

The BIOSAFIRE project: application of the JRC's SSbD framework for the development of new bio-based flame retardants

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INTRODUCTION

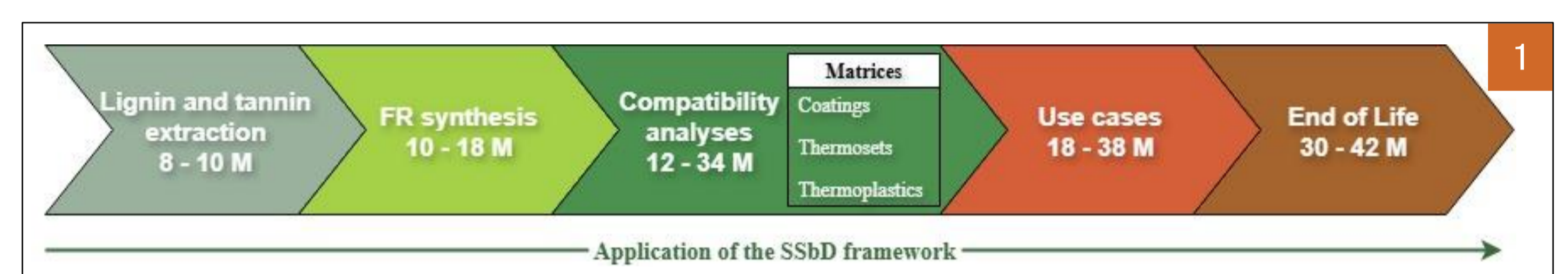
Flame retardants (FRs) comprise a diverse group of chemicals that are extensively used as additives to improve fire safety in multiple sectors. Conventional FRs, such as halogenated FRs, pose various risks for human and environmental health, including persistence, bioaccumulation, and other harmful effects, which have led to some of these FRs being classified as substances of very high concern (SVHC) under REACH regulation. Moreover, due to their extensive use, FRs can be widely detected in various environments as contaminants. All the aforementioned lead to the restriction and banning of some FRs in the EU in accordance with the REACH regulation and the Chemicals Strategy for Sustainability (CSS), which resulted in an urgent need to develop new less hazardous alternatives. Some of those alternatives are already in the market. However, information gaps regarding their safety can be found, so their innocuousness cannot be assured.

Lignins and tannins are two natural biomolecules present in plants, which possess promising structural properties for their use as flame retardants. The EU funded project BIOSAFIRE aims to apply this knowledge to develop new safe and sustainable FRs. For that purpose, the JRC's SSbD framework will be applied to assure the safety and sustainability of the new FRs throughout the whole innovation process. In this way, BIOSAFIRE will pave the way towards a safer and greener flame-retardant industry.

OBJECTIVES

- Develop and upscale new safe and sustainable biobased FRs, based on lignins and tannins
- Test and validate the JRC SSbD framework by adopting a tiered approach to SSbD assessment and decision making throughout the project
- Provide decision support and interoperability across the value chain to ensure consistent data sharing and decision making
- Conduct a solid analysis of the technology and socio-economic situation to ensure the future commercial viability of the developed materials
- Engage with relevant stakeholders and society to promote the use of the SSbD framework and raise awareness towards the use of SSbD new materials

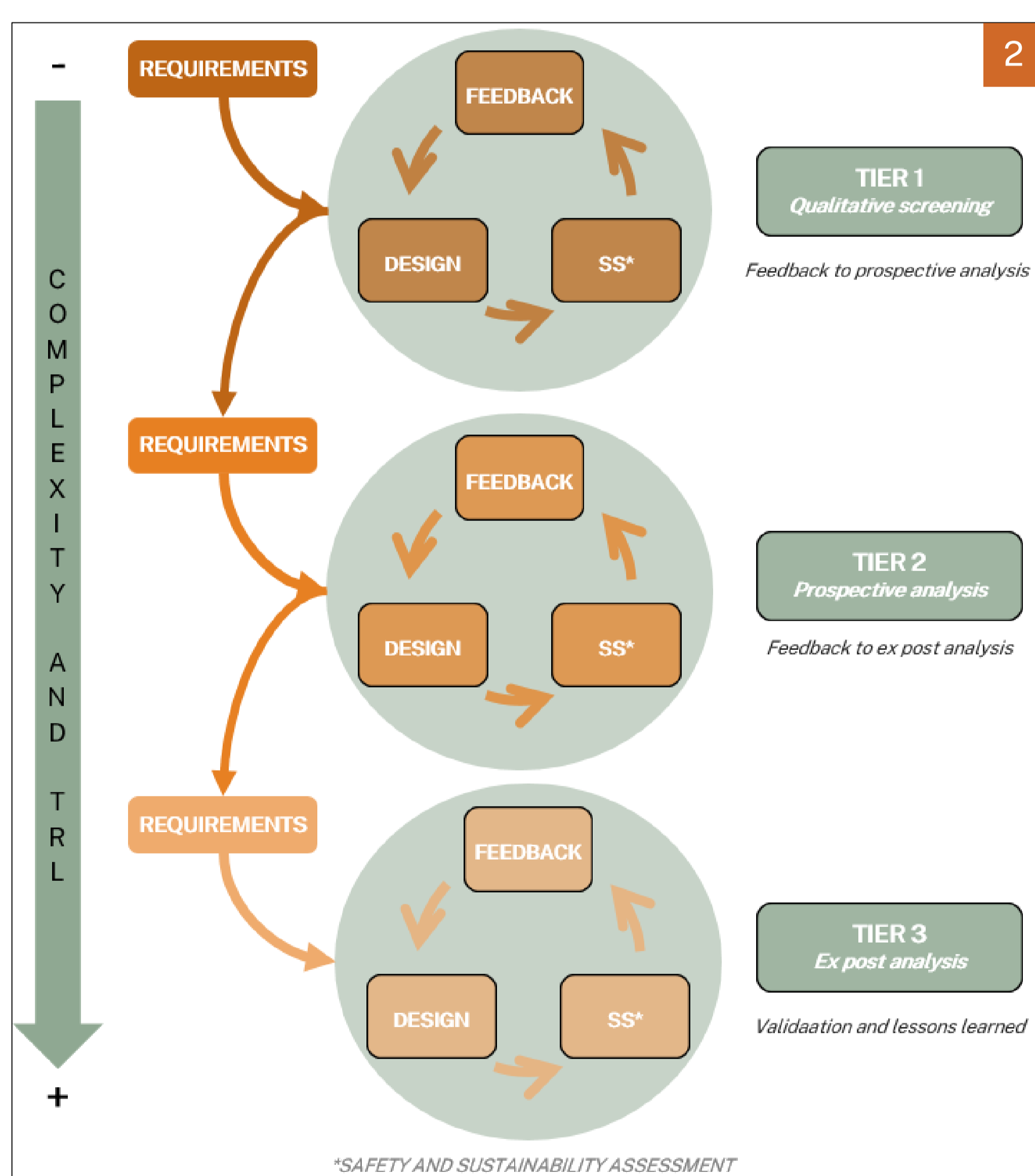
WORKING PLAN



► Timeline of the BIOSAFIRE project

In the BIOSAFIRE project, one of the fundamental pillars is the application of the SSbD framework throughout the whole innovation chain (Fig. 1). For that, an exhaustive early stage-hazard screening and safety assessment, life-cycle thinking and sustainability criteria will be integrated in both product design and development phases.

METHODOLOGY



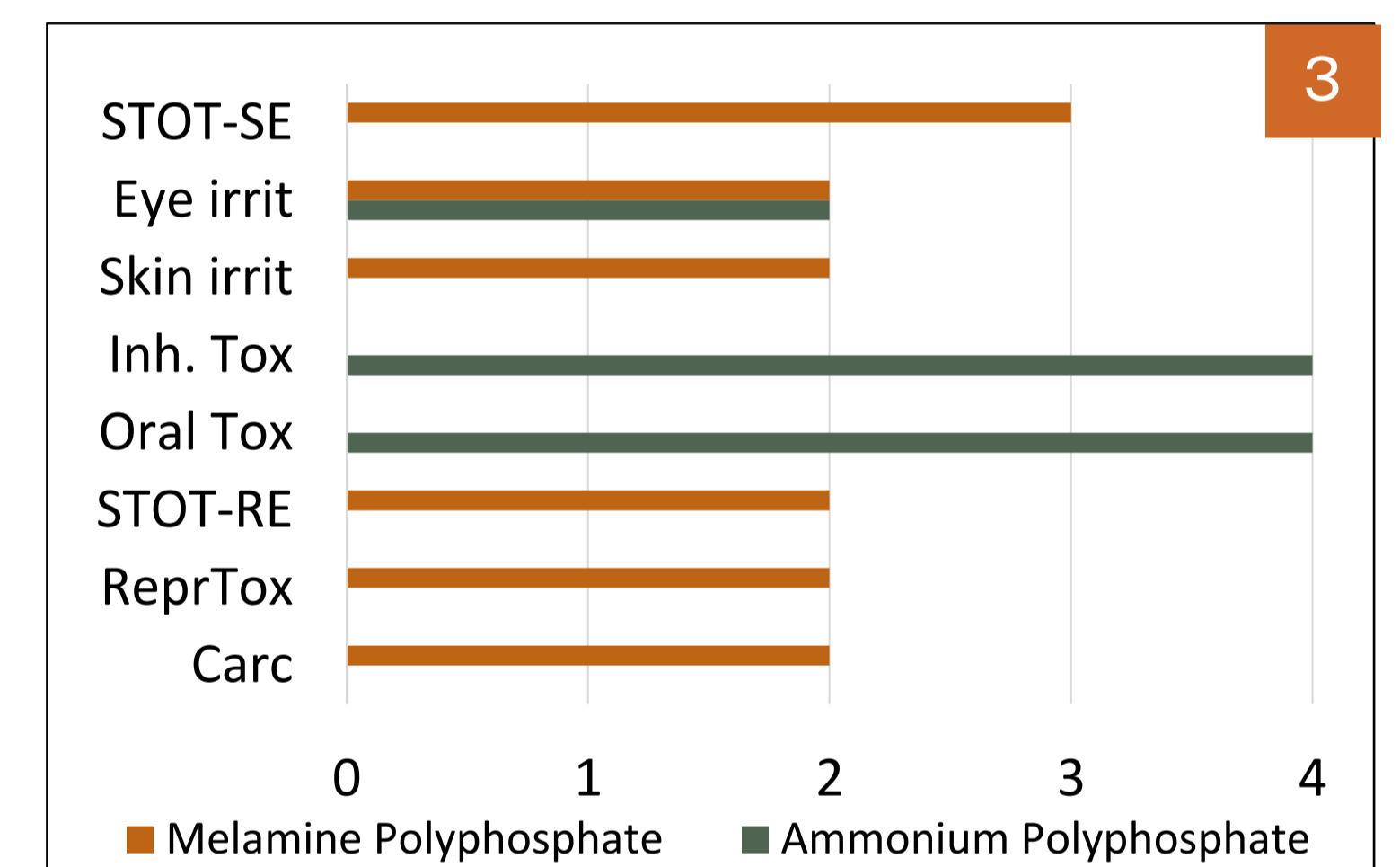
► 3-tiered approach for the SSbD in the BIOSAFIRE project

The BIOSAFIRE project will follow a 3-tiered approach (Fig. 2), to give support to the decision-making process for SSbD in a Stage-gate-approach system.

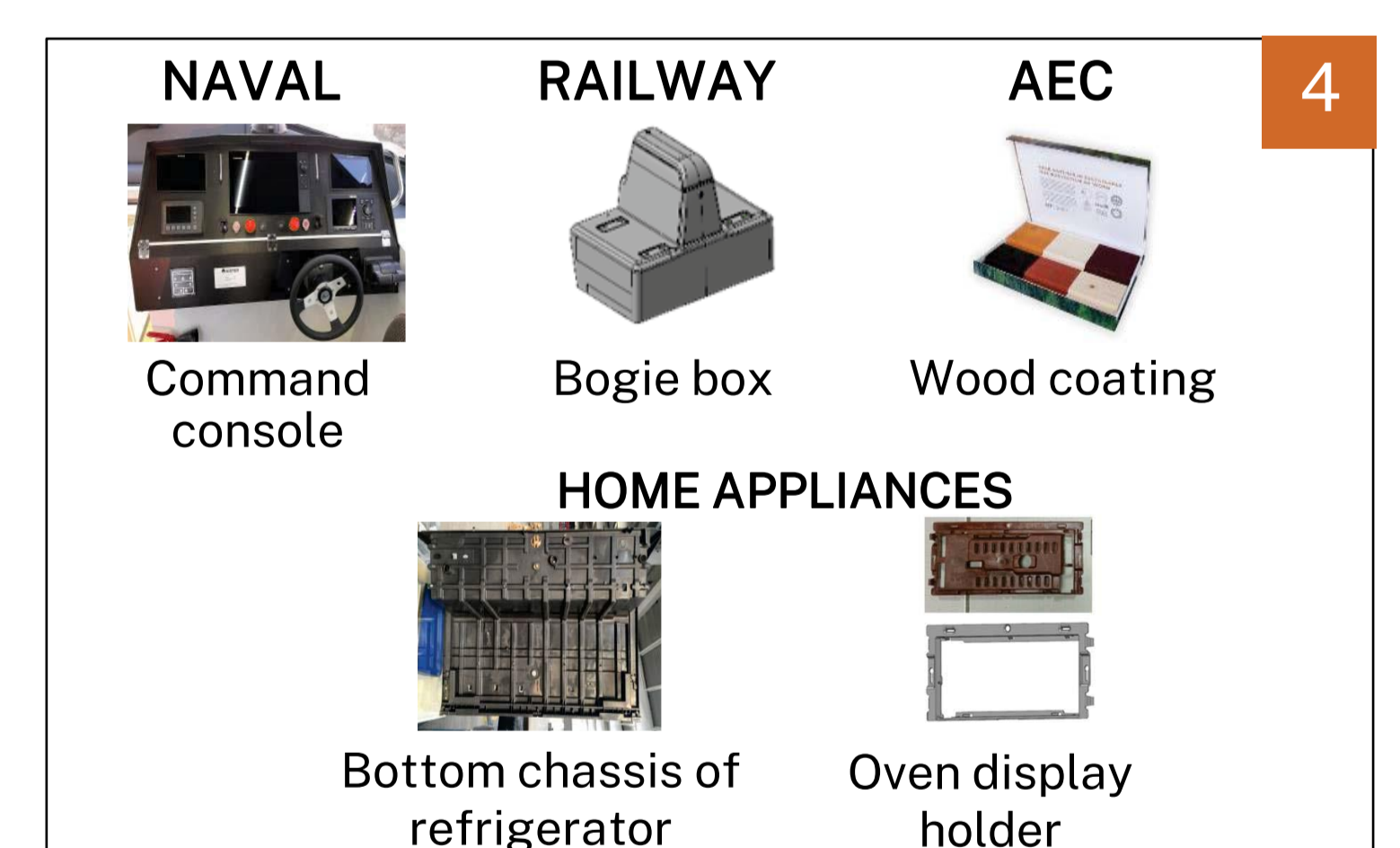
Actually, the project is in the first stages of development. Efforts have mainly been focused on extracting lignins and tannins, planning of relevant testing and identifying and characterizing the materials to be used for later development in Tier 1. Regarding the steps for the SSbD assessment, Step 1 (*Hazard assessment*), 2 (*Human health and safety aspects in the production and processing phase*) and 4 (*Life Cycle Assessment*) of the framework are being carried out.

The developed FRs will be compared with different benchmarks (Fig. 3) to demonstrate their major security and sustainability.

Eventually, the integration of lignins and tannins as FRs in different matrices will be carried out, 5 use cases will be applied to test and validate the framework, covering four industrial sectors (Fig. 4).



► Toxicity categories of conventional FRs (benchmarks)



► Five use cases in the BIOSAFIRE project

REFERENCES

1. Caldeira, C. Farcal, R., Garmendia Aguirre, I., *et al.* (2022). Safe and Sustainable by Design chemicals and materials - Framework for the definition of criteria and evaluation procedure for chemicals and materials. *Publications Office of the European Union, EUR 31100 EN*. doi:10.2760/487955
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EXPECTED RESULTS

The JRC's SSbD framework is expected to be efficiently applied in the development of the FRs within the BIOSAFIRE project and a new generation of high-performance safe and sustainable biobased FRs is expected to be developed, which will eventually substitute the current hazardous FRs.

A portfolio of FRs is expected to be developed in order to cover the industrial needs of different sectors, which will help in widening the potential use and customers of the new generation of FRs from the BIOSAFIRE project. In this way, BIOSAFIRE will be the starting engine for a transition of the FR industry to a greener and safer one and BIOSAFIRE's FRs will be introduced in a globally growing market.

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