.C. Chen, Malachy O. Columb, James Bedford, Jason K. Wong, Adam J. Reid. The incidence and management of peripheral nerve injury in England (2005–2020). Journal of Plastic, Reconstructive & Aesthetic Surgery. https://doi.org/10.1016/j.bjps.2023.02.017 Stapleton L., Zhu Y., Woo Yi-ping J., Appel E. Engineered biomaterials for heart disease. Current Opinion in Biotechnology https://doi.org/10.1016/j.copbio.2020.08.008

Note: 3 highest risk, 1 lowest risk, *unable to score

4.2. AI and environmental regulation

Topic 2	**AI and environmental regulation**
Sources	14 (others)
Causative factors (see section 2)	Advances in applied information technologies and computer sciences are the predominant initiating factor. Contributing factors are changes in cultural and demographic issues, the development of new IT-tools and services, the optimisation of industrial strategies, the increasing availability of large data and the need to orient oneself in them and to use them for decision making.
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	To both environment and human health Uniqueness: 3 Soundness: 3 Severity: 3 Scale: 3 Urgency: 3 Interactions: 3
Parallels with past emerging issues **Potential interactions with other stressors**	
Preliminary estimation of prioritisation (see section 2)	3 Given that the outlined risks are affecting (in a very fundamental manner) how regulators perceive, analyse and act on facts and data, the issue should have highest priority.
Background including reliability of data, a key reference, if possible, any other reasons for concern	Artificial Intelligence (AI), in particular in the form of Large Language Models (LLMs), is currently becoming an increasingly popular support instrument for regulatory decision making and scientific research. This development seems to be only marginally slowed down by the fact that even modern LLMs consistently struggle with basic problems related to logical and mathematical reasoning, linguistic understanding, spatial orientation, basic science, and relational perception (Williams, 2024). A particular problem in this context is the increasing sophistication of LLMs that present their "findings" in a very professional and convincing manner. Given that the quality of a written text is - explicitly or implicitly - often taken as a sign of the quality of the underlying information and logic, a user might be tempted to assume that the presented text is based on credible information, without performing an actual check. Particularly problematic in this context is the finding by Zhout *et al.* (2024) that "scaled-up, shaped-up models tend to give an apparently sensible yet wrong answer much more often, including errors on difficult questions that human supervisors frequently overlook." AI-driven models are increasingly used to prioritise chemicals, fill data gaps and design safer chemicals, but their application to chemical risk assessment (CRA) carries inherent risks. Problems arise from

	biased or sparse training sets, opaque "black-box" logic, poorly calibrated uncertainty estimates, regulatory misalignment and dual use/misuse. If not validated and accountable, AI can distort risk characterisation and ultimately undermine human and environmental protection, leading to public mistrust. The sections below distil the principal risk categories and point to mitigation strategies grounded in current scientific and regulatory discourse. AI's ability to handle big data and provide probabilistic outputs facilitates probabilistic risk assessment. Rather than just replicating human skills at larger scales, AI should be viewed as a transformative technology. Despite potential challenges, like model black-boxing and dataset biases, explainable AI (xAI) is emerging to address these issues (Hartung, 2023). Indeed, many AI toxicity models inherit biases from historically skewed datasets that over-represent well-studied pharmaceuticals and under-represent industrial chemicals, making predictions unreliable outside the comparatively narrow domain of the training set. Rapidly evolving new chemical classes exacerbate this "out-of-distribution" problem. A particular problem is that black-box deep networks often extrapolate with unwarranted confidence (Wassenaar, 2024). REACH and other regulatory frameworks place evidentiary burden on the registrants and authorization holders of a chemical ("No Data, No Market"). Hazard and risk estimates based on black-box AI models may not provide sufficient transparency for scrutiny by regulatory agencies. Therefore, ECHA, the US EPA and other regulatory agencies stress the need for a transparent weight-of-evidence based narratives and auditable model performance. A first step towards a more efficient use of AI in chemical risk and safety assessment will be the full implementation of the OECD AI Principles that demand accountability, robustness and human oversight in high-risk applications. But even then, the problem of accountability for AI-based decisions with respect to chemical safety and risks may persist. Therefore, it is of utmost importance to regulate the use of AI by laying down harmonised rules at EU level, within a transparent governance system. **References:** Hartung T. (2023). Artificial intelligence as the new frontier in chemical risk assessment. Front. Artif. Intell. 6:1269932.doi: 10.3389/frai.2023.1269932 Williams S. and Huckle J. (2024). Easy problems that LLMs get wrong. arXiv preprint arXiv:2405.19616 Wassenaar P.N., Minnema J., Vriend J., Peijnenburg W.J., Pennings J.L. and Kienhuis A. (2024). The role of trust in the use of artificial intelligence for chemical risk assessment. Regulatory Toxicology and Pharmacology, 148, p.105589. Zhou L., Schellaert W., Martínez-Plumed F., Moros-Daval Y., Ferri C. and Hernández-Orallo J (2024). Larger and more instructable language models become less reliable. Nature, 634(8032), pp.61-68.

Note: 3 highest risk, 1 lowest risk, *unable to score

4.3. Use of bacteria and/or fungi to reduce unpleasant smells

Topic 3	**Use of bacteria and/or fungi to reduce unpleasant smells**
Sources (see section 2)	1) Buildings and infrastructure 5) Waste processing and utilization 6) Use of natural resources 11) Product use/misuse 12) Agriculture and food 14) Other: gene-editing
Causative factors (see section 2)	a) Technical advances opening up the prospect of new products and/or processes and/or raising concerns about (waste treatment) safety f) Outcomes of research h) Public/political concern
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	Focus is on human health effects 2 New developed strains which may be inhaled chronically. * * No data to be found 2 Currently rather small scale – but may evolve 2 or * No chronic data on exposure / effects. *
Parallels with past emerging issues **Potential interactions with other stressors)**	
Preliminary estimation of prioritisation (see section 2)	2 The use of risk group 1 microorganisms is probably safe (non-pathogenic) but no chronic data are available on effects on chronic inhalation and skin contact possibly leading to sensitization. In addition, it is not clear how well the mix of microorganisms is controlled at production
Background including reliability of data, a key reference, if possible, any other reasons for concern	Microbial-based cleaning products (MBCPs) are cleaning products that contain viable microorganisms – bacteria, bacteria endospores and/or fungi. MBCPs are applied to among others to fight odours from NH3 and H2S. Product may contain different microorganisms from the genus of Bacillus, Bifidobacterium, Lactobacillus, Saccharomyces. Producers claim that the used microorganisms belonging to risk group 1 are generally recognised as safe (GRAS). (Boesenberg, 2025; Spök, A. 2018). The Netherlands Food and Consumer Product Safety Authority (NVWA) found microbial contaminants in consumer products, and in one case microorganisms belonging to risk group 2, possibly associated with human infections (VWA, 2004). Spray applications of MBCPs lead to aerosols of microorganisms, which can result in chronic/regular respiratory exposure, which in turn, based

	on literature, may result in sensitization and hypersensitivity pneumonitis (Spök A., 2018). It is unclear how widespread the use of these MBCPs is, but information can be found on household, agricultural and industrial applications. **References:** Boesenberg D. *et al.* (2025). Risk analysis approaches for microbial ingredients in microbial-based cleaning. Risk analysis, 2025 1-14 Spök A. *et al.* (2018). Status of microbial-based cleaning products in statutory regulations and ecolabelling in Europe, the USA, and Canada. Food and Chemical Toxicology. 116, 10–19. doi: 10.1016/j.fct.2017.12.057 VWA, 2004. Bacteriële reinigers. Reinigers op basis van micro-organismen met eventuele toevoegingen. Statusrapport over de werking van microbiologische reinigers, de wettelijke aspecten en eventuele gezondheidsrisico's voor de consument en professionele gebruikers. Rapport nr. ND04o071-3. Food and Consumer Product Safety Authority, The Netherlands. http://www.vwa.nl/txmpub/files/?p_file_id=10722

Note: 3 highest risk, 1 lowest risk, *unable to score

4.4. Infrastructure for high performance computing

Topic 4	**Infrastructure for high performance computing**
Sources (see section 2)	1) Buildings and infrastructure 2) Energy and electronic communications 5) Waste processing and utilization 9) Medical developments (technology, pharmaceuticals)
Causative factors (see section 2)	The causative factors above affect the generation (medical developments), collection (electronic communications and waste processing), storage, processing and mining (infrastructure and energy) of digital data.
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	 1 (human health) – 1 (environment) 2 (human health) – 2 (environment) * (human health) – * (environment) 1 (human health) – 2 (environment) 3 (human health) – 3 (environment) *
Parallels with past emerging issues **Potential interactions with other stressors**	Electronic waste (e-waste) is one of the fastest growing solid waste streams in the world (WHO factsheet, 1 October 2024). https://www.who.int/news-room/fact-sheets/detail/electronic-waste-(e-waste)
Preliminary estimation of prioritisation (see section 2)	1 Several efforts are taking place to mitigate the risks to the environment with the development of new technologies to replace water cooling, sustainably produce the required energy, and improve working conditions.
Background including reliability of data, a key reference, if possible, any other reasons for concern.	Computer applications and Artificial Intelligence (AI) usage are growing in terms of data, algorithms and hardware infrastructure with super-linear trends (Gupta *et al.*, 2021; Wu *et al.*, 2022). This growth significantly affects mainly three areas: (i) the consumption of energy by cloud computing data centres; (ii) the local water resources management, since water is necessary for equipment cooling; (iii) the disposal of e-waste at a local or regional scale (Siddik *et al.*, 2021). A medium-sized data centre (15MW) uses as much water as three average-sized hospitals, or more than two 18-hole golf courses (Mytton, 2021). The annual electricity report from the International Energy Agency (IEA) says data centres consumed 460TWh in 2022 (IEA, 2024). For example, large hyperscale data centres, which are increasingly common, have power demands of 100MW or more, with an annual electricity consumption equivalent to the electricity demand from around 350’000 to 400’000 electric cars (IEA, 2024). Generative artificial intelligence (GAI) requires substantial computational resources for model training and inference, but the electronic-waste (e-waste) implications of GAI and its management

	strategies remain underexplored. The e-waste stream of GAI could increase, potentially reaching a total accumulation of 1.2–5.0 million tons during 2020–2030 (Wang *et al.*, 2024). Apart from the above environmental impacts, the operation of smaller or larger data centres may have mesoclimatic effects (Turek & Radgen, 2021). Inside data centres, workers are exposed to a mixture of physical (noise, vibrations, EMF, light) and chemical agents (e.g. Polybrominated diphenyl ethers- PBDEs). **References:** Gupta U., Kim Y.G., Lee S., Tse J., Lee H.H.S., Wei G.Y., ... & Wu C.J. (2021, February). Chasing carbon: The elusive environmental footprint of computing. In *2021 IEEE International Symposium on High-Performance Computer Architecture (HPCA)* (pp. 854-867). IEEE. IEA (2024) Electricity 2024: Analysis and forecast to 2026 https://iea.blob.core.windows.net/assets/6b2fd954-2017-408e-bf08-952fdd62118a/Electricity2024-Analysisandforecastto2026.pdf Mytton D. (2021). Data centre water consumption. *npj Clean Water*, *4*(1), 11. https://doi.org/10.1038/s41545-021-00101-w Siddik M.A.B., Shehabi A. & Marston L. (2021). The environmental footprint of data centers in the United States. Environmental Research Letters, 16(6), 064017. Turek D. & Radgen P. (2021). Optimized data center site selection—Mesoclimatic effects on data center energy consumption and costs. Energy Efficiency, 14(3), 33. Wang P., Zhang LY., Tzachor A. *et al.* (2024). E-waste challenges of generative artificial intelligence. Nat Comput Sci 4, 818–823 https://doi.org/10.1038/s43588-024-00712-6 Wu C.J., Raghavendra R., Gupta U., Acun B., Ardalani N., Maeng K., ... & Hazelwood K. (2022). Sustainable ai: Environmental implications, challenges and opportunities. Proceedings of Machine Learning and Systems, 4, 795-813.

Note: 3 highest risk, 1 lowest risk, *unable to score

4.5. 3D printing of dental orthodontics (DIY orthodontics)

Topic 5	**3D printing of dental orthodontics (DIY orthodontics)**
Sources (see section 2)	8) Human behaviour (socioeconomic, lifestyle, perception) 9) Medical developments (technology, pharmaceuticals) 11) Product use/misuse 13) New materials
Causative factors (see section 2)	a) Technical advances opening up the prospect of new products and/or processes and/or raising concerns about waste treatment safety c) Changes resulting from alterations in price, supply of materials and commodities e) Other socio-cultural or demographic elements f) Outcomes of research g) Large-scale illegal activities h) Public/political concern
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	Focus on human Health 2 3D-printing is a known potential source of specific exposure, the use for DIY medical devices is new. 2 Scarce data. 2 Misuse of medical devices poses a risk that user/consumers are probably not aware of. 1 Probably a relatively small group of patients. 2 Market is not ready for the current developments – need to act soon. Chemical safety – nano-plastics
Parallels with past emerging issues **Potential interactions with other stressors**	
Preliminary estimation of prioritisation (see section 2)	2 Currently the scale is limited, but the potential harm to individuals may be significant
Background including reliability of data, a key reference, if possible, any other reasons for concern	Dental orthodontics are quickly evolving, partially due to the 3D printing of fillings and retainers. The use of biocompatible materials is vital for safeguarding the oral health of the patient (Reidel *et al.* 2025). Because of these developments, a new trend is emerging - DIY orthodontics. Patients can 3D-print their own dental orthodontic devices. Questions should be raised concerning chemical safety: biocompatibility of the DIY materials and the materials placed in the mouth, the leakage of additives and the release of plastics debris (Barile *et al.*, 2025). In addition, the non-supervised use of orthodontics may pose a health risk (O'Dowd, 2020). A report by British

	orthodontists indicates that DIY orthodontics is a growing issue (Carter & Stokes, 2022). DIY orthodontics and related problems are described at: https://www.dentalhealth.org/safe-smiles-diy-orthodontics **References:** Barile C., Cianci C., Paramsamy Kannan V., Pappalettera G., Pappalettere C., Casavola C., Laurenziello M. & Ciavarella D. (2025). Experimental assessment of damage and microplastic release during cyclic loading of clear aligners PLOS ONE Febr. 5. Carter A. & Stokes S. (2022). Availability of 'Do-It-Yourself' orthodontics in the United Kingdom *Journal of Orthodontics*, Vol. 49(1) 83–88 O'Dowd A. (2020). DIY orthodontics – safe, cheaper option or dangerous gamble? *British Dental Journal* 228 NO. 5 Reidel Y.G., Hassan M. & Arnett M. (2025). DIY orthodontics Relapse Correction Gone Wrong: A case study *J. Dent Hyg*. Feb;99(1):55-62.

Note: 3 highest risk, 1 lowest risk, *unable to score

4.6. Effects of EMF from offshore windfarms on marine fauna

Topic 6	**Effects of EMF from offshore windfarms on marine fauna**
Sources	2) Energy and electronic communications 6) Use of natural resources
Causative factors (see section 2)	The need for using renewable energy sources is driving the construction of wind turbine farms close to the seashore to harvest the kinetic energy of wind, convert it to electrical energy and carry the latter with minimal losses ashore.
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	Scores relevant to the environment 1 2 1 2 1 *
Parallels with past emerging issues **Potential interactions with other stressors**	EMF and human health (SCHEER, 2024 a, b)
Preliminary estimation of prioritisation (see section 2)	1 There has been a deceleration recently in the deployment of large-scale offshore windfarms.
Background including reliability of data, a key reference, if possible, any other reasons for concern	The effects of offshore renewable energy harvesting systems have been studied for more than a decade. However, apart from vibrations and sound, EMF are produced from these types of systems to which marine animals are directly exposed, especially when their habitats are close to cables carrying DC/AC currents. The total zone affected by cable-induced magnetic fields (DC and AC) in Hutchinson *et al.* (2020), was 5–10 m on either side of the buried cable, inferring the potential area of influence to be 10–20m wide. The fields also extend vertically (e.g. 2.5m). The measured AC electric field extended approximately 100m and may represent a larger area of potential influence for electro-sensitive species. According to the laws of physics a motional electromotive force (i.e., motional induced voltage) would also arise from an animal passing through the anthropogenic EMF (DC or AC), however this would be below the levels scientific instrumentation could detect. The magnetic field to which marine animals are exposed can be several tens of μT larger than the geomagnetic field. Currently, it is not clear which EMF component (electric/magnetic) and which of its characteristics (intensity/frequency) have an impact on marine animals. **References:** Cresci A., Perrichon P., Durif C.M., Sørhus E., Johnsen E., Bjelland R., & Browman H. I. (2022). Magnetic fields generated by the DC cables of offshore wind farms have no effect on spatial distribution or swimming behavior of lesser sandeel larvae (Ammodytes marinus).

	Marine Environmental Research, 176, 105609. Hutchison Z.L., Gill A.B., Sigray P. *et al.* (2020). Anthropogenic electromagnetic fields (EMF) influence the behaviour of bottom-dwelling marine species. Sci Rep 10, 4219 https://doi.org/10.1038/s41598-020-60793-x Jakubowska-Lehrmann M., Makaras T., Normant-Saremba M., Białowąs M. & Otremba Z. (2025). Exploring the impact of magnetic fields related to submarine power cables on the American mud crab Rhithropanopeus harrisii: A behavioural and physiological perspective. Marine Pollution Bulletin, 212, 117492. Svendsen J.C., Ibanez-Erquiaga B., Savina E. & Wilms T. (2022). Effects of operational off-shore wind farms on fishes and fisheries. Review report. DTU Aqua. SCHEER (2024a). Opinion on the need of a revision of the annexes in the Council Recommendation 1999/519/EC and Directive 2013/35/EU, in view of the latest scientific evidence available with regard to radiofrequency (100kHz - 300GHz). SCHEER (2024b). Potential health effects of exposure to electromagnetic fields (EMF): Update with regard to frequencies between 1Hz and 100 kHz. Watson S. C., Somerfield P.J., Lemasson A.J., Knights A.M., Edwards-Jones A., Nunes J., ... & Beaumont N.J. (2024). The global impact of offshore wind farms on ecosystem services. *Ocean & Coastal Management*, *249*, 107023.

Note: 3 highest risk, 1 lowest risk, *unable to score

4.7. Food insecurity (Fraudulent food; food waste management, changing food supply chain patterns)

Topic 7	**Food insecurity, fraudulent food, food waste management, changing food supply chain patterns**
Sources (see section 2)	5) Waste processing and utilization 6) Use of natural resources 8) Human behaviour (socioeconomic, lifestyle, perception) 10) Environmental change (including climate change) 11) Product use/misuse 12) Agriculture and food
Causative factors (see section 2)	Changes in production in the supply system, including over- and under-production and Supply Chain Inefficiencies; Environmental and climate change impacting production (e.g. drought, flooding); changes in production practices (e.g. pesticide usage); Consumer Behaviour & Misperceptions; Industrial & Manufacturing Waste; Policy & Structural Barriers.
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	Scores relevant for human health and, where appropriate, for environment 3 (human) - 2 (environment) 2 (human) - 1 (environment) 3 (human) - 1 (environment) 2 (human) - 1 (environment) 3 (human) - 2 (environment) 2 (human) - 2 (environment)
Parallels with past emerging issues **Potential interactions with other stressors**	Food and nutrition crisis; food insecurity and micronutrient deficiencies Industrial Pollution and Public Health Crises
Preliminary estimation of prioritisation (see section 2)	3 This should be of the highest priority because interacting supply-system imbalances, climate impacts, inefficient practices, consumer misperceptions, industrial waste, and policy barriers create systemic risks to food insecurity, sustainability, and economic stability that escalate rapidly if left unaddressed.
Background including reliability of data, a	Food insecurity is increasingly recognised as not just an environmental and economic issue but also a growing public health threat in Europe. Global and national estimates of food insecurity are primarily reported by

key reference, if possible, any other reasons for concern	organisations like the Food and Agriculture Organization (FAO) of the United Nations, which publishes the annual *State of Food Security and Nutrition in the World (SOFI)* report. Data are collected through household surveys, food consumption metrics, and the Food Insecurity Experience Scale (FIES), a validated tool that enables cross-country comparisons. However, reliability can vary based on the comprehensiveness of national data systems, underreporting, and temporal lags in data publication. Real-time monitoring remains a challenge, especially during emergencies like pandemics or conflicts (FAO, 2023; van Dooren, 2024). The patterns of production and waste are likely to change as we adapt to new climate patterns, and this will impact the way that we address malnutrition and improve dietary diversity (Chia, 2024; El Bilali, 2022). Decomposing food waste contributes to methane emissions; a potent greenhouse gas linked to climate change. Poorly managed waste attracts pests and pathogens, increasing risks of zoonotic diseases. Changes in weather patterns may lead to changes in ways we produce food and also the pesticides that are used. Discarded food, especially meat and dairy, may contain antibiotic residues, contributing to AMR. The financial strain from food waste indirectly affects healthcare resources, as malnutrition and diet-related diseases (e.g., obesity, diabetes, cardio-vascular diseases) persist despite food surplus (Focker, 2022; Sigala, 2024). **References:** Chia D., Yap C.C., Wu S.L., Berezina E., Aroua M.K., Gew L.T. (2023). A systematic review of country-specific drivers and barriers to household food waste reduction and prevention. Waste Manag Res. 2024 Jun;42(6):459-475. doi: 10.1177/0734242X231187559. Epub 2023 Aug 28. PMID: 37638683. El Bilali H., Berjan S., Ben Hassen T., Memon J.A., Vaško Ž., Allahyari M.S. (2022). Research on food loss and waste in the Western Balkans: A systematic review. Front Nutr. 2022 Sep 21;9:983639. doi: 10.3389/fnut.2022.983639. PMID: 36211507; PMCID: PMC9533125. FAO, IFAD, UNICEF, WFP and WHO (2023). The State of Food Security and Nutrition in the World 2023. Focker M., van Asselt E.D., Berendsen B.J.A., van de Schans M.G.M., van Leeuwen S.P.J., Visser S.M., van der Fels-Klerx H.J. (2022). Review of food safety hazards in circular food systems in Europe. Food Res Int. 2022 Aug;158:111505. Epub 2022 Jun 21. PMID: 35840214. doi: 10.1016/j.foodres.2022.111505. Sigala E.G., Chroni C., Boikou K., Abeliotis K., Panagiotakos D., Lasridi K. (2024). Quantification of household food waste in Greece to establish the 2021 national baseline and methodological implications. Waste Manag. 2024 Dec 15;190:102-112. Epub 2024 Sep 18. PMID: 39299084. doi: 10.1016/j.wasman.2024.09.012. van Dooren C. (2024). Planet-based diets: improving environmental sustainability of healthy diets. Proc Nutr Soc. 2024 Sep;83(3):210-216. doi: 10.1017/S0029665123003737. Epub 2023 Oct 13. PMID: 37827993.

Note: 3 highest risk, 1 lowest risk, *unable to score

4.8. Increasing exposure to chemicals that are neither registered nor authorized in the European market

Topic 8	**Increasing exposure to chemicals that are neither registered nor authorized in the European market**
Sources (see section 2)	7) Transport and storage 8) Human behaviour (socioeconomic, lifestyle, perception) 11) Product use/misuse
Causative factors (see section 2)	c) Changes resulting from alterations in price, supply of materials and commodities e) Other socio-cultural or demographic elements
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	for environment and human health 1 (not unique for the EU, but novel as a result of the practice of drop shipping, which is becoming increasingly common). 3 3 * 3 *
Parallels with past emerging issues **Potential interactions with other stressors)**	Contributes to additional chemical burden of consumers and to environmental exposure through the re-introduction of whole groups of chemicals that are banned (e.g. short-chain chlorinated paraffins, illicit drugs) or controlled at EU level (e.g. prescription-only medicines, e.g., sildenafil) (Lungen and Pennock, 2024). Jeopardizes the implementation of a circular economy (hampers recycling).
Preliminary estimation of prioritisation (see section 2)	3 This issue has high priority, because of the lack of control and a potentially high impact on human health.
Background including reliability of data, a key reference, if possible, any other reasons for concern	Direct purchasing from non-EU retailers leads to an increasing dissemination of consumer products in the EU market that may contain hazardous chemicals at elevated levels. Affected products are mainly clothes, cosmetics, toys, but also food items (e.g. spices) and drugs. Examples of chemicals involved include phthalates, short chain paraffins, heavy metals and others (Kutarn *et al.*, 2023; Huo *et al.*, 2023). Illicit drugs can easily be obtained online (EUDA, 2025). At the end of 2024, EUDA was monitoring 1000 new psychoactive substances (EUDA, 2025). In addition, rogue on-line pharmacies provide access to prescription-only medicines (Venhuis *et al.*, 2014), as well as hazardous weight-reducing chemicals (e.g. DNP: Thomas, 2018; Causanilles *et al.*, 2018) are posing potential public health risks for individuals (CDC, 2024). Almost 95% of the websites that sell prescription-only drugs are operating illegally (CDC, 2024; The Lancet, 2025).

Consumers are usually not aware of the problem, although they may be held responsible for hazards caused by non-compliant products. The same holds true for micro-enterprises and small businesses that use dropshipping.

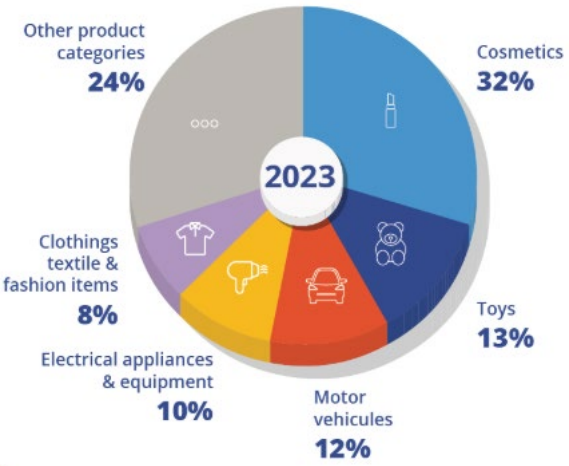
The issue goes beyond chemical hazards. Non-compliant electric appliances are also an increasing problem (fire hazards from leaky batteries for example).

Products sold by companies based in third countries are reported to contain high levels of toxic chemicals:

Https://www.lemonde.fr/en/international/article/2024/08/14/shein-and-temu-products-found-to-contain-high-levels-of-toxic-chemicals_6715032_4.html

https://www.beuc.eu/sites/default/files/publications/BEUC-PR-2025-004_Gaping_holes_in_safety_of_products_sold_on_Temu.pdf

Products that caused alerts at the EU Safety Gate in 2023:



Types of risk:



References:

Causanilles A., Nordmann V., Vught D., Emke E., de Hon O., Hernández F., de Voogt P. (2018). Wastewater-based tracing of doping use by the general population and amateur athletes. Anal. Bioanal. Chem. 410,1793-1803. Doi: 10.1007/s00216-017-0835-3

CDC (2024). Potential public health risk among individuals ordering counterfeit prescription medications from online pharmacies. CDC. Newsroom, Oct 2, 2024.

	https://www.cdc.gov/media/releases/2024/s1002-counterfit-prescription-online-pharmacies.html EU Safetygate Reports: https://ec.europa.eu/safety-gate/#/screen/pages/reports EUDA (2025) European drug report 2025. https://www.euda.europa.eu Huo W., Chen X., Fang H., Guan H., Li Q., Huang M. (2023). Research on the Chemical Hazard Risk of Toys Exported to EU from China Based on the Analysis of the EU "Safety Gate" Alerts Cases: 10.4236/jbise.2023.164004 Kutarna Du X., Diamond M.L., Blumde A., Peng H. (2023). Widespread occurrence of chlorinated paraffins in Canadian consumer products: https://doi.org/10.1039/D2EM00494A Lungen J., Pennock D. (2024). Beware of rogue online pharmacies. PSHP News. May 24, 2024. Pennsylvania Society of Health System Pharmacists, https://www.phsp.org accessed Jan 8, 2026 Thomas S. (2018). Deadly DNP. UK Health Security Agency, Aug 13, 2018. HTTPS://www.ukhsa.blog.gov.uk accessed Jan 8, 2026 Venhuis B.J., de Voogt P., Emke E., Causanilles A., Keizers P.H.J. (2014). Success of rogue online pharmacies: sewage study of sildenafil in the Netherlands. BMJ 349: g4317. https://www.bmj.com/content/349/bmj.g4317 The Lancet (2025). Online pharmacies: a double-edged sword. Editorial. eClinical Medicine 80, 103133. Doi: 10.1016/j.eclinm.2025.103133

Note: 3 highest risk, 1 lowest risk, *unable to score

4.9. Increasing presence of persistent mobile toxic (PMT) compounds in the drinking water supply

Topic 9	**Increasing presence of persistent mobile toxic (PMT) compounds in the drinking water supply**
Sources (see section 2)	Sources: 4) Industrial and related activities 5) Waste processing and utilisation 6) Use of natural resources 8) Human behaviour (socioeconomic, lifestyle, perception) 11) Product use/misuse 12) Agriculture and food 13) New materials
Causative factors (see section 2)	c) Changes resulting from alterations in supply of materials and commodities h) Public/political concern
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	 1 3 3 3 (continental) 3 2
Parallels with past emerging issues **Potential interactions with other stressors**	PBT legislation under REACH
Preliminary estimation of prioritisation (see section 2)	2-3 Medium to high priority. Although regulation in EU has now implemented Mobility as a REACH criterion, many unknown or nonregulated substances (e.g., transformation products) might pose a high risk of drinking water contamination.
Background including reliability of data, a key reference, if possible, any other reasons for concern	Substances that are mobile enough to travel in the water cycle through natural and artificial barriers and persistent enough to survive such a long journey have the highest likelihood of contaminating the sources of our drinking water (UBA, 2021). It is the combination of the two intrinsic substance properties "Persistency" and "Mobility" that cause very high concern. Substances may be characterised as PMT/vPvM. PMT stands for Persistent (not or hardly degradable in the environment), Mobile (well soluble in water and therefore easily transported through the environment) and Toxic (toxic to humans and/or ecosystem). vPvM stands for very Persistent and very Mobile (RIVM, 2025). Mobile substances move easily through the environment, especially water, because they resist being absorbed by soil, sediments or other

	materials and tend to be highly water-soluble. These intrinsic substance properties allow them to spread to the sources of our drinking water (Reemtsma *et al.,* 2016; Gollong *et al.,* 2022). Contamination can be irreversible as these substances remain in the environment, break through filters and survive drinking water purification, thus ending up in the tap water we consume. The EU REACH legislation added mobility only recently as a criterium (EU, 2022; ECHA, 2023) for hazard classification. Criteria for persistence, mobility and toxicity have been set in the amendment to Annex 1 of EC Regulation No. 1272/2008 (EU, 2022). UBA has listed 259 PMT/vPvM substances in the REACH registration database that are hazardous to our drinking water resources (Arp *et al.* 2023). Drinking water suppliers are increasingly confronted with increasing costs to comply with standards. Human biomonitoring data for some PMs is very limited (Kim *et al.,* 2023). Although for some PM substances available data suggest that they do not pose an immediate concern for human exposure (Kim *et al.* 2023; Whelan *et al.,* 2025), for others, such as TFA and other PFAS, proposed environmental quality standards (EQS) and maximum levels in food (EFSA, 2024) are likely to be exceeded. **References:** Arp H.P.H. *et al.* (2023). Prioritised PMT/vPvM substances in the REACH registration database. UBA, Dessau, Germany. ISSN 1862-4804. ECHA (2023). New hazard classes 2023. New hazard classes 2023 - ECHA EFSA (2024). Per- and polyfluoroalkyl substances (PFAS) https://www.efsa.europa.eu/en/topics/per-and-polyfluoroalkyl-substances-pfas EU (2022). ANNEXES to the Commission Delegated Regulation amending Regulation (EC) No 1272/2008 as regards hazard classes and criteria for the classification, labelling and packaging of substances and mixtures. Brussels, Belgium, C(2022)9383 final. Gollong G., Neuwald I.J., Kuckelkorn J., Junek R., Zahn D. (2022). Assessing the protection gap for mobile and persistent chemicals during advanced water treatment - A study in a drinking water production and wastewater treatment plant. Water Res 2022 Aug 1:221:118847. Kim *et al.* (2023). Human exposure to persistent and mobile chemicals: A review of sources, internal levels and health implications. Sci Total Environ. 893, 164764. doi: 10.1016/j.scitotenv.2023.164764. Reemtsma T., Berger U., Arp H.P.H., Gallard H., Knepper T.P., Neumann M., Quintana J.B., de Voogt P. (2016). Mind the Gap: Persistent and Mobile Organic Compounds—Water Contaminants That Slip Through. Environ. Sci. Technol. 50, 10308-10315. doi 10.1021/acs.est.6b03338 RIVM (2025). Website accessed May 2025. https://rvs.rivm.nl/en/onderwerpen/gevaarsindeling/PMTvPvM UBA (2021). PMT and vPvM substances under REACH. Umwelt Bundesamt, Dessau, Germany. https://www.umweltbundesamt.de/en/PMT-substances Whelan *et al.* (2025). A tiered assessment of human health risks associated with exposure to persistent, mobile and toxic chemicals via drinking water. Sci Total Environ 958, 177868. doi: 10.1016/j.scitotenv.2024.177868

Note: 3 highest risk, 1 lowest risk, *unable to score

4.10. Mixtures of chemicals

Topic 10	**Mixtures of chemicals**
Sources (see section 2)	"Initiating factors": 1) Buildings and infrastructure 4) Industrial and related activities 5) Waste processing and utilization 6) Use of natural resources 11) Product use/misuse 12) Agriculture and food
Causative factors (see section 2)	Emissions of chemicals into the natural, agricultural and urban environment, including, but not limited to, pesticides, pharmaceuticals, biocides, cosmetics and industrial chemicals. Basically, all the emission factors listed in section 2.1. are involved.
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	Scores are similar for the environment and for human health. 1 3 3 3 3 3
Parallels with past emerging issues **Potential interactions with other stressors**	The issue has been emerging on various agendas already in the past (see Review in Rudén 2019, Yan 2025) and is now one of the issues discussed for the upcoming REACH revision, for which introducing an additional safety factor for mixtures is discussed (Backhaus 2025). The issue of chemical mixtures is part of the larger issue of multiple stressors. That is, on top of chemical mixtures, there are also non-chemical stressors, in particular climate change related stressors such as excessive heat, drought or ocean acidification. SCHER has provided an Opinion on the issue in 2011 (SCHER, 2011), which will now be revised and updated. A new SCHEER Opinion will be published in 2026.
Preliminary estimation of prioritisation (see section 2)	3. Given that complex chemical mixtures occur everywhere and given their potential risks, the issue is of high priority for improving chemical risk assessment and management.
Background including reliability of data, a key reference, if possible, any other reasons for concern	Humans and ecosystems are typically exposed to mixtures of chemicals, comprising dozens or even hundreds of chemicals (Escher, 2020). Exposures of the general population to individual chemicals are practically non-existent. Nevertheless, regulatory chemical risk assessment is still focussed on assessing chemical risks one compound at a time (Rudén, 2019). This is particularly problematic as the vast majority of empirical mixture studies shows that the risk of a mixture exceeds the risk of each

	individual mixture component (at the concentrations at which they are present in the mixture) (Rudén 2019). This holds true for environmental organisms, as well as for human populations. What is more, even if all chemicals in a mixture are present in amounts that do not cause measurable effects if considered individually, a mixed exposure can lead to unacceptable risks for humans and/or the environment, depending on their dose (concentration), toxicological potency, and the number of components in the mixture. Hence, complex mixtures can cause harm even when individual substances comply with current safety thresholds. Regulatory thresholds (e.g. PNECs, DNELs) are therefore not always sufficiently protective (Rudén, 2019). **References:** Backhaus T., Scholze M., Brack W., Martin O., Slunge D., Ågerstrand M., Kortenkamp A., Escher B. (2025). Include a mixture allocation factor to improve EU chemical risk management. Science 390, 678–680. https://doi.org/10.1126/science.aeb6374 Escher B.I., Stapleton H.M. and Schymanski E.L. (2020). Tracking complex mixtures of chemicals in our changing environment. Science 367(6476), 388-392. SCHER/SCCS/SCHENIR (2011). Toxicity and Assessment of Chemical Mixtures https://ec.europa.eu/health/scientific_committees/environmental_risks/docs/scher_o_155.pdf Rudén C., Backhaus T., Bergman P., Faust M., Molander L., Slunge D. (2019). Future chemical risk management - Accounting for combination effects and assessing chemicals in groups (Swedish Government Official Reports No. SOU 2019:45). Yan *et al.* (2025). Beyond the Single-Contaminant Paradigm: Advancing Mixture Toxicity and Cumulative Risk Assessment in Environmental Toxicology Environ. Sci. Technol. 59, 22, 10711–10714

Note: 3 highest risk, 1 lowest risk, *unable to score

4.11. Nanoplastics

Topic 11	**Nanoplastics** **(Adverse) effects on environment and humans** **Detection in environmental samples**
Sources (see section 2)	Most human activities can be sources of plastics in the environment. Microplastics undergo a process of fragmentation into micro- and finally nanoplastics. Therefore, many of the activites and products listed below may be source of nanoplastics: 1) Buildings and infrastructure 4) Industrial and related activities 5) Waste processing and utilisation 7) Transport and storage 8) Human behaviour (socioeconomic, lifestyle, perception) 9) Medical developments (technology, pharmaceuticals) 11) Product use/misuse 12) Agriculture and food 13) New materials
Causative factors (see section 2)	The causative factors are all possible uses of plastics, in particular disposable and packaging.
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	 2 Extensive information on macro- and microplastics, very scarce or absent on nanoplastics) * 3 3 Global scale 2 or * Probably omnipresent since micro-plastics are found in whole environment and in human tissues *
Parallels with past emerging issues **Potential interactions with other stressors)**	Micro-plastics Nanomaterials
Preliminary estimation of prioritisation (see section 2)	3 The lack of information on environmental exposure and the effects of nanoplastics on humans and the environment (see next box) makes it impossible to define a priority with certainty. However, it is reasonable to assume that they may pose a significant risk.

Background including reliability of data, a key reference, if possible, any other reasons for concern	Nanoplastic pollution is, clearly related to macro- and microplastic pollution, although the possible consequences may be completely different. Plastics are found in several environmental samples and many human tissues. Micro-plastic maybe visualised but not always characterized. Trying to detect nanoplastics is not even something that is often undertaken, since it requires specialised apparatus and expertise. Without data, microplastics cannot be linked to major health and or environmental effects (Schell *et al.*, 2022), while for nanoplastics almost no reliable data are available. This is due to the difficulties in: Sampling: There are currently no methods for sampling nanoplastics. In general, there are no data on microplastics smaller than 20mm. Oceanographic campaigns use methods that do not sample microplastics below 200-250 mm (GESAMP, 2019). Nano-plastics are often simply not retained during filtering of samples (Azari, 2023). Analysis: To date, there are no reliable methods for measuring nanoplastics (Azari, 2023). Unlike microplastics, which cannot enter cells (some doubt exists for smaller ones), it is very likely that nanoplastics cany enter cells of living organisms. The type of interactions they can have with cellular structures is unknown. In recent years, considerable investment has been devoted to research into microplastics. Although the data on different types of plastics is relative scarce and the focus is mainly on exposure (external and internal), until now the results have not revealed major health effects of microplastics. It would be very important to divert this investment towards the study of nanoplastics, for which there is much less information, and where the risk could be possibly greater (Vighi *et al.* 2021; Vighi & Rosal, 2024). **References:** Azari A., Vanoirbeek J.A.J, Van Belleghem F., Vleeschouwers B., Hoet P., Ghosh M. (2023). Sampling strategies and analytical techniques for assessment of airborne micro and nano plastics. Environ Int Apr:174:107885. https://doi.org/10.1016/j.envint.2023.107885. Cai H *et al.* (2021), Analysis of Environmental nanoplastics: progress and challenges. Chem. Engineer. J. 410, 128208. https://doi.org/10.1016/j.cej.2020.128208 GESAMP (2019) Guidelines for the monitoring and assessment of plastic litter in the ocean. Kershaw PJ, Turra A, Galgani F (eds), Rep. Stud. GESAMP No. 99. Lehner R., Weder C., Petri-Fink A., Rothen-Rutishauser B. (2019). Emergence of Nanoplastic in the Environment and Possible Impact on Human Health**.** *Environ. Sci. Technol.* 53: 1748-1765. https://doi.org/10.1021/acs.est.8b05512 Mattson *et al.* (2024). Microplastic Contamination in Aquatic Environments (Second Edition) An Emerging Matter of Environmental Urgency, Chapter 13 - Nanoplastics in aquatic environments—Sources, sampling techniques, and identification methods, pp 381-397 Permana R., Chakraborty S., Valsami-Jones E. (2025). Nanoplastics in aquatic environments: The hidden impact of aging on fate and toxicity *Environmental Chemistry and Ecotoxicology* 7, 429-444. https://doi.org/10.1016/j.enceco.2025.02.007

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Note: 3 highest risk, 1 lowest risk, *unable to score

4.12. Wastewater based epidemiology/surveillance (WBE/WBS) – One Health

Topic 12	**Wastewater based epidemiology/surveillance (WBE/WBS) – One Health**
Sources (see section 2)	3) Disease outbreaks, early warning monitoring, tracking system of emerging pathogens (with possible application to AMR agents), public health response in emergency situations evolution e.g. due to pathogen changes 4) Industrial and related activities 5) Wastewater processing and biomarkers utilization 8) Human behaviour (socioeconomic, lifestyle, perception) 9) Medical developments (technology, pharmaceuticals) 10) Infectious agents change due to environmental / zoonotic changes (including climate changes) 11) Product use/misuse (biological threats/weapons e.g. B. anthrax)
Causative factors (see section 2)	a) Technical advances raising concerns about waste treatment safety c) Changes resulting from alterations in price, supply of materials and commodities d) Changes due to alterations in legislation or public welfare measures e) Other socio-cultural or demographic elements g) Large-scale illegal activities h) Public/political concern
Exposure / Hazard **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions** **provide a score (as 1,2,3 or *) for these criteria** (see section 2)	 2 3 3 3 (global) 3 2
Parallels with past emerging issues **Potential interactions with other stressors**	Parallel with the estimation of illicit drug use. See below
Preliminary estimation of prioritisation (see section 2)	3 High priority should be given to wastewater surveillance as an early warning tool for potential pandemics and other health threatening phenomena.
Background including reliability of data, a key reference, if possible, any other reasons for concern.	Wastewater epidemiology/surveillance (WBE/WBS) is an additional tool for assessing epidemiological situations, as some pathogens or related protein residues are excreted in sufficient quantities by infected individuals through stool, urine, saliva, and other bodily fluids, to make them detectable in wastewater. This allows for a testing strategy-independent monitoring of pathogen circulation, capturing individuals

	who might not undergo diagnostic testing due to mild symptoms. Wastewater testing can therefore provide trends in pathogen loads and circulating variants for specific geographic regions and populations. Nevertheless, results should always be evaluated alongside other data sources. Both communicable diseases and unforeseen/unwanted human exposure to emerging pathogens/agents/chemicals (e.g. exposure of nearby residents to agricultural pesticides) constitute a threat for public health. Early warning systems are required to detect these threats at population levels. WBE/WBS may provide such early warning tools. Sewer systems also provide extra security in the face of increasing illegal dumps of production waste from illegal manufacturing of e.g. drugs of abuse that may cause malfunctioning of the treatment plants (Emke *et al.*, 2018). Analogously, pathogens present in wastewater influents may escape treatment in absence of tertiary treatment and, e.g., during stormwater overflows. Subsequently, the effluents may reach receiving surface waters and cause harm to the aquatic ecosystem. When such surface waters are used as drinking water sources they may, in case of pathogen contamination, represent a threat to human health because they may exceed threshold levels (Xiao *et al.*, 2024), requiring response in terms of risk mitigation measures. Microorganisms can also be transmitted to the ambient air in wastewater droplets, which are generated during aeration or mechanical moving of the sewage (Korzeniewska, 2011). WBS/WBE coupled with Integrated Genomic Surveillance (IGS) represent an effective public health strategy for monitoring infectious pathogens, infectious diseases and transmission events. IGS involves the results of modern DNA sequencing methods and genome sequence analysis methods for pathogen isolates from patient samples which are merged with epidemiological information, enabling the identification of transmission chains and the trend of a disease outbreak. WBE/WBS has been used since the first decade of the millennium to provide objective and spatio-temporal estimates of total illicit drug use (González-Mariño *et al.,* 2020) in populations. The WBS approach can be considered as a large anonymous test which consists of diluted urine from an entire population. The European Union Drug Agency (EUDA) in Lisbon has adopted the WBS approach as a means to obtain data on illicit drug use in the EU (EUDA, 2025). WBS has also been used as a tool for public health assessment in the context of communicable diseases (pathogens) such as COVID and M-pox (Medema *et al.* 2020; Sims and Kasprzyk-Hordern, 2020; Tiwari *et al.,* 2023). WBS can be used to estimate human exposure to and use/consumption of other chemicals, including illegal use of prescription drugs (Venhuis *et al.,* 2014), doping (Causanilles *et al.,* 2018) - see section 4.8 - and exposure to pesticides (Carneiro *et al.,* 2024), as well as for forensic purposes (Emke *et al.*, 2018). WBE/WBS provides a new early warning tool for identifying possible threats to public health and societal well-being. **References:** https://www.rki.de/EN/Topics/Research-and-data/Surveillance-panel/surveillance-panel-node.html https://whova.com/web/AQfkz6SlRjKf9pNhueQHclWRG77PeZBS%40aTYGp60yzg%3D/ Carneiro R.B. *et al.* (2024). A critical review of wastewater-based epidemiology as a tool to evaluate the unintentional human exposure to potentially harmful chemicals. Anal. Bioanal. Chem. 1–17, doi: 10.1007/s00216-024-05596-z Causanilles A. *et al.* (2018). Wastewater-based tracing of doping use by the general population and amateur athletes. Anal. Bioanal. Chem. 410, 1793-1803. Doi: 10.1007/s00216-017-0835-3

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Note: 3 highest risk, 1 lowest risk, *unable to score

5. RE-EVALUATION OF PREVIOUS EMERGING RISKS (SCHEER, 2018 and 2022)

The SCHEER has reviewed the previous list of emerging risks from 2018 and 2022 and has updated them as appropriate by detailing:

- a short description of the issue is provided.
- **if no longer an emerging issue**, a sentence explaining why is provided.
- **if it remains an emerging issue**, updates are provided (e.g. on sources, priorities, exposure or hazard).
- whether the issue has been taken up by any other agency or national body is identified.

The SCHEER did not review the SCENIHR 2014 list (see Annex 1).

The full reference list of the revisited issues can be found in the original documents.

5.1. SCHEER issues revisited

5.1.1. E-cigarettes and chronic diseases (2018)

Short description

E-cigarettes, in their modern form, were introduced in the early 2000s as a tool for smoking cessation. The liquid used in e-cigarettes typically contains nicotine, propylene glycol, glycerine, flavourings, and other chemicals. Since then, accumulating research confirms that e-cigarette aerosols contain several potentially harmful substances, including flavouring agents linked to respiratory toxicity, heavy metals such as lead and nickel, and known or suspected carcinogens. While e-cigarettes may be less harmful than traditional combustible cigarettes in terms of exposure to certain toxicants, their use is not without risk—particularly when compared to no tobacco or nicotine use at all. There remains limited and mixed evidence on their effectiveness as smoking cessation aids, and dual use (both smoking and vaping) is common. Notably, the uptake of e-cigarettes among adolescents and young adults continues to rise globally, often among individuals who were previously nicotine naïve. This trend raises serious concerns about nicotine addiction, respiratory health, and long-term consequences that are still not fully understood. In light of these developments, e-cigarette use is increasingly recognised as an emerging public health risk that warrants ongoing monitoring, regulation, and preventive action, especially to protect younger populations.

Is this still an emerging issue, and if not, why not?

This is no longer considered an emerging issue.

In 2021, SCHEER published an Opinion suggesting strong evidence for risks of long-term systemic effects on the cardiovascular system, moderate for risks of local irritative damage to the respiratory tract and weak to moderate evidence of carcinogenic risk due to nitrosamines (SCHEER Opinion on electronic cigarettes, 2021). Currently it is more or less generally accepted that e-cigarette use is not harmless, and there is an emerging number of literature/studies following up the potential risks of e-cigarette use; a number of reviews and umbrella reviews conclude that e-cigarettes cause addiction, poisoning, inhalation toxicity, burns, and lung injury (Banks *et al.*, 2023; Izquierdo-Condoy *et al.*, 2024)
This does not imply that this issue has been resolved; rather, it indicates that the health effects of e-cigarettes have emerged as a salient issue on the scientific and public health agenda. Moreover, the issue has already been taken up by WHO, or national bodies, e.g. the recent update by the Superior Health Council of Belgium (WHO/WPR, 2024).

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5.1.2. Micro and nano-plastic in the environment and the emerging risk of the conversion of micro to nano plastics in the environment (2018 and 2022)

Short description

The issue of micro and nano-plastics was already described in 2018 (Micro and nano-plastic in the environment) and in 2022 (The emerging risk of the conversion of micro to nano plastics in the environment).
The production, use and disposal of plastic materials is ubiquitous. Plastic polymers are generally inert in nature and are unlikely to be absorbed in the body due to large molecular sizes. They are nevertheless highly persistent in the environment where they may end up via a variety of disposal/emission routes. Gradual degradation of plastic materials over time is known to result in microplastics. These are, in theory, likely to further degrade to nano-plastics.
Microplastics may to pose a risk to the environment especially to aquatic species. Although research in this area is relatively new, a decrease in particle size (from micro to nano) can be envisaged to increase the risks (Lehner, 2019).

Is this still an emerging issue, and if not, why not?

Microplastics are no longer considered as an emerging risk, but nanoplastics are.
In the last few decades, the presence of microplastics (MPs) in all environmental compartments (including food) and the risk this poses for human health and the environment have been extensively studied (Li *et al.*, 2023; Vighi *et al.*, 2021; Ashrafy *et al.*, 2023; Thompson *et al.*, 2024). To date, a huge amount of information has been produced that allows us to quantify current exposure with reasonable accuracy and make reliable predictions about its future projection (Everaert *et al.*, 2018). The effects have also been studied in depth, although the potential danger to humans and the environment is still speculative (Thompson *et al.*, 2024). There are therefore sufficient grounds for arguing that MPs can no longer be considered an emerging risk.

The issue of nanoplastics (NPs) is entirely different, and this remains as an emerging issue as described in section 4.
It should be noted that the conventional division between MPs (>1mm) and NPs (<1mm) is not adequate to address the issue because it is arbitrary and has no precise functional meaning. It would be more appropriate to refer to particles that can cross cell membranes (NPs) and particles that cannot (MPs).
There is probably no precise dimensional threshold for defining these differences. Presumably, it depends on the type of cell, the shape of the particles and other factors of a physical-chemical and metabolic nature. Hereinafter, the term NPs will be used to define all plastic particles capable of crossing cell membranes. These are small or very small particles that are extremely difficult to sample and analyse.

Although some progress has been made in recent years (Cai *et al.*, 2021; Azari *et al.*, 2023; Permana *et al.*, 2025), there are still no reliable methods for sampling NPs in different environmental compartments or for their precise quantification. Some methods have been developed based on pyrolysis and mass spectrometry (see, for example, Shi *et al.*, 2024). It is unclear whether these methods are sufficiently sensitive to assess NP concentrations in natural environmental matrices (e.g. in seawater). At present, we have no information at all on environmental concentrations of NPs in any of the environmental compartments (water, air, soil, biota), although it is reasonable to assume that they would be present in high quantities (Mattson *et al.*, 2025).
Even less is known about the possible harmful effects of NPs on human health and the environment, although it can be assumed that, once they enter cells, NPs may react with cellular components (Joksimovich *et al.*, 2022; Lai *et al.*, 2022).
The impossibility of making a reliable assessment of the risk to humans and the environment for a potentially dangerous contaminant allows it to be defined as an emerging risk.

Has the issue been taken up by any other agency or national body?

Several reports have been published by international organisations and agencies on the issue of MPs (see, for example, GESAMP, 2020; SAM, 2019). Much less has been done on NPs, particularly focusing on human and environmental risk assessment.
NPs was a topic at the 2019 Global Summit on Regulatory Sciences in Stresa, Italy, which was co-organised by the Global Coalition for Regulatory Science Research (GCRSR) and the European Commission's Joint Research Centre (JRC) (Allan 2020, Allan 2021). Moreover, a report has been recently published by the Swedish Environmental Protection Agency (Ekvall *et al.*, 2022),

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5.1.3. Effects of climate change on water pollution (2022)

Short description

Water scarcity, defined as a structural, persistent reduction of water availability, is one of the main problems faced by societies in the 21st century, enhanced by climate change that may produce conditions of water scarcity, particularly in the arid and semi-arid regions of the world,

and is expected to increase in the near future (García-Roger *et al.*, 2011; Robson *et al.*, 2011; Boix *et al.*, 2010; Verdonschot *et al.*, 2010; IPPC, 2014).
A decrease of water quantity is directly related to a decrease of the capacity of freshwater ecosystems to dilute anthropogenic contaminants and can influence the physicochemical and biological characteristics of ecosystems (Barceló and Sabater, 2010; Petrovic *et al.*, 2011).

Is this still considered to be an emerging issue, and if not, why not?

There are several reasons why this issue is no longer considered to be an emerging risk.

The problem of the effects of climate change on water quality has been intensively investigated (see for example Rosinka *et al.*, 2024; van Vliet *et al.*, 2023).
However, climate change is still a growing problem that can produce both conditions of extreme drought and extreme events of exceptional precipitation (floods), which, in both cases, have enormous effects on water quality. In some cases, both extreme events (drought and flooding) can occur in the same area at different times of the year.
There is no sign of improvement in the medium term, and perhaps not even in the long term, and at present, the predictability of these events is rather poor.

It is necessary to improve our understanding of the complex interactions between hydroclimatic, geographical and human factors and to develop strategies for managing water quality in increasingly extreme and hardly predictable hydroclimatic conditions.

Has this issue been taken up by any other agency or national body?

The issue of climate change is periodically described by the Intergovernmental Panel on Climate Change (IPPC), with prospects of increasing average temperatures and reduced annual precipitation leading to prolonged drought periods (see, for example, IPCC 2023). However, there do not appear to be any official reports on the impact on water quality.

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5.1.4. Potential effects on wildlife of increases in electromagnetic radiation

Short description

About every ten years, a new generation of cellular telecommunication networks is introduced. The use of millimetre wave frequencies with the fifth generation (5G) of cellular networks amplifies the controversy with regard to human health and environmental effects of the exposure compared to previous generations of wireless technologies.

Is this still an emerging issue, and if not, why not?

This is still an emerging issue.

The 5G FR1 cellular networks have been deployed in most countries and the exposure pattern of the fauna, in particular within and close to urban areas, has changed. In the meantime, no definite evidence of the presence or absence of effects on wildlife resulting from the exposure to radiofrequency EMF has been established. The introduction of 5G FR2 cellular systems in Europe in the millimetre wave range will further increase scientific uncertainty on these effects. The emerging risk of potential effects to human health and the environment from offshore wind farms has been identified in section 4.

Wildlife (animals, plants) may face exposures (direct or indirect) quite different from humans (different body size, behaviour, habitat, orientation, nesting/roosting near transmitters). Consequently, human-centric exposure guidelines may not guarantee protection of non-human species (Pophof *et al.*, 2023).
Field studies (wild populations, long-term monitoring) are sparse, inconsistent and often confounded by habitat loss, pesticides, climate change and other stressors. This makes it hard to attribute population-level effects to RF exposure alone. Expert reviews therefore note biological plausibility but stop short of concluding widespread ecological harm due to limited heterogeneous field evidence (Froidevaux *et al.*, 2023).

Has this issue been taken up by any other agency or national body?

The issue was only briefly mentioned – since it was out of scope – in the SCHEER 2024 Opinion on 'Potential health effects of exposure to electromagnetic fields (EMF): Update with regard to frequencies between 1Hz and 100 kHz' (SCHEER, 2024). Before that it was treated in more detail in the European Parliament's STOA report 'Environmental impacts of 5G: A literature

review of effects of radio-frequency electromagnetic field exposure of non-human vertebrates, invertebrates and plants.' (STOA, 2021).

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5.1.5. Personal communication and listening devices

Short description

There are mainly two issues associated with personal communication and listening devices, which mostly concern young people since the latter constitute the main users of such devices and start to use them at an ever earlier age. The first one has to do with pedestrian safety. Distraction due to texting, listening to music or using multimedia apps can compromise cognitive and audiovisual awareness and may pose a risk for the safety of pedestrians (e.g. at street crossings). The second issue has to do with near-sightedness (myopia). The increased use of personal digital devices has been mentioned as a risk factor for this trend (especially in the under-40 age group).

Is this still an emerging issue, and if not, why not?

The wrong use of personal communication and listening devices, like smartphones, remains an emerging safety issue.

Smartphone use for communication or entertainment purposes poses a risk not only for car drivers, but also for pedestrians and users of personal mobility devices like e-scooters. Moreover, the screen time spent on smartphones, especially by children, might have not only a physical health impact on vision but also a psychological health effect.

Evidence consistently indicates that visual–manual distraction from smartphone use significantly impairs attention, balance, and situational awareness. Epidemiological and experimental studies show that engaging with a phone while walking or riding increases the likelihood of crashes or near-misses by approximately two to three times (Ren *et al.*, 2021). Observational work further demonstrates that mobile phone tasks such as texting or app navigation reduce gaze scanning and reaction time, particularly in complex traffic environments (Yadav *et al.*, 2022).

Listening devices, including headphones, earbuds, and smartphone audio systems, also pose risks to pedestrian and rider safety. Experimental data among cyclists and e-scooter riders similarly show delayed reaction times and reduced awareness when listening to music or phone calls (Wachnicka and Kulesza, 2020).
Extensive smartphone screen time has substantial long-term health implications. Prolonged exposure is linked to visual impairment (Ha *et al.*, 2025) and psychological effects, including

anxiety and depressive symptoms, are also consistently associated with excessive screen engagement (Yang *et al.*, 2020).

Has this issue has been taken up by any other agency or national body?

The issues have been mentioned in the report of the OECD's International Transport Forum on 'Safer Micromobility' (ITF-OECD, 2024).

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5.1.6. A hydrogen economy – Energy, transport and storage

Short description

Many countries are engaged in defining a hydrogen strategy, regarding this as a significant decarboniser, used for heating and transport. Hydrogen levels in the atmosphere appear to be gradually rising (though it is not clear why), and the concerns being discussed are leakage of additional hydrogen to the atmosphere, which could affect stratospheric ozone depletion through its moistening. The discussion also focuses on how the hydrogen is generated, whether it is using renewable energy or not, transported and stored.

Is this still an emerging issue, and if not, why not?

It is no longer an emerging issue.

Most of the challenges to human health, the environment and safety have been partially resolved except perhaps for the hydrogen impact to the environment/atmosphere.

'With increasing global interest in molecular hydrogen to replace fossil fuels, more attention is being paid to potential leakages of hydrogen into the atmosphere and its environmental consequences. Hydrogen is not directly a greenhouse gas, but its chemical reactions change the abundances of the greenhouse gases methane, ozone, and stratospheric water vapor, as well as aerosols' (Sand *et al.*, 2023). Using a model ensemble of five global atmospheric chemistry models, Sand *et al.* (2023) estimated the 100-year time-horizon Global Warming Potential (GWP100) at 11.6 ± 2.8.

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5.1.7. Chemicals in recycled materials, an issue in a circular economy

Short description

In 2018, the SCHEER stated that "in view of EU-wide strategies toward a circular economy, the issue of hazardous substances in recycled products is getting more and more attention. Risks can arise for the environment, consumers, workers. Over the last decade interest in the circular economy and therefore in recycling has increased considerably. One of the problems of recycling is that the materials may contain substances that pose a risk to man and the environment. So the possible advantages of recycling, such as more energy-efficient and CO2-efficient production, should be weighed against the potential effects of these substances. Examples of hazardous substances incorporated into potentially recyclable material: the flame retardant hexabromocyclododecane (HBCDD) in extruded polystyrene, the plasticiser DEHP, cadmium and lead in polyvinyl chloride (PVC), heavy metals and PAHs in rubber crump from tyres." In 2022 the SCHEER then stated that "In view of EU-wide strategies towards a circular economy within the 'Green Deal', this issue should be broadened […]. Risks can arise for the environment, consumers, workers."

Is this still an emerging issue, and if not, why not?

This remains an emerging issue.

Chemicals in recycled materials are widely recognised as an emerging issue because both the chemical composition of waste streams and the technologies used to recover secondary raw materials are changing rapidly, while knowledge, monitoring, and regulatory control lag behind. Modern consumer products contain thousands of intentionally added substances, non-intentionally added substances (NIAS), and degradation products. When such products enter recycling streams, information on their chemical composition is often incomplete or entirely absent, particularly for legacy substances, confidential additives, and impurities formed during use and ageing. As a result, substances of concern may remain unidentified and be unintentionally reintroduced into new products via recycled materials (Ecomatters, 2019).

Empirical evidence shows that hazardous chemicals can persist through multiple recycling cycles, leading to their accumulation or redistribution in secondary materials (European Environment Agency, 2022). Chemicals of concern in waste streams therefore represent a structural barrier to a non-toxic circular economy (Boxall *et al.*, 2026). This is a particular issue for consumer products used indoors. At the same time, environmental exposures associated with collection, sorting, and recycling facilities, often located near residential areas, remain insufficiently characterised, especially for complex mixtures and transformation products.

Waste electrical and electronic equipment (WEEE) exemplifies these challenges. It is one of the fastest-growing waste streams in the EU (European Commission, 2023). WEEE contains a complex mixture of metals, flame retardants, plastic additives, and legacy persistent organic pollutants. A recent review reported significantly elevated levels of heavy metals and persistent organic pollutants in populations living in e-waste-exposed regions (Parvez *et al.*, 2021). Controlling hazardous chemicals in WEEE is therefore a core objective of circular economy policies, yet effective chemical risk management across global recycling chains remains difficult.

Another emerging issue is the rapid expansion of chemical plastic recycling, including depolymerisation and solvent-based processes. While these technologies are often promoted as

solutions for hard-to-recycle plastics, evidence suggests that they may mobilise or generate contaminants, including monomers, oligomers, catalysts, and degradation products, sometimes increasing overall pollution loads (Shaykevich, 2022; Carney-Almroth, 2025). The toxicological profiles of many of these substances, particularly in complex mixtures, are poorly understood.

Importantly, water itself can be increasingly regarded as a recycled material. Water reuse for industrial processes, irrigation, and even indirect potable applications can concentrate micropollutants such as pharmaceuticals, PFAS, biocides, and industrial chemicals. Advanced treatment reduces but does not eliminate chemical residues, and repeated reuse cycles may lead to novel exposure scenarios and mixture effects that are insufficiently addressed in current risk assessments (EEA, 2022).

The main priorities include:

1. phasing out hazardous chemicals through substitution and safer design. The SSbD principle (Sustainable, Safety by Design; EU, 2022) is an important feature in product development that may act as a driving force for circularity, leading to added value and innovation
2. improving transparency and information about chemicals in products and waste streams (EEB, 2020)
3. updating regulatory frameworks to support safe recycling and reuse

Has this issue been taken up by any other agency or national body?

The issue has been addressed as part of the Circular Economy topic in the EU Foresight System for the Environment (FORENV) VII cycle 2025 and is also tackled by the SCHEER (2025).

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5.1.8. Pharmaceuticals (human and veterinary) and illicit drugs in wastewater and surface waters

Short description

Pharmaceuticals and illicit drugs are, by definition, biologically active compounds. The type of biological effect is highly specific and, in most cases, unwanted for ecosystems.
At the concentrations likely to occur in surface waters, the possibility of effects that may be studied with tools capable to measure traditional endpoints (e.g. acute or chronic toxicity) or more specific effects (e.g. endocrine disrupting effects) is, in most cases, highly improbable (Kidd *et al.*, 2014, 2024). Nevertheless, other types of direct or indirect effects on the functioning of ecosystems, determined by the specific biological activity, are possible and largely unknown.
Pharmaceutical and illicit drug loads in wastewater increase as a result of increased use of legal, illicit and counterfeit drugs, aging of the population and also due to fly tipping of waste from illegal drug manufacturing sites (Emke *et al.* 2018). As a result, wastewater treatment facilities may become jeopardised. This may lead to exposure of aquatic environments (receiving surface waters) because WWTPs do not (completely) remove residuals (Wang *et al.* 2016; Bijlsma *et al.,* 2012).
The occurrence of pharmaceuticals in wastewater and surface waters has been the object of systematic research since the 1990s (Zuccato *et al.*, 2006; Rudd *et al.,* 2014; Ortuzar *et al.,* 2022). However, knowledge on the hazards for aquatic communities is still far from being complete and, in many cases, the possible effects on the aquatic ecosystems are completely unknown.

Is this still an emerging issue, and if not, why not?

Pharmaceuticals are no longer considered as an emerging risk, but illicit drugs are. The SCHEER notes the ongoing issues regarding complex mixtures (Kidd *et al.,* 2024) (see section 4).

The issue of pharmaceuticals in the environment (including illicit drugs) is one of the many issues that have been correctly identified as emerging in the past, and the issue is given a lot of scientific and regulatory attention. Pharmaceuticals in the environment are now widely recognised as chemicals of environmental relevance, subject to routine monitoring, ecotoxicological testing, risk assessment and risk mitigation efforts, but knowledge on the hazards to aquatic communities is still far from being complete and, in many cases, the possible effects on the aquatic ecosystems are still unknown.

It should be noted that illicit drugs abound in wastewaters (Gonzalez-Marino *et al.,* 2020) and several of these drugs (e.g., MDMA, methadone, morphine) are incompletely eliminated during wastewater treatment (Bijlsma *et al.*, 2012; Restrepo-Vieira *et al.*, 2024). As a result, they end up in receiving surface waters where they may pose a risk for aquatic organisms (Verma *et al.*, 2025).

The multiplicity of both legal and illicit drugs present in wastewater raises the issue of exposure (of ecosystems and possibly humans through drinking water) to complex mixtures of chemicals. In 2011, the non-food Scientific Committees of the EC proposed to develop a decision tree for evaluating the risk of chemical mixtures (SCHER, 2011). The matter of mixture toxicity will be addressed in an upcoming Opinion by the SCHEER that will be published in 2026.

Has this issue been taken up by any other agency or national body?

The EMA recently published a revision of the guideline on the environmental risk assessment (ERA) of pharmaceuticals (EMA, 2024). The ERA according to this guideline is based on PBT (persistent, bioaccumulative, and toxic) PBT properties (Zinken *et al.,* 2024), but the issues of mixture toxicity and evaluation of PMT (persistent, mobile, and toxic) properties (see 4.9) are not included.
The Urban Wastewater Treatment Directive (Directive (EU) 2024/3019), which entered into force on the 1st of January 2025, has a particular focus on wastewater pollution with pharmaceuticals, which is why this is being put forward as part of the extended producer responsibility embedded in the Directive.
Several pharmaceuticals are now also part of the list of priority substances under the Water Framework Directive.

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5.1.9. PFAS

Short description

PFAS have been defined by the OECD as fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom. Very few PFAS have been regulated. An Opinion on PFOS and PFOA and their tolerable daily intakes from food was finalised in March 2008 by the EFSA Contam panel (Johansson *et al.* 2008). In 2020, the EFSA set a new, much stricter, threshold for PFAS in food on the basis of new toxicological and epidemiological information (EFSA, 2020). Following a request from the EC, EFSA (2024), together with ECHA, are currently reviewing the health-based reference value of trifluoroacetic acid (TFA).
Three types of PFAS (PFOS, PFOA, PFHxS and their related compounds) have been included in the Stockholm POPs convention (Stockholm Convention, 2023).
For several members of the PFAS group, PBT properties have been demonstrated. Others, in particular those with short fluorinated-carbon chains (C1-C5) and polar head groups appear to be persistent and mobile (PM) and cross natural or technological barriers, thus posing risks to public health because of human exposure. Replacements by industry for the major part appear to rely on fluorine chemistry (e.g. GenX), which inherently leads to similarities in persistence. Many more emerging PFAS have been recently found to occur in surface waters (see e.g. Gebbink *et al.*, 2017, Ulrich *et al.* 2024).

Is this still an emerging issue, and if not, why not?

PFAS remains as an emerging issue.

Although PFAS have become focal points in scientific research, government actions and international regulations since the beginning of this millennium, a shift in focus is needed. Short chain PFAS and Trifluoroacetic acid (TFA) in particular pose an emerging risk that requires vigilance as well as immediate hazard assessment because of their ubiquitous presence in the

environment. As a consequence, and because of their highly persistent character and mobility, they can pose a threat for humans and ecosystems. It has become one of Europe's most widespread yet overlooked pollutants. TFA is an ultra-short PFAS, and its concentrations are orders of magnitude higher than those of other PFAS (Arp *et al.*, 2024). This accumulation is due to many PFAS having TFA as a transformation product, including several fluorinated gases, pesticides (Joerss *et al.*, 2024), pharmaceuticals, and industrial chemicals, in addition to the direct release of industrially produced TFA. TFA meets the criteria of a planetary boundary threat for novel entities because of increasing planetary-scale exposure (Arp *et al.*, 2024).
Finally, it should be remembered that PFAS are a very broad category of substances, comprising over 4,000 compounds. The possibility that some of these may enter production for various applications is high.

Has this issue been taken up by any other agency or national body?

In 2025 the SCHEER concluded that TFA can be classified as a PFAS according to the OECD definition. The SCHEER noted the large overlap in known health effects of TFA (liver metabolism and liver weight) that results in a cumulative effect with the other PFAS (SCHEER, 2025). A recent agreement was reached between the European Council (2025) presidency and the European Parliament's representatives on a proposed directive to review and update the lists of pollutants affecting surface waters and groundwater and corresponding regulatory standards. The agreement adds new substances to the priority lists. TFA, a breakdown product of various PFAS, will be added to the initially proposed sum of 24 PFAS for surface water.
The issue is part of the new development of Environmental Quality Standards (EQS) by the EC, and the discussion on the definition of PFAS (OECD, 2021)

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5.1.10. Drinking water interactions

Short description

New and modified drinking water treatments (such as advanced oxidation processes) are being used to deal with removal of chemical (natural and anthropogenic) contaminants in the source waters. It is anticipated that there may be further interactions between such contaminants, natural organic matter and the treatments, leading to new (or increased) concentrations of transformation products or (disinfection) by-products (DBP) with potential for human health concerns.

Is this still an emerging issue, and if not, why not?

This remains an emerging issue.

New (D)BP will continue to be formed because of novel (newly synthesised) compounds (in particular persistent and mobile ones) popping up in source waters. Proper risk assessment will be difficult as long as the identity of the (D)BP is not known and/or tested/evaluated.
Environmental monitoring programmes carried out over the last two decades have demonstrated that persistent mobile (PM) compounds have become more ubiquitous, in particular in aquatic environments (see section 4.9). For example, Arp & Hale (2022) concluded that among the REACH registered substances detected in drinking water sources, 24–30% were Persistent, Mobile, Toxic / very Persistent, very Mobile (PMT/vPvM) substances. Advanced oxidation processes may be able to transform some of these substances (Thor *et al.,* 2025), but little is known about the transformation products formed. Perhaps even more important, (D)BP formed can be PMT or vPvM compounds themselves (Zahn *et al.*, 2019; Vughs *et al.*, 2019). Currently there are knowledge gaps, e.g., on the formation of BP in non-aqueous systems and BP formation by non-halogen-based biocidal active substances (Li and Mitch, 2018).
Since the detection of Trifluoroacetic acid (TFA) (see section 5.1.9) in the drinking water of the Neckar region in 2016, the German authorities have been working intensively and across disciplines on this substance. TFA is identified as a degradation product of various pesticides and it is also known that certain fluorinated greenhouse gases, like the refrigerant R1234yf, may partially and completely degrade into TFA in the atmosphere. It is also noted that the natural filter and buffer function of the soil to remove pollutants from leachate does not work with chemicals such as TFA and that they can enter the groundwater almost unhindered. Additionally, TFA cannot be removed from water by filters (activated carbon) or ozonation, it can only be removed by reverse osmosis. However, this technology leads to higher energy costs and raises the issue of how to dispose of the resulting concentrates.
Therefore, it is presumed that the number and quantities of chemicals that degrade into TFA are constantly increasing. Emissions to the environment need be reduced urgently, so to protect the environment and drinking water resources and ultimately, human health.

Has this been taken up by any other agency or national body?

The issue of PMT and vPvM chemicals is a focal point of the German Federal Environment Agency since 2017 (UBA, 2025). In 2023, the German Authorities have submitted to ECHA a CLH hazard classification dossier proposing TFA as reprotoxic, very persistent and very mobile (BFR, 2023).

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5.1.11. New RNA pesticides and gene editing to reduce/eradicate pest populations

Short description

Laboratory tests have shown that topical application of RNA could be a new way of controlling plant pests, including viruses and insects, by silencing genes that affect survival and reproduction. It is thought this method could be more publicly acceptable than other forms of genetic modification because its effects will not be passed on to offspring. However, the impact of widespread use of the method as a pesticide on non-target species is not yet known.
New gene editing technologies could also be used to control animal populations, including invasive species, within the coming decade. For instance, applications of CRISPR-enabled gene drive technology are foreseen for several applications, such as the elimination or suppression of insect vectors and transmitting (plant) diseases. At a cost of more than £3 million a year, New Zealand aims to rid itself of rats, possums and stoats by 2050. These methods raise both ethical and ecological questions, from repercussions on wider ecosystems to the potential for gene traits to spread and wipe-out species in unintended areas.

Is this still an emerging issue, and if not, why not?

This issue is highly relevant and still emerging.

RNA-based pesticides (RNAi pesticides) and novel gene-editing technologies, often based on CRISPR/CAS and/or gene-drive technologies are intensively discussed in scientific literature a(e.g. Legros, 2021; Duanmu, 2025), but are not (yet) widely applied. While there are flagship reports such as the OECD Report on "Considerations for the Environmental Risk Assessment of the Application of Sprayed or Externally Applied ds-RNA-Based Pesticides" (OECD, 2020), central legal frameworks such as Regulation (EC) 1107/2009 are not yet updated for the evaluation of RNA-based pesticides, although it is widely recognised that this would be essential in order to provide a solid foundation for the regulatory assessment of RNA-based pesticides. On the other hand, the market for RNAi-pesticides was already valued at 10 million USD in 2023, with an expected growth to 50 million USD until 2034 (GlobeNewsWire, 2025).

The regulatory updates and scientific focus for RNA-based pesticides in the EU focus on two main areas: revising exposure assessment and refining hazard identification for non-target organisms. Since the current framework for Plant Protection Products is based on chemical or microbial agents, the primary update work, led by EFSA and national agencies like RIVM, is establishing a fit-for-purpose methodology for this new technology (RIVM 2023; EFSA 2025).
The key updates focus heavily on exposure due to the formulation of the product. Unformulated dsRNA degrades rapidly, leading to low exposure; however, the new formulations designed to improve field stability (e.g., nanoparticle delivery systems) may increase persistence, bioavailability, and thus, environmental exposure. Therefore, regulatory priority is on assessing the entire formulated product, not just the active dsRNA molecule. Hazard updates are focused on non-target species, particularly non-target arthropods (NTOs). The updates acknowledge that the specificity of RNAi requires new testing protocols, moving beyond standard ecotoxicity tests to consider factors like sequence similarity between the applied dsRNA and the NTO's genome, and different exposure routes (e.g., ingestion by predators of treated pests), which are unique to the RNAi mechanism.

Has this been taken up by any other agency or national body?

EFSA discussed the issue of RNA-based pesticides, which seem to be now included under the broad term "biopesticides", with members of businesses and the EU parliament in 2025 (EFSA, 2025).
Field trials with RNA-based pesticides seem to be ongoing in member states (EU Parliament 2023).
RIVM has been discussing a suitable risk assessment framework for RNAi pesticides in a report from 2023 (RIVM, 2023).

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5.1.12. Nanotechnology organics

Short description

There is increased use of organic substances in complex particulate formulations, including medical and agricultural applications which specifically make use of nanotechnology. This includes the combination of organic and inorganic substances especially in medical developments, which is spurring growth in the development of new materials.
There is therefore a risk of incorrectly applied risk assessment and invalid assumptions: such as "it is organic/biological so it must be safe", or "it is a nanomaterial so we know it cannot be absorbed".

Is this still an emerging issue, and if not, why not?

This is no longer an emerging issue for medical use but still emerging for general use and agricultural (large-scale) use.

The safety of nanomaterials is a broadly recognised concern. In the specific case of 'organic' or 'biological' nanomaterials, developments focus on medical applications (REF https://doi.org/10.1021/acsnano.2c00128, ACS Nano 2022, 16, 9994−1004), for which the materials need to undergo stringent evaluations. The most common non-inorganic nanomaterials are lipid- and polymeric-based nanomaterials, both frequently used as a carrier to deliver active substances.
For non-medical applications, the potential use is infinite and may be used on a large scale in e.g. agriculture. For these applications, the human and environmental exposures (and risks) are less clear (e.g. review paper https://doi.org/10.1016/j.ijbiomac.2025.148605).

Has this issue been taken up by any other agency or national body?

The safety of nanomaterials in general is recognised by agencies and international bodies. In 2017, OECD launched the "Malte Initiative", specifically focussing on test guidelines for nanomaterials; in June 2025, EFSA organised a 1.5-day workshop on risk assessment of nanomaterials and materials containing small/nanoparticles in the food and feed chain (https://www.efsa.europa.eu/en/events/workshop-risk-assessment-nanomaterials-and-materials-containing-smallnanoparticles-food-and).

Both examples show that the safety of all types of nanomaterials is taken seriously and that the specific needs in view of safety are recognised.

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5.1.13. Health effects of human-robot interaction

Short Description

A robot is an automatically controlled, reprogrammable, multipurpose manipulator which can be either fixed in place or mobile for use in industrial automation applications, or increasingly in home applications. Health impacts in the home have tended to focus on risks (e.g. collision) that might physically impact safety. In industrial settings, robots are widely used for inspection in confined spaces which are also sometimes dangerous spaces; to carry out these inspections, operators use multiple interaction interfaces and the operation may involve high cognitive loads when manipulating the robotic agent to prevent hazards.

Is this still an emerging issue, and if not, why not?

The human-robot interaction is no longer considered an emerging risk. Since the 2022 SCHEER emerging risks statement, robots have become much more commonplace and widespread in their use (de Pagter, 2024; Lee *et al.*, 2025).

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5.1.14. Virtual Reality

Short description

Virtual reality (VR) and augmented reality (AR) are gaining momentum as promising new technologies. They can potentially expand the field of human knowledge by changing how people learn, work, play and entertain themselves. High-tech VR and AR headsets are popping up everywhere – from the expensive ones from Samsung, Google and Facebook, to the generic cardboard headsets for the lower-end market.

Is this still an emerging issue, and if not, why not?

This is currently not considered an emerging risk. VR and AR are immersive technologies that have now been firmly integrated into numerous industries, as well as in the fields of education and health care (Rana *et al.* 2025; Metha *et al.* 2023; Arham *et al.* 2024). As these technologies

have become more prevalent in our personal and professional lives, they bring with them security and privacy challenges that are hard to overlook.
VR creates an entirely immersive digital environment that encompasses the user's real-world surroundings. VR headsets are common products that present a computer-generated interface that replaces their physical environment. AR is slightly different; it involves overlaying digital information (visual, auditory, or sensory) onto the real world, enhancing what users see, hear, and feel. Smartphone apps or glasses are examples of AR products that augment a user's environment without directly replacing it (Mooij & Tushuizen 2024; Bernardo, 2022).

Studies have recognised that physical health, psychological and cognitive risks/hazard may result from wrong or extended use such as: Cybersickness (Motion Sickness); Eye Strain and Visual Issues; Musculoskeletal Strain; Physical Injury; Seizures; Hearing Damage; Contagious Conditions; Reality Blurring and Dissociation; Anxiety and Emotional Distress; Cognitive Overload.
These risks are taken into account in development of new/updated tools and in occupational and private use good practices guidelines as well as legal frameworks are developed to allow correct implementation of the technologies. (Williams, 2023; Anses, 2022; Lundin *et al.,* 2023)

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5.1.15. Environmental Factors and the Human Microbiome

Short description

Microbiome refers to "the entire habitat, including the microorganisms (bacteria, archaea, lower and higher eukaryotes and viruses), their genome (i.e., genes), and surrounding environmental conditions" (Marchesi and Ravel, 2015). A key aspect of the human microbiome is the variation in its composition and function observed among populations, over the human life span, and between body sites such as the gut, skin, or respiratory microbiome. Research is showing that the human microbiome has a modulating role between environmental factors and health status (Fallani, 2011; Gibson *et al.*, 2016; Yassour *et al.,* 2016; Chu *et al.*, 2017). On the other hand, microbial changes in the human microbiome are being linked to an array of neurological, gastrointestinal, metabolic, oncologic, hepatic, respiratory and auto immune disorders (Lynch and Pedersen, 2016). In this sense, it seems sensible to have a better understanding of the relation between human exposure to environmental stressors, changes occurring in the human microbiome and the onset of certain health conditions. Additionally, there is sufficient scientific knowledge on toxicity and risk assessment of a great number of environmental chemicals: papers and publications on this topic were generated during the last decades under several regulatory frameworks (WHO, IPCS, EPA, EFSA, ECHA), which can contribute substantially to gaining a better understanding of the underlying critical factors.

Is this issue still an emerging issue? If not, why not?

This is currently not considered an emerging risk but remains an issue of concern due to critical knowledge gaps (validated biomarkers, gut microbiome endpoints that can be used for risk assessment).

Recent studies and review have associated human health (both physically and mentally) with the gut microbiome, and the microbiome has been found responsive towards environmental stressors (Vázquez-Castellanos *et al.*, 2025; Gyawali *et al.*, 2022) In addition, studies suggests correlation between the changes in children's gut microbiota composition and children's growth factors, showing that "beneficial gut microbes" can potentially be exploited to resolve undernutrition syndromes in children (Dong & Gupta 2019).
Moreover, the gut microbiome has been indicated as a target in disease treatment and prevention (Tito *et al.*, 2024; Ahn *et al.*, 2021).
Based on these observations, it is expected that the microbiome may be used as a biomarker for environment exposures and/or health status (Procházková *et al.*, 2024; Florence *et al.*, 2024). Altogether, the microbiome has now been recognised as an important player in health and prevention, and is already known/recognised by the broader public as "gut health", but is often strongly oversimplified (Marcon *et al.*, 2021)

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5.1.16. Emerging infectious diseases in view of environmental degradation

Short description

It is widely recognised that there is a strong link between human and ecosystem/ environmental 'health' and increasingly the focus is on one planet, one health. As our environment and its functions degrade, it is likely that there will be a growth in new infectious diseases and a wider

spread of existing diseases as climatic conditions change. Climate change, population growth, urbanisation and overall ecosystem loss and degradation are the primary causative factors. There is also considerable interest in how a degraded environment may then contribute to the transmission of diseases across species barriers.

Is this issue still an emerging issue, and if not, why not?

The SCHEER considers this is no longer an emerging issue, though it remains a critical issue. The One planet One health agenda has been adopted by many organisations. The Food and Agriculture Organization of the United Nations (FAO), together with the United Nations Environment Programme (UNEP), the World Health Organization (WHO) and the World Organisation for Animal Health (WOAH), promotes a One Health approach to prevent, detect and control the spread of pathogens and diseases among animals, humans and the environment. (WHO, 2025; EESC, 2025).

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6. CONCLUSIONS

The SCHEER identified 12 emerging issues to bring to the attention of the Commission services and revised some previously identified issues. For the twelve new issues, the overall (consensus) prioritisation scores (*, 1, 2, 3 where *= uncertain and 3 is high) are as follows:

Issue		Priority score
4.1	Chemicals in 4D injectable gels	1
4.2	AI and environmental regulation	3
4.3	Use of bacteria and/or fungi to reduce unpleasant smells	2
4.4	Infrastructure for high performance computing	1
4.5	3D printing of dental orthodontics (DIY orthodontics)	1
4.6	Effects of EMF from offshore windfarms on marine fauna	2
4.7	Food insecurity (Fraudulent food; food waste management, changing food supply chain patterns)	2
4.8	Increasing exposure to chemicals that are neither registered nor authorized in the European market	3
4.9	Increasing presence of persistent mobile toxic (PMT) compounds in the drinking water supply	3
4.10	Mixtures of chemicals	3
4.11	Nanoplastics	3
4.12	Wastewater based epidemiology/surveillance (WBE/WBS) – One Health	3

The SCHEER has scored issues 4.2 and 4.8-4.12 as high priority, with issues 4.4 and 4.5 as low priority. The high priority issues include technology-based issues (AI and regulation) and complex chemicals and pollutants and their behaviours. The final high priority issue is based on further developing and applying the One Health approach.

With regard to the previous issues, 7 of the previously identified issues remain classified as emerging, many of which are related to the new high priority issues such as climate change effects on drinking water quality, nano plastics.

Issue		Still emerging
5.1	E-cigarettes and chronic diseases (2018)	N
5.2	Micro and nano-plastic in the environment and the emerging risk of the conversion of micro to nano plastics in the environment (2018 and 2022)	Y
5.3	Effects of climate change on water pollution (2022)	Y
5.4	Potential effects on wildlife of increases in electromagnetic radiation	Y
5.5	Personal communication and listening devices	N
5.6	A hydrogen economy – Energy, transport and storage	N
5.7	Chemicals in recycled materials, an issue in a circular economy	Y
5.8	Pharmaceuticals (human and veterinary) and illicit drugs in wastewater and surface waters	Y
5.9	PFAS	Y
5.10	Drinking water interactions	Y

5.11	New RNA pesticides and gene editing to reduce/eradicate pest populations	Y
5.12	Nanotechnology organics	N
5.13	Health effects of human-robot interaction	N
5.14	Virtual Reality	N
5.15	Environmental Factors and the Human Microbiome	N
5.16	Emerging infectious diseases and environmental degradation	uncertain

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Annex I:
Content of earlier statements on emerging issues of the SCENIHR and the SCHEER

SCENIHR (2014)

1. 3-D video
2. 3-D printers
3. Cyanotoxins risk (haemodialysis and drinking water)
4. The use of nanomaterials for medical imaging and drug delivery
5. Electromagnetic fields, EC Recommendation 1999/519/EC
6. Direct Current Ultra High Voltage Power lines (UHVDC-PL)
7. High-focused Ultrasound for cosmetic use
8. E-cigarette as consumer product
9. Health effects from different composition of exhaust resulting from biobased fuels
10. Graphene nanomaterials
11. Faecal Transplantation

SCHEER (2018)

1. Personal communication and listening devices
2. Virtual reality
3. E-cigarette and chronic diseases
4. Potential effects on wildlife of increases in electromagnetic radiation
5. Chemicals in recycled materials, an issue in a circular economy
6. Pharmaceuticals (human and veterinary) and illicit drugs in wastewater and surface waters
7. Substance Mobility: a new criterion in chemicals regulation
8. Drinking water treatment interactions with compounds and potential health effects
9. Per-and polyfluorinated organic substances
10. New RNA pesticides and gene editing to reduce/eradicate pest populations
11. Do-it-Yourself Synthetic Biology, biohacking
12. Micro and nano-plastic in the environment
13. Nanoparticles released from Building Materials and construction waste to the Environment
14. Environmental factors and the Human Microbiome

SCHEER (2022)

1. Health effects of human-robot interaction
2. Effects of climate change on water pollution
3. Nanotechnology organics
4. The emerging risk of the conversion of micro to nano plastics in the environment
5. Chemical risks in a circular economy
6. Emerging infectious diseases in view of environmental degradation
7. A hydrogen economy, energy and transport and storage
8. Wastewater-based epidemiology, need for rapid population epidemiology (covid, illicit drugs, AMR)- for public health interventions
9. Early detection of risks - Early warning systems