Opinion 23

Substance assessment in light of the precautionary principle: persistence, hazard and risk

BUND

Summary

Chemicals are indispensable to modern society. At the same time, they pose significant risks to humans and the environment, particularly if they exhibit hazardous properties, are highly persistent or spread globally. The risk-based regulation that has prevailed to date, which compares harmful effects with exposure to humans or the environment, is reaching its limits: in the case of persistent substances (in combination with high mobility or bioaccumulation), cause and effect become decoupled in space and time, so that risks are often only recognised once damage has already occurred and the substances can no longer be recovered. For substances without a threshold effect, any exposure constitutes a risk. Where effects are irreversible, damage that has occurred cannot be reversed. Then, the application of the precautionary principle is essential. Against this backdrop, hazard-based assessment is gaining in importance, as is already enshrined in EU chemicals legislation for substances of very high concern (SVHCs).

Even when assessing secondary materials and products in the circular economy, quantitative exposure assessment reaches its limits, as the type and quantity of the chemicals contained are usually unknown.

Friends of the earth (FoE) Germany (Bund für Umwelt und Naturschutz Deutschland BUND) calls for the consistent application of the precautionary principle in the management of chemicals, particularly in the case of extremely persistent 'forever chemicals' such as PFAS and microplastics. Even without proven toxicity, such substances pose a long-term threat, as they accumulate in the environment, cannot be recovered and make subsequent damage almost impossible to control. Historical examples such as CFCs and PCBs show that ignoring persistence can lead to serious environmental problems and high follow-up costs.

The aim of a sustainable chemicals policy is therefore to restrict the use of hazardous and persistent chemicals, to substitute them with functional alternatives, and to promote safe, sustainable and, where possible, recyclable substances ('safe and sustainable by design', SSbD). Exposure and risk assessments remain important, but are not sufficient on their own. Only by taking greater account of all harmful properties and implementing life-cycle-oriented regulation the EU's goal of a 'toxic-free environment' can be achieved.

Introduction

Chemicals are everywhere: the substances produced by the chemical industry are needed for many chemical processes and are found in countless everyday products. A world without (synthetic) chemicals is no longer conceivable, nor is it desirable. For example, most medicines are synthetic chemicals; many sustainability goals can only be achieved with the help of chemicals. However, chemicals can also have properties that are hazardous to human health and the environment. In 2023, 77 % of the volume of chemicals produced in the EU were classified as harmful to health.[1]

Furthermore, the production of chemicals is associated with high energy and resource consumption, which is why the aim of a sustainable chemicals policy must be not only to avoid chemicals with a significant hazard potential but also to limit the quantity of chemicals used to the necessary minimum.[2]

[1] www.eea.europa.eu/en/european-zero-pollution-dashboards/indicators/production-and-consumption-of-chemicals-by-hazard-class

[2] www.bund.net/fileadmin/user_upload_bund/publikationen/ressourcen_und_technik/challenges-for-a-sustainable-cemicals_and_Materials-Position_Paper_BUND.pdf

Procedure for traditional risk assessment

To prevent harm to human health and the environment, the production, import, marketing and use of chemicals are regulated by law: in the EU by the REACH Regulation[3] and other directives and regulations. In principle, a restriction on a substance must be justified by the presence of an unacceptable risk. The risk associated with the use of a substance must therefore be assessed, and this assessment must demonstrate that the level of risk necessitates intervention.[4] As a rule, (adverse) effects and exposure are compared with one another for this purpose. If the expected or measured exposure (concentration in the breathing air, in drinking water, in food, in the body or in environmental media such as surface water and soil) is higher than the threshold of effect – that is, the highest dose or concentration at which no harmful effect occurs – a risk is identified that must be reduced. This approach follows the principle that higher concentrations result in stronger effects than lower ones, which, with a few exceptions (e. g. some endocrine disruptors[5]), is indeed the case. This approach is fundamentally sound, as it enables harm to humans and the environment to be identified and subsequently prevented through appropriate measures. However, each individual use must be assessed, which can involve a very significant amount of work and time. As a result, it often takes years before concrete proposals for

[3] **R**egistration, **E**valuation and **A**uthorisation of **C**hemicals

[4] To clarify the terminology used in the assessment of chemicals: Hazardous properties of a substance are properties that may cause harm to human health or the environment (intrinsic properties). **Hazardous properties** also include, for example, persistence, mobility, global warming potential and damage to the ozone layer. In the case of toxic or ecotoxic effects, these are represented by effect thresholds (DNEL and PNEC values).
An effect threshold refers to the dose or concentration at which adverse effects on health or the environment cannot be ruled out.
Exposure refers to the extent to which, and at what dose or concentration, humans or the environment are exposed to a chemical.
Risk is the product of the potential extent of harm and the probability of occurrence. In chemical assessment, this is quantified by the ratio of expected exposure to the effect threshold.

[5] Substances that affect the endocrine system are called endocrine disruptors

measures are put forward and, ultimately, political decisions are made. During this period, the chemical continues to be emitted, environmental concentrations may rise and, with them, the risk.

Limitations of traditional risk assessment of individual substances

However, for certain substance properties, the traditional exposure-effect relationship can lead to inaccurate results. This is the case when the substance remains in the environment for a long time (persistence) and the spatial extent of an emitted substance is very large (mobility), or when it accumulates heavily in living organisms (bioaccumulation). Exposure and effect are then decoupled in terms of time and space. With such 'long-range chemicals', the harmful effects occur with a delay or at a distance from where the substance was used or emitted. Even if the (toxic) effect of a substance occurs with a delay, it is decoupled in time from the exposure. If no threshold value can be determined (e. g. for carcinogenic, mutagenic or endocrine-disrupting properties), the occurrence of an effect cannot be ruled out even at minimal quantities. An effect threshold can then no longer be determined. In the case of substances with irreversible effects, the effects that have occurred cannot be reversed. Apart from a few intermediates in closed systems, the use of chemicals is not emission-free. Even without a quantitative determination of exposure, substances with such properties must therefore be regarded to pose an unacceptable risk. Such hazardous substances cannot be recovered from the environment. Risk management must therefore be strictly guided by the precautionary principle.

The precautionary principle is established in many areas of environmental and health protection. It is a guiding principle in international law (e. g. the OSPAR Convention for the Protection of the North Sea and the North Atlantic), EU law (Article 191 of the Treaty on the Functioning of the European Union) and national law. As a fundamental concept it states that, in the face of imminent but not yet clearly proven risks to humans and the environment, preventive action must be taken rather than waiting for scientific proof that harm has occurred. It requires that measures be taken to prevent or minimise potential harm, even if clear scientific evidence is not yet available. As early as the presentation of the first federal government's environmental programme in 1971, German minister Hans-Dietrich Genscher said:[6] "Environmental protection must not merely react to damage that has already occurred, but must prevent damage from arising in the first place through precaution and planning."

Substances that – once released into the environment – remain there for a long time, thereby spreading widely and accumulating in the environment, are particularly problematic, especially as they can then no longer be removed from the environment. Even without (known) adverse effects, persistent substances pose a potential hazard. It should be noted that harmful effects are often only identified years after the substances have been introduced to the market. This is made very clear in the publications of the European Environment Agency (EEA) 'Late Lessons from Early Warnings'.[7]

The property of persistence (long-term stability) has become increasingly important in recent decades in the regulatory assessment of substances in both Europe and North America, usually in combination with other substance properties such as bioaccumulation, mobility or toxicity. The EU's REACH Regulation classifies such substances as substances of very high concern (SVHC[8]), which should be substituted wherever possible solely on the basis of their problematic properties.

The global Stockholm Convention bans or restricts particularly hazardous chemicals, which are referred to within the Convention as POPs (persistent organic pollutants). Many POPs are found in higher concentrations in polar regions than in the regions where they were emitted. They can evaporate, be transported over long

[6] Federal Government Environmental Programme of 14 October 1971, p. 3: dserver.bundestag.de/btd/06/027/0602710.pdf

[7] www.eea.europa.eu/publications/environmental_issue_report_2001_22 and www.eea.europa.eu/publications/late-lessons-2

[8] Substances of very high concern

distances through the air and then are deposited in cold regions ('grasshopper effect').

Article 68(2) of the European REACH Regulation already provides that carcinogenic, mutagenic and/or reprotoxic substances in Categories 1A and 1B may generally be restricted in consumer products without the need for a detailed exposure assessment. As part of the upcoming REACH amendment, this provision (generic risk assessment) should be extended not only to endocrine-disrupting substances but also to PBT/vPvB and PMT/vPvM substances.[9] Professional applications comparable to consumer exposure should also be included.

9 PBT: persistent, bioaccumulative and toxic; vPvB: very persistent and very bioaccumulative; PMT: persistent, mobile and toxic; vPvM: very persistent and very mobile chemtrust.org/wp-content/uploads/Waiting-for-REACH_EEB-CHEMTrust_2023.pdf

Persistence as a key assessment criterion even beyond chemicals legislation

A look at global environmental problems shows that these are often caused by highly persistent substances. One example is carbon dioxide, which remains in the atmosphere for decades to centuries. It is only because of this high persistence that it is such a dangerous greenhouse gas. At the same time, carbon dioxide dissolved in seawater leads to acidification, thereby endangering all calcareous species, which poses a major problem for biodiversity in the oceans.

The greenhouse gas nitrous oxide (N_2O) also has a long atmospheric lifetime. Its concentration is likewise rising continuously. It is produced in agriculture from fertilisers, but is also generated in chemical syntheses and in waste treatment. It is also used as an anaesthetic gas and a party drug.

Chlorofluorocarbons (CFCs), which were considered completely harmless when first introduced to the market, are another example. Their ozone-depleting effect was only recognised decades after they were brought to market and was subsequently regulated an international agreement (the Montreal Protocol). Unfortunately, CFCs were initially replaced by hydrofluorocarbons (HFCs), which are also highly persistent and have a significant global warming potential. Decades after their introduction, it is once again becoming clear that these lead to significant environmental impacts.[10] Significantly more environmentally friendly, fluorine-free alternatives were already available when hydrofluorocarbons were first introduced. The environment would have benefited greatly and industry would have been spared high costs had these alternatives been introduced at an early stage.

Polychlorinated biphenyls (PCBs) are another example of the failure to give sufficient consideration to the precautionary principle: they were initially regarded as completely harmless. Decades later, they have been banned worldwide since 2004. However, the persistence and widespread presence of these substances continue to threaten populations of orcas in the ocean.[11]

A more rigorous assessment of the hazardous properties of chemicals, with particular emphasis on persistence, would be appropriate to comply with the precautionary principle and avoid future misguided investments by industry. This fundamental assessment approach can also be applied to other areas of the environmental problems described in the concept of planetary boundaries. Phosphorus (mobilised primarily for fertilisers) and nitrogen (in the various forms of reactive nitrogen) also exhibit (pseudo)-persistent behaviour within their biogeochemical cycles. Environmental concentrations are rising steadily. Five of the nine planetary boundaries are linked to the problem of persistence. Genetically modified organisms, which are classified as 'novel entities' within the framework of the planetary boundaries, may also be irreversibly introduced to the environment and may not only spread in the environment but even multiply. This applies in particular to genetically modified microorganisms such as fungi, bacteria, viruses or unicellular organisms, the use of which in open systems is increasingly being promoted. To facilitate their use, the European Commission recently presented a proposal to reduce regulatory requirements for the placing on the market of genetically modified microorganisms.

[10] Short-lived fluoroolefins are also unsuitable substitutes, as they are transformed to the 'forever chemical' trifluoroacetic acid (TFA) in the atmosphere.
[11] www.science.org/doi/10.1126/science.aat1953

Even in a circular economy, quantitative risk assessment reaches its limits. It should be possible to make a child's toy from any plastic, or food packaging from any recycled paper. This desired circularity and the associated possibility of reusing materials in applications other than those originally intended are not taken into account in traditional risk assessment. Exposure that can lead to risks to humans and the environment then occurs in the secondary products. Recyclers often do not know whether hazardous substances are present in the waste they process and may be 'carried over' into the secondary products. Consequently, a risk exists even if no exposure assessment is carried out. This can only be prevented through greater transparency and by keeping chemicals of concern out of material streams that can be recycled.

The following examples illustrate the aforementioned principles of substance assessment:

Case study 1: Persistent chemicals PFAS

The EU currently intends to restrict the group of substances known as PFAS (per- and polyfluoroalkyl substances), which comprises more than 10,000 individual chemicals. PFAS are extremely persistent; there are no known natural degradation pathways that lead to complete defluorination.[12] They are therefore referred to as 'forever chemicals'. Industry rejects the hazard-based regulatory approach and calls for a risk assessment that takes exposure into account for individual substances and their respective uses. The reality, however, is sobering: the individual substances PFOA and PFOS, which are already regulated, have been replaced by similar per- and polyfluorinated chemicals. Such 'regrettable substitutions' do not solve the problem. The industry criticises the fact that polymeric PFAS such as PTFE (polytetrafluoroethylene, Teflon) are also to be restricted. Although no toxic properties are currently known for these polymers during the use phase, they are in any case persistent. A life-cycle assessment reveals significant emissions of non-polymeric PFAS during manufacture and in the waste phase.[13] 'Forever chemicals' such as PFAS must therefore be regulated even if no toxic or ecotoxic properties are (yet) known for them. Their applications must be restricted to the few cases where they are indispensable, i. e. where they are necessary for safety, society or health and where no suitable alternatives are yet available.

Conclusion: The extreme persistence of PFAS necessitates their restriction as a group of substances. The regulatory approach based on substance groups avoids substitutions that do not eliminate risks but merely shift them. It should also be applied to other groups of substances that share a property of particular concern. This would create greater safety and also significantly reduce the burden of assessment and regulation. For essential applications, emissions should be minimised as far as possible. The approach demanded by industry contradicts the precautionary principle and would only marginally reduce the risks posed by PFAS.

[12] www.bund.net/fileadmin/user_upload_bund/publikationen/chemie/Background_Fluorochemicals_Web_EN.pdf and doi.org/10.1186/s12302-023-00721-8

[13] www.oecd.org/content/dam/oecd/en/publications/reports/2025/11/synthesis-report-on-understanding-fluoropolymers-and-their-life-cycle_2ed189aa/35b035df-en.pdf

Case study 2: Bisphenols – substances with no threshold effect

Bisphenols are used in the manufacture of plastics and resins and are found in many everyday products. Until a few years ago, bisphenols were also present in thermal paper as a coupling agent. The best-known bisphenol is bisphenol A (BPA).

BPA is toxic to reproduction and harmful to health and the environment as an endocrine disrupting chemical (EDC).[14] The endocrine effect can occur at very low concentrations. Even if higher concentrations show no harmful effects, they can sometimes be observed at lower concentrations (non-linear dose-response relationship), often only at certain life stages (e. g. as a foetus, as a baby or as an adolescent during puberty). Hormonal effects are also taken into account in environmental assessments.

These characteristics mean that, in the view of many scientists, a no effect concentration cannot be derived for bisphenol A. There is consensus on this regarding hormonal effects in the environment, but not regarding effects in humans, where regulation currently assumes an effect threshold.

The development of the tolerable daily intake (TDI) guiding value for BPA highlights the uncertainties in the assessment of endocrine-disrupting substances. In 2006, the European Food Safety Authority (EFSA) set a TDI of 40 µg/kg/day for BPA. In 2015, this value was reduced to 4 µg/kg/day. Since 2024, based on new studies, the TDI has been just 0.2 ng/kg.d.,[15] i. e. a total of 200,000 times lower than in 2006. Data from human biomonitoring show that BPA concentrations in the blood of virtually the entire EU population exceed the new threshold derived by EFSA. This is an example of how the standard safety factors used in the assessment of toxicological data do not, in some cases, guarantee safety for human health.

In response, the EU restricted the use of BPA and certain other bisphenols in food contact materials. Manufacturers responded to the stricter assessment of BPA by substituting it with other, less well-studied bisphenols. However, scientific studies have shown that other bisphenols can have effects that are just as harmful as those of BPA.[16]

Conclusion: As a precautionary measure, the assessment of endocrine effects on human health should also be based on the assumption that no threshold effect can be determined. Furthermore, the example of BPA shows that the derivation of threshold effects, such as a tolerable daily intake (TDI), is often fraught with considerable uncertainty. Therefore, for substances of concern, the hazardousness should be sufficient to warrant regulatory action. Furthermore, bisphenols serve as an example of why the assessment and measures should not be limited to a single, well-studied substance, but should instead regulate the entire group of substances (in this case: bisphenols).

[14] ECHA (2021): Assessment of regulatory needs - Bisphenols. echa.europa.eu/documents/10162/c81f4917-8545-1798-c19e-a3bac82001ee
[15] chemtrust.org/bisphenols_ban_food_contact_materials_win/ and doi.org/10.2903/j.efsa.2023.6857
[16] doi.org/10.1186/s12302-024-00900-1

Case study 3: Polymers – the microplastics problem

With a few exceptions, plastics (polymers) that cannot enter the body due to their size are not toxic but are extremely persistent. Production figures (currently around 460 million tonnes per year worldwide) continue to rise, and with them the volumes of waste polluting the environment, particularly the oceans.[17] Above all, global agreements to restrict plastic production and use would help, but have unfortunately failed so far.

Plastic particles smaller than 5 mm in diameter (micro- and nanoplastics) are particularly insidious. They cannot be recovered from the environment and have even been detected in remote regions, e. g. on the mountain peaks of the Alps. They are also found in various organs of the body, where they can trigger inflammatory reactions, for example. Micro- and nanoplastics pose an additional problem: the particles have a very large relative surface area, through which they can release substances that are not firmly bound to the polymer matrix into the environment. 16,000 plastic chemicals are known: many additives that impart desired properties to the plastic, but also residues, auxiliary materials, impurities and production by-products. Many of these substances are known to be hazardous chemicals. Primary microplastics, which are added in this form to products such as personal care products, are now restricted in the EU. No effective measures have yet been taken against secondary microplastics, which arise, for example, through abrasion.

Conclusion: Polymers, which are currently largely exempt from substance evaluation and regulation under the REACH Regulation, are an example of extremely persistent substances where the traditional regulatory approach – evaluating and regulating substances based on their intrinsic properties – reaches its limits. It is only small particles that exhibit harmful properties. These are produced directly to a small extent, but arise for the most part during the use and waste phases. To assess the health and environmental hazards of these substances, a life-cycle approach is therefore required, which incorporates into the assessment also emissions and exposure to the substances during the use and waste phases as well as in the circular economy.
Emissions during manufacture should also be considered, as demonstrated by the example of fluoropolymers (see above), which are produced using non-polymeric PFAS. The largest PFAS contamination sites are found at production sites. Furthermore, the increasing environmental impact of plastic makes it clear that material flows must be drastically reduced, i. e. the production and waste volumes of plastic must be limited globally.
Plastic is also an example of the limitations of traditional risk assessment in the circular economy. Plastic products should, where possible, be reused or mechanically recycled. However, the material composition of the secondary products is usually not comparable to that of the primary products. The quantity and type of additives and degradation products determine the risk. Additional stabilising additives are often added during recycling. Risks can only be avoided through increased transparency and the avoidance of hazardous additives.

[17] www.bund.net/fileadmin/user_upload_bund/publikationen/ressourcen_und_technik/plastic-radical-rethink-reduction-microplastics-material-flows-recycling-climate-biodiversity-additives-background-bund-2025.pdf

Goal: Chemicals without hazardous properties

Most chemicals still have properties that are harmful to health and/or the environment. They can only be handled safely – if at all – if safety measures are taken. An important goal of sustainable chemistry is chemicals without hazardous properties, particularly in consumer products and substances that are released into the environment as intended. The widespread, though sometimes costly, methods for reducing risks (technical mitigation measures and personal protective equipment) are necessary and sensible, but their effectiveness is limited because, for example, they are not always fully complied with in small and medium-sized enterprises or in the Global South, and furthermore, they merely reduce emissions/exposure rather than avoiding them.

Chemicals without hazardous properties ('benign by design') would help to significantly reduce the risks to health and the environment associated with the use of chemicals. An approach is currently being tested and further developed in the EU that is primarily intended to identify safe and sustainable chemicals during product development ('safe and sustainable by design', SSbD).[18] This is an important step, but it will only find widespread application if sufficient data is available and the effort involved is not too great. To help chemical users identify safe chemicals when selecting products, the simpler Chem-Select procedure was developed on behalf of the German Federal Environment Agency.[19] Chemicals with properties of concern should, as a matter of principle, be excluded from these selection procedures. In addition to the substance characteristics taken into account in the SSbD concept, the substance should also be as recyclable as possible with regard to circular chemistry.[20]

Not all chemicals can be inherently safe, i. e. harmless. Sometimes the hazardous property is linked to the desired function: fuels must be flammable; there are no non-toxic disinfectants, as the aim is to kill bacteria; reactive reagents must usually be corrosive. Protective measures are required when handling such substances! However, substances whose hazardous properties are not linked to their function are not necessarily required. For example, biocides must be toxic to achieve the necessary effect. As a rule, however, they should not be persistent, but rather easily and completely biodegradable. Furthermore, even chemicals without hazardous properties must not be used in large quantities without caution. They should be used sparingly, and not just for the sake of resource conservation!

Furthermore, not all chemicals can be readily degradable. Sometimes there is a conflict of objectives between the desired long shelf life of a product (which contributes to resource conservation) and the desired short lifespan of the chemical. In such cases, both objectives must be weighed against one another. In any event, however, the use of 'forever chemicals' with extreme persistence must be avoided.

Assessment and conclusions

Industry, as well as the German Federal Institute for Risk Assessment (BfR[21]), fundamentally reject hazard-based assessment and regulation. They argue that it sets the wrong priorities. Important substances would be unnecessarily banned without posing a risk to human health or the environment. Regulations should be limited to risks that have actually been identified. With this line of argument, chemical manufacturers and industrial users are also finding a receptive audience in the political sphere.

However, such an approach ignores issues of regulatory burden, the need to prevent harm (precaution) and long-term risks. Risk assessment based on quantitative exposure-effect comparisons leads to inaccurate results for persistent and particularly hazardous chemicals:

[18] doi.org/10.2760/487955
[19] chemselect.uba.de/
[20] www.thieme-connect.com/products/ejournals/pdf/10.1055/a-2554-7325.pdf
[21] www.bfr.bund.de/mitteilung/gefahr-oder-risiko-als-massstab-ein-unterschied-mit-folgen-fuer-die-chemikalienbewertung-der-eu/

- In the case of persistent substances, potential future harm is completely overlooked.
- For substances with delayed effects and dangerous (persistent) transformation products, harmful effects are underestimated or go unrecognised.
- For substances without a threshold effect, a risk exists even at minimal concentrations.

The objective of avoiding or at least restricting the use of such chemicals can only be achieved if, taking into account the precautionary principle, the hazard assessment is sufficient to justify regulatory measures. Generic risk management in accordance with Article 68(2) of the REACH Regulation should then be initiated. In the course of this, the possibilities must also be examined and taken into account in the decision as to whether the desired function can be achieved without hazardous chemicals ('functional substitution').[22]

It should also be borne in mind that, for many substances, uses and exposures cannot be recorded or determined, e. g. if they are carried over into secondary products as part of the material recycling process or are released into the environment as micro- or nanoparticles during the use and waste phases.

The hazard-based approach should be applied not only to substances of very high concern (SVHCs) under the REACH Regulation, but also to extremely persistent chemicals and all substances of concern under the Ecodesign Regulation 2024/1781.[23] These include highly toxic and ecotoxic substances, as well as substances that negatively impact the reuse and recycling of materials. Only in this way can the EU's goals of a 'toxic-free environment' and a circular economy free of harmful substances be achieved.

Exposure assessments nevertheless remain an important tool for the evaluation of substances. They continue to be necessary for the prioritisation and development of risk mitigation measures, and for the evaluation of chemicals and their applications where the abovementioned hazard criteria are not met. Furthermore, the assessment of existing chemical burdens (water pollution, contaminated sites, waste, contaminated products) cannot be carried out without an assessment of exposure as part of the risk assessment. In the medium term, the aim should be to significantly reduce the proportion of hazardous substances in chemical production and use, and to increasingly develop and use substances without hazardous properties. This applies in particular to chemicals involving consumer exposure.

[22] doi.org/10.1021/es503328m

[23] eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202401781

Friends of the earth Germany (BUND) recommendations and demands

A. Demands for sustainable substance assessment

1. **Chemicals policy** must be **clearly guided by the precautionary principle:** future risks must be avoided, not least to provide certainty for business in terms of action and investment.
2. **Treat highly persistent substances as a potential source of risk:** Experience has shown that many highly persistent substances ('forever chemicals') have led to environmental damage, in some cases unexpectedly. Such highly persistent substances should be avoided wherever possible, particularly in applications where they come into direct contact with the environment.
3. **Restriction of the use of hazardous chemicals:** Chemicals with hazardous properties should be avoided where possible or replaced with less harmful alternatives. This applies in particular to substances of very high concern (SVHCs) under REACH, as well as extremely persistent chemicals and other substances of concern under the Ecodesign Regulation 2024/1781.
4. **Endocrine-disrupting, immunotoxic and neurotoxic substances, as well as persistent, bioaccumulative or mobile substances in consumer products and in comparable commercial applications, should generally be restricted** (extension of the generic risk management procedure pursuant to Article 68(2) of the REACH Regulation).
5. **Chemicals with similar properties and common structural features should, where possible, be assessed as a group.** Compared to the usual piecemeal approach, in which each substance is evaluated individually, this allows substances to be assessed and regulated more effectively and, in most cases, with less administrative burden. This approach helps to avoid undesirable substitutions; it increases clarity and predictability for industry and helps companies avoid unnecessary investment in harmful or unsustainable alternatives. This applies in particular to the PFAS substance group, the use of which should be restricted to essential applications.
6. **Taking the life cycle into account:** Persistent chemicals should be assessed over their entire life cycle, including the manufacturing and waste phases, in order to minimise risks.
7. **Transparency and the avoidance of hazardous substances in products (e. g. in polymers) that are recycled** are necessary for an effective circular economy with high-quality recycling.
8. **Promotion of 'benign by design' approaches:** Chemicals should be developed in such a way that they do not possess any hazardous properties and are safe and sustainable ('safe and sustainable by design', SSbD). Aspects relating to recyclability should also be taken into account.
9. **Promotion of functional substitution:** The desired function should be achieved without hazardous properties of chemicals wherever possible.
10. **Risk assessment for chemicals that are not particularly persistent or hazardous:** Exposure assessments and quantitative risk assessments remain necessary, particularly for chemicals that do not exhibit particularly high persistence or hazardous properties, as well as for existing contamination such as water pollution, contaminated sites and waste.

B. Calls for the sustainable management of plastics and plastic products

1. **Ban on primary microplastics and measures against secondary microplastics: Primary microplastics** should continue to be restricted, and effective measures against secondary microplastics, e. g. from abrasion, should be introduced.
2. **Polymers must be included in the registration requirements under the REACH Regulation.** The current general exemption is no longer tenable in view of the wide-ranging environmental and health problems associated with the manufacture, use and disposal of plastic.
3. **Global agreements to restrict plastic production and use:** International agreements to reduce plastic products and manage plastic waste, as well as to address microplastics, should be pursued.

These demands aim to promote sustainable chemistry and achieve the EU's goal of an environment that is as 'toxic-free' as possible.

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