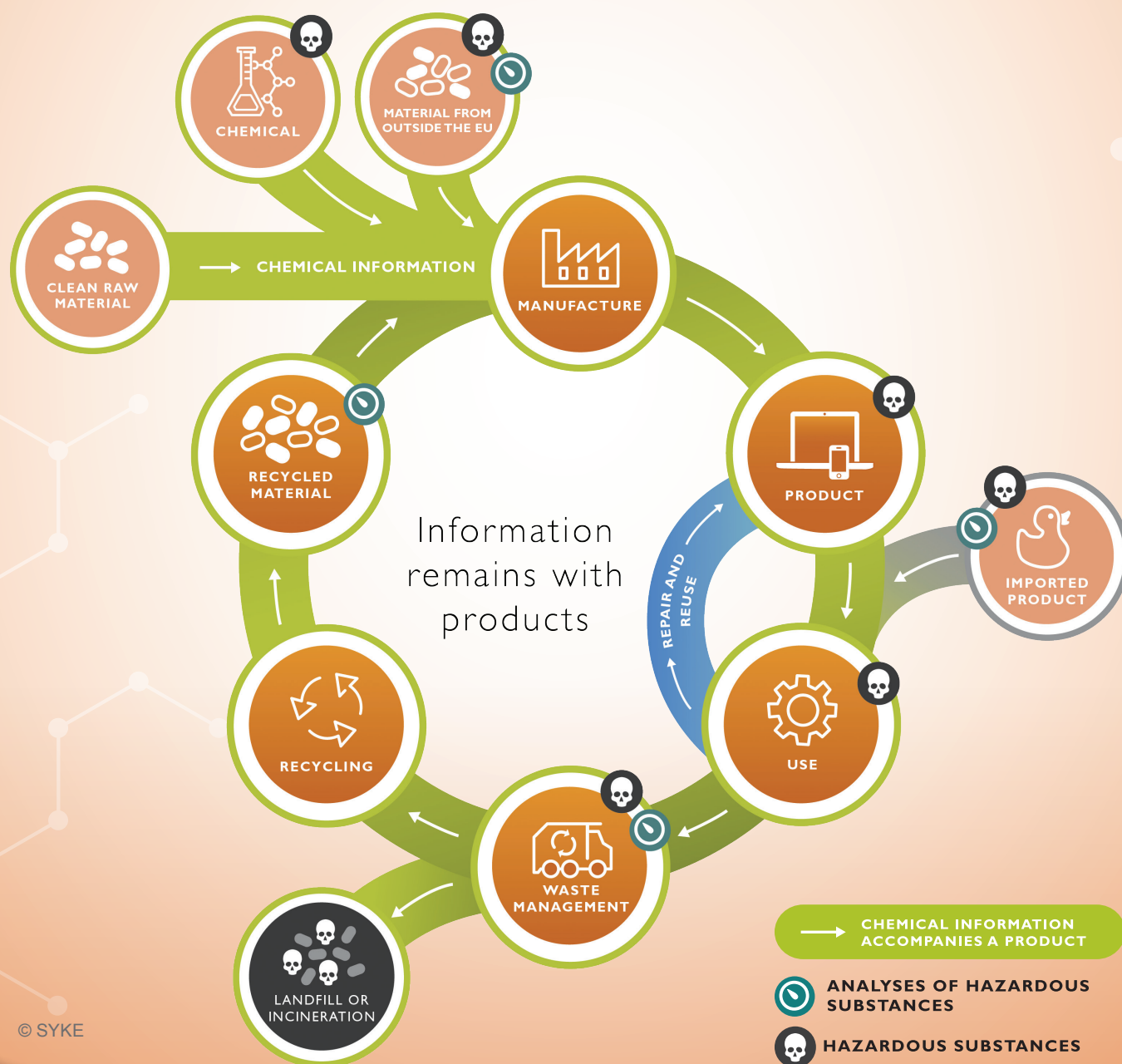


# Managing chemicals and material cycles

In the circular economy the value of products and materials is preserved for as long as possible, while simultaneously minimizing environmental deterioration. Material cycles should not entail any risks to humans or the environment. In a sustainable circular economy we must also manage substances that give desirable qualities to products, but which may cause problems when products are reused or recycled. We must strive to reduce the use of hazardous substances throughout entire product's life cycle: from design to production, use, maintenance, reuse and recycling. Products imported from outside the EU represent a special challenge in the context of the circular economy, since information on their exact composition may be unavailable.



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# Limiting hazardous substances through product design

Key elements in the management of risk from hazardous substances are good product design and measures to ensure that chemical information always accompanies products. In eco-design, the emphasis should be on the re-usability, reparability and recyclability of a product, as well as the choice of non-toxic materials. A well-designed products may be recyclable in modular parts, with the content of each part duly considered. Product ecolabelling schemes help consumers to find environmental friendly products with regard to their energy efficiency, climate impacts and chemical content.

Additives used in materials, such as colorants in plastics, hinder their reuse.

Ensuring that chemical information remains with products whenever they are transferred to new owners enables the effective management of chemicals throughout product's life cycle, all the way to the recycling of their material content. Chemical information may be transferred using digital tools, such as barcodes, QR codes or RFID tags.

Risks associated with harmful substances must be carefully assessed.

## New business opportunities in leasing and maintenance

In the circular economy more businesses may lease equipment instead of selling it, while maintenance services can also be more widely offered. The maintenance, part replacement and reassembly of products provide good opportunities to manage risks related to hazardous substances.

## Scope for innovation in recycling and utilising wastes

Recycled materials vary by composition, age and origin. When recovering waste as material there is a risk that hazardous substances may re-enter product cycles. To guarantee the quality and safety of recycled materials, new extraction and purification methods must be developed, materials should be chosen carefully, and waste management systems must be planned to anticipate such risks.

Traceable data on the content of a product reduces the need to examine the quality of recyclable waste. New reliable ways to analyse and comparably measure hazardous substances in recycled materials must still be found. Measured data guarantees the quality of such materials and in this way will increase their value.

Hazardous substances should be removed from material cycles and be destroyed. Persistent organic pollutants (POPs) are examples of these bioaccumulating substances, which are dangerous to reproductive health or cause cancer.



## Brominated flame retardants

Certain brominated flame retardants are persistent organic pollutants, which must be removed from circulation and permanently destroyed by safely incinerating them. They have been widely used in the plastic parts of electronic equipment and vehicles. To effectively destroy these compounds, waste management operators must carefully identify the materials and components that contain them. Plastic parts containing brominated flame retardants may either be separated intact manually from the equipment and vehicles, or from shredded waste, for example by optical separation. If these materials cannot be separated, all the shredded waste must be incinerated.

## Using waste in earthworks

Surplus earth from construction sites can be more extensively used instead of virgin soil and aggregate in earthworks. Various wastes such as ashes, crushed concrete, treated waste incineration bottom slag and shredded tyres can also be utilised for this purpose. These materials, however, contain harmful substances, and their beneficial use is only acceptable after such risks have been duly identified, assessed and managed. New criteria are currently being devised to regulate the use of such materials in Finland without specific environmental permits. The revised legislation will include new limit values for concentrations of harmful substances in such materials, as well as requirements for the regular monitoring of the quality of such wastes. Risks will also be reduced by covering earthwork structures containing such wastes with a suitable top layer.



## Recycling plastic packaging

The composition of post-consumer plastic packages has to be known prior to their reuse as raw material for new products. The Finnish Environment Institute, Fortum Waste Solutions Oy and Borealis Polymers have together studied the quality of this waste stream. Concentrations of substances of very high concern (SVHC) were found to be low. By contrast, concentrations of phthalates (with SVHC classification) up to a thousand times higher than those in packaging waste were found in samples of plastics from toys. Phthalates are used as softeners in plastics. To minimise risks related to such hazardous substances, consumers must be efficiently and frequently informed to ensure that they do not dispose of harmful plastics in plastic packaging collection bins.



## Recommendations for the safe recycling of materials

- First and foremost, all products should be manufactured to be sustainable, with chemical management considerations, reparability, reusability and the recyclability of their material content integrated into their design. The product design requirements in the Ecodesign Directive should be expanded to cover sustainability, reparability, serviceability, product lifespans and material content considerations including possible hazards. The same properties should be required of products imported from outside the EU. Chemical information should be provided to customers to help them demand safe products.
- It is important to develop quick ways to measure hazardous substances, as well as precise and comparable analytical methods to guarantee the quality of recycled materials. These methods should also be applied in EU-wide standards for recovered raw materials, and in threshold limits for hazardous substances in wastes. The risks of hazardous substances to humans and the environment can only be effectively assessed using measured data.
- The key to chemical safety in material cycles in future will be the inclusion of chemical information with products. Digital solutions must be developed and implemented to achieve this goal. This work can be supported by EU product legislation, and new technical ways to integrate chemical information with products.
- Co-operation between businesses, researchers and the authorities on the national and international level is needed to support product design and the smooth transfer of chemical information. There is also a need for new tools to facilitate the identification of favourable alternatives to hazardous substances. An EU-wide knowledge base on such substitutes would especially be helpful to small and medium-sized enterprises and could be a new module in IPCheM.
- The most dangerous hazardous substances should be removed from material cycles at the end of their life cycle. Support should be provided to help companies and researchers devise new extraction and purification methods.
- The productisation of services such as leasing can create opportunities to manage risks related to hazardous substances. Manufacturers of products such as machinery and equipment could take responsibility for any hazardous chemicals their products contain also during servicing, repair work, re-assembly and the separation of their material content for re-use.

### Further information:

Brominated flame retardants: Requirements for the management of waste containing persistent organic pollutants. Ministry of Environment. Environmental Administration Guidelines 4en/2016. <http://urn.fi/URN:ISBN:978-952-11-4636-7>

Earthworks (in Finnish): [ym.fi/jatteetmaanrakentamisessa](http://ym.fi/jatteetmaanrakentamisessa)

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IPCheM – the Information Platform for Chemical Monitoring: <https://ipchem.jrc.ec.europa.eu/RDSIdiscovery/ipchem/index.html>

Leading the cycle – A Finnish road map to a circular economy 2016–2025; report by the Finnish Innovation Fund Sitra, 2016: ISBN 978-951-563-978-3 <https://media.sitra.fi/2017/02/24032659/Selvityksia121.pdf>

Plastics (in Finnish): <http://www.syke.fi/hankkeet/arvi>

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