ROYAL SOCIETY OF CHEMISTRY

Contents

Summary:

The chemical sciences underpin several of the UK's growth sectors, with the chemistry workforce contributing an average of £83 billion per annum to UK GDP. To enable and grow chemistry's contribution to the economy, environment, and society, we recommend:

Growth in the UK:

- Deliver the UK's ambition for science and innovation and aim for the UK to be a leading G7 country in R&D investment.
- Promote international collaboration by continuing to fund and support participation in international funding programmes like Horizon Europe and Framework Programme 10.
- Attract the best talented researchers and innovators through an internationally competitive visa scheme and ensure the UK workforce has the right skills for science and innovation.
- Support vocational and technical qualifications to equip the future workforce with the technical skills our economy needs and safeguard the chemical sciences sector's contribution to the UK economy.
- Urgently address the financial sustainability of higher education in a way that ensures quality chemistry teaching and research remain available in all regions

A world-class chemistry education for all

- Ensure the science curriculum is up-to-date and imparts knowledge, technical and transferrable skills, including high quality fully funded practical chemistry education
- Improve access to expert chemistry teachers by addressing the teacher recruitment and retention crisis with long-term solutions that make teaching a more attractive option and investing in high-quality subject-specific professional development for teachers.

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Chemicals, health and the environment:

- Establish science-driven chemicals regulation to improve innovation, environment, and health, including addressing contaminants of emerging concern.
- Drive the transition to a sustainable circular economy of materials to improve supply security for critical minerals and other vital materials and minimise impacts on the environment and human health.
- Monitor indoor air quality to improve health.

About the Royal Society of Chemistry & introduction to submission

We work at the heart of the chemical sciences community to create a future that is more open, more green, and more equal. Together, we're helping chemistry to change the world.

We enable exciting progress that would be otherwise impossible. As an independent catalyst for change, we connect people and ideas through partnerships, conferences, events and networks that span the globe.

We publish scientists' discoveries and insights so they can be used to improve our health, environment and lifestyles. And we're transforming how we do that with a commitment to open access: everyone, everywhere, should have the same potential to read and share knowledge.

We care about protecting our natural environment, about tackling discrimination to build a truly inclusive world, and about making cutting-edge chemistry accessible wherever it's needed for the good of society.

It's all built upon and lifted up by our diverse global membership, with every one of those 60,000 members bringing a unique and valuable perspective. The chemical science community has the knowledge, skills and passion to make those a reality – together, we're changing the world.

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Our policy, evidence and advocacy work draws on insights from our scientific community and its work, to show how Governments, Parliaments and other decision-makers can enable chemical scientists to make the world a better place and draw on the insights from their work to achieve economic, social and environmental benefits.

Chemistry underpins several of the UK's growth sectors, e.g. advanced manufacturing, clean energy industries and life sciences, and as such makes a significant contribution to the UK economy. Research by Cambridge Econometrics for the RSC in 2020 showed that over the period 2013-19:

- The chemistry sector contributed an average of £83 billion per annum to UK GDP
- It contributed an average of £39 billion per year of GVA.[1]

This contribution is driven by a strong chemical sciences workforce that is projected to grow faster than the workforce overall in the coming decade.

- Research by Lightcast for the RSC in 2023, showed that the current chemical sciences workforce numbers over 314,000 workers across many roles and industries and underpins an additional 1.4m related jobs in chemistry-centred industries[2].

[1] See Chemistry's Contribution Summary report p.8 retrieved 12.10.2023 11:45 https://www.rsc.org/globalassets/22-new-perspectives/talent/chemistrys-contribution-workforce-trends-and-economic-impact/workforce-summary-report

[2] Future Workforce and Educational Pathways report: What does the future look like for the chemical sciences?

- It further showed that this workforce is projected to grow by around 6.5% in the coming decade, compared to 5% for the wider UK economy. This translates into at least 12,000 new jobs in core chemistry occupations and approximately 100,000 new jobs in chemistry-centred industries.

We would be pleased to meet with you and talk through these research findings and the rest of our evidence base. If you have any questions about our submission, or would like to discuss any in more detail, please contact our Public Affairs Manager Matt Davies on daviesm@rsc.org.

1. Growth in the UK economy

- **Create an ambitious, inclusive, and stable R&D and skills policy environment for UK science and innovation to thrive**

Research, development and innovation drive productivity, economic growth and raise living standards, benefitting individuals and communities across the UK. Long-term investment in R&D will create good jobs in all nations and regions, ensuring that the UK is equipped to meet challenges such as mitigating and adapting to climate change, becoming a clean energy superpower, improving human health and tackling other emerging global challenges like improving the UK's food and energy security.

To maximise the benefits that research, development and innovation bring, we call on the Government to:

- Provide **clarity and certainty on longer-term and ambitious R&D investment plans and a stable policy environment** to give private and public sector partners, including international investors, the confidence to make their own long-term R&D investment decisions.
- Ensure the **UK workforce is equipped with skills that are fit-for-purpose for a modern world**, including the digital and sustainability skills science requires.
- Enable the UK to **attract and retain the best talented researchers and innovators**, through an **internationally competitive visa scheme** and by supporting **a positive and inclusive science culture**.

Below, we set out how these asks can be achieved.

- *Provide **clarity and certainty on longer-term and ambitious R&D investment plans and a stable policy environment** to give private and public sector partners, including international investors, the confidence to make their own long-term R&D investment decisions.*

We were pleased to see the importance of R&D recognised in the Autumn Budget with the commitment to maintain real-term uplifts to R&D budgets in the short term. In the longer term, we encourage the government to be ambitious, **aiming for the UK to be a leading G7**

country in R&D investment and to **be among the top science and innovation nations globally**.

We welcome the establishment of 10-year funding cycles, which will enable private and public sector partners to plan strategically and be confident in their funding decisions. These funding cycles need to be developed with the sector and sit alongside a suite of different funding mechanisms which support the diversity of organisations in the R&D sector. This includes:

- **Supporting un-hypothecated curiosity-driven research alongside mission-based funding**. Quality-related research (QR) funding (and equivalents in the devolved nations) is a vital mechanism to enable curiosity-driven research in the UK. As a major source of non-ringfenced funding for universities, it can be used flexibly to drive new ideas and respond to emerging challenges, and often goes on to underpin the innovations of the future. It further enables universities to make long-term investments in the talent pipeline and infrastructure.

  In recent years QR funding has been under increasing pressure as universities are needing to use it to cover the full economic cost of research. Recent reports from the Office for Students TRAC data indicate that the proportion of costs recovered from UKRI councils has decreased to 68.9%[3] and at the same time, UUK analysis shows that in England, there has been a 15% drop in real-terms QR funding, and an even bigger drop in the devolved nations. We urge the Government to reverse the real-terms decline in QR funding and aim for a higher cost recovery of publicly funded research.

- **Enabling international collaboration** by continuing to fund and support participation in international funding schemes such as the €95 billion Horizon Europe research and innovation programme and its successor, Framework Programme 10 (FP10). The Government's position paper on FP10 was a very welcome step in this direction. Providing certainty demonstrates the Government's commitment to creating a long-term, stable policy and funding environment for research and innovation in the UK as well as resetting EU-UK relations.

- **Ensuring there is sufficient financial support for and investment in innovative R&D-driven SMEs**, particularly at the scale-up stage, to maximise economic growth and allow for SMEs to thrive. This is often the point of business development at which foreign investment takes the firm overseas, meaning UK PLC can miss out on the economic returns of technology developed here.[4] Research by the Enterprise Research Centre commission by the RSC in 2022[5] indicated a number of

[3] Office for Students, Annual TRAC 2022-23, June 2024. See https://www.officeforstudents.org.uk/media/lqjivwol/annual-trac-2022-23-update-july-2024.pdf

[4] For example, Ziylo, a spin-out from chemistry research at the University of Bristol was acquired by Novo Nordisk (Denmark), and GalliProst, an imaging agent developed at King's College London, is now owned by Ariceum Therapeutics (Germany).

[5] ERC commissioned by RSC, What works for innovation: Supporting R&D and innovation in deep tech chemistry SMEs, 2022. See https://www.rsc.org/globalassets/22-new-perspectives/discovery/igniting-innovation/what-works-for-innovation-report.pdf

mechanisms, particularly relevant to deep tech chemistry SMEs (a subset of businesses that are using chemistry as the core of disruptive technologies), which can help these businesses to succeed. These include:

- Ensuring access to the appropriate public funding opportunities. These should be facilitated through online portals, clearly signposted, and supported as a public good.
- Securing access to funds that enable deep tech start-ups to undertake proof of concept research which is often crucial to securing further funding.
- Addressing challenges with grant applications on both the supply and demand side. On the supply side, the usual three-year funding opportunities do not allow for the innovation to be fully tested or developed. The Government's planned work on longer-term funding needs to address this. On the demand side, there is a lack of understanding of what makes a convincing proposal by businesses. Accordingly, there is a case for training to improve businesses' competences in this area.

- **Addressing the critical shortage of laboratory facilities in the UK**, ensuring chemical scientists can access appropriate laboratory space wherever they work, across the country. Through engagement with deep tech chemistry ventures and the wider ecosystem, we identified the driving forces behind the lack of access to suitable laboratory facilities for these businesses. These drivers include the impact of geographical location, a lack of investment, and a complex planning environment, among others[6].

  In relation to this, we welcome the proposed reforms to the National Planning Policy Framework and other changes to the planning system, including to allow the building of new laboratories. Complementing our response to these proposals, we reiterate two areas of focus that could help address the challenges that early-stage deep-tech chemistry ventures in particular encounter in finding suitable and affordable laboratory spaces:
  - Ensure lab space and infrastructure corresponds to regional R&D strengths and that this need has a place in national narratives and strategy to provide long-term confidence and motivation to key stakeholders who can mobilise investment in this space.
  - Develop policy that encourages strategic plans to 1) identify lab space needs in areas of scientific strength, recognising the specific needs of different sub-sectors, 2) ensure there are enough planners to deal with demand and 3) upskill planners through robust tools and guidance for science spaces to make the planning process more efficient for lab space developments.

- **Ensuring the science budget fully enables maintaining, repairing and upgrading existing infrastructure and facilities.** This can be a cost-effective way to achieve the UK's science ambitions. Results from a survey of the Heads of

[6] RSC, Unlocking innovation: A systems approach to addressing the shortage of chemistry labs for start-ups, September 2024. See https://changemakers.rsc.org/rsc-site/content/Deep-Tech-Chemistry/Lab-access.aspx

Chemistry UK group held in 2021 indicate that many university chemistry departments have insufficient resource to maintain or upgrade equipment and facilities or maintain technical expertise. This could affect what research can be carried out, impact the sector's ability to develop and apply frontier techniques, hamper industry-university collaborations and inhibit the sector's ability to remain internationally competitive. The need for additional investment to address disconnects between capital investment and funding for operational costs, including to maintain infrastructure (sometimes referred to as the "batteries not included" problem), has also been highlighted out by the Royal Society[7] and Russell Group[8].

- *Enable the UK to **attract and retain the best talented researchers and innovators**, through **an internationally competitive visa scheme** and by supporting **a positive and inclusive science culture.***

To attract and retain the best talented researchers and innovators, the government must develop an immigration system that works for the research and innovation sector. This needs to recognise that:

- Scientific research and innovation need frontier knowledge and skills that are often scarce and part of a limited and global talent pool;
- international collaboration is vital to science, and
- that high-skilled and internationally competitive roles are not always afforded a commensurate salary, particularly in academia and start-up businesses.

High-Skilled and Global Talent routes must reduce financial barriers. This requires visa schemes that are internationally competitive and:

- **welcoming in tone and attitude**, appropriate to attracting the best scientists, researchers, technicians, teachers, innovators, students and entrepreneurs to the UK;
- **keep costs and burdens to a realistic minimum and allows payment over the period of the visa, rather than up-front**; and
- **ensure overseas students are, and feel, welcomed in the UK** and recognise their contribution to local universities and economies.

Royal Society analysis shows the UK immigration costs are up to 17 times higher than the average of other leading science nations[9]. Expensive up-front costs are the most significant barrier for many individuals to come to the UK, especially if accompanied by their family.

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[7] The Royal Society, Royal Society response to the House of Commons Business, Innovation and Skills Committee inquiry into the Government's Industrial Strategy, p3, September 2016. See https://royalsociety.org/-/media/policy/publications/2016/09-30-16-industrial-strategy.pdf

[8] Russell Group, Strong foundations for UK research, innovation and education, p3, February 2024. See https://russellgroup.ac.uk/media/6201/briefing-investing-in-capital-feb-24.pdf

[9] The Royal Society, Summary of visa costs analysis, 2024. See https://royalsociety.org/-/media/policy/publications/2024/summary-of-visa-costs-analysis-2024.pdf

They are also prohibitive to SMEs, with half of small businesses saying they cannot afford visa sponsorships[10].

To improve the attractiveness and inclusiveness of careers in the research, development and innovation sector and drive equality of opportunity, the Government should work with UKRI and the wider sector to continue to implement and build on the work started in the 2021 R&D People and Culture strategy. It should also continue implementing measures to reduce research bureaucracy as outlined in the Tickell Review, ensuring that any potential unintended consequences of these measures are carefully considered.

- *Ensure the **UK workforce is equipped with skills that are fit-for-purpose for a modern world**, including the digital and sustainability skills science requires.*

Chemistry represents an area of strong growth potential for the UK: our research shows the number of jobs in the sector in the UK could grow by 6.5% over the next decade, outpacing the wider labour market by 30%. These tend to be highly qualified and well-paid jobs, with a current median salary of £38k (25% above overall UK median).

If chemistry is to reach its potential as a force for positive change in the world, we must take a holistic approach today to prepare the workforce of tomorrow. With the right curriculums, the right investment in skills and the right support through employers, training providers and professional bodies, the chemical sciences workforce can continue to make the most of digital technologies and play a crucial role in achieving environmental sustainability, better health and the net zero transition.

To guarantee the long-term supply of skilled workers for the sector, government should:

- **Ensure education, skills and higher education policies enable the full growth potential of chemistry sectors**, maximising their contribution to economic growth and achieving the Government's Missions and Industrial Strategy.
- **Ensure an up-to-date science curriculum** that:
    - imparts knowledge, technical and transferrable skills, partly through high-quality, fully funded practical chemistry education;
    - features content on real-world concerns and challenges that will interest students; more diverse representation and global contexts to help more students see themselves in a scientific career;
    - is taught by teachers with appropriate subject expertise.

We are engaged with all the current curriculum and assessment reforms across the UK and hope that our recommendations will be captured in this

- **Enable and support action to promote a variety of routes into the chemical sciences sector** including greater uptake of vocational training options that award recognised qualifications, while appreciating that higher education will continue to be the key route into the sector. Provision of both higher and vocational education must be accessible around the country and to a diverse cohort of students. It is important

[10] ERC commissioned by RSC, What works for innovation: Supporting R&D and innovation in deep tech chemistry SMEs, 2022. See https://www.rsc.org/globalassets/22-new-perspectives/discovery/igniting-innovation/what-works-for-innovation-report.pdf

to ensure policy and messaging support parity of esteem between academic and vocational routes

We were pleased to see the government provide some short-term certainty to level 3 providers, through guaranteeing funding for several applied science qualifications (BTECs) running to 2025/26. The continued funding of a wide range of courses at level 3 will ensure progression opportunities for all young people and ensure the UK workforce is equipped with skills that are fit-for-purpose for a modern world. However, the long-term security of these applied science pathways needs to be provided to ensure some stability in the sector.

The Government should incentivise CPD for existing workers to help them develop skills relevant to the current and future trajectory of the chemical sciences, reversing the current trend of declining investment in workforce training; focus on provision of green skills for sustainability and clean technology in chemical manufacture and products, as well as digital skills to employ the latest advances in data and AI-driven tools. **We are also calling on the Government to incentivise employers** to provide access to CPD for their staff. The biggest reported barriers to CPD are cost and time commitments. Employers need to reserve these for the benefit of their workforce. This could be incentivised through conditions attached to Innovate UK, Research Council funding or government investment, or through the tax system.

In recent times, we have seen several universities closing or reducing their teaching and research provision in chemistry departments. The risks posed by chemistry department closures are detrimental not only to our future workforce but also to broader aspects of science, innovation and economic growth in the UK.

Chemistry departments contribute to our national economy but also to regional and local economies; for example, via SMEs, through knowledge exchange, innovation and impact and by providing access to the infrastructure and facilities that are necessary for research and development.

There is undoubtedly a growing need for chemical scientists, as evidenced by both the Department for Education's work on Skills England and the RSC's report on the future chemistry workforce. Chemistry departments also provide employers in many sectors with a pipeline of highly skilled employees necessary for sustained economic growth, which is particularly important for sectors driving green innovation and better health.

It is vital the Government acts to manage the risk of universities ceasing to offer chemistry and other courses that provide substantial long-term benefits to the UK economy.

We recognise the need for change in higher education and will work with Government and other stakeholders to shape this, whilst seeking to ensure the skills and capabilities we need for the future through training chemical scientists.

In the meantime, we call on Government to:

- **Urgently address the financial sustainability of higher education** in a way that ensures quality chemistry teaching and research remain available in all regions to meet economic, employer and student needs.
- **Address the cost-of-living issues affecting undergraduate and postgraduate students**.

- **Ensure quality provision of both higher education and vocational and technical routes for chemistry in all nations and regions**, so that higher education in chemistry is accessible locally to all potential students.

2. A world-class chemistry education for all

Education is a leading determinant of economic growth, productivity, employment, and earnings. Investing in school level chemistry and science education is key to breaking down barriers to opportunity and guaranteeing an effective labour pipeline to maintain the strength of the chemical sciences.

- Practical chemistry is an essential part of the chemistry discipline because it supports the understanding of the subject as an empirical science and is core to understanding the question 'How do we do chemistry?'. The skills developed through practical work can be used by young people in their future studies and careers in the sciences and beyond.
- We believe that all learners should have access to relevant and regular practical chemistry activities. However, our research has shown that teachers in England are finding it increasingly difficult to run them. In our science teacher survey 2023, cost of consumables and chemicals (34%) and a lack of equipment (33%) were identified as top barriers to running practical work. **Schools should be supported to provide hands on practical activities as a part of their curriculum through sufficient funding for consumables and chemicals as well as enough science technicians.** In our Science Teaching Survey 2024, 41% of respondents said that their mainstream or special school was understaffed for science technicians. Shortages of school science technicians[11] also make it harder for schools to support practical chemistry. The **Government should review science technician pay and conditions, considering what policy measures might help to attract and retain science technicians in the future.** We know from our previous research[12] that most of the science technician workforce is employed on a term-time only basis, which comes with a significantly lower salary compared to those technicians on a full-year contract. Additionally, in our Science Teaching Survey 2022, technicians highlighted that pay and recognition was a high priority for them.[13] **We welcome the reinstating of the School Support Staff Negotiating Body (SSSNB) to ensure that support**

[11] https://www.rsc.org/news-events/articles/2020/nov/school-science-technicians/ see also results from our Science Teaching surveys https://www.rsc.org/policy-evidence-campaigns/chemistry-education/education-reports-surveys-campaigns/the-science-teaching-survey/

[12] Worth, J. (2020). The Science Technician Workforce in English Secondary Schools. Slough: NFER. nfer-science-technicians-workforce-report-1.pdf

[13] Royal Society of Chemistry. The Science Teaching Survey 2022 https://www.rsc.org/policy-evidence-campaigns/chemistry-education/education-reports-surveys-campaigns/the-science-teaching-survey/2022/inadequate-professional-development/#subject-specific-cpd

staff are paid fairly and have access to training and career progression opportunities.

To deliver a world-class chemistry education for all students, teachers must have appropriate subject expertise for the classes they are required to teach. Longstanding chemistry teacher shortages and a lack of access to effective subject-specific CPD is hindering this ambition.

Chemistry ITT targets have frequently been missed for over a decade and attrition rates remain high.[14] 39% of respondents in our 2024 Science Teaching Survey said that their school was understaffed for chemistry teachers.[15]

A combination of policy interventions will be needed to reach the Government's overall target of 6,500 more teachers.[16] **Financial incentives, such as bursaries and early career retention payments, have a role to play but are unlikely to be enough on their own.**

The teacher recruitment and retention crisis should be addressed with long-term solutions to make teaching a more desirable profession that can withstand population and economic fluctuations so that young peoples' future job prospects are not adversely affected by teacher shortages. **Teachers' working conditions (including excessive workload) must be improved to ensure that the profession can both retain good teachers and attract new ones.**

DfE evidence shows that efforts to reduce workload have not been effective enough.[17] Weekly working hours for leaders and teachers remain unacceptably high at 58.2 hours for full-time leaders and 52.4 hours for full-time teachers in 2023, both of which were an increase from the previous year. Average weekly teaching hours also increased from 23.7 hours in 2022 to 24 hours the following year.

We welcome the Government's plans to create AI tools to help with marking and generating tailored feedback for students to free up teachers' time. Alongside this **we urge Government to consider emerging evidence that teaching hours rather than just overall working hours could be a predictor of teacher shortages.** [18]

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[14] DfE. Initial teacher Training Census academic year 2024/25 https://explore-education-statistics.service.gov.uk/find-statistics/initial-teacher-training-census

[15] Royal Society of Chemistry. The Science Teaching Survey 2024 https://www.rsc.org/policy-evidence-campaigns/chemistry-education/education-reports-surveys-campaigns/the-science-teaching-survey/

[16] Worth, J. and Tang, S. (2024) How to recruit 6,500 teachers? Modelling the potential routes to delivering Labour's teacher supply pledge. Slough: NFER. https://www.nfer.ac.uk/publications/how-to-recruit-6-500-teachers-modelling-the-potential-routes-to-delivering-labour-s-teacher-supply-pledge/

[17] DfE. Working lives of teachers and leaders: wave 2 summary report https://www.gov.uk/government/publications/working-lives-of-teachers-and-leaders-wave-2/working-lives-of-teachers-and-leaders-wave-2-summary-report#teacher-and-leader-workload

[18] Gorard, S., Ledger, M., See, B. H., & Morris, R. (2024). What are the key predictors of international teacher shortages? *Research Papers in Education*, 1–28. https://doi.org/10.1080/02671522.2024.2414427

Excessive workload does not just affect teacher retention; our 2024 Science Teaching Survey[19] found that a lack of non-contact time (e.g. for planning, marking, practising practical work), had a detrimental effect on their students' learning outcomes in the previous year for 82% of science teachers from mainstream secondary schools in England.

Teaching requires a complex set of skills and an individual teacher's effectiveness is dependent on a wide range of factors. However, the most effective teachers have good subject and pedagogical content knowledge.[20] Subject-specific professional development has a role to play in improving teacher effectiveness as well as tackling teacher shortages.

High-quality in service CPD as well as pre-service Subject Knowledge Enhancement courses can enable teachers to develop their knowledge in new areas or subjects. This is useful when there are disparities between shortages across the science disciplines, but it also has the potential to improve teacher retention.[21]

In our most recent Science Teacher Survey[22] we asked teachers about subject-specific continual professional development (CPD). Worryingly, 53% of chemistry teachers said that they had not had enough subject-specific professional development in the past twelve months. The year earlier, when asked about the barriers to accessing subject specific CPD, 49% of teacher in England said lack of funding for cover teachers and 63% cited course costs and expenses to attend.[23] In light of recent cuts to DfE funded science CPD, **Government should put plans in place to ensure cost is not a barrier preventing teachers' access to subject-specific CPD in the sciences.**

Supporting and developing the existing teaching workforce is a cost-effective way of addressing teacher shortages in sciences and ensuring that all young people, irrespective of their background or circumstances, receive an excellent science education. Investment is needed to set up a systematic approach to subject-specific CPD in the sciences (including pre-service Subject Knowledge Enhancement courses and the Early Career Framework) to ensure that quality assured subject-specific CPD is available for all teachers of the sciences as part of the government's proposed teacher training entitlement.

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[19]Royal Society of Chemistry. The Science Teaching Survey 2024 https://www.rsc.org/policy-evidence-campaigns/chemistry-education/education-reports-surveys-campaigns/the-science-teaching-survey/

[20] Coe, R., Aloisi, Sutton Trust report (2014) What makes great teaching? Review of the underpinning research. https://www.suttontrust.com/wp-content/uploads/2014/10/What-Makes-Great-Teaching-REPORT.pdf

[21] Van den Brand, J. and Zucollo, J. (2021) the cost of high-quality professional development. Education Policy Institute https://epi.org.uk/publications-and-research/the-cost-of-high-quality-professional-developmentfor-teachers/#:~:text=A%20new%20report%20from%20the%20Education%20Policy%20Institute,government%20an%20extra%20%C2%A3210m%20in%20funding%20a%20year

[22] Royal Society of Chemistry. The Science Teaching Survey 2024 https://www.rsc.org/policy-evidence-campaigns/chemistry-education/education-reports-surveys-campaigns/the-science-teaching-survey/

[23] Royal Society of Chemistry. The Science Teaching Survey 2023 https://www.rsc.org/policy-evidence-campaigns/chemistry-education/education-reports-surveys-campaigns/the-science-teaching-survey/2023/insufficient-subject-specific-professional-development/#cpd-barriers-table

3. Chemicals, health and the environment

The UK chemicals and materials sector has high economic growth potential, with an opportunity to secure and grow a significant number of jobs. If supported in the right way, the chemical industry alone could generate upwards of £544 billion annually for the UK economy by 2050[1].

However, to compete internationally, be sustainable and align with the UK's Net Zero ambitions, the sector must become more circular and transition away from fossil-derived feedstocks, replacing them with biomass, chemical recycling, and utilising captured carbon where these alternatives are more sustainable.

As a member of the UK Alliance for Sustainable Chemicals and Materials[2], we think *Government should enable this step change* by:

- Devising a long-term roadmap and a stable policy environment to **enable investment in research, development, commercialisation and manufacture of sustainable chemicals and materials**, to benefit communities across the UK and achieve green economic growth.
- Working with the chemicals and materials sector to **ensure the UK landscape supports this growth**, from feedstocks to infrastructure and skills, to ensure the development of resilient UK supply chains.
- Developing and implementing **policies shaping markets to enable the UK's transition to sustainable chemicals and materials**, including the leveraging of public procurement to create demand for sustainable chemicals and products manufactured in the UK.

Furthermore, there are currently supply chain risks for some of the materials that will be vital for our Net Zero transition, in addition to unsustainable levels of resource use.
One example is the materials needed to build the significant additional wind and solar capacity that is required by 2030. Our analysis suggests that, to meet the UK's 2030 targets for wind technology alone, we will require 40 million tonnes of materials. Efforts to secure the supply of the material inputs into wind technology will be in competition with equally pressing material needs in several other sectors central to society and our journey to a more sustainable future, ranging from solar energy and electric vehicle technology to construction and healthcare.

To ensure access to critical minerals and the other vital materials our economy needs, whilst improving our environment and human health*, Government should drive the transition to a sustainable circular economy of materials* in partnership with relevant stakeholders by:

- Enabling an appropriate UK **resource and waste infrastructure** and robust **product labelling** and **material tracking**
- Directing effort towards **reducing material consumption** and **repairing and reusing products** before eventual recycling (or composting where suitable)
- Incentivising **resource-efficient design and production** alongside assessments of criticality and substitutability of materials
- **Supporting world-class research** into sustainable materials, including to limit emissions along the entire material and product lifecycles.

A UK Chemicals Strategy for innovation, health, and environment
Government should create a Chemicals Strategy that would provide policy direction for chemicals, waste, and pollution prevention, and build national confidence in the UK

chemicals regulation regime. To support this effort, the RSC has outlined a range of options towards improving the regulatory regime for chemicals in this recent report.

Cross-governmental department budgets need to enable the necessary bespoke training and upskilling regulatory professionals in the skills and competencies needed to deliver high quality regulatory regimes for chemicals.

There is a need to identify a departmental policy lead on chemicals regulation in order to clarify and streamline the chemicals regulation regime. Increased cross-governmental coordination could increase the speed and efficiency of regulatory decision-making, enabling businesses to innovate and commercialise new technologies. Having a more centralised chemicals regulation system will also smooth barriers to international trade by facilitating a clearer pathway to the UK market.

One area of chemicals policy needing urgent attention is Per- and Polyfluoroalkyl substances (PFAS), where more stringent limits for our drinking water are needed to manage risks to human health. Further actions are needed to better characterise environmental contamination and prevent pollution at the source. A study conducted by the Forever Lobbying project suggests that the cost of cleaning up forever chemical emissions in the UK could reach up to £9.9bn a year if emissions remain uncontrolled.[24]

The public also strongly support action in this area. We have undertaken the UK's first survey of public attitudes to PFAS, revealing that 9 in 10 people in the UK think it is 'very important' to effectively control levels of the group of chemicals in food, drinking water and the environment. The survey also showed that 84% of respondents supported regulation requiring PFAS-using industries to reduce and reverse contamination; 75% supported a fee or tax on these industries for end-of-life management and environmental cleanup; and 77% supported additional government funding for research and innovation.

As set out in our recent policy position, the Government should:

- Ensure the many hundreds of sources of PFAS are reported and captured in a national inventory.
- Identify, test, and regulate the pathways of PFAS from factory emissions and product related waste to surface and ground waters through tighter environmental standards.
- To reduce the potential for harmful levels of PFAS to accumulate in the receptor of the human body, establish new statutory action standards for PFAS in drinking water of a maximum concentration of 10 ng/L per single PFAS and 100 ng/L for the overall summed concentration of all PFAS.

Pollution in water is driving an unprecedented global crisis. Water bodies – including lakes, rivers, coastal waters and oceans – make up 71% of the Earth's surface, yet they are widely contaminated with cocktails of toxic chemicals and plastics. Contaminants of Emerging Concern (CECs), including microplastics, PFAS and pharmaceuticals, represent a troubling subset of pollutants, which are often unregulated and poorly understood.
However, what is well-evidenced is that they are impacting our environment, resulting in adverse consequences for ecosystems and human health.
The UK government and regulators must act now to protect our waters, and by extension us, by taking the following steps:

- Implement **comprehensive** and **adequately resourced monitoring programmes** for CECs in water, soils, sediments, wildlife and humans.

[24] Unaffordable - The absurd cost of 'PFAS as usual'

Monitoring is essential to understanding the scale of pollution, identifying hot spots and assessing long term trends.

- Implement a stronger '**polluter pays' principle** by making additional treatment to **remove CECs from urban wastewater** mandatory. This could be funded via extended producer responsibility of major polluters of CECs (e.g. industries that produce or use problematic CECs) that consequently end up in wastewater streams
- Commit to **identifying** and **tackling** the other **major diffuse sources** of CECs in waterbodies, such as pollution from road run-off, waste emissions and agriculture.

Poor air quality is the largest environmental risk to public health in the UK, contributing to an estimated 29,000 to 43,000 deaths a year in the UK.[8] We spend up to 90% of our time indoors and indoor air is an important contributor to our overall exposure to air pollution. However, there are considerable gaps in our understanding of how indoor exposure to pollutants affects health. This includes the specific health impacts and the associated costs to health, which are not well-documented compared to outdoor exposure.

Understanding indoor air quality exposure through monitoring and funding research is essential for providing insight into the economic impacts of poor indoor air quality on human health.

Government should direct effort to improving indoor air quality for the health benefit of all by:

- Putting in place **long-term, systematic monitoring of indoor air quality and health.** This would inform policy prioritisation and assess the impact of interventions.
- **Investing in indoor air quality research** and support for multidisciplinary collaborations. This could build on existing cross-sector funding mechanisms and needs to be longer term.