ROYAL SOCIETY OF CHEMISTRY

A chemicals strategy for a sustainable chemicals revolution

A balanced approach for future chemicals policy with science at its heart

Chemical sciences and the chemicals sector are important contributors to sustainable prosperity, now and in the future. They revolutionise our lives with new products and solve grand challenges, through the development of new materials, new science, new technologies and new ways of assessing the risks of chemical hazards.

According to the United Nations Global Chemicals Outlook II (GCO II) report 'From Legacies to Innovative Solutions' published in June 2019[1], chemicals production and consumption is set to double by 2030, from a $5 trillion industry globally in 2017, with production set to increase mainly in emerging economies. If chemicals production is doubled, chemical pollution must not double as a consequence.

"The global goal to minimize adverse impacts of chemicals and waste will not be achieved by 2020" – legacy issues of chemical pollution need to be addressed with greater urgency internationally, particularly plastic waste and persistent organic pollutants (POPs).

GCOII report (2019)

A time for revolution

Current attempts at the massive undertaking of addressing chemical pollution are not working. For the world to solve the major environmental and health challenges we face, there must be a sustainable chemicals revolution. It is time for governments and civil society to take a fresh look at working together to develop a revolutionary global chemicals strategy – a strategy that delivers on the vision of economic growth and on delivering new, life-changing chemical products.

Scientists in our community have engaged actively with us in round tables and workshop events to help develop our vision for a chemicals strategy. Together, we have identified four pillars on which any chemicals strategy has to be based: education, innovation, circular economy and regulation.

In this document, vision statements for each of these pillars combine with enablers, resources and governance to illustrate the significance of these themes to any chemicals strategy. The thinking behind the statements is especially relevant in the UK at the moment, as the government is developing a 25-year plan for the environment, within which a new UK chemicals strategy is promised.

Putting science at the heart of strategy

A chemicals strategy should be based around high standards and global leadership, with world leading education, research, innovation and regulation. In a UK chemicals strategy, the government should seek maximum cooperation and consistency with EU chemicals policy 2030 and the EU Green Deal, and with the United Nations Strategic Approach to International Chemicals Management (SAICM). The next major phase of UN SAICM will be determined in Q4 2020 and scientists and industry leaders need to play stronger roles in this global activity, and in areas such as sustainable chemistry where the UK is world-leading.

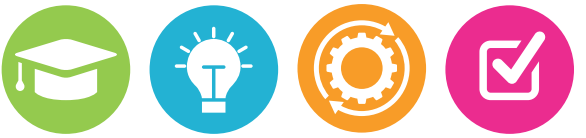
Science and innovation must be at the heart of any chemicals strategy. Effective business models will support a circular economy. To secure a sustainable future, they must strive for zero waste and net zero carbon emissions, and apply pragmatic and balanced regulation that seeks to enable entrepreneurial innovation while ensuring high standards of human health and environmental protection.

Chemistry has a central role in finding and delivering sustainable ways of reducing our reliance on finite global resources.

Please contact Dr Camilla Alexander-White if you are interested in working with us further as our work on chemicals strategy evolves at **policy@rsc.org**

[1] unenvironment.org/explore-topics/chemicals-waste/what-we-do/policy-and-governance/global-chemicals-outlook

CHEMICALS STRATEGY – FOUR PILLARS



EDUCATION

INNOVATION

CIRCULAR ECONOMY

REGULATION

Enablers

- Research and new knowledge
- Data
- Evidence
- Digital

Resources

- Funding
- Skills and workforce
- Infrastructure

Governance

- An efficient and accountable decision-making framework

On the following pages, we present our vision statements for each pillar of a future chemicals strategy on a 2030 horizon.

EDUCATION

Successful chemistry education gives students the understanding and skills that will enable them to become scientifically literate and responsible citizens, and provides a sound basis for future study and careers in a range of fields.

Educators, scientists and citizens engage with each other to develop a shared understanding of how chemicals and products are made, used and managed. All work together to use chemicals sustainably – making the most of the benefits and managing the risks responsibly.

The curriculum at all levels should support students in gaining the necessary skills and understanding to make and use chemicals safely and sustainably for a modern world.

Understanding chemistry as a practical science supports development of technical skills, an understanding of hazard and risk, and an appreciation of application and innovation in the chemical sciences.

A vision for 2030

1. **Chemistry education at all levels, and through the chemistry curriculum, is creating highly skilled scientists, technicians and engineers of the future**, and helping the next generation to fill identified gaps in skills and expertise for innovating and managing chemicals sustainably within a growing chemicals sector.
2. **The UK education system, through school, higher and further education, and professional development, is training knowledgeable professionals and informed and scientifically literate citizens** who understand the nature, value and importance of chemicals in products. Citizens appreciate how chemicals in our environment are managed sustainably, by using science and technology and circular economy models.
3. **Users of chemicals in supply chains and end-consumers are fully informed on their safe use**, understanding hazard and risk, and how hazardous chemicals that are beneficial and essential to society are managed to ensure humans and environment are kept safe. Citizens and consumers have access to reliable, balanced sources of information on key issues and are able to make informed choices on the products they buy[2]. They see chemicals as a necessary and important part of life[3].

A **hazard** is any source of ***potential*** damage, harm or adverse health effects on something or someone.

Risk is the likelihood or probability that a person ***will be*** harmed or experience an adverse health effect if **exposed** to a hazard.

Hazards are intrinsic to the chemical and often cannot be changed: **risks can be managed** by controlling exposure.

4. **The UK, through its education system and science base, is seen as a world leader in developing capabilities for sustainable chemicals management and identifying emerging issues in other parts of the world**. UK educators and scientists have strategic collaborations with global partners to share skills and experience[4].

[2] rsc.org/new-perspectives/sustainability/elements-in-danger/
[3] rsc.org/globalassets/04-campaigning-outreach/campaigning/public-attitudes-to-chemistry/public-attitudes-to-chemistry-research-report.pdf
[4] rsc.org/membership-and-community/connect-with-others/geographically/pacn

INNOVATION

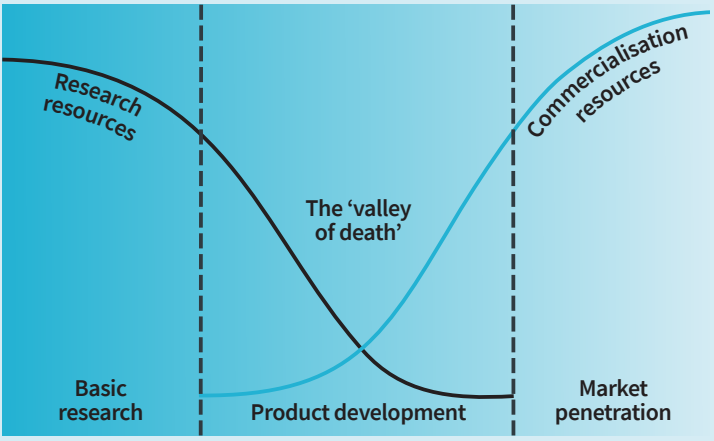
Chemical science innovators have the power to create solutions to some of society's biggest challenges – from climate change to combating disease.

The chemical science industry in the UK is very diverse and currently comprises 2,500 small and medium enterprises (SMEs). These SMEs make up 97% of the UK chemicals industry and employ 40% of chemists[5].

The UK is a world leader in science, technology and innovation. When researchers and businesses come together with international collaborators, we can implement new approaches and inventions to tackle the biggest of global challenges, including plastic pollution and climate change.

A vision for 2030

1. **The UK is leading innovation in the chemicals sector and, along with all other nations, has embraced and delivered upon the UN's Sustainable Development Goals 2030**[6] with the drive to create a safe and sustainable environment.
2. **Government incentives and funding structures are in place** to support entrepreneurs and innovators of new materials and products to bridge the 'valley of death' between early R&D and commercialisation.



3. **Innovation is supported by a regulatory system that is balanced, proportionate and based on risk assessment**. There are no unnecessary barriers to innovation, with both financial and technical help being made available to enable SMEs to bring novel products responsibly to the market.
4. **The cutting-edge interdisciplinary science that underpins innovation is promoted and facilitated by adequate funding schemes and international research collaborations (in EU and globally)**, using appropriate initiatives in education, training and regulation.
5. **Potential environmental impacts of chemical and product innovations are considered upfront** and assessed with appropriate tools early in the design phase, for example with the rigorous and quality-controlled implementation of consistent and regulated life-cycle analysis (LCA).
6. **Innovative methods are changing the way risk assessment is performed**. More innovative in vitro and computational methods for testing the safety of chemicals have been validated, and new data on biomonitoring of chemicals in humans and wildlife[7] are being used in innovative chemical risk assessment approaches. These methods reduce, refine and replace the need for animal testing and are more human relevant.

[5] parliament.uk/documents/commons-committees/Exiting-the-European-Union/17-19/Sectoral%20Analyses/7-Sectoral-Analyses-Chemicals-Report.pdf
[6] https://sustainabledevelopment.un.org/
[7] https://www.hbm4eu.eu/

CIRCULAR ECONOMY

Circular economy approaches are becoming increasingly possible. New data and digital technologies enable more transparent communication, data sharing and better managed chemical supply chains, although challenges remain.

The EU has been leading the way in developing circular economy strategies, and the UK could be a strategic partner in the near future. Circular economy approaches could become a reality through new targeted initiatives in the chemicals sector, including in electronic, plastic and food wastes.

A vision for 2030

1. **The UK is a zero waste society with a circular economy**[8]. Legislation, incentives, data and tools are in place to ensure secondary resources are valued and treated as feedstock for safe new products rather than being defined as 'waste' and where possible minimise demand for primary resources. The waste hierarchy, 'reduce, reuse, recycle' is followed and embedded.
2. **Product design facilitates a circular economy**. Government provides incentives to promote 'design for life', standardised life cycle analysis (LCA) and use of 'product passports'. Producers are taking enhanced responsibilities for managing the resources and waste that results from the sale of their products.

> Product passports include information on chemical composition and identifiers of recyclability and degradability and are linked to the National Materials DataHub that enables tracking of materials through the supply chain.

3. **Sound science underpins resource, chemicals and waste management**. Decisions, for example on trade-offs between phasing out substances of concern versus extending product life cycles, are underpinned by evidence. Decision makers seek advice from experts through a scientific advice mechanism in an efficient and timely way.
4. **An interdisciplinary approach is taken to resource, chemicals and waste management**, supported not only by science, but also by engineering, supply chain economics, sociology and behavioural science. End-users are strongly engaged too and make informed decisions based on product labels with information on resource efficiency and carbon impact.
5. **The research and innovation (R&I) that underpins circularity and sustainability is well funded**. R&I contributes to waste minimisation, replacement of substances of very high concern (SVHCs) and conservation of critical raw materials (for example in electronic products[9]) to feed back into the economy, and contributes to a 'sustainable chemicals' revolution.

[8] rsc.org/globalassets/04-campaigning-outreach/policy/environment-health-safety-policy/principles-for-waste-strategies.pdf

[9] rsc.org/globalassets/04-campaigning-outreach/policy/environment-health-safety-policy/critical-raw-materials-in-waste-electrical-and-electronic-equipment.pdf

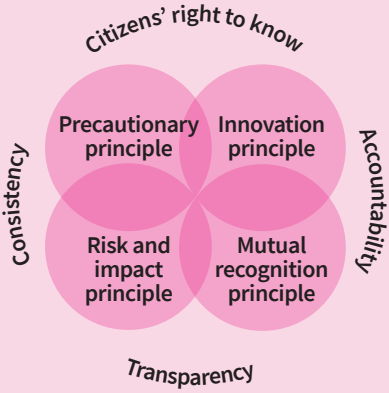
REGULATION

Regulators and industry work together to ensure chemicals are made and used in a safe and sustainable way – to benefit society and to create a level playing field for trading chemicals and products.

The Royal Society of Chemistry supports risk-based regulation (wherein not only the hazards of chemicals are considered but exposure too) as informed by the best science evidence on exposure, toxicology and considering socio-economic factors, to enable pragmatic and effective decisions to benefit society best.

A vision post-EU *exit*

1. **People and the environment are protected to the highest possible standards**, as informed by the latest exposure modelling, in situ real-time environmental monitoring data and best possible toxicological science.
2. **The citizens' 'right-to-know' and transparency form key principles of regulation and chemicals/product supply**. Consultation is carried out with stakeholders on important high priority issues, in an authoritative Chemicals Stakeholder Forum and stakeholder working groups.



3. **A regulatory framework is in place for chemicals management that is acknowledged by all to benefit society through pragmatic implementation of a set of core principles**[10]. Regulatory (chemical safety) decisions are based on a sound set of principles, including the 'precautionary' principle, 'risk & impact' principle, 'innovation' principle and 'mutual recognition' to harmonise with global trading partners, especially the EU. The framework and decisions based on it are revisited periodically to consider new science and new concepts.
4. **Ongoing scientific collaboration and data sharing with EU and global research partners helps provide the best harmonised data and evidence possible for risk assessment**. New data and evidence generation underpinning regulation is supported by substantive research programmes.
5. **Credible scientific experts are supporting government decision-makers** and identifying and prioritising issues through transparent scientific advisory mechanisms (for example using expert working groups or task-based groups drawn from registers of specialists).
6. **Regulators make decisions for chemicals based on long-term societal goals**, such as enabling green innovation and achieving zero waste and net-zero carbon emissions, so as to avoid 'regrettable substitutions' and to include standard life cycle analysis (LCA) and carbon accounting across decision making processes.
7. **The right resource is in place for effective enforcement of regulations**. It is recognised that regulation is of little purpose unless it is seen to be effectively enforced.

[10] rsc.org/globalassets/04-campaigning-outreach/tackling-the-worlds-challenges/environment rsc_principles_for_chemicals_in_the_environment.pdf

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Putting science at the heart of a chemicals strategy, for a truly sustainable world.

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