Marrying safety with sustainability in food packaging

Briefing for businesses
– October 2022

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#We choose reuse

ZERO WASTE EUROPE

TOXIC-FREE FOOD PACKAGING

Contents

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Zero Waste Europe is the European network of communities, local leaders, experts, and change agents working towards the elimination of waste in our society. We advocate for sustainable systems and the redesign of our relationship with resources, to accelerate a just transition towards zero waste for the benefit of people and the planet.

The Toxic-Free Food Packaging campaign is a collaboration between Zero Waste Europe and other NGOs with the goal of creating a toxic-free environment where nobody should have to worry about the presence of health-harming chemicals in the products that come into contact with our food.

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Abbreviations

BPA: Bisphenol A
CMR: chemicals with carcinogenic, mutagenic, or toxic to reproduction properties
ECHA: European Chemicals Agency
EDC: Endocrine Disrupting Chemical - chemical that affect hormones and their role in how the body develops and functions
EFSA: European Food Safety Authority
FCCoC: Food contact chemical of concern
FCAs: Food contact articles
FCMs: Food Contact Materials - materials and products that come into contact with our food, such as storage containers, factory equipment, kitchen utensils, and food packaging
NIAS: Non-intentionally added substances
PFAS: Per- and polyfluoroalkyl substances
SVHC: Substance of very high concern

1. Introduction

The clear limitations and negative impacts of single-use packaging are currently being exposed by governments, NGOs, and consumers alike, while reusable packaging is a priority on the agenda of European policy-makers.[1] The Ellen MacArthur Foundation is clear in its recommendations regarding packaging: reuse models can unlock significant benefits, and to create a circular economy for plastic we must eliminate all problematic and unnecessary plastic items.[2] The public are also "hungry" for change - more and more people want to do "the right thing". Importantly, consumer demand for eco-friendly and sustainable product packaging has proven remarkably stable and robust throughout the societal changes that have occurred in the last several years.[3] If the right reusable options are available, people want to use them.[4]

- Three quarters of people worldwide believe single-use plastics should be banned as soon as possible.
- Almost two-thirds of global consumers show interest in refillable packaging.

Industries are urged to respond to these emerging demands. As a result, more and more solutions are being developed toward reuse, recycling, and alternative materials. Importantly, all of these approaches can align well with companies' sustainability targets. Moreover, the economic factor should not be ignored: it has been suggested that shifting just 20% of plastic packaging from single-use to reuse is an upstream innovation opportunity estimated to be worth USD 10 billion.[5]

Certain reuse models may be more appropriate than others, depending on the context in which they are to operate (e.g. on the go consumption vs. at-home delivery).[6] In order to achieve widespread adoption, reuse services should be designed for convenience, enabling consumers multiple accessible places for drop-off and pick-up options. A recent ZWE report explored the evidence needed (from a quantitative and qualitative viewpoint) for determining the product

[1] France implemented a decree for article 67 of the AGEC law that sets a trajectory for the minimum share of reused packaging to be put on the market per year, which should reach 10% in 2027. Austria, Denmark, Luxembourg, the 1 Netherlands and Sweden asked the European Commission to introduce mandatory reuse targets for certain product groups in the revised Packaging & Packaging Waste Directive.
[2] Reuse – rethinking packaging (ellenmacarthurfoundation.org); Plastics and a circular economy | Ellen MacArthur Foundation
[3] GLOBAL BUYING GREEN REPORT 2022. Preference for Sustainable Packaging Remains Strong in a Changing World
[4] Reuse systems unpacked | 27th June 2022 | Report by HUBBUB
[5] Upstream Innovation: a guide to packaging solutions (ellenmacarthurfoundation.org)
[6] Reuse_EllenMacArthurFoundation.pdf (plasticchange.dk)

categories that are most suitable for the transition of some packaging from single-use to reusable options.[7] From a food packaging categories perspective, it can be argued that the sectors of beverage (especially beer, wine, soda drinks, water), as well as take-away food and drinks, have potential to greatly increase their reuse rates in the coming years and should be seriously considered as targets for legislative action.

While the staggering amount of waste (in particular plastics littering) from food packaging became very visible in recent years, the fact that food packaging and common tableware can also be a source of problematic chemicals - raising concerns about potential health impacts - is much less recognised. More than 12,000 chemicals have been identified for intentional use in the manufacturing of food contact materials (FCMs) and food contact articles (FCAs),[8] of which 352 chemicals with known carcinogenic, mutagenic (for which risk assessors agree that no safe levels for exposure exist), or toxic to reproduction properties.[9] In addition, there is a much higher number of non-intentionally added substances (NIAS).[10]

- Products we use to pack, store and cook food are one of the most common ways Europeans are exposed to harmful chemicals through food and drink on a daily basis.
- Official polling found that 84% of Europeans worry about the health impact of chemicals in products and 90% about their impact on the environment.

Progressive companies can help consumers avoid potentially harmful exposures, while ensuring long-term sustainability of their own business. Importantly, being proactive towards chemical safety can be a strong business asset.[11] Europe continues to be a major challenge for most companies, based on the higher production costs, and the overall regulatory environment. In 2020, the European Commission published its Chemicals Strategy for Sustainability (CSS), which is part of the EU's zero pollution ambition - a key commitment of the European Green Deal. The CSS announced a range of actions that will better protect health and the environment from harmful chemicals, including plans to ban some of the most toxic chemicals (see Restrictions Roadmap published in 2022) in consumer products, and food contact materials (FCM) such as packaging.[12] The European Commission's seriousness about addressing public concerns over hazardous

[7] #GetBack: Making Europe transition to reusable packaging - Zero Waste Europe
[8] Groh et al. 2021. Overview of intentionally used food contact chemicals and their hazards - ScienceDirect
[9] Zimmermann et al. 2022. Implementing the EU Chemicals Strategy for Sustainability: The case of food contact chemicals of concern - ScienceDirect
[10] NIAS are chemicals that are present in a food contact material (FCM) or food contact article (FCA) but have not been added for a technical reason during the production process. NIAS have various sources and can be grouped into side products, breakdown products, and contaminants. For more information see: https://www.foodpackagingforum.org/food-packaging-health/non-intentionally-added-substances-nias
[11] Chemical safety in your business (europa.eu)
[12] How the EU chemicals strategy can help to make our food packaging toxic-free - Zero Waste Europe

substances in products means many companies will have to reassess their product portfolios and work on reformulation.

Surveys of SMEs and manufacturing companies show that when small firms are aware of the EU regulations and know how they affect their business, they are the most active in re-designing their manufacturing processes.[11] Using safer alternatives to hazardous chemicals improves business reputation towards customers, consumers, investors and the community, who are nowadays more conscious on chemical toxicity and the need for sustainability. Additionally, it may help a company to be more competitive on both the EU and international markets (especially those facing emerging regulatory pressure).

There is no impact-free packaging solution (this is why we should avoid packaging whenever possible in the first place), but safe and sustainable packaging systems by design (e.g. free from toxic chemicals and reusable) can significantly reduce the negative impact of packaging on humans and the environment. We have now entered what must be the decade of urgent actions, as science shows we need to deal with a triple crisis: climate, pollution and biodiversity emergencies.

It is crucial for companies to 'close the tap' of pollution related to the whole life cycle of their products.

This briefing provides resources that can help companies identify the most safe and sustainable packaging options. In the next sections, we will highlight the opportunity for businesses to contribute to the transition towards non-toxic and reusable packaging, and discuss the concept of safe and sustainable food packaging, including regulatory developments and a number of current issues related to chemicals and materials (toxic recycling, "bio" plastics and microplastics).

2. Food packaging

Food packaging and tableware are called Food Contact Articles (FCAs), and they are made of different Food Contact Materials (FCMs). There are 17 different types of FCMs mentioned in European legislation.[13] These include plastics (in both rigid and flexible forms, both virgin and recycled), glass, ceramics, metals, silicones, paper and board – or a combination of the above. But also less obvious materials such as wood, textiles, adhesives, printing inks, varnishes and coatings, and wax.

Single-use plastic, paper and cardboard packaging account together for the biggest share of the market.[14] Newer materials include for example silicone, bamboo, bio-based or biodegradable / compostable plastics.

Apart from core materials used for making FCMs and FCAs, a wider variety of colourants and adhesives is used for labelling or decoration.[15]

While some (mainly non-governmental) organisations provide consumers with guidelines to inform them about the correct use of FCMs and the possible safety issues triggered by their misuse,[16] others create an overview of common materials to support users in making decisions for a suitable reusable solution.[17]

2.1 Urgent need for safe packaging

The functional elements of product packaging focus on ensuring safety for the food it packages, and are, among others, locking and sealing, moisture resistance; resistance to breakage. Some food products (like milk, yoghurt, soup, fruit juices and concentrates) can, for example, require aseptic standards for exclusion of harmful microorganisms. When it comes to chemicals present in food packaging, safety must be considered in terms of the hazards associated with those chemicals.[18]

[13] Food Contact Materials Briefing - Health and environment Alliance (HEAL) (env-health.org)
[14] ZWE 2020. Towards_safe_food_contact_materials.pdf
[15] Hazard prioritisation of substances in printing inks and adhesives applied to plastic food packaging (researchgate.net)
[16] SAFE - Safe Food Advocacy Europe. FCM guidelines for consumers.
[17] DUH: To-go-shopping: guide on reusables (in German)
[18] How the EU chemicals strategy can help to make our food packaging toxic-free - Zero Waste Europe

In the EU, more than 8,000 chemicals can be used in different types of food packaging and other FCMs.[19] Products made from plastic can contain a wide array of chemicals used as additives to achieve desired characteristics including flexibility (softeners and plasticisers), durability against heat or sunlight (stabilisers and antioxidants), antimicrobial agents, brightness agents, colourants, or fillers. Single-use packaging paper and paperboard can also contain a variety of additives added for functionality, e.g. grease-proofing agents, dry-strengthening agents, etc.

Many of the chemicals approved for use in FCMs are hormone disruptors (known as endocrine-disrupting chemicals, EDCs) — such as bisphenols found in the lining of cans, phthalates in plastic food wrap, and fluorocarbon chemicals in greaseproof wrappers. EDCs can leach into food and enter people's bodies. Human biomonitoring studies show that food packaging is one of the significant sources of exposure to EDCs such as BPA and phthalates in children and adults.[20] **Repeated daily exposure to these chemicals may contribute to serious human health risks,** such as decreased fertility, obesity, diabetes, and even long-term hormonal cancers (for more details see Section 4.1 The issue of hazardous packaging, and Table 1 in Annex).

Unfortunately, the current EU legislation does not adequately prevent such exposure.[21] Due to the lack of alignment between Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) and the legislation on FCMs, **several substances of very high concern (SVHCs) are still permitted in food contact in Europe,**[22] **and many of them can still be legally used in food contact plastics.**[23]

Chemical migration can occur under diverse situations and is affected by the temperature, type of food, packaging material, and storage time (for more details see Table 2 in Annex). Several studies have analysed or summarised chemical migration from different types of food contact materials and articles, including plastics, paper, can coating, and reusable food contact articles.[24] Of the 2881 food contact chemicals that were extracted or detected to migrate, more than two thirds were identified in plastic FCMs, followed by paper and board (887).

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[19] JRC Publications Repository - Non-harmonised food contact materials in the EU: Regulatory and market situation: BASELINE STUDY: Final report (europa.eu)
[20] Human biomonitoring: facts and figures (who.int); Dietary intake and household exposures as predictors of urinary concentrations of high molecular weight phthalates and bisphenol A in a cohort of adolescents | Journal of Exposure Science & Environmental Epidemiology (nature.com); Perfluoroalkyl chemicals (PFAS) - ECHA (europa.eu); ChemicalsCircularEconomy.pdf (hbm4eu.eu)
[21] Simoneau et al. 2016: Non-harmonised food contact materials in the EU: Regulatory and market situation: BASELINE STUDY: Final report. JRC report
[22] Food Contact Chemicals Database (FCCdb) | Food Packaging Forum
[23] Commission Regulation (EU) No 10/2011
[24] New research on chemical migration from plastic, paper, can coating, and reusables | Food Packaging Forum

Most available studies (70%) provide data on single-use food contact articles such as food and beverage packaging while studies on reusable containers account for less than 15%.[24] Importantly, a generalisation on safety for food packaging associated with plastics is not possible without a comprehensive characterization of the complex chemical mixtures present in different products. For example, tests performed by the Norwegian Consumer Council showed that many of the reusable water bottles popular with consumers leach into drinks phthalates, bisphenol A, lead, and other chemicals that are dangerous even at very small amounts. This was also the case for bottles used by children.[25] The tested bottles were purchased in various shops in Norway, however many of the same brands can also be found in shops in most other European countries. On a positive note, **the wide variation in the levels of hazardous substances detected between different bottles shows that many of the manufacturers have significant potential to improve their products**. Tests showed in fact that it is possible to make plastic bottles without almost any problematic substances.[25] More recently, scientists reported on the migration of over 400 plastic-related compounds, some being identified as being hazardous, from refillable sport bottles into drinking water.[26] Generally, dishwashing was found to enhance chemical migration, and comparison with glass bottles indicated that dishwashing-related chemicals absorbed better to plastic (polyethylene).

Additionally, **use of recycled materials potentially creates new pathways through which humans can be exposed to hazardous chemicals in contaminated material flows**, as shown for example for recycled plastic or paper used in food contact materials.[27] (for more information check Section 4.2 Toxic recycling - hazardous chemicals caught in the loop).

Finally, and above all, we should not forget that we do not use products in isolation, and all food contact articles and other consumer products that surround us, can contribute to **total exposure to a mixture of chemicals that can be worrisome**.[28]

> "Human biomonitoring studies in the EU point to a growing number of different hazardous chemicals in human blood and body tissue. Combined prenatal exposure to several chemicals has led to reduced foetal growth and lower birth rates."
>
> European Commission's *Chemicals Strategy for Sustainability*, 2020

[25] Drinking bottles leach chemicals: Forbrukerrådet (forbrukerradet.no)
[26] Hundreds of chemicals migrate from reusable plastic bottles | Food Packaging Forum
[27] ChemicalsCircularEconomy.pdf (hbm4eu.eu); Recycled plastic bottles leach more chemicals into drinks, review finds (theworldnews.net)
[28] Chemical-cocktails: CHEMTrust-report_March-2022.pdf

Further reading:

- 2020: Press Release: Scientists and civil society speak out: chemicals in food packaging are making us sick - Zero Waste Europe
- 2021: Testing finds that 8 out of 10 packaging materials for food contain highly toxic chemicals – ChemSec
- 2021:Throwaway Packaging, Forever Chemicals: European wide survey of PFAS in disposable food packaging and tableware (arnika.org)
- 2022: More than 3,000 potentially harmful chemicals found in food packaging | Food safety | The Guardian

2.2 Sustainable packaging

There is no simple and direct answer for **whether a packaging item is sustainable or not**. Sustainability should be always associated with looking at the 'whole picture' of environmental impacts: assessing a packaging product comprehensively (considering its whole life cycle; for more information see Table 3 in Annex) and making sure that a product's impact is minimised. Importantly, **'safety' and 'sustainability' concepts are directly interlinked, and chemical safety is an essential element of sustainability**.[29] In order for food packaging to be truly sustainable, it needs to be safe for both human and environmental health. Therefore, of utmost importance is the use of only adequately tested, non-hazardous chemistry in products.[30]

Packaging material that is considered to be among the safest[31] and the most sustainable[32] today is glass. If applied in reusable / refillable products, glass means healthy and recyclable packaging - a true circular, sustainable packaging product. The science-based information about the chemicals that migrate from packaging into food and drink found that of the 2881 food contact chemicals detected, only 47 were detected in the glass & ceramic food contact materials (FCMs), with coatings being almost exclusively a relevant source of those chemicals.[33]
Importantly, a higher percentage of consumers consider glass and metal to be more favourable than plastic and carton packaging.[34]

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[29] JRC Technical Report 2022: "Safe and sustainable by design chemicals and materials - Framework for the definition of criteria and evaluation procedure for chemicals and materials"
[30] Tackling the toxics in plastics packaging | PLOS Biology
[31] Glass safest packaging for food new research says (glass-international.com); Exploring the Safest Food Packaging Options | FSR magazine;
[32] zwe_reloop_executive-summary_reusable-vs-single-use-packaging_-a-review-of-environmental-impact_en.pdf (zerowasteeurope.eu)
[33] Full article: Systematic evidence on migrating and extractable food contact chemicals: Most chemicals detected in food contact materials are not listed for use (tandfonline.com)
[34] GLOBAL BUYING GREEN REPORT. Preference for Sustainable Packaging Remains Strong in a Changing World 2022buyinggreenreport.pdf (triviumpackaging.com)

Often however, moving away from materials applicable for reuse but with a high tendency for chemical migration, such as plastic, to more inert ones like glass or stainless steel, is hampered by various considerations and ”practicality”. For example in Germany, polypropylene (PP) is a material that is already widely used by various reuse system providers such as Vytal, Recup/Rebowl and Fairbowl. The main reason is that reusable containers made of PP have a relatively low material value, which translates into smaller deposit amounts, while at the same time they are suitable for "on the go" and have several desirable features such as: light weight, unbreakable, stackable, leak-resistant, dishwasher safe and a long shelf life. All three of these suppliers are certified with the Blue Angel, an environmental label recognised by all environmental NGOs in Germany. However, a generalisation on safety for food packaging associated with polypropylene based on chemical signatures is not possible because a comprehensive characterization of the complex chemical mixtures present in plastics is missing. Certain products trigger a range of toxicological endpoints, whereas others do not. On a positive note, this also implies that alternative polymer formulations which do not contain chemicals that induce the toxicity are available on the market.[35]

In general, manufacturing reusable packaging with inert materials (e.g. glass, stainless steel) can enormously reduce the overall impact of such packaging, i.e. significantly reduce overall emissions, including minimised release of potentially hazardous substances that can be found in plastics and other packaging materials.

Further reading:

- ➔ Single-use plastic take-away food packaging and its alternatives - Life Cycle Initiative | hosted by UN Environment Programme
- ➔ Packaging stakeholder guidance on converting to reuse, using safer additives | Food Packaging Forum
- ➔ Upstream 2022. Reuse wins at events. A life-cycle analysis of reusable and single-use cups
- ➔ SPHERE: the packaging sustainability framework - World Business Council for Sustainable Development (WBCSD)
- ➔ Design Principles for Materials Used in Reusable Packaging & Foodware Services — Upstream | Sparking innovative solutions to plastic pollution (upstreamsolutions.org)
- ➔ Towards safe food contact materials in a toxic-free circular economy - Zero Waste Europe

[35] Benchmarking the in Vitro Toxicity and Chemical Composition of Plastic Consumer Products | Environmental Science & Technology (acs.org)

3. Opportunity for businesses to contribute to the transition towards safe and reusable packaging

Navigating the myriad of potential packaging and FCMs impact metrics is not an easy task. Businesses currently face challenges in addressing and improving their sustainability and circularity. How can they find a good balance between packaging functionality and sustainability (which includes chemical safety)? How do they ensure that trying to solve one issue will not create another problem somewhere else?

As packaging waste continues to leak into the environment, and its production, waste, and disposal is a source of hazardous chemicals, it is crucial for companies to help to “close the tap”. Industries should comprehensively evaluate their substances and processes, and eliminate any deemed unsafe or inessential.

There is no perfect (entirely impact-free) packaging solution, but there are resources that can help to find the currently most sustainable one.

Avoiding harmful substances: First, a business operator needs to know more about what’s in packaging, how it was made, and how it can potentially affect human health. When having ‘the full picture’, a company can make changes to how materials and processes are chosen. Evidence that the fewest food chemicals of concern are detected in metal, glass and ceramic, thus materials that can easily be applied in reusable and refillable packaging, exist already.

It can be challenging to get data on what chemicals are in your company’s packaging materials, where they are used, and why. Often, testing packaging and products is the best way to ensure that they are free of hazardous chemicals, and possibly to identify where issues may exist in packaging or a product portfolio.[36] This is however not always easy, especially for small SMEs. We therefore need (urgently!) laws to increase transparency across the supply chain.[37]

On the other hand, as the regulatory burden increases, companies unwilling to transition to using and producing more sustainable chemicals are facing significant pressure. A number of retailers

[36] Tackling the toxics in plastics packaging - PMC (nih.gov)
[37] Still wanted: Chemical transparency – ChemSec

and corporations are taking voluntary steps to phase out some of the hazardous chemicals in their products.[38] The Food Packaging Forum database on migrating chemicals can serve manufacturers and businesses as a list of priority chemicals for urgent phase-out.
It is in fact a win-win situation: removing toxic chemicals from food packaging and other food contact materials does not only protect human health and the environment, but also earn investor, retailer and consumer confidence while building brand trust.[39]

But where to look for support in decision-making for packaging strategies? First **inform yourself, then take action:**

- Use Understanding Packaging (UP) Scorecard to start - to **assess human health and environmental impacts of common foodware and food packaging choices**.[40] The UP Scorecard is a free, easy-to-use, web-based tool. Scores are provided for plastic pollution, chemicals of concern, climate, water use, sustainable sourcing, and recoverability, simplifying your search for safe and environmentally sound packaging (for more information see Section 6). For example SPHERE, a new sustainable packaging framework, includes Chemicals of Concern as a metric and recommends using the UP Scorecard.[41]

- Check the Food Packaging Forum database that brings together **key information about hundreds of voluntary initiatives and commitments by food brands and retailers** from around the world that have gone beyond legal requirements to improve the chemical safety and resource efficiency of their food contact materials. The database provides an entry row for each initiative or commitment and includes key information about, among others, the country or region where it is applicable, whether or not it is related to chemical safety, whether it is a commitment or an initiative,and a short summary describing it. Finally, it also provides links to other useful resources.

- When necessary, start working on redesigning packaging with circularity in mind - notably by **reducing the complexity of packaging (e.g. fewer layers, materials, polymers and chemicals, and use ones well evaluated) and designing it to last** – this can reduce uses of hazardous chemicals, reduce food waste, and get rid up to 75% of the packaging waste. It

[38] Starbucks announced in spring 2022 that the company will ban PFAS in all packaging internationally by 2023, and the corporate parent company of Burger King announced that their companies will phase out added PFAS by 2025. Vanguard uncovered: Eco-Products president on creating fiber packaging without PFAS or regrettable substitutes (packaginginsights.com)
[39] Safer Food Packaging - EDF+Business; For how much longer dare investors ignore the impact of chemicals? – ChemSec
[40] Making the most of the Food Chemicals of Concern (FCOC) List | UP Scorecard
[41] SPHERE: the packaging sustainability framework - World Business Council for Sustainable Development (WBCSD)

will also ensure that this packaging is primarily reused and effectively recycled in Europe at the end of its life.[42]

The sections below discuss in more details a number of the fundamental concepts related to FCMs (and reusable food packaging in particular), and chemicals.

[42] Packaging at the core - Zero Waste Europe 2022

4. Safe and Sustainable packaging must be toxic-free

4.1 The issue of hazardous packaging

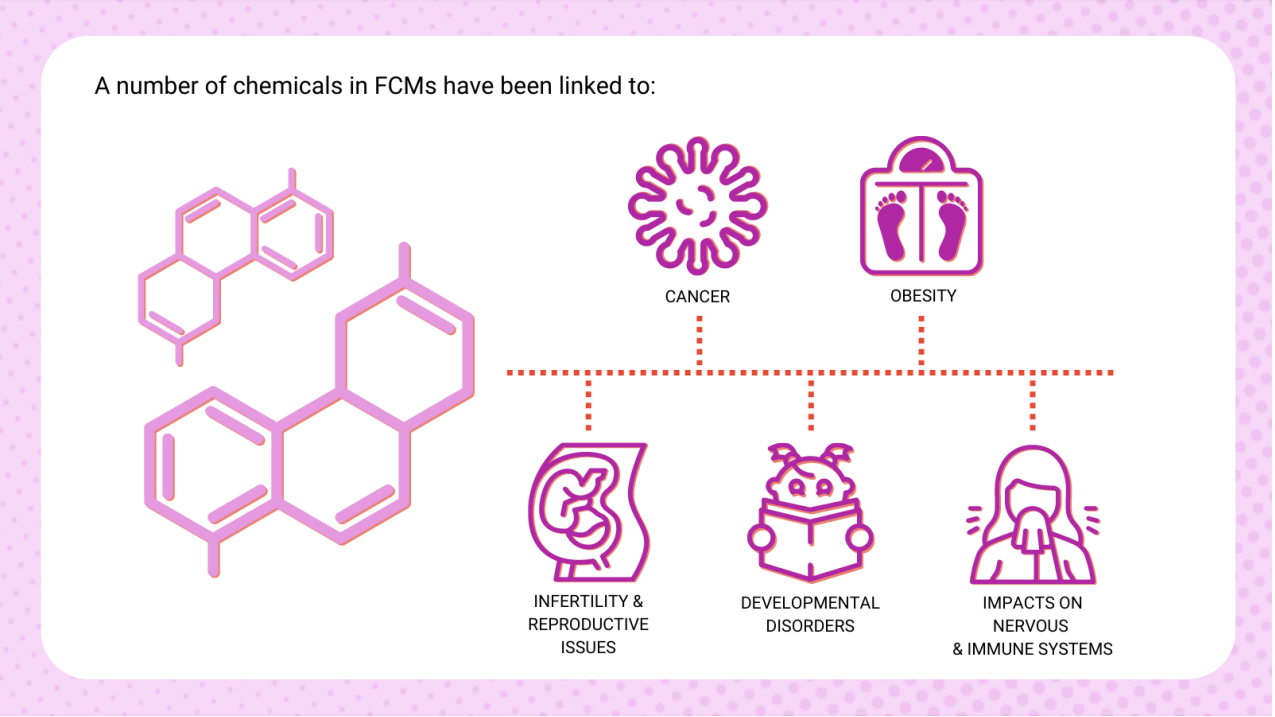
Current safety assessment of food contact chemicals is not sufficient to protect human health. Packaging is a greater source of exposure to toxic chemicals than previously thought.

Strong scientific evidence shows that food contact materials, including packaging, are a relevant source of exposure for known synthetic hazardous substances as well as for many toxicologically uncharacterized chemicals, both intentionally and non-intentionally added.[43] These chemicals have hazardous properties such as being carcinogenic, mutagenic or reprotoxic, persistent, bioaccumulative and toxic, or endocrine disrupting. Bisphenols, phthalates and fluorocarbon compounds (PFAS, also known as "forever chemicals") are just a few best known and studied examples of harmful chemicals that can be present in food packaging.[44]

Many of the chemicals associated with FCMs can be found in our bodies (including in urine, serum, plasma, placenta, umbilical cord, breast milk, and foetal tissues), and have been linked to harmful impacts on our health, i.e. development of cancers, problems with reproduction, disturbed metabolism, obesity, diabetes, and impaired brain development.[45] They can also negatively impact our immune system, resulting in a reduced ability to fight infections or respond to vaccines. Certain chemicals have effects on multiple generations as exposure to these chemicals prenatally or during adult life can negatively impact the health of future generations. (for more information see Table 1 in Annex)

[43] Impacts of food contact chemicals on human health: a consensus statement | Environmental Health | Full Text (biomedcentral.com); Chemicals in a Circular Economy: Using human biomonitoring to understand potential new exposures
[44] https://www.foodpackagingforum.org/food-packaging-health/bisphenol-a; https://www.foodpackagingforum.org/food-packaging-health/phthalates; https://www.foodpackagingforum.org/food-packaging-health/per-and-polyfluoroalkyl-substances-pfass
[45] Impacts of food contact chemicals on human health: a consensus statement | Environmental Health | Full Text (biomedcentral.com)

Figure 1: FCMs linked to health impacts, Zero Waste Europe



A wide array of chemicals in FCMs have been linked to a number of health issues (Figure 1), namely:

- Cancer (global rates of breast, endometrial, ovarian, prostate, testicular and thyroid cancers have been increasing over the past 40–50 years),
- Infertility and other reproductive disorders (from 1973 to 2011, the total sperm count of men in Western countries dropped by 59%),
- Developmental disorders (increasing risks for child learning, attention, and behavioural problems, with the costs related to neurodevelopmental disease and IQ loss reaching EUR 157 billion per annum)
- Impacts on nervous and immune systems (multiplying up to 4 times the likelihood of children falling ill)
- Global obesity (which has tripled since 1975), with more people now obese or overweight than underweight, and is increasing in every country studied, especially in children. Almost 2 billion adults are now overweight, including almost 40 million children under five that are obese or overweight.

Migration levels of packaging chemicals in food are typically too low to result in acute adverse health effects; a major aim of risk management is, therefore, to protect consumers from potential adverse effects arising from **repeated dietary exposure** to packaging chemicals over a long period (**chronic exposure**).

Ultimately, developing solutions for improving the safety of FCMs and for achieving the circular economy should be science-based decisions, made in **the interest of improving public health.** Notably, importance of ensuring that FCMs do not contain the most harmful chemicals and implementing the generic approach to their risk management has been clearly recognised by policy makers, what translated into commitments made in the EU Chemicals Strategy for Sustainability (CSS) and ambitious Restrictions Roadmap (for more information see Section 5. Upcoming policy & regulatory developments).

Available Resources

There are a number of excellent resources, created by a team of researchers led by the Food Packaging Forum, which can help in identifying and learning about chemicals in FCMs:

- The **Food Contact Chemicals database (FCCdb)** identifies 12,285 food contact chemicals that could be used in the production of food contact materials and articles worldwide. **608 chemicals are highlighted as the most hazardous, and a further 1,411 chemicals are identified as being of potential concern**. However, for many of the chemicals in this database, toxicological data is scarce or not available at all.

- The **Database on Migrating and Extractable Food Contact Chemicals (FCCmigex)**. Scientists analysed 1210 scientific studies where chemicals had been measured in all types of food contact materials and articles, including food packaging, processing equipment, tableware, and reusable food containers.[46] In total, **the database contains more than 3,000 food contact chemicals** and over 22,000 database entries. FCCmigex also contains a dedicated **PFAS page** which shows that published scientific studies have so far detected 29 different PFAS that were found to migrate from food contact materials into food or food simulants. Most were in paper and board products, but some were also found in plastics and metal coatings.

- **A recent peer-reviewed study** prioritises **388 food contact chemicals considered harmful** for being phased-out urgently, including 352 substances that are known to have **carcinogenic, mutagenic, or toxic to reproduction** (CMR) properties, 22 **endocrine disrupting chemicals**, and 32 **chemicals with**

[46] Systematic evidence on migrating and extractable food contact chemicals: Most chemicals detected in food contact materials are not listed for use (tandfonline.com)

persistence- and bioaccumulation-related hazards. Importantly, the study shows that **plastic monomers** known to have CMR hazard properties can transfer into foods under actual conditions of use, making them highly relevant for human exposure.[47] This is directly in contradiction to the earlier common assumption that monomers, used as starting materials for the manufacturing of plastic polymers, do not migrate from finished food packaging.

Part of the recurring problem is that of a 'regrettable substitution': due to regulatory developments and public awareness, manufacturers are replacing problematic chemicals with substances that have similar properties and therefore raise similar concerns about toxicity and health effects. A typical example is BPA being substituted with other bisphenols. Popular "BPA-free" product labels do not therefore guarantee that the consumer will not be exposed to another, equally toxic, bisphenol.

Another example of a 'regrettable substitution' occurs when single-use plastic is replaced with single-use paper packaging[48] or reusable plastic with alternative materials like reusable 'bamboo' cups and tableware[49] that can be of equal concern for leaching hazardous chemicals into food as conventional plastics.

Finally, there is clear evidence that the production of FCMs and in particular food packaging, is evolving with new and innovative types of materials being used and introduced onto the market, like packaging materials made of or containing nanomaterials.[50] Studies have found differing mechanisms of nanomaterials release from food packaging, and the OECD points to a need for a better understanding of such migration.[51] Many unanswered questions exist related to the risks of human exposure associated with migrating nanomaterials.[52]

[47] Zimmermann et al. (2022) "Implementing the EU Chemicals Strategy for Sustainability: The case of Food Contact Chemicals of Concern." Journal of Hazardous Materials.
[48] Harmful chemicals in paper food packaging? "Problematic" findings prompt calls for EU safety assessment (packaginginsights.com); BEUC report 2019: "MORE THAN A PAPER TIGER. European consumer organisations call for action on paper and board food contact materials"
[49] BfR statement on bamboo cups and tableware | Food Packaging Forum
[50] Evaluation of the legislation on food contact materials (SWD(2022)163) (COMMISSION STAFF WORKING DOCUMENT)
[51] OECD 2022. Important Issues on Risk Assessment of Manufactured Nanomaterials. Series on the Safety of Manufactured Nanomaterials No. 103
[52] Jokar, M., et al (2016). Six open questions about the migration of engineered nano-objects from polymer-based food-contact materials: a review. Food Additives & Contaminants: Part A; (PDF) Nanomaterials in food contact materials: considerations for risk assessment (researchgate.net)

Further reading:

- Best Practices in Chemicals Management - A Chemicals Management Crash Course (ChemSec)
- Turning the Plastic Tide - HEAL Plastics report (env-health.org)
- Plastics, EDCs & Health: Authoritative Guide | Endocrine Society
- Perfluoroalkyl substances and changes in body weight and resting metabolic rate in response to weight:-loss diets: A prospective study - PubMed (nih.gov)
- VeilleNanos - Presence of nanos in food: what is the state of play? and AVIS et RAPPORT de l'Anses relatif aux nanomatériaux dans les produits destinés à l'alimentation
- Food contact material applications: overview and procedure | EFSA (europa.eu); Food Contact Materials: legislation on food contact materials (FCMs) in the EU

4.2 Toxic recycling - hazardous chemicals caught in the loop

Recycling food packaging is an important part of achieving a circular economy in the European Union - the European Commission aims for all plastic packaging to be reusable or recyclable by 2030.[53]

However, hazardous chemicals are not always removed during the recycling process. That means toxic chemicals are recycled along with the other materials, and this is true especially for recycled plastic and for recycled paper and cardboard.[54]

Toxic-free material cycles are a key priority because while some packaging can be reduced (by e.g. simply avoiding packaging in the first place, as done by French and Spanish bans of plastics to package most fruit and vegetables[55]) or reused[56], we will likely always need some kind of food packaging for certain applications.

The recycling process may result in the formation of novel chemical species, which creates a concern about the potential migration into food of unexpected / uncharacterised substances from packaging made of recycled materials. Recycled materials can therefore contain hazardous

[53] https://ec.europa.eu/commission/presscorner/detail/sv/MEMO_18_6
[54] Geueke et al. 2018. Food packaging in the circular economy: Overview of chemical safety aspects for commonly used materials. Journal of Cleaner Production; ChemicalsCircularEconomy.pdf (hbm4eu.eu)
[55] That's a wrap: French plastic packaging ban for fruit and veg begins | France | The Guardian
[56] zwe_reloop_report_reusable-vs-single-use-packaging-a-review-of-environmental-impact_en.pdf.pdf_v2.pdf (zerowasteeurope.eu); Realising Reuse Report: reusable packaging target of 50% in key sectors could drastically reduce CO2 emissions, water consumption and waste - Rethink Plastic (rethinkplasticalliance.eu); #GetBack: Making Europe transition to reusable packaging I Zero Waste Europe

chemicals, sometimes at levels higher than those found in virgin materials, and even in products considered as safe (like PET beverage bottles).[57]

The industry often suggests that the new technology of "chemical recycling" is the solution to the problem of removing hazardous chemicals from plastics for the purpose of recycling for specific FCM applications. However, the ECHA's opinion is that "*There is little knowledge about the abilities of different chemical recycling processes to eliminate substances of concern. To make sound conclusions, investigations at chemical recycling plants should be carried out*."[58] Such investigations - evidence that the new technology can produce food safe plastic materials - will become obligations for operators and competent authorities under the new regulation on recycled plastic materials and articles intended to come into contact with food.[59] Nevertheless, concerns related to the presence of NIAS and to the implementation and enforcement of the new rules remain valid.[60] As a matter of priority, the Food Contact Material (FCM) Framework Regulation (EU 1935/2004) needs a comprehensive revision to ensure the elimination of hazardous chemicals, which the EU Commission is presently undertaking.

We must prioritise public health and the environment while encouraging more closed-loop and high-quality recycling. For this reason, **we must eliminate hazardous chemicals from the start** (via packaging design) in primary articles, so that when the packaging is recycled or composted, it is safe. And when packaging is recycled - materials are kept in a circular economy.

Further reading:

- ➔ How harmful chemicals in food packaging can hamper the circular economy
- ➔ Governments and stakeholders reflect on toxics in recycling | Food Packaging Forum
- ➔ We need to get toxic chemicals out of plastic packaging, not abandon recycling - Ambr (ambr-recyclers.org)

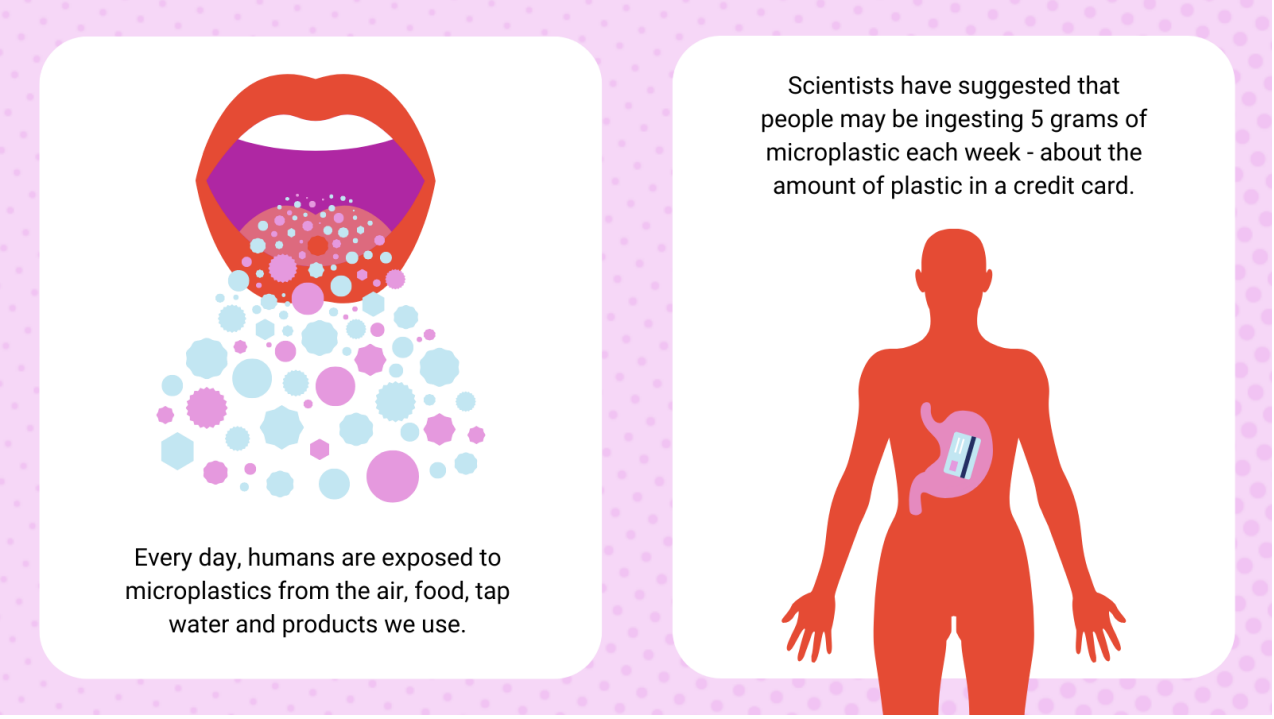
4.3 Tiny microplastic: a problem that is not tiny at all

Microplastics are plastic pieces that measure less than five millimetres across. They are formed by breaking away from larger plastics that fragment over time.

[57] Scientific review reveals the chemicals migrating from PET drink bottles | Food Packaging Forum
[58] https://echa.europa.eu/-/reach-requirements-need-to-be-considered-in-chemical-recycling
[59] The new regulation, repealing the Regulation (EC) No 282/2008, and entering in force on 10/10/2022
[60] 2022.02.21 FINAL letter re new regulation on recycled plastics in FCMs (zerowasteeurope.eu)

Microplastics pollution has contaminated the entire planet, from the summit of Mount Everest to the deepest oceans. Plastic products release microplastic even before they are disposed of and materials break down in the environment. Similarly to microplastics, nanoplastics may be released into the environment directly or form due to the fragmentation of larger particles.

Figure 2: Microplastics in human body, Zero Waste Europe



Human exposure to microplastics is manifold, including via the air, food, tap water or come from the products (including plastic beverage packaging[61]) we use - scientists showed that babies fed formula milk in plastic bottles were swallowing millions of particles a day, and suggested that people may be ingesting 5 grams of microplastics each week — about the amount of plastic in a credit card.[62]

Recently, microplastics were revealed in the placentas of unborn babies, and found in blood and the lungs of people; the most common particles were polypropylene (PP), used in plastic packaging, and polyethylene terephthalate (PET), used in plastic bottles.

Microplastics now constitute **a potential threat to global ecosystems and humans** at an almost unimaginable scale. The adverse effects on organisms that are exposed to microplastics can be separated into two categories: physical effects and chemical effects. The former is related to the

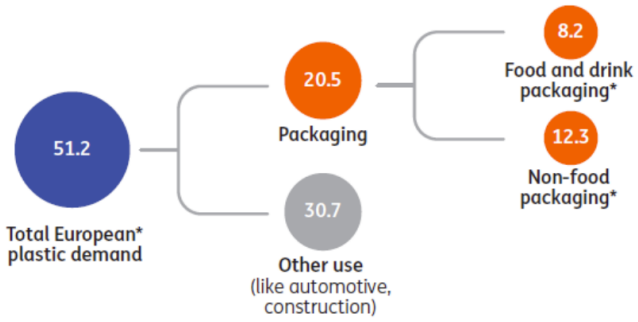
[61] Download the survey report "Bottled water: We drink plastic!" (agirpourlenvironnement.org)
[62] WWF, "Assessing Plastic Ingestion from Nature to People." 2019, [Online]. Available: https://awsassets.panda.org/downloads/plastic_ingestion_press_singles.pdf

particle size, shape, and concentration of microplastics, and the latter is related to hazardous chemicals that are associated with microplastics. Furthermore, toxicity and the relative ease with which microplastics cross biological barriers are expected to increase as the size decreases. This raises further concerns about smaller microplastics, and in particular, nanoplastics (i.e. particles up to 100 nanometres).[63]

A report from the World Health Organisation (WHO) confirms an overwhelming consensus among all stakeholders: measures should be taken to mitigate exposure to nano- and microplastics. This should include reducing the use of plastics, when possible.[64]

Even if the full health impact to the human body is still not known – more and more evidence shows that we should be concerned, and precautionary measures should be taken. And the only way to minimise our exposure to microplastic is to drastically reduce plastics use.

Figure 3: Plastic Demand in Europe (2018), in million metric tonnes, ING Economics Department



Source: Plastics Europe, Europe is EU28, Norway and Switzerland.
* ING estimates, based on the assumption that 40% of all plastic

Further reading:

- ➔ Microplastics | Food Packaging Forum
- ➔ CUSP cluster - The European Research Cluster to Understand the Health Impacts of Micro- and Nanoplastics (cusp-research.eu) Funded by the European Union, a multidisciplinary team of scientists, industry and policymakers collaborating in research on the complex relationship between micro- and nanoplastics (MNPs) and human health, from early life to adulthood.

[63] Scientific Opinion to the European Commission, 2019: Environmental and Health Risks of Microplastic Pollution.
[64] Dietary and inhalation exposure to nano- and microplastic particles and potential implications for human health (who.int)

4.4 Spotlight on "Bio": problems with bio-based, biodegradable and compostable plastics

Bio-based plastics cover a broad range of feedstocks and materials, with wide variations in terms of their environmental impacts. The use of the generic term "bioplastics" triggers confusion and does not allow a specific assessment of two material-related issues that are markedly different (**sourcing**, on the one hand, and **end-of-life** options, on the other).

Bio-based plastics refer to plastics sourced from living natural materials (such as plants) and cannot be considered as inherently circular and sustainable; they can contain up to 75% of conventional fossil-based plastic and be non-biodegradable.[65] Nevertheless, bio-based content continues to be used as a marketing tactic to signify environmental added-value of plastic products.

Biodegradable and compostable plastics, as other conventional plastics, are often still fossil-based and mostly rely on the use of virgin materials, are non-reusable, short-lived and usually not recycled. As such, they perpetuate a linear model where items are used once and with a short lifetime before being disposed of, contributing to the loss of valuable resources and to externalities associated with their production and end-of-life.[66]

Most often, **compostable items** and packaging are in reality not composted (because they are not compostable under the usual composting conditions that apply for organic waste, e.g. in consumers' gardens) but instead end up in incineration or landfills, or risk polluting the environment as they are disposed of incorrectly. This is sometimes due to misunderstanding fostered by vague terminology, inadequate or partial information, the absence of the right infrastructure, or infrastructures refusing such plastics because they are not actually compostable under the conditions of some composting facilities.[67]

Currently, bio-based plastics are most commonly produced from carbohydrate-rich food plants, such as corn or sugarcane, or oily plants.[68] Importantly, there is still a risk that renewable resources used for the creation of these 'bio' plastics, in a context of economic growth and increased interest in biomass across many sectors, could occupy land that could otherwise be used for food production, and / or could also be depleted (beyond bio-based plastics).[69]

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[65] https://rethinkplasticalliance.eu/ressource/plastic-fake-out-falling-into-the-trap-of-bioplastics/
[66] Biodegradable, oxo-degradable and compostable bags observed over three years in the sea, open air and soil (europa.eu)
[67] Biodegradable and compostable plastics — challenges and opportunities — European Environment Agency (europa.eu)
[68] https://bioplasticseurope.eu/about
[69] Crenna et al. 2018. Natural biotic resources in LCA: Towards an impact assessment model for sustainable supply chain management. Journal of Cleaner Production, 172, 3669–3684

"Renewable resources do not continue to grow indefinitely and they can be depleted beyond the point of renewability", Crenna, 2018.

These 'bio' plastic materials are still relatively new on the market, not actively regulated, and discussions around them are dominated by issues related to sourcing and end-of-life options. However, the usage phase is still mostly ignored. Recent evidence suggests that reusable plastic bottles made from biodegradable polyethylene may actually leach more problematic chemicals than single-use bottles, because plasticizers may migrate more easily as the biodegradable plastic bottles slowly degrade during use.[70]

To summarise, a cautious approach is necessary in formulating a framework for bio-based, biodegradable, and compostable plastics. Biodegradability and compostability properties should be no valid reasons to grant exemptions from much needed measures to reduce resources, single uses, waste and overall impacts of plastics.

Further reading:

- ➔ Biodegradable and compostable plastics — challenges and opportunities The European Environment Agency
- ➔ Biodegradable, oxo-degradable and compostable bags observed over three years in the sea, open air and soil (europa.eu)
- ➔ Spotlight on biodegradable plastics ECOS (ecostandard.org)
- ➔ Plastic Fake Out: Falling into the trap of Bioplastics - Rethink Plastic (rethinkplasticalliance.eu)
- ➔ Food Packaging Forum fact sheet: Bioplastics

[70] Non-target screening for the identification of migrating compounds from reusable plastic bottles into drinking water - ScienceDirect

5. Upcoming policy & regulatory developments

Regarding food packaging and other food contact articles, general requirements for their safety are governed by Regulation (EC) No 1935/2004 - regulation of food contact materials (FCM).[71] The principles set out in this piece of European Union law are 45 years old and have only recently been evaluated.[72] (for more details see last section in Annex: Main conclusions (main deficiencies) from evaluation of FCM regulation).

Currently, EU rules on chemicals used in FCM are less protective than other EU chemical regulations.

Another issue is that some emerging issues related to chemicals, such as introducing onto the market packaging materials made of or containing nanomaterials, as well as the risk to consumers from increasing exposure to microplastics, are not well or not at all accommodated in the current FCM legislation. The current legislation favours risk assessment and risk management of well-established chemistry, with a focus on defined starting substances to produce synthetic polymers in order to manufacture plastics.[69]

As a result of these realities, the Member States are increasingly introducing national legislation which creates a fragmentary approach within the EU and the broader economic community. Denmark, Germany, France and Switzerland have all passed legislation banning or restricting certain harmful chemicals, which has led to calls at the EU-level, from civil society and within industry to address the law at a broader EU scale. At the end of 2020, the European Commission finally kicked off a revision of EU laws on chemicals in FCMs; the process is however facing more and more delays and at the date of writing this report it is unclear when this revision will take place.

[71] Legislation: Food safety (europa.eu)
[72] Evaluation of the legislation on food contact materials (SWD(2022)163) (COMMISSION STAFF WORKING DOCUMENT)

Specifically on safe, non-toxic packaging, an ambitious reform of both the EU's food contact materials and chemical policy frameworks is an opportunity to be guided by a key principle of the EU Chemicals Strategy for Sustainability (CSS): to eliminate the most hazardous chemicals from consumer products.

Further reading:

- ➔ European Commission takes first step towards toxic-free food packaging (chemtrust.org)
- ➔ How the EU chemicals strategy can help to make our food packaging toxic-free - Zero Waste Europe
- ➔ BEUC comments to the Food Contact Materials REFIT evaluation
- ➔ Food Contact Materials Briefing - Health and environment Alliance (HEAL) (env-health.org)

5.1 Much more scrutiny on chemicals is expected in the (near) future

Recently, the EU released an ambitious Restrictions Roadmap under the Chemicals Strategy for Sustainability, that would outlaw the use of harmful polymers like PVC and chemical groups like PFAS and bisphenols by 2030.[73] The bans on groups of chemicals will prevent companies from circumventing the law by making minor chemical alterations to compounds, as is often done in industry.[74]

The European Food Safety Authority (EFSA) on the other hand, recently published and consulted a new draft Scientific Opinion on BPA and proposed a new Tolerable Daily Intake (TDI) limit that is 100,000 times below the current TDI. This *de facto* means that BPA could no longer be used in food packaging.

The implementation of the European chemicals legislations are greatly affecting chemical manufacturers, as well as downstream companies and retailers.[75] **Forthcoming chemicals regulations will add significant complexity for the packaging industry**. Being proactive can provide clarity and a route to managing this uncertainty. Companies that passively wait on regulatory guidance could even elevate the risk of not meeting rapidly approaching deadlines, and in failing to comply with regulations if they wait too long or rush unfavourable substitutions.[76]

[73] EU declares blanket ban on harmful packaging chemicals but braces for petrochemical fightback (packaginginsights.com)
[74] Why a group restriction of the bisphenols is long overdue (chemtrust.org)
[75] https://chemsec.org/business-and-investors/investors/
[76] Navigating regulatory uncertainty in packaging: A new wave of chemical-substance regulations | McKinsey

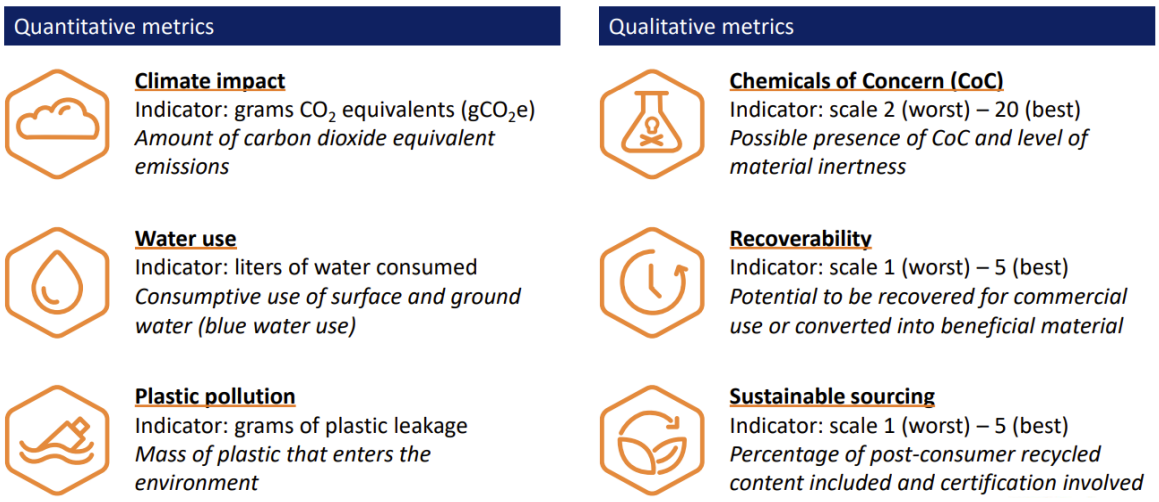
Progressive manufacturers and businesses can immediately start this transition by introducing new models, new innovative solutions, and/or by scaling up existing safer solutions for packaging (e.g. avoiding toxic glues and inks, using glass or metal containers for reusable options). That will obviously generate short-term costs for industry, but in the long run, these costs become an investment, benefit frontrunners, allow the industry to innovate and help businesses to achieve long-term sustainability.

Further reading:

- ➔ What goes around. Enabling the circular economy by removing chemical roadblocks - ChemSec
- ➔ Safer chemicals are good for business, creating jobs and growth - CHEM Trust
- ➔ Plastic Additives — ChemForward. A plastic additive optimisation tool that enables users to check the chemical hazard profile of over 1100 plastic additives to find the safest option for a particular function.
- ➔ Going Beyond Compliance to Manage Business Risks from Toxic Products
- ➔ New guide helps retailers with chemical management. Non-profit Clean Production Action has published a guide for retailers wanting to address consumer and investor concerns about hazardous chemicals in products.
- ➔ The SIN List is developed by the non-profit ChemSec: one of the most progressive chemical standards in the world.
- ➔ Marketplace hosted by ChemSec gathers all green chemistry innovations in one place, making it easier for companies to choose safer solutions.

6. UP Scorecard: become empowered to remove toxic chemicals from food packaging

Figure 4: The mix of quantitative and qualitative metrics used within this scorecard, Food Packaging Forum



We need to expand how we evaluate the performance of food packaging; the Scorecard is a guide to moving away from carbon tunnel vision to a holistic assessment of all the impacts that packaging has on health and the environment.

➔ Introduction and guidance

The UP Scorecard provides a standardised way to holistically evaluate common foodware and food packaging options to make responsible food packaging choices simple. It enables users to choose foodware and packaging that can assist in reducing negative impacts on human health and the environment. The tool not only evaluates common quantitative environmental metrics like climate impact and water use, it also allows for a qualitative assessment of issues like the recoverability of a product and the potential harm from chemicals of concern in a product.

Especially the chemicals of concern metric is a novelty and guides you through avoiding the most concerning substances in food packaging and moving towards healthier materials.

The chemicals of concern score indicates (1) whether the container is free of one or more tiered lists of chemicals of concern to be avoided based on human and environmental hazards, (2) the quality of the information used to support such a claim, and (3) the propensity of chemicals of concern to migrate from the material into food and the environment.

Normally, the information about the potential presence of certain chemicals of concern in a product and the quality of this information is not made publicly available by packaging manufacturers and distributors. Therefore, the UP Scorecard assumes by default that a product is not compliant with any tiered list. If the user knows about the chemical composition of a packaging item, they can use this information in the tool to increase a product's score, e.g. by declaring compliance of a product with one of the tiered lists. The idea behind this approach is to help start the discussion with suppliers and create a pathway towards safer chemicals and materials as well as to help increase the transparency of chemicals of concern along the value chain.

In combination with the other five metrics, the UP Scorecard allows for safe and environmentally sound purchasing decisions for foodware and food packaging. This enables intuitive, transparent, and science-based decision making in procurement and beyond. The UP Scorecard is being developed and managed by an established multi-stakeholder expert group including leading global food service companies, NGOs, and technical experts. Learn more and make use of the UP Scorecard to improve your decision-making.

➔ Making the most of the Food Chemicals of Concern List

The Chemicals of Concern (CoC) metric within the UP Scorecard is fundamental in helping choose foodware and packaging without chemicals of concern. An important component of this metric is the Food Chemicals of Concern (FCOC) List, a first-of-its-kind, harmonised list of chemicals of concern that guides users away from known hazards and encourages them toward safer chemistry in foodware and packaging.

The FCOC List isn't only valuable within the UP Scorecard. No matter whether you are a food service company, retailer, restaurant, food brand, or foodware/packaging manufacturer - the FCOC

List can be a helpful stand-alone resource in prioritising which chemicals of concern to look out for and take action on in your operations. Some examples of uses for the FCOC List could include:

- ✔ Communicating to suppliers a chemical management goal
- ✔ Setting expectations within your supply chain about transparency, disclosure, and verification
- ✔ Building an inventory of what is known and not known in your supply chain

When implemented consistently across the industry, these activities can also send a **strong and consistent demand signal up the supply chain for safer materials that foster packaging circularity**.

The FCoC List is available for use as a freely downloadable spreadsheet that can be further filtered and sorted as needed.

Further reading:

- ➔ Making the most of the Food Chemicals of Concern (FCoC) List (UP Scorecard)
- ➔ Resources for eliminating toxic chemicals from food packaging to drive a safer future and a stronger business (UP Scorecard)
- ➔ SPHERE: the packaging sustainability framework - World Business Council for Sustainable Development (WBCSD)
- ➔ Removing toxic chemicals from food packaging starts with you. Safer Food Packaging - EDF+Business
- ➔ Guidance for Reusable Packaging (sustainablepackaging.org)
- ➔ 2021-Plastics-All-Golden-Design-Rules-One-Pager (theconsumergoodsforum.com)
- ➔ READY-TO-USE GUIDE Reusable packaging (CITEO)

CONCLUSIONS & RECOMMENDATIONS

- Food packaging and common foodware are **only sustainable if they are toxic-free.**
- EU legislation should urgently phase out the most hazardous chemicals and ensure packaging and other food contact articles are safe for use, reuse and recycling. As a principle, **products that cannot be safely used, reused and recycled at the end of their life should not be produced or placed on the market in the first place.**
- Removing toxic chemicals from food packaging and other food contact materials will not only **protect human and environmental health**, but also can **create investor, retailer and consumer confidence** while building brand trust.
- Reusable packaging systems are a crucial solution for sustainable packaging systems and well **enabling a circular economy.**
- **Manufacturers can already introduce innovative solutions and/or scale up existing safer solutions** for packaging (e.g. by avoiding toxic glues and inks, using inert materials for reusable options).
- **Tools like the UP Scorecard can immediately be used to support decision-making** strategies for packaging and dialogue with suppliers.

ANNEX

Table 1. KNOWN HAZARDOUS CHEMICALS THAT CAN BE FOUND IN FCMs:

Bisphenols: a group of chemicals widely used in the production of polycarbonate polymers and epoxy resins, which act as a protective lining on the inside of some metal-based food and beverage cans. They are also used in inks and coatings, adhesives, paper. BPA is the most well-known and commonly used bisphenol and has been classified as an endocrine disrupting chemical (EDC) and toxic for reproduction. Evidence shows negative impact of BPA on brain development and children's behaviour, increased blood pressure, development of cardiovascular and metabolic diseases (such as diabetes and obesity), and cancer.[77] BPA has recently been increasingly substituted globally using other, structurally similar bisphenols such as BPF and BPS, but these replacements have been found in some instances to have equal or even more hazardous properties.

Phthalates: a group of chemicals that are often added to plastic packaging to increase their flexibility (this is why they are called plasticisers) and durability.[78] Some have been classified as toxic for reproduction and/or as EDCs. Exposure to phthalates is linked to elevated blood pressure, insulin resistance, obesity and diabetes. For people who can or want to become pregnant, chronic phthalate exposure is associated with fertility issues, high miscarriage rates, and pregnancy complications such as anaemia.[79]

PFAS (per- and poly-fluoroalkyl substances): often used in a wide variety of food contact materials that many people use day-to-day, such as non-stick cooking surfaces, bakery bags, takeaway boxes, fast-food wrappers and microwave popcorn bags, due to their grease and water resistant properties. Due to their extreme persistence, they are also often called “forever chemicals”. It is now clear that some PFAS accumulate in the body and are linked to reproductive and developmental abnormalities, increased cholesterol, suppressed immune response, and tumour formation. Studies suggest that some PFAS can be endocrine disruptors and obesogens (which affect how the body controls weight and lead to obesity).

Heavy Metals: potentially toxic metals are present in ceramic and vitreous materials due to use of specific metal oxides during manufacture (mainly lead, barium and cadmium), and as decorative pigments (cadmium and several other heavy metals). Those metals pose an array of serious health risks, especially to children, and have no safe level in the diet. Evidence confirms that lead and cadmium migrate from a significant number of ceramic and vitreous FCMs in toxicologically relevant amounts, and the expected consumption patterns of food in contact with these materials would lead to intake amounts that may adversely affect health. [80]

Biocides: chemical substances that are applied in or on FCMs to reduce the number of microorganisms on the food itself and on any material coming into contact with the food. They

[77] How Does BPA Affect the Human Body? Bisphenol A Health Effects (medicinenet.com)
[78] https://www.foodpackagingforum.org/food-packaging-health/phthalates
[79] Phthalates and Their Impacts on Human Health: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8157593/
[80] Food safety – heavy metals in ceramic, glass and enameled table and kitchenware (europa.eu)

include, among others, alcohols, aldehydes, amines, quaternary ammonium compounds, halogen compounds, ionic silver and nanosilver and oxidising agents.[81] So far there is a huge gap in the relevant data on risks related to biocides.[82] Many biocides used on surfaces are irritants and sensitizers / allergens. They can have toxic, carcinogenic or endocrine disrupting properties. The release of biocides into the environment also increases the likelihood of developing resistance; there is scientific evidence that the use or misuse of biocides can contribute to the increased occurrence of bacteria that are resistant not only to biocides but also to antibiotics.[83]

Not Intentionally Added Substances (NIAS): comprise all substances that have not been added for a technical reason during manufacturing of FCMs and FCAs. They have various sources and can be grouped into side products, breakdown products, and contaminants. They can migrate into food, drinks, and the environment. A complete characterization of all NIAS and identification of those that may be of concern is currently unrealistic; thus, conclusions on the safety cannot be drawn.[84]

Table 2. FACTORS THAT INCREASE THE RISKS OF CHEMICAL MIGRATION INCLUDE:[85]

- Higher temperature: Chemical migration increases at higher temperatures (e.g. plastic containers in particular can leach harmful chemicals when heated).
- Smaller packaging: Small packaging formats have a high surface-to-volume ratio enabling higher chemical migration (e.g. small sachets or small yoghurt / juice cups, so often packaging for children).
- Fatty and acidic food: Many chemicals migrate at higher levels in fatty and / or acidic foods than in aqueous foods.
- Longer storage times: In general, chemical migration increases over time. Consequently, the sum of migrated chemicals can be larger because of longer contact time.

Table 3. Core principles determining sustainability of packaging over the product life cycle:[86]

- minimising the drivers of climate change
- avoiding harmful (and untested) chemicals
- optimising design and efficiency and extending its lifetime
- maximising circularity (including reuse, repair, renewable and recycled content, etc.)
- optimising end of life footprint
- minimising the drivers of biodiversity loss (in terms of land use, water use, etc.)

[81] FPF_Dossier07_Biocides.pdf (foodpackagingforum.org)
[82] Biocides – risks and alternatives - Challenges and perspectives regarding the handling of biocides in the EU (pan-germany.org)
[83] Effects of Biocides on antibiotic resistance (europa.eu)
[84] FPF_Dossier03_NIAS_2nd-edition.pdf (foodpackagingforum.org)
[85] Fact sheet | Food Packaging Forum
[86] SPHERE: the packaging sustainability framework - World Business Council for Sustainable Development (WBCSD)

Main conclusions (main deficiencies) from evaluation of FCM regulation (SWD(2022)163):

- Article 3 of the FCM Regulation does not define the level of safety or quality expected for FCMs. Further, it does not state how safety should be achieved nor how it can be demonstrated.
- The current legislation is not sufficiently effective at taking into account the possible combination effects of substances migrating from FCMs, in particular that the toxicity of combinations of substances could be larger than that of individual substances.
- The effectiveness of the legislation on plastic FCMs is also weakened by several derogations that exist for the assessment and authorisation of substances at EU level.
- The EU rules for plastic FCMs are technically complex and resource intensive; for the Commission to manage, for EFSA to provide scientific risk assessment, for EU Member States to implement and enforce and for industry, in particular SMEs, to ensure compliance.
- The specific EU rules on plastic require a high-level of expertise, which is rarely available in Member States.
- Member States are able to carry out inspections and controls only in a very limited capacity and the current systems of official controls as implemented cannot adequately enforce the requirements of the legislation.
- Rules on FCMs remain very relevant with citizens, who show an increased interest in food safety and related health issues.
- The current legislation has not fully met the needs and expectations of businesses, in particular those producing many non-plastic FCMs. The current system in general provides inadequate support to SMEs.
- Declaration of compliance (DoC, a written declaration stating that FCMs comply with the specific rules) is often incorrectly filled-in and incomplete. Obtaining adequate supporting information through the whole of the supply chain is very difficult; downstream users do not currently have access to necessary information that is contained in confidential documentation supporting DoC of the chemical industry.
- The current legislation and approaches are also largely incompatible with current trends in the switch from materials synthesised from traditional chemistry such as polymers to more novel or natural, sustainable alternatives.
- Other novel developments, such as those that incorporate nano-technology and chemical recycling, are presently insufficiently addressed, whereas future needs that cannot be met by current rules are linked to growing consumer interests in re-use, recycling and environmental concerns.

A study [87] by enforcement authorities underlined that, following a request by Member States, the chemical industry could not provide adequate supporting documentation showing that they comply with the FCM Regulation.

[87] McCombie G, Hötzer K, Daniel J, Biedermann M, Eicher A, Grob K. 2016. Compliance work for polyolefins in food contact: results of an official control campaign. Food Control. 59:793–800.