

## SUSTAINABLE SURFACE PROTECTION BY GLASS-LIKE HYBRID AND BIOMATERIALS COATINGS

Safe- and sustainable-by-design organic and hybrid coatings



BIO-SUSHY

Circular, sustainable and biobased coatings

November 18th, 2025 – On line



Funded by the  
European Union

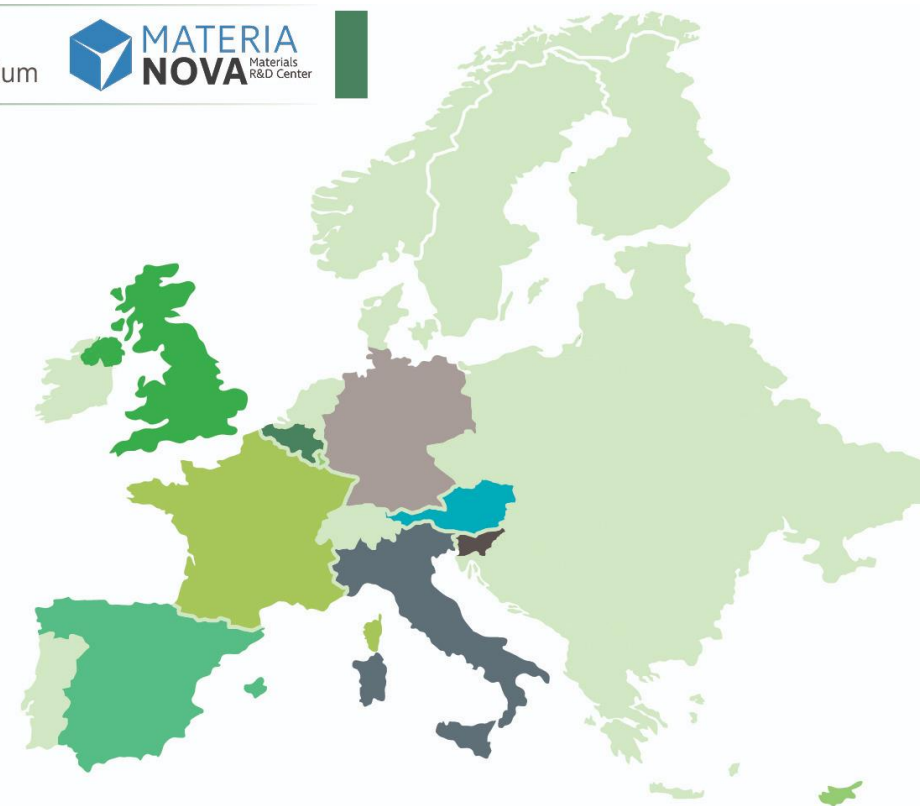
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Horizon's Europe GA number: 101091464

# Team

The **BIO-SUSHY** project is a collaboration between 14 partners from 7 EU countries and 1 EU-associated country: 6 RTDs, 5 SMEs, 1 large company, 1 university, and 1 national association.

## BIO-SUSHY COORDINATOR:

Materia Nova, Av. Nicolas Copernic 3, 7000 Mons, Belgium



# Impacts



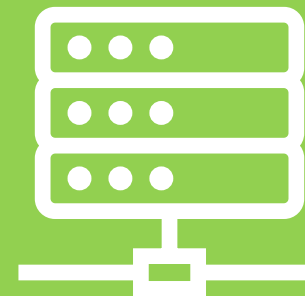
**25% reduction of  
environmental  
impact**



**Contribution to  
SSbD criteria and  
guiding principles**



**Reduction of PFAS  
in the  
environment**



**Computational  
tools to support  
SSbD concepts**

# Impacts



Integration into  
**standardization**  
process



Enhance **social**  
**acceptance**



Provide **business**  
**opportunities**  
to EU's SMEs



Boosting  
**EU R. D. & I.**

# Introduction

## PFAS, What?

PFAS (per and polyfluorinated alkyl substances) provide excellent **water** and **oil repellency** properties.

## Why is it a problem?

PFAS are known as '**forever chemicals**' due to their resistance, widespread, and linked to **environmental** and **health problems** like cancer and decreased fertility.

## How?

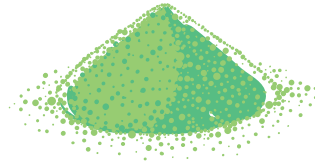
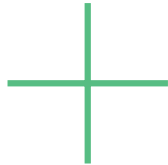
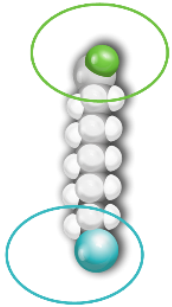
Exposure could happen through **eating**, **drinking**, or **using** consumer products containing PFAS.

You may have  
assumed PFAS  
without knowing it



# Objectives

Develop **3 PFAS-free bio-based coatings**



Thermoplastic bio-based **powder**

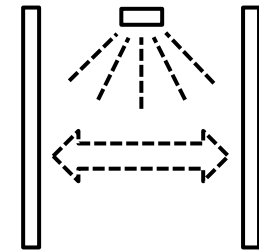
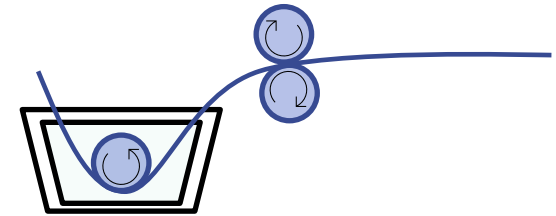
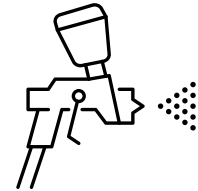


Water-based **hybrid sol-gel** organic



Solvent-based **hybrid sol-gel** inorganic

Hydro/oleophobic  
**additives**



# BIO-SUSHY Methodology – Based on 3 pillars



**SAFE AND  
SUSTAINABLE BY  
DESIGN**



**MODELLING**



**R&I COATING  
DEVELOPMENT**



# R&I Coating Development



TEXTILE COATING



FOOD PACKAGING

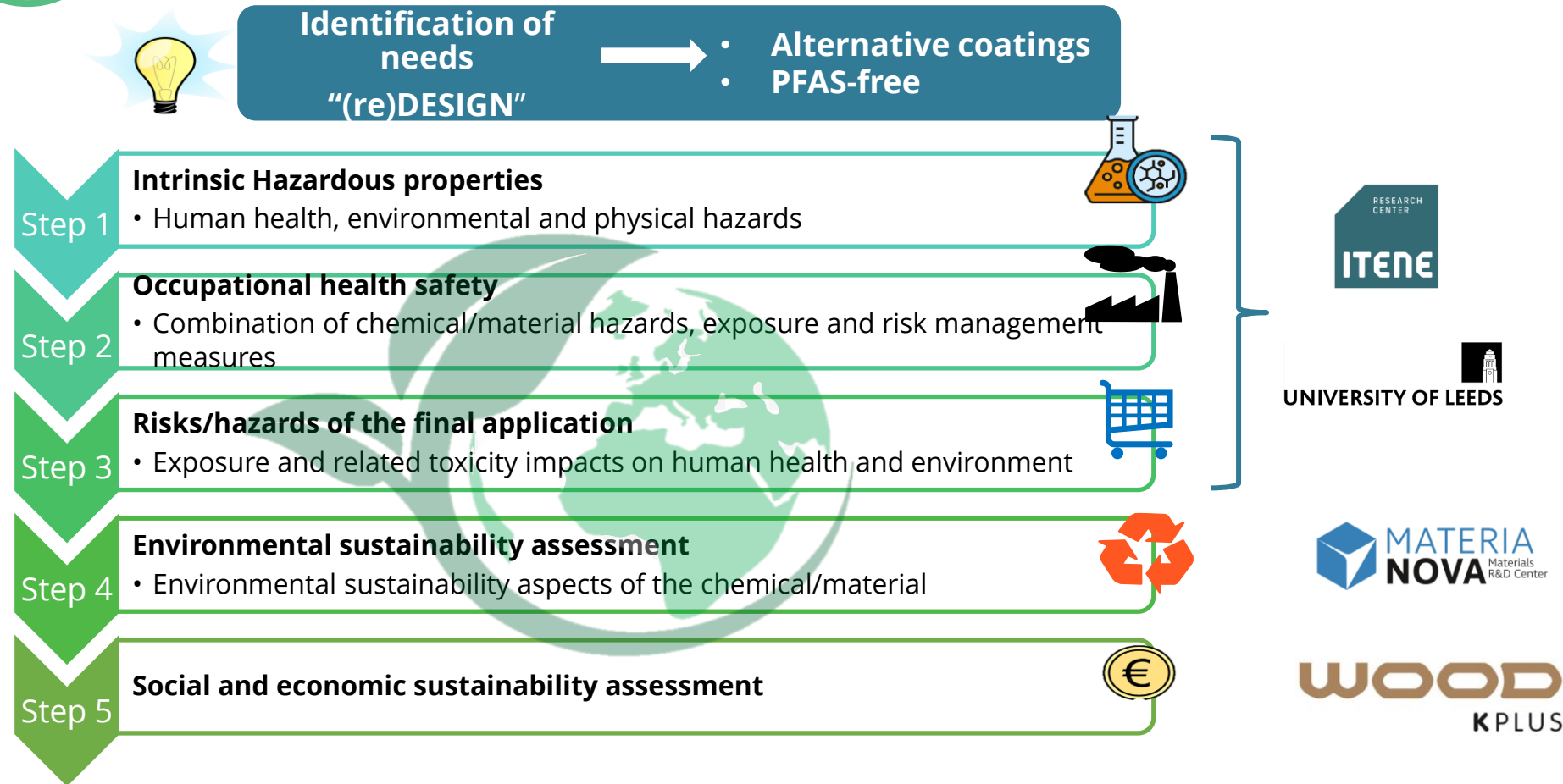


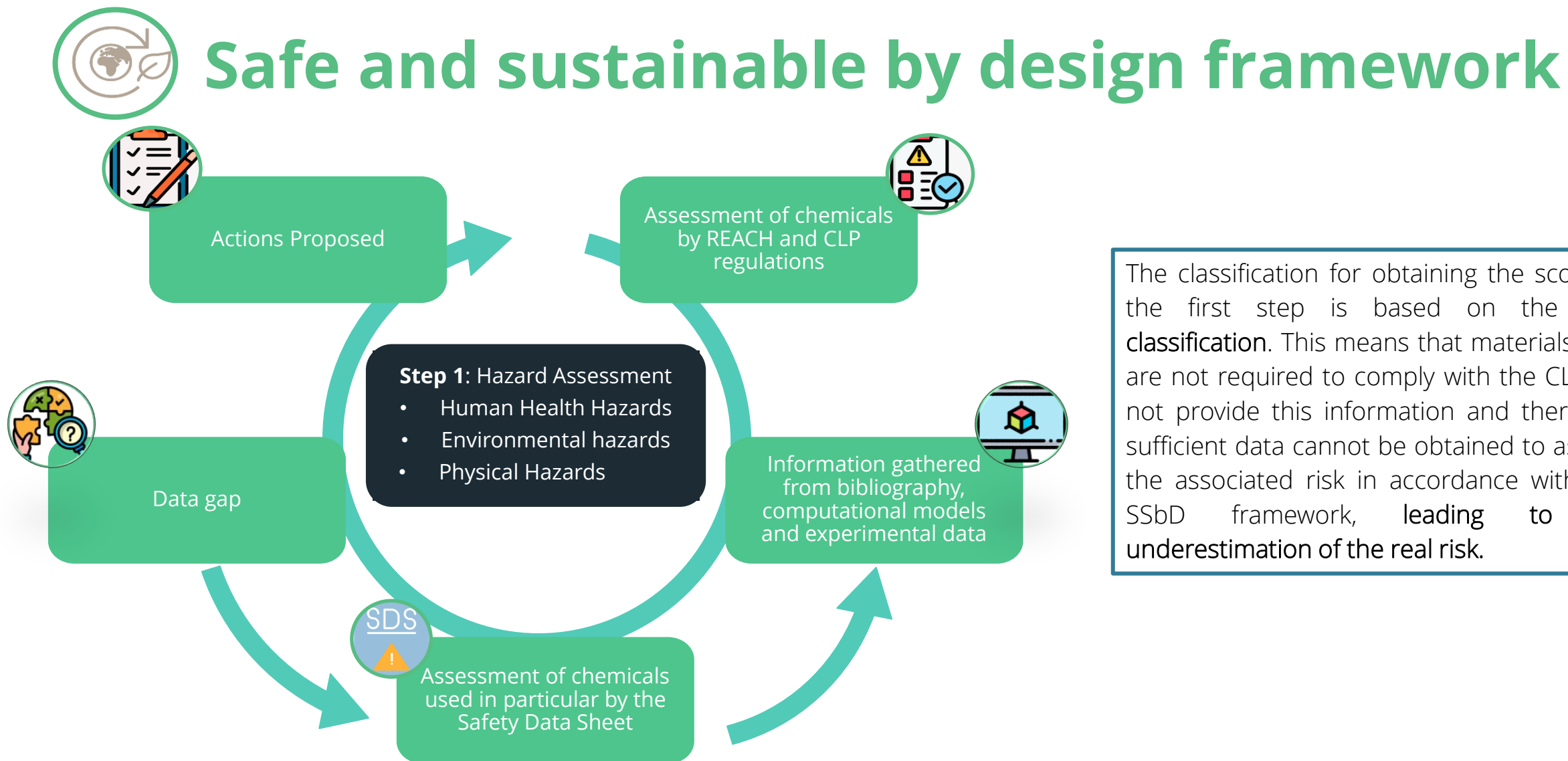
GLASS COSMETICS  
PACKAGING

- Development of **3 novel SSbD coatings materials** with water and oil repellency
- **Validation** of coating materials with 3 case studies
  - Textile
  - Food packaging
  - Glass packaging



# Safe and sustainable by design framework

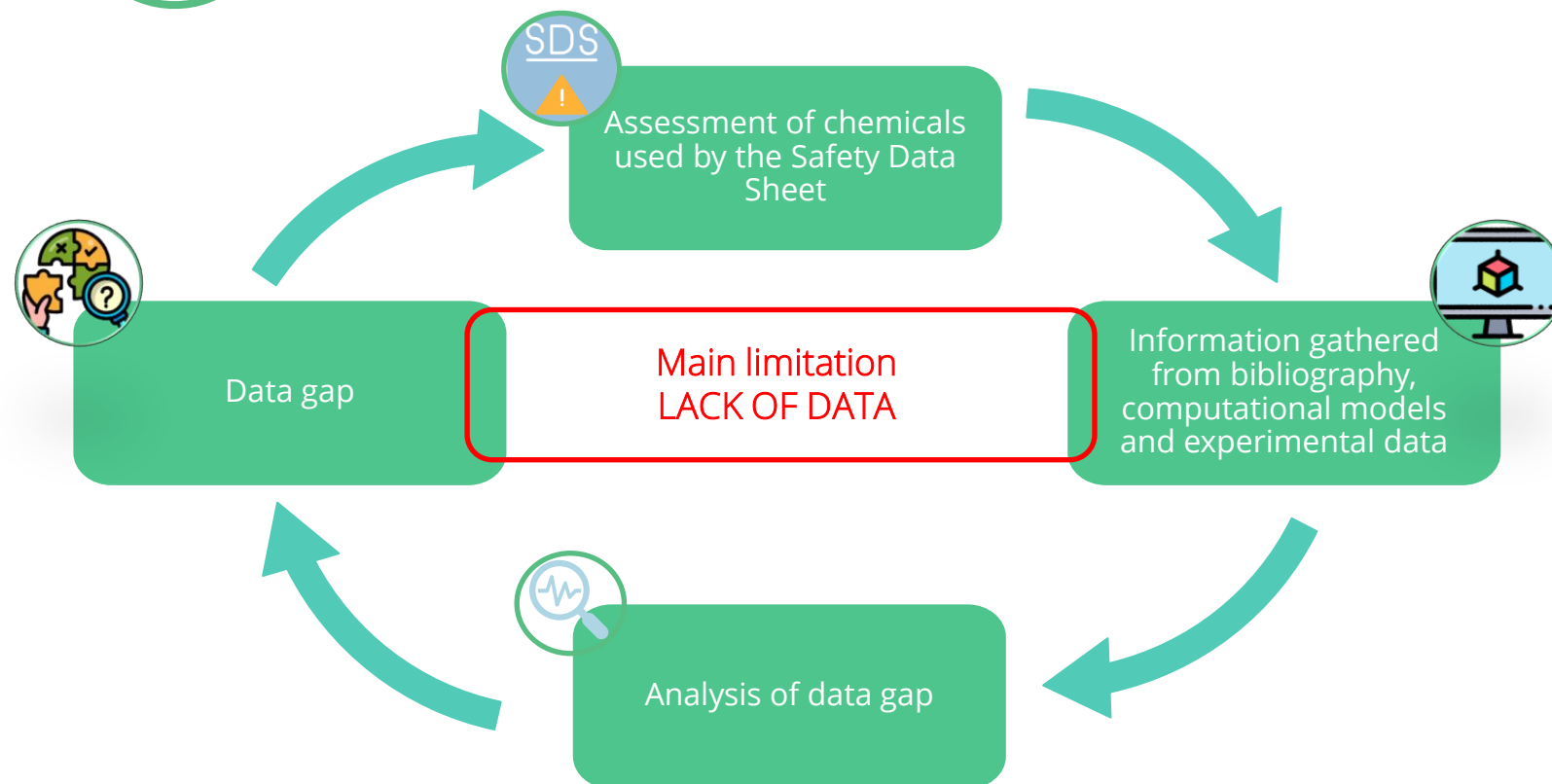




The classification for obtaining the score in the first step is based on the CLP classification. This means that materials that are not required to comply with the CLP do not provide this information and therefore sufficient data cannot be obtained to assess the associated risk in accordance with the SSbD framework, leading to an underestimation of the real risk.



# Safe and sustainable by design framework



Following the current framework, in the absence of data, the proposed scoring system tends to indicate that those lack-of-data compounds are safe, leading to an underestimation of the real risk.

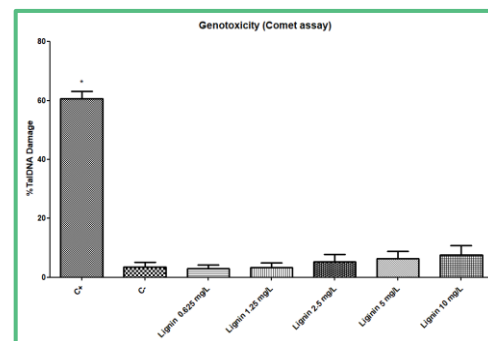


# Safe and sustainable by design framework

Information gathered from bibliography, computational models and experimental data

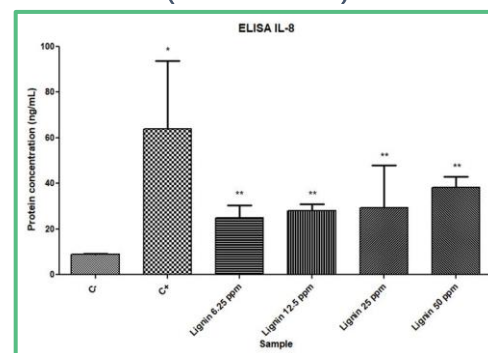


Commet assay test (OECD 489)



✓ Genotoxicity

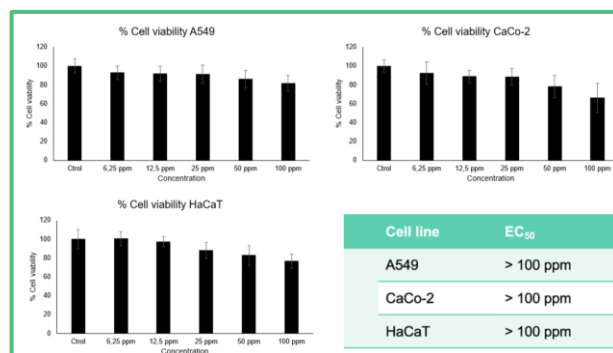
ELISA test (OECD 422E)



✓ Skin sensitisation

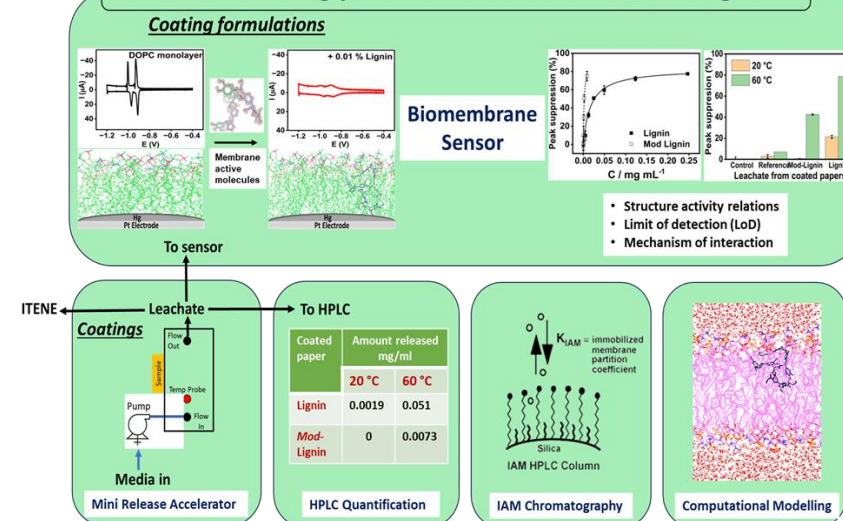
MTT test

Cell lines: (inhalation) A549, (dermal) HaCaT, (gastrointestinal) CaCo-2



✓ Acute toxicity

UoL Screening platform for formulations/coatings

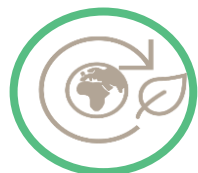


DATA GENERATION



SSbD framework for Advanced PFA-free coatings



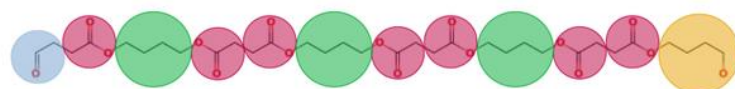
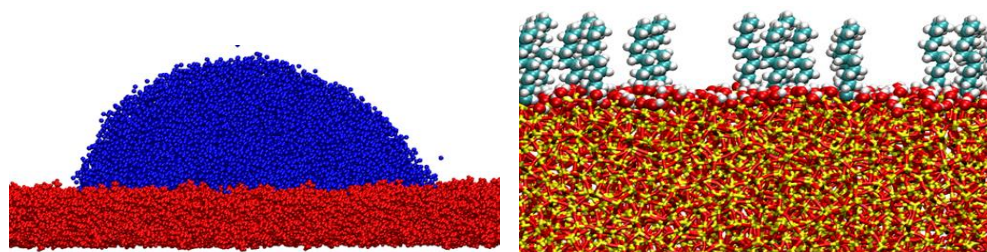


# Safe and sustainable by design framework

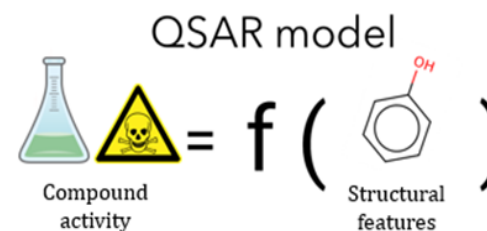
Information gathered from bibliography, computational models and experimental data



Validation of physical based modelling and simulation of repellent properties and leaching mechanisms of reference coating for data generation



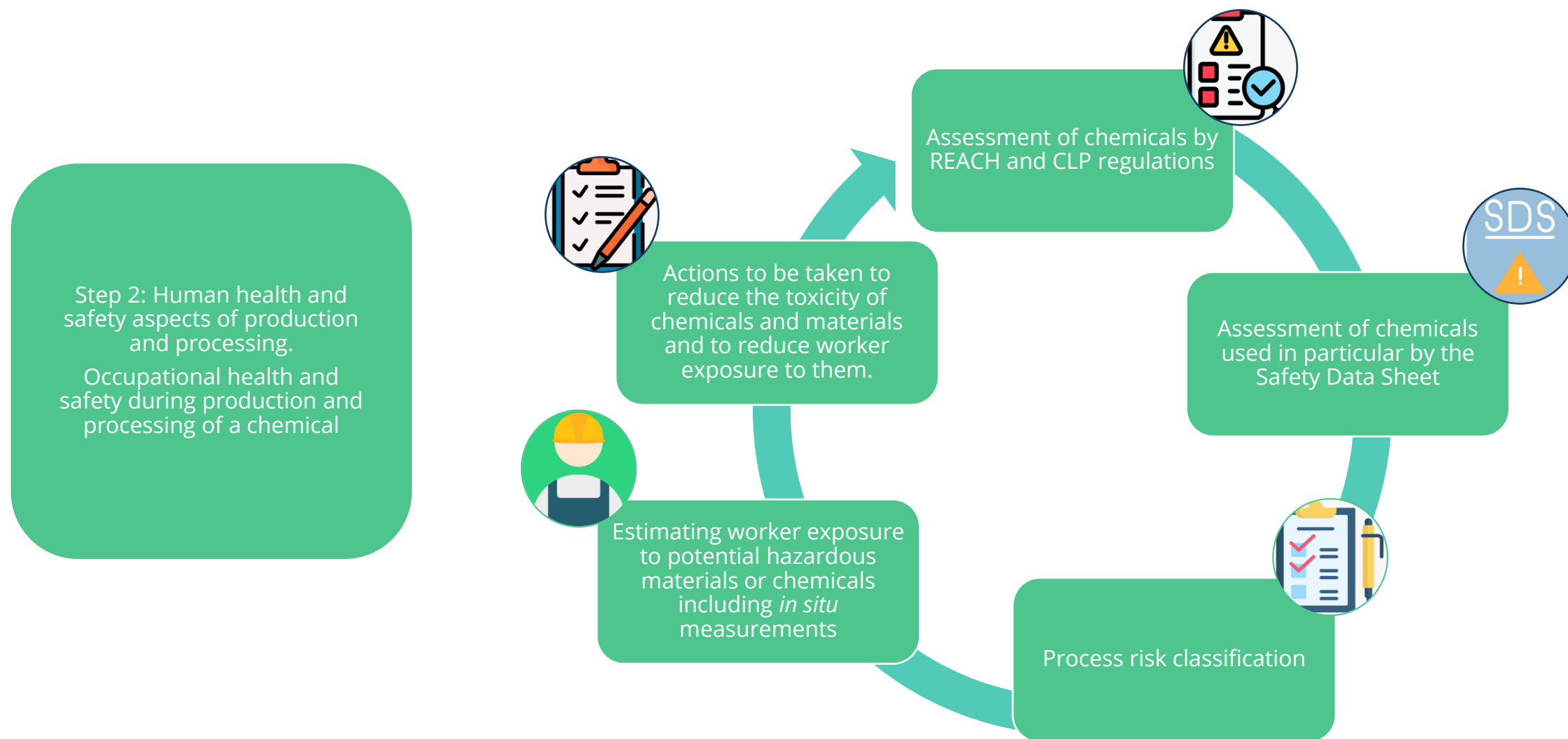
Several models have been selected for the fill-the-gaps process

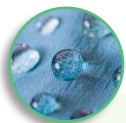


Main limitation  
APPLICABILITY DOMAIN  
NOT APPLICABLE FOR MIXTURES



DATA GENERATION





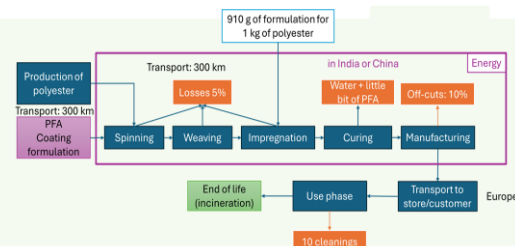
## SSbD Step 4 - LCA

1. Define a benchmark and a functional unit

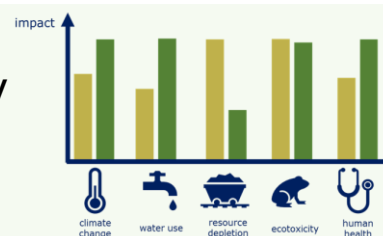
2. Define a range of improvement

Position to reference	Score	Colour code	
No improvement	0	Red	Fail the criteria
Improvement + 5%	1	Orange	
Improvement + 5% to 20%	2	Yellow	Pass the criteria
Improvement + 20% to 40%	3	Light Green	
Improvement > 40%	4	Dark Blue	

3. Model whole life cycle of the benchmark and the new product



4. Compare the results for each impact category between benchmark and new product → score



The proposed scoring system is not suitable for all compounds, such as in step 4, where the scoring is based on the improvement of new materials compared to the chosen benchmark. For example, in the case of biopolymer use, there is a lack of data to model it reliably, which generates too much uncertainty. The scoring system therefore needs to be revised in this case.



## SSbD Step 5 – SLCA: Activities Overview

- Identification and Prioritization of Social Risks and Opportunities (Impact (Sub-)Categories)
- Social Risk Mapping on sector- and country-level



### 1. Identifying relevant topics and issues

- Literature review (case study specific, SLCA studies, etc.)
- Guidelines (UNEP Guidelines, SSbD Guidelines, etc.)



### 2. Mapping:

Case study value chains and stakeholder

- Value chains, locations and stakeholders characterization
- Definition of reference products and hypothetical value chains



### 3. Prioritize: Ranking processes and stakeholder relevance, identify issues

- Project internal Workshop
- Qualitative Interviews with Value Chain Experts



### 4. Risk Analysis: Identification of Social Risks on sector- and country-level

- Market- and sector analysis
- Social Hotspots Identification (SHDB Risk Mapping Tool)

# CONCLUSIONS

- The BIO-SUSHY project represents a proactive step toward aligning innovative coating technologies with the EU's sustainability and safety goals.
- The main challenge is the lack of data, and one outcome of BIOSUSHY will be providing it.
- Following the current framework, in the absence of data, the proposed scoring system tends to indicate that those lack-of-data compounds are safe , leading to an underestimation of the real risk.
- The use of computational tools is extremely helpful, however, their use for mixtures is still insufficient and for polymers are not good, due to polymers are outside of the applicability domain for the QSAR models. Nanoparticles present the same challenge.
- With the new framework to be published soon, some of the limitations we have observed during its implementation will be resolved.

# Thank You



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Project Manager

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