

Safe Chemicals Innovation Agenda

Towards a Research Agenda for Safe Chemicals, Materials and Products

Executive summary

Priority areas for Research and Development

This report, the Safe Chemicals Innovation Agenda, proposes seven areas where Research and Development is needed to stimulate the safe design of chemicals, materials and products:

- **Theme 1: Water, grease and dirt repellents.** Most applied treatments rely on fluorochemicals where concerns include persistence in the environment and bio-accumulation in living organisms. The theme focuses on developing effective fluorine-free alternatives, focusing on essential uses.
- **Theme 2: Fire safety.** Many flame retardant chemicals exhibit persistent, bioaccumulative and toxic behaviours and are associated with carcinogenicity, neurotoxicity and endocrine disruption. This theme focuses on filling data gaps so alternatives can replicate this key functionality or redesigning products, where appropriate.
- **Theme 3: Preservation.** Some preservatives are associated with endocrine effects, oestrogenic properties, are linked to cancer and allergic skin reactions or are classified as toxic for reproduction. This theme focuses on developing safe alternatives; a key challenge is that substitution of harmful preservatives may require extensive product reformulation.
- **Theme 4: Plasticising.** The theme focuses on developing alternatives without the adverse effects on reproduction or endocrine activity found within the main families of chemical plasticisers. Such solutions may be alternative chemicals or materials. Over 90% of plasticisers are used in flexible PVC applications.
- **Theme 5: Solvents.** Conventional solvents are often volatile organic compounds. This theme focuses on developing safer alternatives; substantial reformulation and production process changes are amongst the key challenges. An important subgroup are the polar aprotic solvents.
- **Theme 6: Surfactants.** Surfactants (surface-active agents) include known or suspected endocrine disrupting chemicals, and some are immunotoxic and toxic in the aquatic environment. This theme focuses on several specific issues relating to molecule behaviour, production scale-up and raw materials.
- **Theme 7: Process regulators (curing agents).** This research theme comprises a series of technical barriers to effective substitution of hazardous chemical curing agents, used in the polymerisation process to improve the strength, toughness and durability of products such as resins, rubbers and foams.

A concrete recommendation is to transform these themes into **seven programmes or projects under the 9th Framework Programme and/or other relevant European and national programmes**. Specific emphasis within such programmes is recommended on participation of the entire value chain and a prolonged scoping stage involving end-users to define essential user requirements.

A Safe Chemicals Innovation Agenda

A strategic objective of the Netherlands is to contribute to the European transition towards a non-toxic environment and a circular economy. To that end, the Ministry of Infrastructure and Water Management, in cooperation with the Ministry of Economic Affairs and Climate with the support of stakeholders across Europe, have developed a **Safe Chemicals Innovation Agenda (SCIA)**. This is a coherent agenda for research needs that, if satisfactorily addressed by the scientific, technical, business and policy making community will accelerate the safe design of chemicals, materials and products ("safe by design"). The document aims to reflect the current state of knowledge and is a recognition of the progress made in the field, but is also a call to action.

The Safe Chemicals Innovation Agenda focuses on three interlinking elements: first, the essential functionalities of widely used chemicals; second, (groups of) hazardous chemicals considered as difficult to substitute and; third, potential for new market niches and/or longer term competitive advantage for European businesses. Based on this the SCIA identifies seven **research themes**. These are areas where new or different technical and scientific research activities will accelerate safe by design. Each theme then highlights several **research questions**: technical and scientific research requirements arising from each theme. Within some themes, such as plasticisers, solvents and surfactants, **bio-based alternatives** may be a viable option, where this creates synergy with climate policy.

The consultation identified six further issues, in particular **fertilisers, pesticides, energy storage, surface protection, methodologies for alternatives assessment and legacy contamination**. These provide further avenues for research, but are not elaborated in detail.

From substitution to safe design in the context of circular economy

Major progress has been made in reducing the harm caused by dangerous chemicals in Europe. But damage to the environment and public health continues. The risks of all existing substances are not fully understood and new risks are emerging. Regulatory requirements alone are not sufficient, because substitutes are often drop-in replacements which are not necessarily much safer. More fundamental innovation is needed to develop safe chemicals, materials and products (including non-chemical solutions), and to take toxicity into account at the design stage. This in turn is essential to achieve a circular economy and to address issues with recycling and reuse.

How have stakeholders helped prioritise areas for research?

This research agenda has been developed in cooperation with representatives of European industry, the European Commission and international public bodies, Member States, NGOs and scientific institutes. It has deliberately been driven by the views of stakeholders alongside findings from technical, scientific and policy literature. An iterative framework was designed to aid the identification of research themes and questions and to evaluate their merits systematically against pre-defined criteria. These include the contribution to protecting public health and the environment, coherence with wider policy goals, the economic rationale and the nature of the technical or scientific challenge. Based on this, two levels are considered:

- Level 1: direct replacement of the substance of concern by a significantly different substance with comparable functionality, rather than drop-in replacement with a similar chemical. We refer to this as the **'molecular level'**.
- Level 2: replacement of the material that the substance of high concern is used in, or redesigning processes, products, services and/or product chains, including non-chemical solutions. We refer to this as the **'material', 'product/service' or 'process' level**.

A long list of potential research themes and questions were prioritised and enhanced at a stakeholder workshop in March 2018 in Amsterdam.