



National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Towards a *safe circular economy*: successes, opportunities and challenges





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Towards a safe circular economy

The climate is changing dramatically. As such, the need to achieve the climate targets is more pressing than ever ([IPCC 2021](#)). In addition to climate change, however, environmental pollution and substances of concern also pose a risk to our healthy, sustainable and safe living environment. This is why the EU is committed to *zero pollution and a toxic-free environment* ([EU 2020](#)).

The production of substances is expected to double until 2030. Most of these substances are harmful to either humans or the environment ([EU 2020](#)). More and more often, the news features reports on high concentrations of harmful substances, such as PFAS, in the environment. This only highlights and intensifies the need for action.

Raw materials are crucial for creating a healthy, sustainable and safe living environment. In a circular economy, today's waste are tomorrow's products. Reusing products and recycling materials creates savings on (new) raw materials and reduces CO₂ impact. The downside of this strategy is that substances of concern remain in the cycle and new ways of exposure may be created. Examples of these types of substances of concern include flame retardants, pigments, and plasticisers.

Circular solutions therefore are not always or automatically safe for people and for the environment, which is why it is vital to have a clear understanding of the presence and risks of substances of concern in a circular economy. Our aim is to recycle materials as much as possible, but to ensure substances of concern are no longer in circulation.

The best way to get to grips with this is by manufacturing products that do not use substances of concern, making them safe raw materials further down the line. On top of that, we have to safely manage the risks associated with the substances already present. These are responsibilities that have to be taken on by all partners in the value chain. This process is monitored by RIVM.

Future vision on substances in a circular economy

In a circular economy, substances of concern may only be used if there are no alternatives and the function of the substance in the product or material is indispensable or 'essential' to society. Their use may not lead to risks to sustainability or risks to human health or the environment due to side effects and problem shifting. Chemical recycling, for example, can remove substances of concern, however, it is generally associated with a higher CO₂ impact than mechanical recycling ([RIVM, 2020](#)). It is therefore necessary to consider in advance how substances of concern are removed or broken down.

Towards a safe circular economy

Products may contain substances of concern that are still present after the recycling process. These are substances that may be hazardous to humans and/or the environment. A circular economy therefore is not automatically safe. By taking into account substances of concern in production, use and recycling, we are moving towards realising a safe circular economy. This process is monitored by RIVM. The government can encourage action and amend legal frameworks.

- Products that contain substances of concern
- Products that do not contain substances of concern

Production



Challenge: Prevention of substances of concern from the design phase (Safe & Sustainable by Design)

Best practice: The Cradle to Cradle® design principle



Challenge: Collaboration to facilitate a safe circular economy: from production to processing



Use



Challenge: Availability of information on substances of concern for production, use and processing

Best practice: The SCIP database provides information on the presence of substances of concern in products



Processing



Challenge: Prevention of risks to humans and the environment when reusing materials containing substances of concern

Best practice: Development of a risk assessment methodology for substances of concern for waste processing



Challenge: Removal of substances of concern during recycling process

Best practice: Technology to remove flame retardants of concern from polystyrene





Identifying substances

To gain insight into which substances of concern are being used, information on (the safety of) substances must be available across the entire chain. Some of this information will be available during the production phase, however, it is subsequently lost further down the chain or cannot be shared due to restrictions on trade secrets. Consequently, it is difficult for the waste processing industry to know to what extent substances are present in waste flows. Insufficient information can lead to limited reuse or even destruction of materials.

Database of substances

The European Chemicals Agency (ECHA) recently developed the SCIP database. The purpose of this database is to give consumers and the waste processing industry more insight into the presence of substances of concern in products. Suppliers are required to make this information available (ECHA, 2019). At present, the usability of the database is limited, in part due to fact that the requirement to supply information is limited to substances that are on the list of Substances of Very High Concern (SVHC) – which does not include all substances of concern. The material passport is another useful development to track the presence of substances. The passport contains information on the substances (of concern) and accompanies the product in digital form. The tool is already used in certain sectors (such as in the construction sector) or at certain steps in the product chain (such as information for consumers).



Managing substances

The first step in managing the presence of substances lies first and foremost in designing safe products. This means that no substances of concern are used in the product, making it safe for use as a raw material at a later stage. This prevents the creation of new problems. As they say: ‘prevention is better than cure’. Secondly, we will have to tackle the risks of the substances of concern already present. This may, for example, be achieved by developing innovative processing methods or separate collection of waste. In addition, agreements can be made on expanding producer responsibility, making manufacturers responsible for the collection, sorting and processing of products that are at the end of their lifecycle. Furthermore, the legislative framework can be amended or revised to ban or phase out substances of concern in products.



Safe & Sustainable by Design

Safe & Sustainable by Design is a concept in which the safety and sustainability of materials and substances are taken into account at the earliest possible stage of their design. A product designed based on this concept will be able to be (re-)used safely. Furthermore, if this product is made from reusable and separable materials, this creates an additional incentive for the reuse of the (safe) materials. The concept is part of the EU Green Deal and Chemical Strategy. The Dutch Ministry of Infrastructure and Water Management is currently fleshing out the concept through the Safe & Sustainable by Design programme.



Future strategy through flow-specific action

It is not easy to obtain a comprehensive and accurate breakdown of the substances of concern contained in products or materials. Myriad materials and products contain many types of substances of concern. RIVM has developed a method to determine the potential risks of substances of concern in a circular economy, which allows any problems as well as potential solutions to be identified over time ([RIVM, 2020](#)). Using the recommendations outlined below, the government and businesses will be able to realise a safe circular economy. RIVM is currently implementing these steps with chain partners for eight distinct material flows.

1. Select an approach specific to a product or material flow

It is best to focus on a specific product or material flow that contains substances of concern, such as flame retardants in electronics. Knowledge regarding the reuse of products and materials will often be sector specific. This is due to the fact that information will relate to a variety of substances, various applications and amounts of substances of concern.

2. Collectively draw up future scenarios and commitments

Draw up a scenario for a safe circular economy specific to a certain material flow or product. This scenario should link circular objectives (such as the use of recycled material) to the presence of substances. Subsequently, it should be determined what specific action is required to achieve these objectives. The substances present may not pose a risk in this regard. It is vital that all chain partners should be involved both in formulating the objectives and in implementing the various actions – from designers to public authorities to civic organisations.

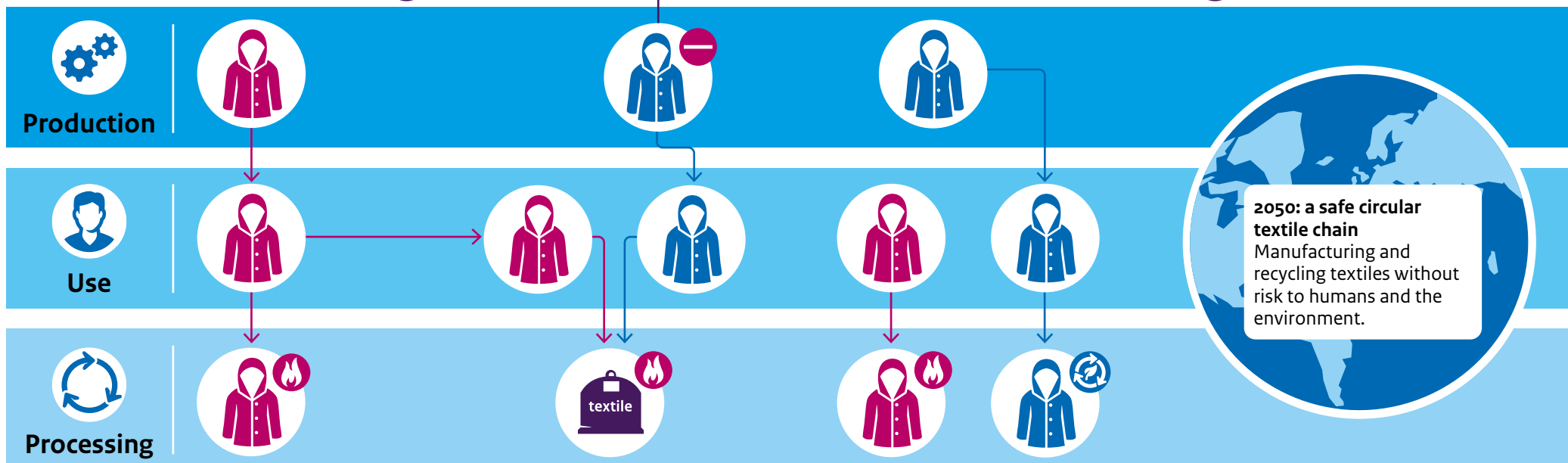
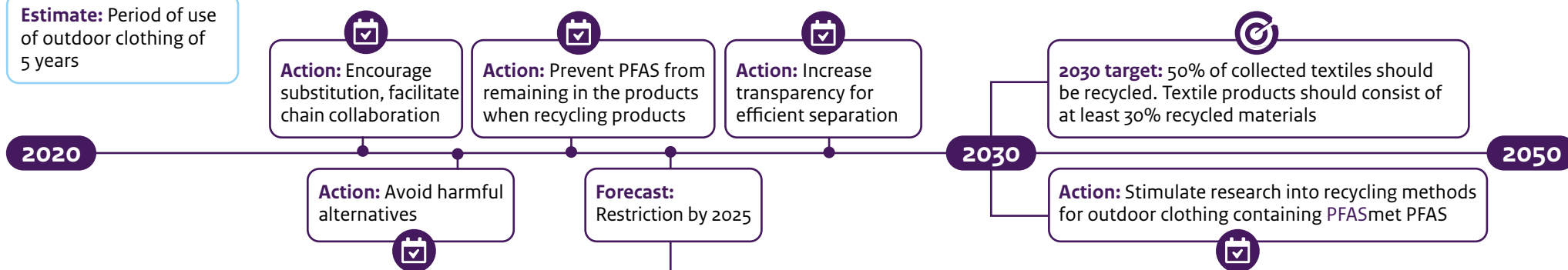
We will present two examples on the following pages: PFAS in textiles and flame retardants in polystyrene. These examples will demonstrate what a future scenario might look like. This may provide a sector with appropriate direction in terms of the action to be taken as well as a platform for coordination.





Future scenario for PFAS in textiles


PFAS are a group of substances of concern that are used for a number of purposes, like making clothing dirt and water repellent. This infographic outlines a potential future scenario with corresponding actions for production, use and processing, thereby creating a circular textile chain that is safe to humans and the environment.


Estimate: Period of use of outdoor clothing of 5 years



 EPS without the flame retardant HBCDD

 EPS with the flame retardant HBCDD

 Incineration of materials

 Recycling of materials

Future scenario for the flame retardant HBCDD in EPS (polystyrene) for the construction sector

HBCDD is a substance of very high concern that was used as a flame retardant in EPS (also known as polystyrene) in the construction sector until 2016. This infographic outlines a potential future scenario with corresponding actions for production, use and processing, thereby creating a safe and circular chain for EPS.

Estimate: Period of use of insulation material is > 60 years

Ban on the use of the flame retardant HBCDD

Action: More and better collection systems

1975

EPS released during renovation of buildings (built from the 1970s onwards)

2016

2021

Best practice: Opening of the PS Loop recycling plant. Removal of the flame retardant HBCDD in the recycling process

2050

2075

Action: Greater recycling capacity

Production



Use

Processing

2050: a safe and circular chain for EPS
All EPS for the building sector to be processed without risk to humans and the environment.



Specific steps to be taken

A scenario in which targets, corresponding actions, and potential obstacles are laid down may form the basis for further commitments in the chain. This applies both to restricted substances and to substances for which there are no restrictions (yet), but for which restrictions may arise in relation to reuse or recycling. The following recommendations may help companies, public authorities, and civic organisations take steps in this direction.

1. Stimulate the chain approach

The best opportunity lies in the further stimulation of the chain approach. Future scenarios with corresponding actions should be formulated for key material flows that contain substances of concern. Manufacturer responsibility, for example, may be fleshed out and shaped further. Expanding information obligations may provide more insight into substances across the entire chain. Introducing mandatory take-back of products through collection and recycling systems may improve the controlled use and processing of products and substances in critical applications, such as batteries.

The government can facilitate and support such collaboration, for example, by calling on the relevant parties to formulate a vision for the entire chain, which would include a coherent and jointly drafted set of actions. The government can also provide direction for the transition through policy, for example, by setting clear targets for the phasing out of substances of concern and encouraging regulations on transparency on the use of substances.

Businesses have a primary duty to take action. They are able to market safe and clean products and pass the information on down the chain. Government policy can regulate and encourage businesses in this regard, for example, through commitments on substances and incorporating opportunities for research into safe alternatives. A key example of this is the PFAS Action Programme that was launched recently, which is a partnership of the Dutch Ministry of Infrastructure and Water Management and the Confederation of Netherlands Industry and Employers (VNO-NCW). The aim of the programme is to seek out safe alternatives to PFAS, for example, in firefighting foam.

Collaboration with all parties within the chain represents a significant opportunity. Given that all parties have their own area of responsibility (occasionally confined to part of the chain), a coordinating party is required. Taking on this coordinating role, the government will be able to encourage a joint chain approach, which will allow us to realise the safe use and reuse of substances, including substances of concern, in materials and products.

2. Monitor actions and impact

It is vital to monitor whether actions are being implemented and whether all parties are still moving in the same direction. RIVM is developing a monitoring strategy for that purpose and will be providing support for its implementation ([RIVM, 2021](#)). This will allow the progress in achieving a safe circular economy by 2050 to be identified for each specific product or material flow.

It is equally essential that in addition to monitoring the results of actions, we monitor their actual impact. This impact, however, such as a decrease of the amount of EPS (polystyrene) containing the substance of concern HBCDD, will often only become visible in the long term.



Existing initiatives

Various government authorities and agencies are working on regulating substances of concern. The European REACH Regulation (Registration, Evaluation, Authorization and Restriction of Chemicals) sets out regulations for the registration and regulation of the production and import of substances into the EU. Companies in the Netherlands are obliged to continuously attempt to reduce the emission of a national list of substances of concern (Zeer Zorgwekkende Stoffen, ZZS) to zero and protect employees from exposure to harmful substances. The substances of concern on the Dutch list are substances with specific hazardous properties and are being addressed by the Dutch government as a top priority. There may be specific rules for products regarding what substances they may contain with a view to protecting consumers. There are also rules on the processing of waste streams in which national substances of concern are present (LAP3).

3. Revise the legal framework

Current legislation relating to dealing with substances of concern is based on a linear economy. This will have to be adapted to a circular economy. A start in the regard has already been made, for example, by way of the Dutch Circular Materials Plan (CMP) and the Environmental Management Act Modernisation programme. Substances are often regulated at EU level and implementation is a lengthy process. At the national level, action on achieving a safe circular economy can be taken more rapidly and proactively as far as regulations allow, for example, in relation to thermally remediated soil. Legislation must take into account that new applications, below the road surface, may lead to new risks, such as the leaching of substances. Legislation is likewise required to deal with substances of concern in applications that are indispensable or critical. Any risks that are passed on must be acceptable.

Transfer and exchange

There are a number of promising examples of how substances of concern can be removed from the circular economy – which is an important issue. However, consideration must also be given to the transfer or exchange of risks with other environmental effects. If, for example, we wanted to remove substances of concern from products with a low concentration of substance of concern and a low carbon footprint, e.g. using chemical recycling, this would require a large amount of energy, resulting in high CO₂ emissions.

An effective method to assess the risks of substances of concern for specific waste flows is currently available. If the risk is negligible, a decision can be made to recycle materials containing substances of concern, for example. The trade-off between safety and sustainability can be made clear using the Safe and Sustainable Material Loops method, which, for example, was used for the sleepers used by the Dutch railway company ProRail ([RIVM, 2021](#)).



Guidance should also be provided for the handling of products of concern in critical applications. Plasticisers may be used in medical plastic tubes because they are required from a functionality perspective and yet plasticisers may continue to be harmful to human health. It is therefore vital that work is carried out on achieving sustainable, healthy and safe alternatives without the use of any substances of concern. We must avoid any alternatives that are beneficial to our health, but that are harmful to the environment and vice versa. Any substances in concern that remain in products must be processed safely and in a controlled manner. This requires legislation given that absence of a regulatory framework may lead to illegal exports or uncontrolled processing, as controlled processing methods are expensive or non-existent.

4. Share knowledge, experiences and data

To gain a clear picture of the transition towards a circular economy, it is vital that all data and knowledge for specific products or material flows should be collected and interpreted in a centralised manner. This will identify any blind spots and provide scope for further research. That central location may, for example, take the form of a centre of expertise or a knowledge platform. An independent body that organises cooperation between the government, the education sector, businesses, and residents. Existing information systems for raw materials, such as the SCIP database, material passports and, in future, the Dutch Raw Materials Information System (GRIS), may provide useful tools in this regard. A centralised location of this kind will be able to collect as well as share information, such as regarding Safe & Sustainable by Design, substitution, and dealing with the risks of current substances.

Danish Centre for Circular Chemistry

A Centre for Circular Chemistry has been established in Denmark, which focuses on the substitution of substances of concern in products and manufacturing. The Centre was set up as part of an agreement between the Danish Parliament and Government on new chemistry initiatives and partnerships. The Centre conducts research, advises and inspires companies to take actual action to replace substances of concern. One of the studies the Centre conducted, for example, related to increasing the recycling of plastic without increasing the risk of substances of concern entering the environment ([Stenmarck et al, 2017](#)).



Collaboration is the key to success

How we deal with our raw materials is crucial to a healthy, sustainable, and safe living environment. In a circular economy, today's products are tomorrow's raw materials. However, we will not be able to get rid of substances of concern in the next few years.

Even though the risks of substances of concern are less visible than, say, the impact of climate change, it is nevertheless time to take action. This is something that must be done together – there is no single party that can resolve the problem on its own. In addition, we will only be seeing the impact of the myriad steps we are taking now in years to come (please see the future scenario for EPS (polystyrene) on page 8).

Next steps

By gaining more insight and control of substance of concern, we can make even better use of the circular economy to create a healthy, sustainable and safe living environment.

- We will be avoiding risks by using circular design that omits substances of concern – unless a critical application is concerned – using the Safe & Sustainable by Design concept as our guide.
- We will be making agreements on substances of concern already present, with due consideration of the transfer or trading off of risks with other environmental effects.
- We will be drawing up a scenario with all chain partners for each specific stream. This scenario will set out specific actions on how to deal with the substances of concern already present. The business community will be able to take on the implementation of those actions.

The government will be able to support, stimulate and accelerate the transition by initiating cooperative ventures, revising the legislative framework and by collecting data, knowledge and experiences with creating scenarios and making that information widely available.

All of these actions require knowledge – knowledge that is developed and maintained with a specific goal in mind and that can be used at any given time. Knowledge institutions, sitting alongside the government, markets players as well as citizens, have a crucial role to play in this endeavour.



Additional information

To find out more, please find a list of relevant websites on the circular economy and substances below.

Policy

- [EU Chemicals Strategy for Sustainability Towards a Toxic-Free Environment](#)
- [European Green Deal](#)
- [Safe by Design NL](#)
- [National Waste Management Plan](#)
- [Government-wide programme 'A Circular Economy in the Netherlands by 2050'](#)
- [ECHA SCIP database](#)

Substances in a circular economy

- [Waar zit wat in \[What is in what\]](#)
- [RIVM Consumer exposure to chemical substances \[Risks of substances\]](#)
- [Council for the Environment and Infrastructure \(2020\), rapport Greep op Gevaarlijke Stoffen \(2020\) \[Getting a grip on hazardous substances\] advisory report](#)
- [Health Council of the Netherlands \(2018\) - Gevaarlijke stoffen in een circulaire economie \[Hazardous substances in a circular economy\]](#)
- [RIVM \(2021\) - Zicht \(krijgen\) op Zeer Zorgwekkende Stoffen in een circulaire economie. Concretisering van een monitoringsstrategie \[Gaining insight into Substances of Very High Concern in a circular economy. Realising a monitoring strategy\]](#)
- [RIVM \(2020\) - Omgaan met zeer zorgwekkende stoffen in een circulaire economie \[Coping with substances of concern in a circular economy\]](#)
- [RIVM \(2019\) - Clean Material Recycling project](#)
- [RIVM \(2019\) - Creating safe and sustainable material loops in a circular economy](#)
- [Rijkswaterstaat - Afval Circulair, Kenniscentrum Circulaire Economie \[Circular Waste, Knowledge Centre for the Circular Economy\]](#)

Specific case studies

- [RIVM \(2018\) - Verkenning milieueffecten rubbergranulaat bij kunstgrasvelden \[Environmental impact survey of rubber granulate in artificial turf fields\]](#)
- [RIVM \(2020\) - Analyse dwarsliggers in het spoor op duurzaamheid en veiligheid voor het milieu \[Analysis of railway sleepers for sustainability and environmental safety\]](#)
- [Danish Consumer Council \(2015\) - Test: Unwanted chemicals found in pizza boxes](#)
- [Polystyrene Loop](#)
- [Centre for Circular Chemistry](#)
- [Modint - Op zoek naar alternatieven voor PFAS in textiel \[Finding alternatives to PFAS in textiles\]](#)

This report was drafted in the context of the Work Programme on Monitoring and Directing the Circular Economy, 2019-2023.

This work programme is a partnership between Statistics Netherlands (CBS), the Institute of Environmental Studies Leiden (CML), the CPB Netherlands Bureau for Economic Policy Analysis (CPB), the National Institute for Public Health and the Environment (RIVM), the Netherlands Enterprise Agency (RVO), Rijkswaterstaat (RWS), the Netherlands Organisation for Applied Scientific Research (TNO) and Utrecht University (UU) under the auspices of the PBL Netherlands Environmental Assessment Agency (PBL).

The government aims to have established a fully circular economy by 2050. The purpose of the work programme is to be able to monitor and evaluate the course set out by the government towards 2050 and to provide the government with the knowledge required for the design and calibration of policy.

Please find more information on the Work Programme on Monitoring and Directing the Circular Economy on <https://www.pbl.nl/en/topics/circular-economy>

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