Scientific Committee on Health, Environmental and Emerging Risks

SCHEER

Statement II on emerging health and environmental issues (2022)

The SCHEER adopted this document by written procedure on 13 January 2022

ABSTRACT

The purpose of this 2nd 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

Opinion to be cited as:

SCHEER (Scientific Committee on Health, Environmental and Emerging Risks). SCHEER Statement II on Emerging Issues (2022), 13 January 2022.

ACKNOWLEDGMENTS

Members of the Working Group are acknowledged for their valuable contribution to this Opinion. The members of the Working Group are:

The SCHEER members:

Roberto Bertollini
Teresa Borges
Wim de Jong
Pim de Voogt
Raquel Duarte-Davidson
Peter Hoet
Rodica Mariana Ion
Renate Krätke
Demosthenes Panagiotakos
Ana Proykova
Theodoros Samaras
Marian Scott (Rapporteur)
Emanuela Testai
Theo Vermeire (Chair)
Marco Vighi
Sergey Zacharov

All Declarations of Working Group members are available at the following webpage:
Register of Commission expert groups and other similar entities (europa.eu)

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 arethe 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.

SCHEER members

Roberto Bertollini, Teresa Borges, Wim de Jong, Pim de Voogt, Raquel Duarte-Davidson, Peter Hoet, Rodica Mariana Ion, Renate Kraetke, Demosthenes Panagiotakos, Ana Proykova, Theo Samaras, Marian Scott, Emanuela Testai, Theo Vermeire, Marco Vighi, Sergey Zacharov

Contact

European Commission
DG Health and Food Safety
Directorate C: Public Health
Unit C2 – Health information and integration in all policies
L-2920 Luxembourg
SANTE-C2-SCHEER@ec.europa.eu

PDF ISSN 2467-4559 ISBN 978-92-68-06322-4 doi:10.2875/095403 EW-CA-23-032-EN-N

The Opinions of the Scientific Committees present the views of the independent scientists who are members of the committees. They do not necessarily reflect the views of the European Commission. The Opinions are published by the European Commission in their original language only.

http://ec.europa.eu/health/scientific_committees/policy/index_en.htm

TABLE OF CONTENTS

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.

Early identification of emerging issues is of great potential value in order 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 April 2016 - December 2021). The first SCHEER statement was published in 2018: Statement on emerging health and environmental issues, adopted on 20 December 2018). 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 also 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 recognised the need to establish a very flexible framework in order to correctly identify emerging issues and their potential impacts (see document 'Emerging Issues and the Role of the SCHEER, Position Paper', SCHEER, 2018).

SCHEER members have been asked during plenary meetings, in dedicated 'brainstorming sessions', to identify emerging/relevant issues that they think should be flagged for the Commssion Services.

The criteria used to identify an emerging issue were as follows:

- Novelty of the stressor or process
- Scale of possible impacts on man and /or the environment
- Severity of impacts for particular organisms (priority for life threatening)
- Urgency i.e. the temporal nature of the likely changes (priority for rapid increases)
- Not investigated in depth recently by a reputable scientific body
- Anticipated to be increasingly important over time

A standardised format has been used and issues have been placed in particular categories. 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 fill in the following:

- The topic proposed
- The author (SCHEER member)
- Sources (one or more selected items from the ones mentioned under point 1 between 1-12)
- Causative factors (one or more selected items from the ones mentioned under point 2 between a and h)
- 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

1) Sources

Risks associated with:

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

2) Causes / Contributing 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

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.

3. NEXT STEPS

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

4. ISSUES

4.1 Human-computer/robot interfaces

Topic	**Health effects of human-robot interaction**
Initiator(s)	Ana Proykova, Theodoros Samaras
Sources **Causative factors** **(see above)**	8) Human behaviour (socioeconomic, lifestyle, perception) 9) Medical developments (technology, pharmaceuticals) (a) Technical advances will open up the prospect of new products and/or processes and/or raised concerns about waste treatment safety (d) Changes due to alterations in legislation or public welfare measures
Hazard (Rank features as 1,2,3 or *) on **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions**	To have a specific understanding of what a robot is, it is necessary to adopt the definition offered by the ISO 8373:2012 that describes a robot as an automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications 1-2: home robots - the definition of safety has been traditionally interpreted to exclusively apply to risks that have a physical impact on a person's safety (collision risks) 1-2: In the chemical industry, robots are widely used for inspection in confined spaces; operators use inspection robots within confined dangerous spaces to inspect defects in pipelines; to do so operators use multiple interaction interfaces; the operation may involve high cognitive loads when manipulating the robotic agent to prevent hazards 2: problems may arise in the future if the human-robot complex interfaces are not well understood 2: the problem is global, which generates uncertainties due to the different technological levels of countries around the world 2: the problem has been recognised over the last decade 2: due to several stressors – human brain status versus emotional status – for home robots; for collaborative robots at work (so called "**cobots**") there are operator-control related hazards, which include overheating of hardware parts of the robot, due to suboptimal control of speed and orientation of the robot by the operator
Parallels with past emerging issues. Potential interactions with other stressors)	Virtual reality and augmented reality in education are new technologies that can be correlated with the human-robot interaction. Stress on brain and neural system of humans
Preliminary Estimation of importance (*,1,2 or 3 where	3 For home robots - information is still limited and the use of cobots requires changes in health standards.

***=uncertain and 3 is high)**	
Background including reliability of data, a key reference if possible any other reasons for concern.	Martinetti *et al.* (2021) *Redefining Safety in Light of Human-Robot Interaction: A Critical Review of Current Standards and Regulations.* Front. Chem. Eng. https://doi.org/10.3389/fceng.2021.666237 Human robot interactions downloaded from https://www.sciencedirect.com/topics/computer-science/human-robot-interaction Kolling T *et al.* (2016) *What Is Emotional About Emotional Robotics*?, in Emotions, Technology, and Health, edited by Tettegah and Garcia. Academic press. Kelley R *et al.* (2014) *Intent Recognition for Human–Robot Interaction*, in Plan, Activity, and Intent Recognition, edited by Sukthankar, Gaib, Bui, Pynadath and Goldman, Elsevier. Riek L, Hartzog W, Howard D, Moon A, Calo R (2015) *The Emerging Policy and Ethics of Human Robot Interaction, Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction Extended Abstracts* http://papers.laurelriek.org/riek-hartzog-howard-moon-calo-hri15.pdf

4.2 Climate change and water pollution

Topic	**Effects of climate change on water pollution**
Initiator(s)	Marco Vighi
Sources **Causative factors** **(see above)**	Water scarcity, defined as a structural, persistent reduction of water availability, is one of the main problems faced by societies in the 21st century. Water scarcity problems have increased in many regions since the 70's and it is likely that they continue over this century due to the increasing human population, accelerated economic activity and land-use changes (Stocker *et al.*, 2013; Herrera-Pantoja and Hiscock, 2015). Arid and semi-arid regions, which occupy more than one third of the planet's land surface and host about 30% of the world population, are particularly vulnerable to the increasing pressure on water resources (Safriel *et al.*, 2005). These regions have been described as the most exposed to the impacts of climate change by the Intergovernmental Panel on Climate Change (IPPC), with prospects of increasing average temperatures and reduced annual precipitation leading to prolonged drought periods (IPPC 2012, 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 physico-chemical and biological characteristics of the ecosystems (Barceló and Sabater, 2010, Petrovic *et al.*, 2011). In arid and semi-arid regions characterised by high anthropogenic impact, the waterflow in rivers may be mainly represented by (treated or untreated) urban or industrial wastewater. For example, in summer, the waterflow of the Manzanares river may be composed, by more than 80%, of wastewater from the city of Madrid. Climate change may produce and increase conditions of water scarcity that may be particularly relevant in the arid and semi-arid regions of the world. The changes in the hydrological regime leading to long periods of drought and to the concentration of the annual rainfall in a few extreme events has been documented for the last few decades 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). Besides the direct consequences that a reduced water flow may produce on the aquatic communities, it will reduce the dilution effect on contaminants, increasing the occurrence of adverse effects, such as toxicity and eutrophication, in freshwater bodies. However, even the sporadic flood events may be deleterious in terms of environmental pollution because they may collect and transport pollutants accumulated in the drainage areas during drought periods. Thus, water scarcity, along with water quality deterioration problems resulting from a global change scenario, have become two of the most important threats for the sustainability of aquatic ecosystems in (semi-)arid areas and in other regions with excessive water abstraction (Davis

	et al., 2010; Vörösmarty *et al.*, 2010; Petrovic *et al.*, 2011; Arenas-Sanchez *et al.*, 2016, 2021). Taking into account that many areas affected by the scarcity of water resources (both in terms of quantity and quality) are in developing or underdeveloped countries, the worsening of the situation can lead to serious political, social and economic consequences, including a substantial increase of migratory fluxes.
Hazard (Rank features as 1,2,3 or *) on **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions**	1: this is an old problem, modified by a changing environmental scenario. Extensive literature, partly quoted above, already exists on this topic. 3: there are no doubts and there is experimental evidence, documented by extensive literature that the problem already exists in many parts of the world. 3: the problem will escalate in the future, affecting the availability of good quality water resources. It may have serious social and economic implications. 3: the problem is global. Arid and semi-arid regions cover about one third of terrestrial ecosystems. It may involve about 30% of the world population. 3: the problem is still ongoing and is expected to worsen in the near future. Considering that the problem of climate is unlikely to be solved in the short term, the only possible courses of action are to protect water quality and improve water availability in extremely arid poor areas of the world. 3: the topic itself derives from the interaction between two stress factors (water scarcity and pollution). Moreover, it may interact with several economic and social stressors: water availability, health, etc.
Parallels with past emerging issues. Potential interactions with other stressors)	As mentioned above, the problem is connected with many other stressors.
Preliminary Estimation of importance (*,1,2 or 3 where *=uncertain and 3 is high)	3 Being connected with the availability of water resources, both in terms of quantity and quality, the problem is of extreme importance.

Background including reliability of data, a key reference if possible any other reasons for concern.	Arenas-Sanchez A, Rico A, Vighi M. 2016. Effects of water scarcity and chemical pollution in aquatic ecosystems: State of the art. *Sci Total Environ* 572:390–403. Arenas-Sanchez A, Dolédec S, Vighi M, Rico A. 2021. Effects of anthropogenic pollution and hydrological variation on macroinvertebrates in Mediterranean rivers: A case-study in the upper Tagus river basin (Spain). *Sci Total Environ* 766:144044. Barcelo D, Sabater S. 2010. Water quality and assessment under scarcity: Prospects and challenges in Mediterranean watersheds. *J Hydrol* 383:1–4. Boix, D., E. García-Berthou, S. Gascón, L. Benejam, E. Tornés, J. Sala, J. Benito, A. Munné, C. Solà, Sabater, S., 2010. Response of community structure to sustained drought in Mediterranean rivers. *J Hydrol*, 383: 135-146. Carere M, Miniero R, Cicero MR. 2011. Potential effects of climate change on the chemical quality of aquatic biota. *Trends Anal Chem* 30:1214–1221. Davis, J., Sim, L., Chambers, J., 2010. Multiple stressors and regime shifts in shallow aquatic ecosystems in antipodean landscapes. *Freshwater Biology*, 55: 5-18. García-Roger, E. M., Sánchez-Montoya, M.M., Gómez, R., Suárez, M. L., Vidal-Abarca, M. R., Latron, J., Rieradevall, M., Prat, N., 2011. Do seasonal changes in habitat features influence aquatic macroinvertebrate assemblages in perennial versus temporary Mediterranean streams? *Aquatic Sciences*, 73: 567-579. Herrera-Pantoja, M., Hiscock, K.M., 2015. Projected impacts of climate change on water availability indicators in a semi-arid region of central Mexico. *Environmental Science and Policy*, 54: 81-89. IPCC (Intergovernmental Panel on Climate Change), 2012. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (Eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, 582 pp. IPCC (Intergovernmental Panel on Climate Change), 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (Eds.)]. IPCC, Geneva, Switzerland, 151 pp. Navarro-Ortega, A., Acuña, V., Batalla, R.J., Blasco, J., Conde, C., Elorza, F.J., Elosegi, A., Francés, F., La-Roca, F.,Muñoz, I., 2012. Assessing and forecasting the impacts of global change on Mediterranean rivers. The

SCARCE Consolider project on Iberian basins. *Environ. Sci. Pollut. Res*. 19 (4), 918–933.

Navarro-Ortega, A., Sabater, S., Cullerés, D.B.i., 2014. Scarcity and multiple stressors in the Mediterranean water resources: the SCARCE and GLOBAQUA research projects. *Contrib. Sci.* 193–205.

Petrovic M, Ginebreda A, Acuña V, Batalla RJ, Elosegi A, Guasch H, De Alda ML, Marce R, Muñoz I, Navarro-Ortega A. 2011. Combined scenarios of chemical and ecological quality under water scarcity in Mediterranean rivers. *Trends Anal Chem* 30:1269–1278.

Robson, B., Chester, E., Austin, C., 2011. Why life history information matters: drought refuges and macroinvertebrate persistence in non-perennial streams subject to a drier climate. *Marine and Freshwater Research*, 62: 801-810.

Safriel, U., Adeel, Z., Niemeijer, D., Puigdefabregas, J., White, R., Lal, R., Winslow, M., Ziedler, J., Prince, S., Archer, E., King, C., 2005. Dryland systems. In: Hassan, R.M., Scholes, R., Ash, N. (Eds.), Millennium Ecosystem Assessment: Ecosystems and Human Well-being: Current State and Trends. Island Press, Washington, DC, pp. 623–662.

Stocker, T. F., Qin, D., Plattner, G. K., Tignor, M. M. B., Allen, S. K., Boschung, J., Nauels, A., Xia, Y., Bex, B., Midgley, B., 2013. IPCC, 2013: climate change 2013: the physical science basis. Contribution of working group I to the fifth assessment report of the intergovernmental panel on climate change.

Verdonschot, P. F., Hering, D., Murphy, J., Jähnig, S. C., Rose, N. L., Graf, W., Brabec, K., Sandin, L., 2010. Climate change and the hydrology and morphology of freshwater ecosystems. In Climate Change Impacts on Freshwater Ecosystems. Kernan, M., Battarbee, R. Moss, B. (Eds.). Blackwell Publishing Ltd.

Vörösmarty, C. J., McIntyre, P. B., Gessner, M. O., Dudgeon, D., Prusevich, A., Green, P., Glidden, S., Bunn, S. E., Sullivan, C. A., Liermann, C. R., 2010. Global threats to human water security and river biodiversity. *Nature*, 467: 555-561.

4.3 Nanotechnology organics

Topic	**Nanotechnology organics**
Initiator(s)	Peter Hoet, Wim De Jong
Sources **Causative factors**	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".
Hazard **(provide the potential score (as 1,2,3 or *) for the following criteria** **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions**	- uniqueness, **2**: a diversity of materials are currently explored such as cationic liposomal NP [(1)], Polymerization of α and β tubulin heterodimers [(2)], micro and nanovesicles [(2)], protein based particles [(2)], nanostructured antimicrobial peptides (AMPs) [(3)]. Most of the current nano-organics are developed in view of potential medical applications (drug delivery) - soundness, **2**: It is unclear to what extent these materials will be used and whether other applications are to be expected beyond medical ones -severity, ***** or **3**: Uncertain to what extent these materials will accumulate in any tissue and whether they will cause significant effects when used – in view of the nano-size, precaution should be taken -scale, **2:** Medical use – will probably only affect relatively small but specific groups - urgency, **2**: Materials are mainly in development, not yet in use on a large scale. - interactions, **3:**
Parallels with past emerging issues. Potential interactions with other stressors)	Risk assessment of nanomaterials of metal/metaloxide composition.
Preliminary Estimation of prioritisation (*, 1, 2 or 3 where	2

***=uncertain and 3 is high)**	
Background including reliability of data, a key reference if possible any other reasons for concern.	The knowledge on the hazard and risk assessment of nanomaterials/nanoparticles is increasing. However, there is one group of nanomaterials that can be considered as borderline materials. Organic nanoparticles have already been known for a long time (e.g. liposomes, micelles). They can be considered borderline materials as they are organic in nature and do have sizes in the nano-range (below 1 µm), and sometimes even below 100 nm, the size indicated for nanomaterials/nanoparticles. Nanoparticles can be considered as minute pieces of matter generally of a solid nature. It is clear that the interaction of a biological system with a solid insoluble nanoparticle can differ considerably from the interaction of a biological system with a particulate of organic nature, or a particle with an organic surface. The principle of using organic coatings or substances on the surface of a nanomaterial is widely investigated for medical application with the aim of specific drug targeting. Organic nanostructures behave like nanoparticles as long as they remain intact, but change to organic biological behaviour after dissociation at a potential target sight. It is necessary that a clear distinction is made in the risk assessment between so-called hard solid (in)soluble nanomaterials (e.g., metal and metal oxides) and so-called "soft" nanomaterials composed of organic molecules, as they can have a totally different interaction/effect in biological systems. References Maiti B, Bhattacharya S (2021) Liposomal nanoparticles based on steroids and isoprenoids for nonviral gene delivery. Nanomedicine and Nanobiotechnology, 2021 e1759. https://doi.org/10.1002/wnan.1759 Kolanthai E *et al.*, (2021) Nanoparticle mediated RNA delivery for wound healing Wiley Interdisciplinary Reviews: Nanomedicine and Nanobiotechnology 2021, e1741. https://doi.org/10.1002/wnan.1741 Yang Z *et al.* (2021) Nanostructured Antimicrobial Peptides: Crucial Steps of Overcoming the Bottleneck for Clinics Frontiers in Microbiology 2021 doi: 10.3389/fmicb.2021.710199

4.4 Nanoplastics

Topic	**The emerging risk of the conversion of micro to nano plastics in the environment**
Initiator(s)	Qasim Chaudhry, Pieter-Jan Coenraads (SCCS)
Sources **Causative factors** **(see p. 1 of this document)**	Source: (item 5) Waste processing and utilization Causative: (item a) Technical advances opening up the prospect of new products and/or processes and/or raising concerns about waste treatment safety. (item h) Public/political concern.
Hazard **(Rank features as 1,2,3 or *)** **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions**	The increasing environmental pollution by plastic materials has come under the focus of attention of authorities around the world. For example, the WHO has recently launched a health review after microplastics have been found in 90% of bottled water. The UK has banned the use of plastic microbeads in cosmetic products (https://chemicalwatch.com/62944/uk-microbeads-ban-enters-into-force). The production, use and disposal of plastic materials is now ubiquitous. Plastic polymers have not been considered substances of health concern because they 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. Some forms of microplastics are also used in cosmetic products, which makes their direct emission into the aquatic environment possible. Microplastics are known 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). This subject has been the focus of recent R&D and it is proposed that it be taken up as a topic of emerging environmental risk that needs further exploration. Research needs have been identified (Vighi *et al.*, 2021).
Parallels with past emerging issues. Potential interactions with other stressors	This is a relatively new topic. Human exposure to nano particles and its subsequent health effects are of concern; this is now a rapidly expanding area of research. After decades of ignorance, partially caused by technical shortcomings in characterisation and quantification, the concern regarding nanoplastics has recently come under the focus of attention of researchers, authorities and the general public. Nanoplastics 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).
Preliminary Estimation of importance (*,1,2 or 3 where	3

***=uncertain and 3 is high)**	
Background including reliability of data, a key reference if possible any other reasons for concern.	Allan J, Belz S, Hoeveler A *et al.* (2021) Regulatory landscape of nanotechnology and nanoplastics from a global perprective. Regul Toxicol Pharmacol 122. Doi: 10.1016/j.yrtph.2021.104885 Allan J., Sokull-Kluettgen B., and Patri A.K., Global Summit on Regulatory Science 2019 Nanotechnology and Nanoplastics, EUR 30195 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-18435-5, doi:10.2760/517689, JRC120318. Andrady AL (2017) The plastic in microplastics: A review, Marine Pollution Bulletin, 119(1): 12-22 Galloway TS, Cole M, Lewis C. (2017) Interactions of microplastic debris throughout the marine ecosystem, Nature Ecology & Evolution volume 1, Article number: 0116, doi:10.1038/s41559-017-0116 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 Vighi M, Bayo J, Fernández-Piñas F, Gago J, Gomez M, Hernandez-Borges J, Herrera A, Landaburu J, Muniategui-Lorenzo S, Muñoz AR, Rico A, Romera-Castillo C, Viñas *et al.*L, Rosal R (2021) Micro and Nano-Plastics in the Environment: Research Priorities for the Near Future. Rev. Environ. Contam. Toxicol., 257, 163-218. doi.org/10.1007/398_2021_69 Wright SL, Kelly FJ (2017) Critical Review: Plastic and Human Health: A Micro Issue? Environ. Sci. Technol., 51(12) 6634–6647. www.efsa.europa.eu/en/press/news/160623 www.independent.co.uk/environment/microplastics-microbeads-health-risks-investigations-uk-government-ban-possibility-a7416271.html

4.5 Chemicals in a circular economy

Topic	**Chemicals risks in a circular economy**
Initiator(s)	Theo Vermeire, Pim de Voogt, Marian Scott
Sources **Causative factors** **(see section 2 of this document)**	Many potential sources include but are not limited to use of wastewater in agriculture, recycling of plastics, extraction of metals from electronic waste. a, c, g, h
Hazard **(Rank features as 1,2,3 or *)** **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions**	Uniqueness: 1 Soundness: 3 while not yet widespread, there are a number of applications where issues have already been highlighted including LAS in wastewater (SCHEER, 2020 Opinion on the potential for anaerobic biodegradability in marine and freshwater of Linear Alkylbenzene Sulphonates (LAS)) and SCHEER 2017 (Proposed EU minimum quality requirements for water reuse in agricultural irrigation and aquifer recharge) Severity: * Scale: 3. This is a global problem Urgency: 3: countries around the world are already implementing strategies and policies for a circular economy Interactions: 3
Parallels with past emerging issues. Potential interactions with other stressors)	A previous SCHEER signal (SCHEER, 2018) concerned emerging risks from chemicals in recycled materials. In view of EU-wide strategies towards a circular economy within the 'Green Deal', this issue should be broadened to include direct and indirect impacts from different strategies in the circular economy (as categorised by the 9 Rs, Potting *et al.*, 2017). Risks can arise for the environment, consumers, workers. R0 Refuse: no negative impacts. Examples: biological plant protection replacing chemical plant protection, digital cash receipts replacing printed ones. R1 Rethink: another approach to using materials and products (e.g. by sharing or leasing) may lead to faster wear and higher emissions of substances of concern. Example: car sharing, performance models (customer pays for the use of a product rather than for the product itself). R2 Reduce: higher material efficiency may be achieved through increased use of substances of concern. R3 Reuse: extended use of materials and products may contain restricted substances; or lead to more wear and these may lead to higher emissions of substances of concern. Examples: (i) direct or indirect exposure to microbiological agents (viruses, bacteria, parasites

	and helminths) or chemical substances that may be present in reclaimed water, (ii) exposure of aquifers (through recharge) to such agents may jeopardise groundwater and drinking water quality, (iii) reuse of household/grey wastewater for preparing drinking water (as is done in e.g. Singapore and on the International Space Station) that, when difficult-to-remove chemicals are present, may lead to concentrations increasing with every cycle, (iv) reuse of waste building materials (for e.g., road construction) may lead to direct emissions when metals or organics leach during rain events. R4 Repair, R5 Refurbish, R6 Remanufacture: see R3. In addition, other substances of concern may be needed to allow these processes. R7 Repurpose: substances of concern in (parts of) products and materials that will be re-used for another purpose than originally intended may present unforeseen risks. Examples: 1) heavy metals and PAHs in rubber crump from tyres, toys from e-waste plastics, 2) ticking and foam from matrasses containing flame retardants transformed into automotive textiles. R8 Recycle: recycled materials and products may contain substances of concern. Examples: 1) DEHP, cadmium and lead in polyvinyl chloride (PVC), 2) cobalt, acetonitrile, propanesultone, 1,2-dimethoxyethane or lithiumnickel dioxide in lithium-ion batteries, 3) E-waste 4) inhalation of bioaerosols from composting. R9 Recover: recovery of energy from materials may lead to emission of substances of concern. Examples: incineration (emission to air), digestate (emission to soil). In all of these cases, the possible advantages of circularity, such as more energy-efficient and CO_2-efficient production, should be weighed against the potential adverse effects. As specific examples, with regard to the e-waste, this has become an ever growing issue, with more than 52 million tonnes of e-waste predicted in 2021, around 20% of which is recycled and the remainder going to landfill, including metals, such as copper, mercury, lead and cadmium. Modern electronics can contain up to 60 different chemical elements including base metals such as copper and tin, special metals such as cobalt, indium and antimony, and precious metals like silver, gold and palladium. Although some chemicals present in electronic components are hazardous, many have economic value (WEF, 2019). This example underlines the importance of re-cycling and the recovery and re-use of materials, but also the possible environmental risks. A second example is that of Biodegradable bioplastics (BBPs) which are becoming more widespread. They are made from renewable carbon such as plant material (bioplastics) and are regarded to have "enhanced rates of biodegradation compared to conventional plastics." (Bio-Plastic-Risk project, University of Plymouth). New research is examining " the fate of BBPs in the environment, their effect on organisms and ecosystem function and develop environmental risk assessments and characterise

	BBPs in terms of their composition (chemical structure, additives) as well as features that can be used to assess deterioration (molecular weight, thickness, strength) in the environment to then evaluate the risk to marine and terrestrial organisms". (Haider *et al.*, 2018) "In terms of biodegradable plastics, concerns were raised regarding contamination of recycling streams, due to the difficulty of separating them from mechanically recyclable plastics. Some companies indicated they were undertaking eco-toxicity assessments when studying the degradation of their products in accordance with standards such as PAS100, EN13432, and AS4736. Little evidence was presented or cited with regard to the impact of biodegradable plastics in the open environment." (DEFRA, 2021).
Preliminary Estimation of importance (*,1,2 or 3 where *=uncertain and 3 is high)	3
Background including reliability of data, a key reference if possible any other reasons for concern.	**References** SCHEER (Scientific Committee on Health, Environmental and Emerging Risks) Statement on emerging health and environmental issues (2018), 20 December 2018. SCHEER, 2020. Opinion on the potential for anaerobic biodegradability in marine and freshwater of Linear Alkylbenzene Sulphonates (LAS). SCHEER 2017. Proposed EU minimum quality requirements for water reuse in agricultural irrigation and aquifer recharge. Potting J, Hekkert M, Worrell E and Hanemaaijer A, (2017). Circular Economy: Measuring innovation in product chains. PBL Netherlands Environmental Assessment Agency, The Hague, PBL publication number: 2544. EFSA CEF Panel (EFSA Panel on Food Contact Materials, Flavourings and Processing Aids) (2015). Scientific Opinion on the safety assessment of the processes 'Biffa Polymers' and 'CLRrHDPE' used to recycle high-density polyethylene bottles for use as food contact material. EFSA Journal 2015 13(2), 4016, 25 pp. doi:10.2903/j.efsa.2015.4016. Grant K., Goldizen F.C., Sly P.D., Brune M.-N., Neira M., van den Berg M., Norman R.E. (2013). Health consequences of exposure to e-waste: a systematic review, Lancet Glob Health 1, e350–61. Janssen M.P.M. *et al.* (2016). Plastics that contain hazardous substances: recycle or incinerate? RIVM Letter report 2016-0025. KEMI (2012). Material recycling without hazardous substances – Experiences and future outlook of ten manufacturers of consumer products. Swedish Chemicals Agency, Report PM14/12. Verschoor A.J., Bodar C.W.M., Baumann R.A. (2018). The environmental impact of rubber infill near synthetic turf fields. National Institute for Public Health and the Environment (RIVM), Bilthoven, The Netherlands, DOI 10.21945/RIVM-2018-0072.

	Bodar C., Spijker J., Lijzen J., Waaijers-van der Loop S., Luit R., Heugens E., Janssen M., Wassenaar P., Traas T. (2018). Risk management of hazardous substances in a circular economy. Journal of Environmental Management 212: 108-114. Beekman M., Bakker J.C., Bodar C.W.M., van Leeuwen L.C., Waaijers-van der Loop S.L., Zijp M.C., Verhoeven J.K. (2019) Coping with substances of high concern in a circular economy RIVM-Letter Report 2019-0186 (in Dutch). WHO-EURO (2017) Circular economy and health: opportunities and risks. WHO Regional Office for Europe. ISBN 9789289053341. Voulvoulis, N. (2018) Water reuse from a circular economy perspective and potential risks from an unregulated approach. Current Opinion in Environmental Science & Health 2:32–45. EEB (2017) Keeping it clean, How to protect the circular economy from hazardous substances. European Environment Bureau, Brussels, Belgium. WEF (2019) A New Circular Vision for Electronics Time for a Global Reboot T P. Haider, C Völker, J Kramm, K Landfester, F R. Wurm (2018) Plastics of the Future? The Impact of Biodegradable Polymers on the Environment and on Society. https://doi.org/10.1002/anie.201805766 DEFRA (2021) Standards for bio-based, biodegradable, and compostable plastics Summary of responses to the call for evidence and Government Response. UK Govt.

4.6 Emerging infectious diseases in view of environmental degradation

Topic	**Emerging infectious diseases in view of environmental degradation**
Initiator(s)	Roberto Bertollini, Marian Scott, Raquel Duarte-Davidson, Demosthenes Panagiotakos)
Sources **Causative factors**	It is widely recognised that there is a strong link between human and ecosystem/ environmental '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. While this has been recognised for some time, it has been highlighted in the Covid era and it is widely anticipated that the situation will worsen. 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.
Hazard **(provide the potential score (as 1,2,3 or *) for the following criteria** **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions**	The main challenges are lack of understanding about the relationships that exist between exposure and pollution, and environmental change. Exposure to environmental pollution may weaken the human immune system, thus increasing weaknesses to new infections. Uniqueness: 2 Soundness: 3. A number of diseases have been associated with environmental degradation and there is growing recognition of zoonotic effects Severity: 3 we have seen the considerable social and economic costs from poor air quality, and more recently Covid-19 Scale:3. This is a global problem Urgency:3 Interactions: 3: interacts with everything, climate change, circular economy, depletion of resources, population growth
Parallels with past emerging issues. Potential interactions with other stressors)	Environmental degradation can have a significant impact on human health. Estimates of the share of environment-related human health loss are as high as 5% for high-income OECD countries, 8% for middle-income OECD countries and 13% for non-OECD countries. (OECD 2001) The World Health Organization (WHO) estimates that environmental stressors are responsible for 12–18% of all deaths in the 53 countries of the WHO Europe Region. Improving the quality of the environment in key areas such as air, water and noise can prevent disease and improve human health. Air pollution and exposure to hazardous chemicals are important causes of the environment-related burden of

	disease in OECD countries. The transport and energy sectors are major contributors to air pollution, while important sources of chemical pollution are agriculture, industry, and waste disposal and incineration (OECD, 2001).
Preliminary Estimation of prioritisation (*, 1, 2 or 3 where *=uncertain and 3 is high)	Priority 3
Background including reliability of data, a key reference if possible any other reasons for concern.	The rise of Covid-19 has precipitated a wider and more urgent recognition that human health is intrinsically linked to planetary health. With growing environmental degradation and pollution, climate change, biodiversity loss, there is likely to be a growing impact on human health. The relationships between all these factors are not well known, and are likely to be complex, in some cases indirect. While Covid-19 is the current pandemic, it comes after other infectious diseases including SARS and Ebola, which can be linked to degradation of the environment. There is a growing body of literature emphasising the one planet health agenda. References: Everard M, Johnson P, Santillo D, Staddon C (2020). The role of ecosystems in mitigation and management of Covid-19 and other zoonoses. Environmental Science & Policy Volume 111, Pages 7-17. Di Marco, M, Baker M, Daszak P, de Barro P, *et al.* (2020) Sustainable development must account for pandemic risk. PNAS, 117 (8), 3888-3892. Tollefsson J, (2020). Why deforestation and extinctions make pandemics more likely. Nature Vol 584, 13 August 2020. Guegan J-F, Ayouba A, Cappelle J, de Thoisy B, (2020) Forests and emerging infectious diseases: unleashing the beast within. Environmental Research Letters 15. UNEP Frontiers (2016). Emerging issues of environmental concern. Chapter Zoonoses: Blurred Lines of Emergent Disease and Ecosystem Health. WHO (2016) Preventing disease through healthy environments: A global assessment of the burden of disease from environmental risks.

4.7 Hydrogen economy and the risks attached

Topic	**A hydrogen economy, Energy and transport and storage**
Initiator(s)	Marian Scott, Theo Samaras
Sources **Causative factors**	Technical advances, the drive for net zero and the need to decarbonise energy and transport are all driving developments of new energy sources
Hazard **(provide the potential score (as 1,2,3 or *) for the following criteria** **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions**	The main challenges in terms of environmental impact seems to be atmosphere, and contribution to climate change. But there are also industrial concerns about (i) safety (https://www.icheme.org/media/9792/xix-paper-04.pdf), as, hydrogen has a higher ignition temperature but a much more explosive character, and (ii) its potential impact on free hydroxyl roots in the atmosphere (https://theconversation.com/dont-rush-into-a-hydrogen-economy-until-we-know-all-the-risks-to-our-climate-140433) that would result in an increase of methane (a known GHG). Uniqueness: 2 the hydrogen economy is one of the main alternative energy sources to fossil fuels Soundness: 3 Severity: 2 Scale: 3 global Urgency: 3: globally, at this time, new energy sources are being researched Interactions: 2: this issue has implications for climate change, with carbon and GHGs
Parallels with past emerging issues. Potential interactions with other stressors)	Greenhouse gases, CCS, ozone layer depletion,
Preliminary Estimation of prioritisation (*, 1, 2 or 3 where *=uncertain and 3 is high)	Priority 2
Background including reliability of data, a key reference if possible any other reasons for concern.	Many countries (and EU) are very much engaged in defining a hydrogen strategy, regarding this as a significant de-carboniser, 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 of the stratosphere, and contribution to climate change through increasing the growth rates of methane and tropospheric ozone. The discussion also focuses on how the hydrogen is generated, whether it using renewable energy or not. The risks and benefits will strongly depend on the mode of production (green or blue hydrogen, e.g., https://www.forbes.com/sites/jimmagill/2021/02/22/blue-vs-green-hydrogen-which-will-the-market-

	choose/?sh=2caed90b3878), on the technological application (domestic, transportation, or industrial use) and on the mode of use (energy source, distribution, or storage). Therefore, there are still large uncertainties as to policy, technology, infrastructure, safety regulations and acceptance (https://iea.blob.core.windows.net/assets/9e3a3493-b9a6-4b7d-b499-7ca48e357561/The_Future_of_Hydrogen.pdf). References: DG Environment for Policy alert, Environmental Impacts of Hydrogen-based Energy Systems, Oct 2006. Niculescu V, Anghel M, Stefanescu I (2010) Environment Impact of Hydrogen - a Renewable Source of Energy in 2nd International Conference on Chemical, Biological and Environmental Engineering (ICBEE). Derwent R, Simmonds P, O'Doherty S, Mannings A, Collins W (2006) Global environmental impacts of the hydrogen economy *Int. J. Nuclear Hydrogen Production and Application, Vol. 1, No. 1*57-67. BEIS HYDROGEN FOR HEATING: ATMOSPHERIC IMPACTS A literature review (2018) research paper no. 21. van Renssen S (2020) The hydrogen solution? Nature Climate Change, 10: 799–801. Ueckerhadt F, Bauer C, Dirnaichner A, Everall J, Sacher R,Luderer G (2021). Potential and risks of hydrogen-based e-fuels in climate change mitigation. Nature Climate Change, 11, 384-393.

4.8 Methodology on wastewater-based epidemiology

Topic	**Wastewater-based epidemiology,** need for rapid Population epidemiology (Covid, illicit drugs, AMR)- for public health interventions
Initiator(s)	Pim de Voogt, Marian Scott, Teresa Borges
Sources **Causative factors**	An alternative, non-invasive testing and surveillance methodology for disease and drug use prevalence. This approach has especially come to prominence due to population surveillance of Covid-19.
Hazard (provide the potential score (as 1,2,3 or *) for the following criteria **- uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions**	The main challenges are methodological (the metabolites being measured, aka biomarkers: their analysis and stability), the excretion rates of the biomarkers, the sampling regime, the effect of weather, the population size estimation Uniqueness: 2/3 Soundness: 3 Severity: 2: this is a methodological issue, so the requirement here is to ensure that sampling (and thus inference) is appropriate Scale:3: can be used globally Urgency:3. The methodological issues need to be resolved urgently with growing use of such approaches Interactions: 2
Parallels with past emerging issues. Potential interactions with other stressors)	
Preliminary Estimation of prioritisation (*, 1, 2 or 3 where *=uncertain and 3 is high)	Priority 2
Background including reliability of data, a key reference if possible any other reasons for concern.	Wastewater-based epidemiology has been used including: exposure to pesticides, doping use, use of counterfeit medicines, tobacco, alcohol and nicotine, and some forensic purposes. In Covid times, its use has become more widespread. So far, wastewater sampling has retrospectively shown that the virus is present in cities several months before large COVID-19 outbreaks, that there is a correlation between quantitative RT-PCR data and the reported incidence of cases, and that the presence of SARS-CoV-2 in wastewater is ubiquitous. It seems that there is potential to use environmental surveillance for early warning, particularly of clusters or outbreaks in countries that have already contained transmission and are easing public health and social measures, or in the event of seasonality. There are numerous benefits of wastewater sampling, but the collection and interpretation of data is an emerging field (ref 2). In addition, the normalisation of data and

	QA/QC are critical to enable time trends per different locations. References: https://www.emcdda.europa.eu/publications/topic-overviews/content/wastewater-faq_en Oreilly K, Allen D, Fine P, Asghar H (2020). The challenges of informative wastewater sampling for SARS-Cov-3 must be met: lessons from polio eradication. Lancet Microbe 1(5) 189-190 Challenges in Measuring the Recovery of SARS-CoV-2 from Wastewater Rose S. Kantor,* Kara L. Nelson,* Hannah D. Greenwald, and Lauren C. Kennedy EST, 55 2021, 3514-3519 https://doi.org/10.1021/acs.est.0c08210 Castiglioni S, Bijlsma L, Covaci A, Emke E, Hernández F, Reid M, Ort C, Thomas KV, van Nuijs ALN, de Voogt P, Zuccato E (2013) Evaluation of Uncertainties Associated with the Determination of Community Drug Use through the Measurement of Sewage Drug Biomarkers. Environ. Sci. Technol. 47, 1452-1460. https://pubs.acs.org/doi/10.1021/es302722f World Health Organization. Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes COVID-19. Available from: https://www.who.int/publications/i/item/water-sanitation-hygiene-and-waste-management-for-the-covid-19-virus-interim-guidance. August 2020.

4.9. Early detection in general – early warning systems (EWS)

Topic	Early detection of risks - Early warning systems
Initiator(s)	Roberto Bertollini, Theodoros Samaras, Raquel Duarte-Davidson, Teresa Borges, Demos Panagiotakos
Sources **Causative factors**	This is the second more methodological issue covered in this opinion (wastewater epidemiology being the other). The development of EWS is required due to the plethora of environmental and human health issues where early warning would be beneficial to ensure that appropriate and timely action is taken. (SEP, 2016) (8, 11, 2) Agencies and governments wish to take advantage of newer technologies to have early warnings (h)
Hazard **(provide the potential score (as 1,2,3 or *) for the following criteria** **-uniqueness** **- soundness** **- severity** **- scale** **- urgency** **- interactions**	The inability to identify real, severe risks of high impact early enough, the amplification of unreal, perceived risks of low impact, the inefficiency of resource use to deal with and recover from risks all require rapid and reliable EWS systems. Uniqueness:2 Soundness:3 Severity: 3 Scale: 2 Urgency: 3 Interactions: 2. We need to be concerned with the potential for false detection, and the carry over to mistrust in science (Martens *et al.*, 2018, MPF, 2018, JRC 2018).
Parallels with past emerging issues. Potential interactions with other stressors)	
Preliminary Estimation of prioritisation (*, 1, 2 or 3 where *=uncertain and 3 is high)	3
Background including reliability of data, a key reference if possible any other reasons for concern.	Early warning (EW) is "the provision of timely and effective information, through identified institutions, that allows individuals exposed to hazard to take action to avoid or reduce their risk and prepare for effective response.", (UNEP, 2012), Many agencies are trialling different approaches to develop early warning systems, often the focus is on automatic systems (e.g. data science using artificial intelligence (Pavlidis *et al.*, 2019)) supplemented also with expert knowledge, regulatory systems, etc. (Sumpter *et al.*, 2021). UNEP (2012). Early warning systems. A state of the art analysis and future directions. Science for Environment Policy (SEP) (2016). Identifying emerging risks for environmental policies. Future Brief 13.

	Pavlidis DE, Filter M and Buschulte A, 2019. Application of data science in risk assessment and early warning. EFSA Journal 2019;17(S2):e170908, 10 pp.https://doi.org/10.2903/j.efsa.2019.e170908 Sumpter J, Collins C, Depledge M, Galloway T, Hutchison G, Johnson A, Matthiessen P, Murphy R and Owens S (2021) Recommendations for a Prioritisation and Early Warning System (PEWS) on Chemicals in the Environment. Hazardous Substances Advisory Committee (HSAC) report Media and Disaster Risk Reduction: Advances, Challenges and Potentials. R. Shaw, S. Kakuchi, M. Yamaji (Eds). Springer Nature Singapore Pte Ltd. 2021. ISBN 978-981-16-0284-9. B. Martens, L. Aguiar, E. Gomez-Herrera, F. Mueller-Langer. The digital transformation of news media and the rise of disinformation and fake news - An economic perspective. Digital Economy Working Paper 2018-02.JRC Technical Reports. 2018. https://ec.europa.eu/jrc/sites/jrcsh/files/jrc111529.pdf Early alert system for fake news. MaxPlanckForschung Heft 3/2018, pp. 20-25. https://www.mpg.de/12605067/F001_Focus_020-025.pdf

5. CONCLUSIONS

The SCHEER identified 9 emerging issues to bring to the attention of the Commission services. The overall prioritisation scores (*, 1, 2, 3 where *=uncertain and 3 is high) are as follows:

4.1	Health effects of human-robot interaction	3
4.2	Effects of climate change on water pollution	3
4.3	Nanotechnology organics	2
4.4	The emerging risk of the conversion of micro to nano plastics in the environment	3
4.5	Chemicals risks in a circular economy	3
4.6	Emerging infectious diseases in view of environmental degradation	3
4.7	A hydrogen economy, energy and transport and storage	2
4.8	Wastewater-based epidemiology, need for rapid population epidemiology (covid, illicit drugs, AMR)- for public health interventions	2
4.9	Early detection of risks - Early warning systems	3

The SCHEER has scored all of these issues as being of moderate to high priority.

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