POLICY BRIEF
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GOVERNMENT'S ANALYSIS, ASSESSMENT AND RESEARCH ACTIVITIES

Perspectives into topical issues in society and ways to support political decision making

Safe and sustainable circular economy

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AIMING FOR HARMLESS MATERIAL CYCLES

The goals of circular economy include reducing the consumption of materials and retaining the value of products and materials as long as possible. The aim is not only to improve resource efficiency by repair, reuse and material recycling, but also to achieve environmental benefits in general by reducing the use of virgin materials. This also makes circular economy one of the ways to combat climate change. Management of chemicals in the circular economy supports the goals of sustainable development.

Managing harmful substances in the circular economy is a balancing act between maximising the recovery and recycling of waste and the protection of health and the environment. Old products, especially ones with a long life span, may have materials that contain hazardous chemicals. The use of the chemicals was allowed at the time when the product was manufactured, and the risks associated with the chemicals were recognized much later. The occurrence of hazardous chemicals in humans or the environment has been reduced by regulations and restrictions.

The most hazardous substances found in products include **persistent organic pollutants (POPs)** and **substances of very high concern (SVHCs)** that e.g. may affect reproductive health, are mutagenic and carcinogenic.

Finland is committed to the international restrictions on POPs. The European Chemicals Agency (ECHA) maintains a list of SVHCs also including substance-specific information. Based on constantly increasing research-based information about findings in the properties of the chemicals, chemicals in the environment or their impact on humans, new compounds are added to the lists of POPs or SVHCs.

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POPs (28 compounds, 8th of August 2019) are toxic, accumulate in organisms and may travel far via air, water and organisms. The use of these substances is internationally prohibited or restricted by an international convention (Stockholm Convention) and an EU Regulation ((EU) 2019/1021). (www.pops.int)

The Stockholm Convention has been implemented through the POP Regulation on waste management and placing persistent organic pollutants on the market ((EU) 2019/1021). The POP Regulation prohibits waste disposal and recovery activities that may lead to the recovery, recycling, reclamation or reuse of the substances – excluding some individual exceptions. The POP Regulation does not limit the reuse of products. Placing substances within the scope of the POP Regulation and products that contain those substances on the market is prohibited as a rule, unless the substance is an unintentional contaminant residue.

The POP Regulation specifies the permitted disposal and recovery operations for wastes that exceed the substance-specific concentration limit as follows:
• Physico-chemical treatment (disposal method D9)
• Incineration without the recovery of energy (disposal method D10)
• Incineration while using the waste to generate energy (recovery method R1)
• Recycling and reclamation of metal (recovery method R4); only permitted for specific types of waste with metal content and certain methods

SVHCs (201 substances, 8th of August 2019) are substances identified in the risk management procedure of the REACH Regulation ((EU) 1907/2006), listed in the candidate list of the European Chemicals Agency ECHA (https://echa.europa.eu/fi/candidate-list-table). The listed substances may become subject to authorisation, after which their use will require applying for an authorisation for a fixed period. Identification of a SVHC means immediate obligations in the substance's delivery chain in order to enable its safe use. The presence of a SVHC in an article also creates registration and communication obligations.

Implementing the project through interaction with the stakeholders

In the SIRKKU project, several workshops and discussions events were arranged with stakeholders from different industrial sectors for establishing a dialogue on the project focus and results. The project work was complemented with interviews and electronic surveys. During the first expert workshop recycling of construction and demolition waste as well as plastic and composite materials in particular were selected as the target fields. In addition, based on the results of the expert workshop, it was decided to focus on following three groups of hazardous substances: *brominated flame-retardants, phthalates and short-chain chlorinated paraffins.*

The change from a linear to a circular economy poses new challenges on the chemicals and waste regulations which have been drawn up based on the premises of linear economy.

Circular economy creates new challenges for management of chemicals

In future, design of new products will address repairability, reuse and recovery also taking into account safety aspects related to humans and the environment. However, we will still have to manage waste with unknown chemical content for decades. If the chemical information accompanies a product in all phases from manufacturing till the end-of-life in future, this enables that in future, the materials or elements containing harmful or hazardous substances can be removed from the material cycle for final treatment and pure materials without harmful substances can safely be recycled.

Policy measures – waste-based material cycles

There are several differences between regulation for waste and products and chemicals. For waste, the main concern relates to safe waste management. For products, the requirements are highly dependent on application and risk related to the use of the product (exposure routes, receptors, environment conditions etc.). If waste is used as products, the product regulation needs to be considered. On the other hand, today the end-of-life requirements set demands for product design. (Fig. 1)

As a general rule, the same information is required regarding the chemical content of both waste-based and virgin materials. However, the waste legislation does not require as accurate data on the chemical composition of the material as chemicals regulation. Consequently, information on the chemical content of waste is not sufficient to address the needs of chemicals regulation. It can be hard to provide the sufficient chemical information on the waste-based materials in order to guarantee their safe use as raw materials and products.

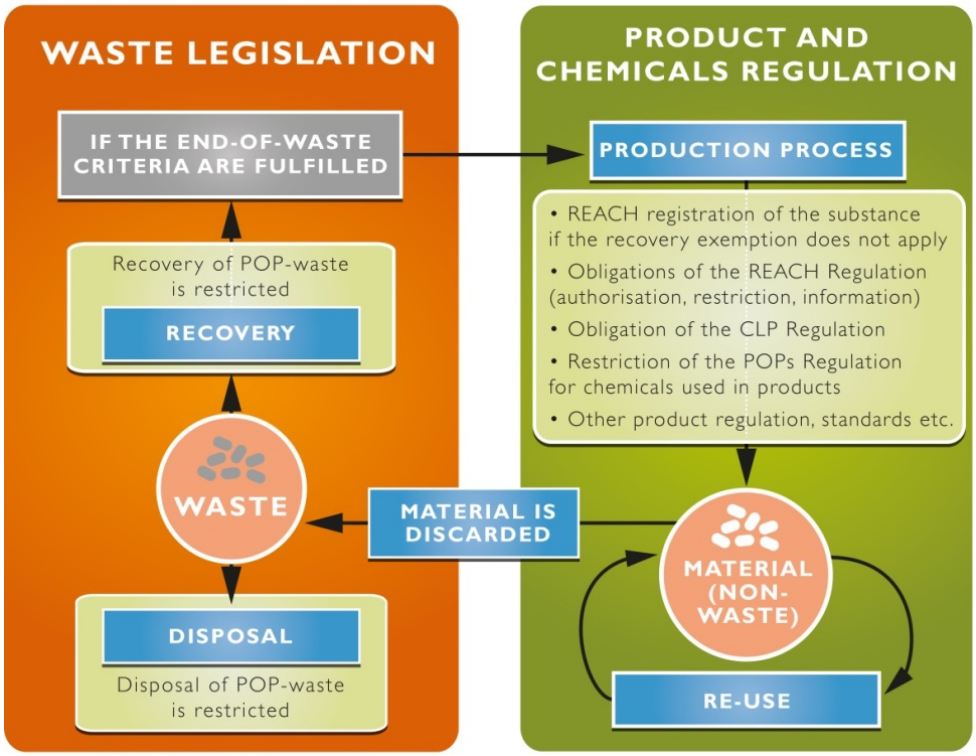

Figure 1. Regulatory framework for management of chemicals during the life cycle of the product. Occupational safety must be taken into account in all phases of the life cycle.

The transition from a linear to a circular economy requires new kinds of measures

The European Commission has already identified problems related to the transition from the scope of waste regulation to the scope of chemicals regulation:

• The actors processing waste do not often have accurate information on the chemical content of the material due to the varying origins of the waste, the difficulty of determining the content and the potential contamination of waste by harmful substances → it is difficult for the actors to find an applicable regulatory framework for the use of waste-based materials.
• The use of substances which has been restricted after the product was manufactured.
• The regulation concerning the End-of-Waste classification of waste material, meaning the point where the material is no longer considered as waste, has not been comprehensively

harmonised, and the scope of application of the concept of waste remains unclear.
• The definitions of substances classified as hazardous in waste regulation and chemicals regulation do not match.

In the SIRKKU project workshops, practical challenges were identified together with the different sectors of industries:
• The permit processes for the recovery of waste take a long time, from months up to several years, and their duration cannot be estimated in advance.
• It may not be possible to get enough material of good quality, or selling the product for re-use takes too long, requiring facilities for long-term storage.
• The life cycle assessments required by carbon neutral construction are difficult to carry out on recycled products.
• Some waste materials, such as reinforced plastic waste, cannot be currently recycled. For these wastes there is a need for suitable disposal or processing methods without long permit process times.

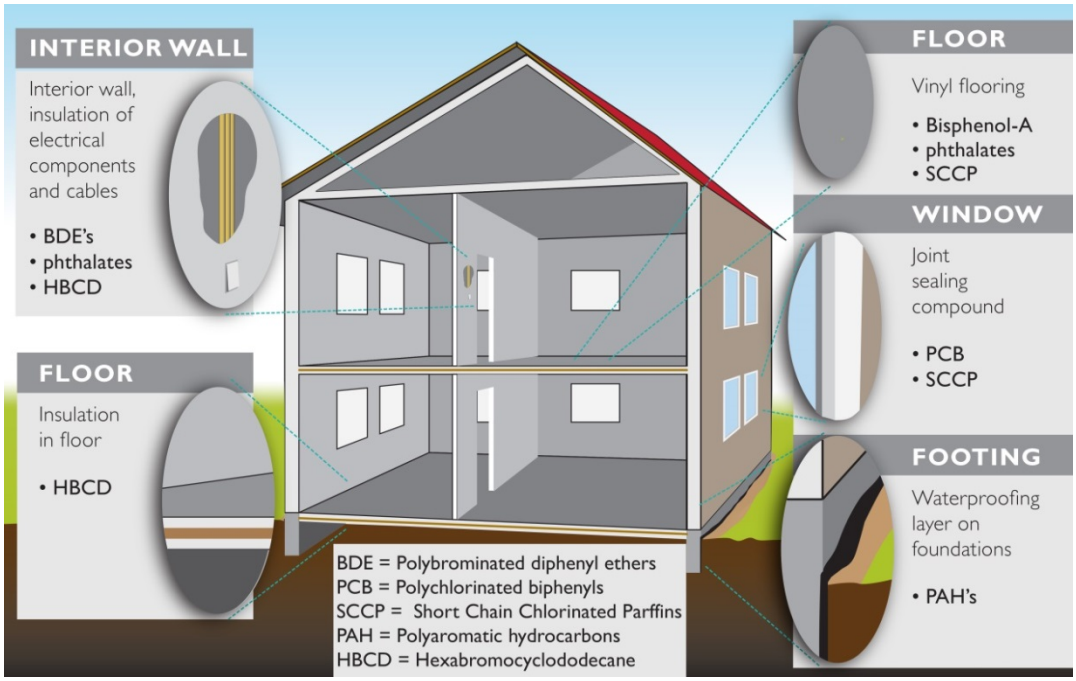

Figure 2. Examples of harmful substances found in buildings.

Demolition as a case study

Demolition was selected as the case study. Apart from asbestos, there is only very little published information about the hazardous substances contained in construction products. Only reports on concentration levels measured in harmful substance surveys have been published. Construction materials and products that contain hazardous substances can be found in various building structures (Fig. 2). The selective demolition of buildings including waste sorting is the stage where construction waste is created. After this, the processing of waste consists of many different individual operations, which may be mechanical, biological, chemical or thermal in nature.

The behaviour of POPs in the waste processing chains has not been studied extensively. Some individual studies have been conducted on different waste streams, but the outlines of the studies vary by the accuracy of the value chain as well as the target substances, which makes direct comparisons between the studies difficult. Identification on the compound level

is currently not feasible on an industrial scale, because identification can only be done with laboratory methods. Therefore, identification in field conditions must be limited to the level of elements for the time being. The identification of substances in products and materials is often done visually rather than by measuring.

Recommendations for the management of hazardous substances in a circular economy

1. **Quantitative information on POPs and SVHCs in products, waste streams and the environment is needed.** Statistics on chemicals must be developed so that even the new chemicals included in the list of SVHCs can be identified in the material streams.
2. **Technological development is needed**. In particular, methods suitable for identifying substances in different matrices must be developed. Both quick methods for identifying chemicals on site as well as the development of laboratory analytics for the reliable analysis of POPs and SVHCs in different matrices are needed. This also requires financial investments.
3. **Procedures for the national and case-by-case creation of end-of-waste classifications must be simplified**, so that a predictable framework for promoting a safe circular economy can be improved. The licensing authorities need instructions and information on hazardous substances to support decision-making.
4. **Methods must be developed for improving the flow of information** on the material content of products and harmful substances **throughout the product's life cycle**, all the way to the waste phase and new life cycles. The flow of information must be developed on the national and the EU level.
5. **Investments must be made in developing new materials.** Health hazards and environmental damage could be reduced and business benefits created by the choice of materials. The impact of their use on health and the environment must be taken into account comprehensively in developing new materials and chemicals.
6. **Source separation of waste is important**. Monitoring and price control that encourages sorting is also needed in larger extent than currently.
7. **Risk assessment guides could help to control chemicals in the circular economy.** Among other things, a guide on carrying out harmful substance surveys in buildings to be demolished is needed; it should also include instructions on risk management in the recycling of construction waste. Resources must be allocated to the development of occupational safety, because changing the operating environment creates a need to establish new practices, methods and monitoring, including from the point of view of population exposure.
8. **The part of the waste stream that contains unidentifiable chemicals should be directed to energy production**. If it is not possible to identify the chemicals contained in the material, the boundary conditions set on the use as material in chemicals regulations, such as the REACH registration requirement, are not met.
9. **Financial incentives are needed for the use of recovered and recycled materials**. Efforts must be targeted so that the best financial, health and environmental benefits are reached. Research is needed to support the assessment of the overall environmental impacts.

Recommendations for the field of construction in particular

1. **The safety coordinators at construction sites must be trained** to assess harmful substances in recycled construction materials to ensure occupational safety.
2. **The customer that orders the construction project must ensure that the actors involved in the construction work are qualified to carry out work that may cause**

a health hazard. They must also take the safety of the immediate surroundings into account. When choosing the principal contractor, the customer must require that the safety regulations set by the customer are met.

3. Building inspection must check that **the building demolition plan has assessed the risks caused by the harmful substances contained in the construction materials and their risk management measures.**
4. **Certification is needed for the actors carrying out the harmful substance survey**, which ensures that the methods of conducting harmful substance surveys of different construction materials and recycling them are consistent.

Suggested reading

Safe and sustainable circular economy Report on the management of POPs and SVHCs in circular economy (Report in Finnish, English abstract):
https://tietokayttoon.fi/hankkeet/hanke-esittely/-/asset_publisher/kestava-ja-turvallinen-kiertotalous-sirkku
SIRKKU- project materials: materiaalitkiertoon.fi/turvallinenkiertotalous

Additional information

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