

Chemicals and the circular economy Dealing with substances of concern

SUMMARY

Unlike the traditional linear economic model based on a 'take-make-consume-throw away' pattern, the circular economy is an economic model based on sharing, leasing, reuse, repair, refurbishment and recycling, in an (almost) closed loop. One of the challenges associated with this model is the presence of substances of concern in products, which risk being passed on to waste and subsequently recycled.

A large number of European Union (EU) legal acts are relevant to the theme of substances of concern in material cycles. They relate to three broad areas: chemicals, products and waste. The European Commission is expected to publish a communication on the interface between these policy areas by the end of 2017.

The main challenge in relation to chemicals and the circular economy is increasing recycling and reuse, while making sure consumers are not at risk from exposure to substances of concern that may be present in products and passed on to waste. More specific challenges relate, among other things, to long-term exposure, lack of information, trade aspects and implementation of EU law.

Increased policy coherence in the current regulatory framework could help the situation. More specifically, elements of possible remedies include: disseminating information about the presence of substances of concern in products, reducing and substituting them, and improving the management of substances of concern that cannot be substituted. However, there may be some difficulties in implementing these solutions, in particular regarding the administrative burden and costs.

The European Parliament supports the development of non-toxic material cycles so that recycled waste can be used as a major, reliable source of raw materials. Stakeholders' views on the topic are mixed.



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Glossary

Substance: a chemical and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurity deriving from the process used.

Substance of concern: a chemical that is proven or suspected to be harmful to human health or the environment.¹

Background

Unlike the traditional linear economic model based on a 'take-make-consume-throw away' pattern, the **circular economy** is an economic model based on sharing, leasing, reuse, repair, refurbishment and recycling, in an (almost) closed loop, which aims to retain the highest utility and value of products, components and materials at all times. In practice, it implies reducing waste to a minimum. Moving towards a more circular economy could deliver opportunities including reduced pressures on the environment, enhanced security of supply of raw materials, increased competitiveness, innovation, growth and jobs.

The shift to a circular economy could also pose challenges, however, in terms of financing, key economic skills, consumer behaviour and business models. One of the challenges is also the presence of substances of concern in products. Large volumes of chemicals, some of which may be hazardous, are included in ubiquitous products, from building materials to textiles and electronic appliances. Some of these are passed on to waste, and risk subsequently being included in recycled materials.

The question of **substances of concern in material cycles** was highlighted in the [seventh environmental action programme](#), adopted in 2013 by the European Parliament and the Council. One of its goals is that of 'developing by 2018 a Union strategy for a non-toxic environment', among other things by minimising 'exposure to chemicals in products ... with a view to promoting non-toxic material cycles and reducing indoor exposure to harmful substances'. As announced in the 2015 circular economy action plan, the European Commission is expected to publish a communication on the 'analysis of the interface between chemicals, products and waste legislation and identification of policy options' by the end of 2017.

EU legislation

European Union (EU) legislation on substances of concern in material cycles relates to three broad areas (chemicals, products and waste), as illustrated in Figure 1 below.

Chemicals

The 2006 **regulation on the registration, evaluation, authorisation and restriction of chemicals** (widely known as the [REACH Regulation](#)²) sets out the general regulatory framework on chemicals as follows:

- Under the regulation's **registration** regime, manufacturers are required to assess and register substances they place on the market. Recyclers benefit from an exemption, as they do not need to register a substance obtained through a recovery process (for instance a metal) provided this substance is the same as a substance which has already been registered by another company. However, recyclers placing a substance on the market remain responsible for assessing its hazardous properties. The concept of 'same substance' has some flexibility, as a substance may contain a significant share of impurities, which may differ according to the source and the manufacturing/recycling process.

- REACH's **authorisation** regime aims to ensure that 'substances of very high concern' are adequately controlled. The 'candidate list', which identifies substances of very high concern, is widely seen as an important driver for substituting hazardous chemicals. Manufacturers of substances of very high concern are required to notify the European Chemicals Agency (ECHA) if the substance is used in products in a concentration over 0.1 % and in a quantity totalling over one tonne per year. Substances of very high concern may be banned (and specific uses subsequently authorised for specific companies). One relevant example is [DEHP](#), a plasticiser used in PVC, which has been banned since 2015, although specific uses have been [authorised](#) for a few companies.
- REACH's **restriction** regime also allows the possibility to address specific risks from substances used in specific products, such as lead in jewellery.

The 2008 **Classification, Labelling and Packaging Regulation** ([CLP Regulation](#)) requires companies (including recyclers) to notify the classification and labelling of any substance they put on the market to ECHA, which makes this information available in an [inventory](#).

The 2012 [regulation on the export and import of hazardous chemicals](#) implements within the EU the [Rotterdam Convention](#) on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade. It regulates the import and export of certain hazardous chemicals, including pesticides.

The 2004 [regulation on persistent organic pollutants](#) implements international agreements³ establishing control measures for substances that persist in the environment and bioaccumulate through the food web. In particular, it prohibits or severely restricts the production and use of intentionally produced persistent organic pollutants, and contains provisions on the environmentally sound disposal of waste containing persistent organic pollutants.

Figure 1 – Overview of EU legislation relevant to substances of concern in material cycles



Source: European Parliamentary Research Service.

Products

The 2001 **General Product Safety Directive** ([GPSD](#)) aims to ensure that products placed on the market are safe and in particular that they do not pose health risks (although it does not cover environmental risks or waste-related aspects). It allows the European Commission to take emergency measures, for instance withdrawing products from the market or temporarily banning the use of certain substances. Examples of emergency

measures taken in the past include banning certain phthalates in toys or the fungicide dimethylfumarate (DMF), which was present in imported furniture.

The 2012 [regulation on biocides](#) requires products treated with biocides (i.e. pesticides not used on plants) to bear labels mentioning, among other things, the active substance(s) used.

In addition, other sector-specific EU legislation exists for **certain products**, as summarised in Table 1.

Table 1 – Overview of restrictions on chemical use in selected products

	Restrictions	Derogations	Legislative act
Toys	Use of substances harmful to health, such as carcinogenic, mutagenic or reprotoxic (CMR) substances, heavy metals and certain allergenic fragrances	Derogations under strict conditions if no alternative deemed available.	2009 Toy Safety Directive
Food contact materials	General safety requirements; specific measures for plastics (including recycled plastics), ceramics, regenerated cellulose film, and active and intelligent materials ⁴		2004 regulation on food contact materials
Packaging	Concentration of four heavy metals (lead, cadmium, mercury and hexavalent chromium)	Derogations for glass as well as plastic crates and pallets provided that limit values cannot be met as a result of recycled materials being used in manufacturing	1994 directive on packaging and packaging waste
Vehicles	Concentration of four heavy metals (lead, cadmium, mercury and hexavalent chromium)	Limited number of derogations mainly relating to older vehicles or spare parts for older vehicles	2000 directive on end-of-life vehicles .
Electrical and electronic equipment	Concentration of four heavy metals (lead, cadmium, mercury and hexavalent chromium) and two flame retardants (PBB and PBDE)	Large number of derogations where no alternative deemed available	2011 directive on the restriction of hazardous substances
Batteries and accumulators	Concentration of mercury and cadmium	Limited derogations related to nickel-cadmium batteries in power tools	2006 directive on batteries and accumulators

Source: European Parliamentary Research Service.

Waste

The 2008 **Waste Framework Directive (WFD)** is the main legal act in the field. In particular, it defines hazardous waste based on classification criteria for chemicals from the Classification, Labelling and Packaging Regulation and applies stringent requirements for its management. The directive also establishes the principle of the [waste hierarchy](#), which sets waste prevention (including 'reducing the content of substances of concern in materials and products') as the preferred policy option to be pursued. The directive defines when something becomes waste (i.e. when its holder discards or intends or is required to discard it) and specifies that by-products from production processes are not

to be regarded as waste if a number of conditions are met. It also defines when waste is no longer waste (i.e. when it has undergone a recovery process, including recycling, and complies with criteria known as 'end-of-waste criteria' drawn up based on set conditions). Hazardous waste may cease to be waste provided its recovery enables it to be used without endangering human health and without harming the environment.⁵ End-of-waste criteria have been adopted for [metal](#), [glass](#) and [copper](#); however, no agreement could be reached for criteria on other materials, such as plastics and paper. In the absence of EU criteria, national rules can apply.

The Waste Framework Directive, the 1999 [Landfill Directive](#), as well as a series of directives on specific waste streams⁶ set conditions and targets for waste management. In 2017, [legislative procedures](#) modifying the directives were ongoing.

The 2006 [Waste Shipment Regulation](#) sets information and prior notification procedures for cross-border waste transport, requires Member States to carry out inspections, and implements the [Basel Convention](#) banning exports of hazardous waste to non-OECD countries.

The 1996 [directive on PCBs/PCTs](#) required Member States to draw up inventories and to decontaminate equipment by 2010. PCBs and PCTs are persistent organic pollutants. In a '[fitness check](#)' published in 2014, the European Commission noted that, notwithstanding significant progress, the deadline had not been met by most Member States.

Challenges

The **main challenge** in relation with chemicals and the circular economy may be seen as promoting a transition to a circular economy, which involves significantly increasing recycling and reuse, while making sure consumers are not at risk from exposure to substances of concern that may be present in products and passed on to waste.

This can be translated into a series of more **specific challenges** that can be grouped into three broad areas: chemicals and products; chemicals and waste; products and waste.

Chemicals and products

Challenges in this area include the following:

- **The presence of substances of concern in products:** Circumstantial evidence suggests substances of concern may be widespread in certain products. For instance, a 2016 [report](#) on hazardous substances in construction products by the Swedish Chemicals Agency identified 46 substances of concern in construction products in the EU, many of which are volatile or semi-volatile.
- **Long-term and combined exposure to substances of concern:** A number of scientific studies indicate that humans may be subject to long-term and low-level exposure to substances of concern from products, for instance through indoor dust.⁷ Cumulative effects could materialise, particularly when chemicals share hazardous characteristics (such as endocrine disruption or reproductive toxicity). Recent research indicates that the combined effect of prenatal exposure to certain chemicals through the environment is associated with reduced birth weight.⁸ However, risks from cumulative exposure are mostly not considered under EU legislation.
- **Lack of knowledge about chemicals (of concern) present in products:** Two elements are particularly relevant. First, the composition of products is generally proprietary information protected by law, for instance under the 2016 [Trade Secrets Directive](#). Second, legal requirements to make available information on the presence of certain substances in products do not appear to be systematically implemented. Although

companies are required to notify ECHA about substances of very high concern in products they put on the market, it appears this is not being done systematically, especially as regards imported products. ECHA indicates in a 2016 [report](#) that the number of these notifications remains 'worryingly low'. Although products treated with biocides are required to bear a label mentioning among other things the active substance(s) used, a 2016 [report](#) by the Swedish Chemicals Agency found that only a minority of investigated products with a biocidal claim (such as 'antibacterial') provided this information, and that some products containing biocides (in particular preservatives) were put on the market without a claim or labelling. The lack of information on substances of concern in products is subsequently passed on to the waste sector.

Chemicals and waste

Challenges in this area include the following:

- **The presence of substances of concern in waste streams:** Several aspects are particularly relevant. First, recyclers (who are required to assess the hazardous properties of a material they put on the market) often have difficulty acquiring safety information from manufacturers of the relevant substance. Second, the hazardous properties of two substances considered as the same under REACH may differ significantly as a result of the presence of substances of concern among impurities. Third, waste processing can itself trigger additional harmful emissions, for instance due to shredding or grinding. Fourth, recent research suggests that banned chemicals can prevail in waste for long periods. A 2016 [study](#) of contaminants in paper recycling indicates that banned substances of concern could persist in significant concentrations in paper products for 10 to 30 years as a result of recycling. Another 2016 [study](#) on brominated flame retardants widely used in plastics until 2000 (and largely banned under the Stockholm Convention since 2009) indicates that these chemicals are present at high concentrations in certain plastic materials destined for recycling markets and were also found in new products. Its modelling suggests that in the Netherlands, 22 % of these banned substances found in electronic waste (and 33 % of those present in automotive plastic waste) are being recycled or reused.
- **Difficulties in applying EU waste classification rules:** The European Commission notes, in its [roadmap](#) on the communication expected at the end of 2017, that waste classification rules (in particular distinguishing between hazardous and non-hazardous waste) are applied and enforced inconsistently across the EU, which creates legal uncertainty for economic operators.
- **Issues related to trade in waste:** A 2012 [report](#) by the European Environment Agency indicates that exports of non-hazardous waste outside the European Union multiplied between 1999 and 2011, and that certain types of hazardous waste, in particular electronic waste, are exported outside the EU as used products. In 2013, the European Commission [estimated](#) that 25 % of waste shipments did not comply with the Waste Shipment Regulation.
- **Inconsistencies in the regulatory framework:** In a 2014 [report](#), the Swedish Chemicals Agency notes that there is a clear division between the waste and the chemicals realms, which are governed by a different logic and set of rules and other authorities. More specifically, it points out that legal criteria defining hazardous waste are based on the Classification, Labelling and Packaging Regulation, but do not take into account substances of very high concern under REACH or substances identified as persistent organic pollutants under the Stockholm Convention.

Products and waste

Challenges in this area include the following:

- **The need to maintain (or increase) recycling rates:** Recycling is essential in a transition towards a more circular economy. It can deliver benefits as a result of reduced costs, savings in greenhouse gas emissions, and generally diminished environmental impacts. However, meeting new EU targets for waste recycling requires sufficient material input in recycling processes.
- **Regulatory focus on some products:** All product categories are not equally regulated. The 2014 report by the Swedish Chemicals Agency mentioned above notes that although EU legislation regulates the presence of certain substances of concern in specific products (see Table 1), certain 'large and important' product categories in terms of waste management and chemicals control are not regulated at EU or national level, for instance building products and textiles.
- **Lack of clarity on how materials cease to be waste:** Criteria laid down in EU legislation and further specified in case-law can be difficult to apply. In particular, it is not always clear when a recovery process has been fully carried out, or how to prove that materials recovered from hazardous waste do not endanger human health or harm the environment.

Potential remedies

Increased policy coherence in the current regulatory framework could provide some solutions. More specifically, elements of possible ways to respond to the challenges outlined in the section above include those listed below:

- **Ensuring widespread information about the presence of substances of concern in products:** One way to do this could be through 'product passports', as proposed in 2013 by the [European resource efficiency platform](#). Such product passports would contain information about the components and materials (including substances of concern) used in a product, and specify how the product can be safely disassembled and recycled at the end of its life.⁹
- **Reducing and substituting substances of concern used in products:** One way to do this could be through product design. This would reduce exposure throughout the life time of products, and increase the reusability and recyclability of products, their components and their materials. Products designed to reduce and substitute the presence of substances of concern can be promoted through a variety of instruments, for instance voluntary labelling schemes (such as the [EU Ecolabel](#) or the [Nordic Swan Ecolabel](#)) and green public procurement (as illustrated in [criteria for furniture](#) recently adopted by the European Commission). In principle, the [Ecodesign Directive](#) could provide a legal framework for restricting certain chemicals in specific products, although the scope of the directive is currently focused on energy efficiency.
- **Improving the management of substances of concern that cannot be substituted:** This could include, at waste management stage, collecting and separating materials that contain substances of concern with the aim of maintaining uncontaminated waste streams and ensuring as far as possible that recycled materials remain free of substances of concern.

However, **difficulties** could arise when implementing these remedies. These include the administrative burden associated with 'product passports'; the costs inherent in redesigning products; the limited efficiency and effectiveness of the EU Ecolabel scheme (highlighted in a recent [fitness check](#)); and the fact that according to a 2016 [study](#), for

some materials, optimised waste sorting and collection may not be an effective strategy to reduce the contamination of recycled materials.

European Parliament position

In its resolution of 9 July 2015 on [resource efficiency: moving towards a circular economy](#), the European Parliament called upon the Commission, the Member States and the European Chemicals Agency 'to step up their efforts to substitute substances of very high concern and to restrict substances that pose unacceptable risks to human health or the environment in the context of REACH, not least as a means to fulfil the requirement of the 7th Environment Action Programme to develop non-toxic material cycles, so that recycled waste can be used as a major, reliable source of raw material within the Union'.

In its resolution of 25 November 2015 on a draft Commission implementing regulation granting three companies [authorisation to recycle plastics containing the banned softener DHEP](#), Parliament urged the Commission to withdraw the draft on the basis of the findings made by bodies of the European Chemicals Agency. Parliament stressed that 'recycling should not justify the perpetuation of the use of hazardous legacy substances', such as DEHP, and called for a swift end to the use of DEHP in all applications, based on the wide availability of safer alternatives to soft PVC and to DEHP.'

Stakeholders' views

A number of **trade associations** (including [BusinessEurope](#), the association of the retail, wholesale and international trade sector [EuroCommerce](#), the [American Chamber of Commerce to the EU](#), the [Confederation of Danish Enterprise](#), and the European Engineering Industries Association [Orgalime](#)) generally call for the approach taken to be based on risk (and not merely on the presence of substances of concern), agreeing a methodology to carry out cost-benefit analyses of the use of recycled materials containing substances of concern, implementing existing regulation more effectively, and setting harmonised end-of-waste criteria at EU level for secondary raw materials. In addition to this, BusinessEurope advocates keeping requirements relating to substances of very high concern in secondary raw materials proportionate, fair and linked to risks; and EuroCommerce advocates simplifying formalities for cross-border waste shipments and not classifying materials as waste when further use is safe and legal.

[Eurometaux](#), the association of the European non-ferrous metals industry, calls for priority to be given to measures that promote the safe recycling of metals with hazardous properties without an additional regulatory burden. Rather than establishing additional end-of-waste criteria, it advocates harmonised criteria for a by-product status. [CEFIC](#), the association of the European chemical industry, calls for differentiated approaches for each value chain and for certain waste streams to be prioritised as regards the development of remedies. It also emphasises the need to develop new recycling technologies. [FEAD](#), the European association of waste industries, calls for a balance to be struck between quality and quantity in recycling and the REACH authorisation regime to be adapted to take the constraints of recyclers into account.

Non-governmental organisations (including the [European Environmental Bureau](#), [Health Care Without Harm Europe](#), [CHEM Trust](#), the European Consumer Organisation [BEUC](#) and [Zero Waste Europe](#)) generally advocate action to prevent substances of concern from entering material cycles in the first place, ensuring economic operators have access to sufficient information on the presence, location and concentration of hazardous chemicals in products, and designing a legal framework that is not less protective of the

environment and human health when products are made of recycled materials. Besides this, CHEM Trust and BEUC call for all chemicals meeting 'substance of very high concern' criteria to be added to the candidate list under REACH's authorisation regime; BEUC also highlights the importance of consumer confidence for the success of the circular economy; and Zero Waste Europe calls for improvements to be made to the traceability of waste management and efforts to bring international standards into line with European norms.

Main references

Bourguignon, D., [Closing the loop: New circular economy package](#), EPRS, European Parliament, 2016.

Bourguignon, D., [EU policy and legislation on chemicals: Overview, with a focus on REACH](#), EPRS, European Parliament, 2016.

Swedish Chemicals Agency, [Rules on chemicals in the life-cycle of articles: a legal analysis](#), 2014.

Endnotes

¹ These substances are carcinogenic, mutagenic and/or toxic for reproduction; persistent, bio-accumulative and toxic; very persistent and very bio-accumulative; endocrine disruptors; or toxic to a specific organ or system in the human body. For more details on the types of chemicals of concern, see D. Bourguignon, [EU policy and legislation on chemicals: Overview, with a focus on REACH](#), EPRS, European Parliament, 2016, p.6.

² For an overview of the REACH Regulation, see D. Bourguignon, op. cit.

³ The [Aarhus Protocol](#) to the UNECE Convention on long-range transboundary air pollution (CLRTAP) and the [Stockholm Convention](#) on persistent organic pollutants.

⁴ On plastics, the relevant legislation contains a positive list of substances authorised in plastics food packaging and sets further requirements on recycled plastics used for food packaging. For more details, see E. Karamfilova, [Food Contact Materials – Regulation \(EC\) 1935/2004: European Implementation Assessment](#), EPRS, European Parliament, 2016.

⁵ As interpreted by the EU Court of Justice in its judgment in case [C-358/11](#).

⁶ [Directive on packaging and packaging waste](#); [Directive on end-of-life vehicles](#); [Directive on waste electrical and electronic equipment](#); [Directive on batteries and accumulators and waste batteries and accumulators](#).

⁷ See for instance S. Mitro et al., '[Consumer product chemicals in indoor dust: a quantitative meta-analysis of U.S. studies](#)', *Environmental Science and Technology*, 2016.

⁸ See for instance E. Govarts, '[Combined Effects of Prenatal Exposures to Environmental Chemicals on Birth Weight](#)', *International Journal of Environmental Research and Public Health*, 2016.

⁹ This could build for instance on the existing [Environmental Product Declaration](#), a global programme for certified environmental declarations based on ISO 14025 and EN 15804. In September 2017, there were over 700 environmental product declarations in 14 product categories for products manufactured by companies based in 36 countries.

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