

# Science and Evidence Delivery Plan 2021-2024





# Contents

<b>Foreword</b>	<b>2</b>
<b>Key objectives for our portfolio of science and evidence work</b>	<b>3</b>
<b>Regulatory frameworks which are fit for the future</b>	<b>6</b>
<b>The right evidence for the future</b>	<b>10</b>
<b>The impact of social and workplace change on the health and safety of the future workforce</b>	<b>13</b>
<b>The right intervention strategy for the British industrial asset base</b>	<b>16</b>
<b>Taking responsibility for health at work</b>	<b>18</b>
<b>Lessons learned from investigations</b>	<b>21</b>
<b>Science and evidence needed to underpin HSE's work as a result of COVID-19</b>	<b>24</b>
<b>Enabling society to benefit from the appropriate regulation of chemicals</b>	<b>28</b>
<b>Work with strategic stakeholders and partners</b>	<b>30</b>
<b>Foresight</b>	<b>32</b>
<b>Capability and capacity</b>	<b>34</b>
<b>Governance, assurance and engagement</b>	<b>36</b>

# Foreword

Science, engineering and evidence underpins the work of HSE, and provides a basis for robust decision making. It is a requirement for HSE under the HSW Act to, 'make such arrangements as it considers appropriate for the carrying out of research and the publication of the results of research and the provision of training and information, and encourage research and the provision of training and information by others'.

Our [Science and Evidence Strategy](#) and our [Science and Evidence Investment Plan](#) describe how we do this, largely through our science hubs. Each of these provides a focus for thinking and enables us not only to consider the issues of today, but also how we might address the knowledge gaps to equip us to help reduce risk in the future world of work.

The global pandemic has required us to respond at pace to provide evidence regarding transmission and control of the SARS-CoV-2 virus. Our focus on this aspect has meant that we could contribute to the national and global response in a practical and pragmatic way using insights from the real-world of work. This approach has been particularly helpful in our leadership of one of the National Core Studies for COVID-19.

We have undertaken a refresh and re-prioritisation of our plan so that we can be assured that the work outlined here meets the needs of a post-pandemic world and learns from the experiences of delivering science and evidence during this challenging period.

We have also reflected on the experiences relating to risk, and we have decided to modify the remit of our demographics hub to more closely reflect the impact of social and workplace change on the health and safety of the future workforce.

Our plan also reflects the needs of all Divisions in HSE, including the new Building Safety Regulator and the Chemicals Regulation Division.

I would like to thank everyone who has contributed to the process of developing this plan, including the Science, Engineering and Evidence Assurance Committee, who provided helpful views and comments as to our approach.

**Professor Andrew Curran,**

**Chief Scientific Adviser and Director of Research**

## Key objectives for our portfolio of science and evidence work

- Ensure a rolling review against HSE evidence needs to meet evolving regulatory priorities and anticipate the changing world of work, including the new HSE strategy currently under development
- Build research and development programmes to meet HSE's emerging needs for the Building Safety Programme and for chemical regulation post Brexit
- Build a longer-term science planning cycle which is informed by engaging with stakeholders (nationally and internationally) to better understand what HSE needs to do and how we might benefit from working with others.
- Explore opportunities to influence and benefit from Research Council funding, such as gaining invitations to Research Council 'sandpit' meetings in topics key for HSE's needs and jointly applying for funding with other bodies to UK Research and Innovation (UKRI) calls
- Explore further strategic opportunities for programmes of co-funded research projects that meet HSE needs
- Develop a plan of science and engineering activities that help address the health and safety (and where necessary avoid unacceptable environmental) risks of current and future places of work
- Develop a cross-cutting research programme on new and emerging risks
- Create topic groups in strategic areas to help coordination
- Understand and prepare for the new world of work post-COVID
- Create HSE research topic groups in strategic areas to help coordinate, develop and disseminate research
- Develop a proportionate approach for the evaluation of the impact of science and research on helping Britain work well that includes stakeholder input to development of benefits and pathways to impact. This approach will ensure that lessons learned during impact evaluations will feed into subsequent planning and commissioning of research

- Publish, and refresh HSE's [Areas of Research Interest](#) document<sup>1</sup> with a view to encouraging extramural activity, collaboration and the commissioning of research and development

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<sup>1</sup> The Cabinet Office required government departments with science interests to publish an ARI to articulate the big research challenges they could not address alone. This has the potential to grow cross-government shared research projects



# Regulatory frameworks which are fit for the future

Vision: Regulatory frameworks which are fit for the future ensuring health and safety compliance, including for the new building safety regime, and enabling innovation in the workplace.

The aim of the programme of work in this science hub is to develop our understanding of the current and future world of work and building safety to ensure that our regulatory framework is fit for purpose. In recent years, HSE has undertaken an extensive review of health and safety regulations and has simplified the regulatory framework, making compliance with and understanding of legislation easier.

We will continue with this work, ensuring science, engineering evidence and analysis underpins and contributes significantly to meeting the government's better regulation agenda and Business Impact Target.

Research in this science hub will be developed to understand how well current regulatory frameworks can accommodate expected trends in work demographics, working patterns, new and smarter technologies, health hazards, building safety risks and hazards and data analysis, new uses for old substances and new classes of materials and how regulatory frameworks may need to change. It will also provide the evidence base to target improvements in regulation where required.

We will develop evidence for innovative approaches to regulation through collaboration across HSE and other government departments and learn lessons from international frameworks to make sure we maintain our world-class reputation for regulatory excellence.

Work in this science hub links to the following key action in HSE's Business Plan:

Provide an effective regulatory framework

## What did we deliver in 2020/21?

- We took forwards a range of new projects, including COVID-19 specific work (see section on 'Science and evidence needed to underpin HSE's work as a result of COVID-19')
- Initiated a programme of work focusing on the use of advanced manufacturing techniques in the explosives industry.

- Development of a GB process for determining occupational exposure limits for substances hazardous to health
- Provided analytical support to policy development, including post-implementation reviews (e.g. post-implementation reviews of the Offshore Installations (Offshore Safety Directive) (Safety Case etc) Regulations 2015 (SCR 2015) and The Health and Safety at Work etc Act 1974 (General Duties of Self-Employed Persons) (Prescribed Undertakings) Regulations 2015
- Provided analysis and research to support the ongoing set-up of the Building Safety Regulator
- Produced National Statistics on the Costs to Britain of occupational injury and short-latency illness

### **Our priorities for 2021/24**

- Continue to support regulatory change following the UK's exit from the European Union, for example by conducting regulatory analysis for the implementation of the EU transition and Northern Ireland Protocol
- Understand and develop necessary changes to the regulatory framework post-COVID and in the transition to the new working environment
- Support the establishment of the new Building Safety Regulator including establishing an operational dataset and building an analytical function for the new regulator
- Complete Insight and Service Design qualitative research with new duty holder groups under Building Safety Regulations including clients, designers, contractors, accountable persons, building safety managers and related groups
- Further develop the use of our evidence base to inform future regulatory approaches to ensure serious risks are diagnosed and proportionate action is taken
- Through initiatives such as the Regulatory Intelligence Hub, develop links between regulators where data and intelligence can be shared to improve efficiency and effectiveness
- Develop relationships and research that will help address the health and safety aspects of the UK's Build Back Better: our plan for growth and associated strategies, ensuring that HSE remains an enabling regulator for innovation in the workplace

- Progress opportunities that will help us understand the role of technology in supporting our regulatory framework. This will range from exploring trends and drivers for change in regulatory approaches, to opportunities to enhance our regulatory functions through use of technology such as Artificial Intelligence (AI) and the Internet of Things
- To further develop our understanding of advanced manufacturing to help enable safe adoption of these techniques in the UK. This will mean we will progress additional science and evidence to support a robust regulatory framework where required
- To develop collaborative research in the area of AI and autonomy. This will aim to build on expertise across academia and industry with a clear focus on the health and safety implications of this rapidly advancing technology

## **Our key projects for delivery 2021/24 and beyond**

### **Impact and analysis**

- Provide analytical support to policy development including impact assessments and post-implementation reviews
- Support regulatory change following the UK's exit from the European Union

### **Developing a risk-based approach for the Building Safety Regulator**

- Provide analytical and scientific support to establish and underpin the work of the new Building Safety Regulator including priority data modelling and research to develop understanding of building safety risk and hazard factors

### **Machinery controls**

- Provide insight about emerging technologies in the field of machinery controls to inform future HSE policy and guidance

### **Workplace sensors**

- Developing the evidence to support appropriate use of workplace sensors to enable effective health and safety management, research and regulation

### **Advanced manufacturing**

- Investigating the health and safety implications of innovative methods of manufacturing

### **Recirculating Local Exhaust Ventilation (LEV)**

- Review current evidence around the effectiveness of recirculating systems of exhaust ventilation for managing exposure risks

### **The new workplace**

- Understanding transmission pathways and developing the technologies and regulatory frameworks for the new working environment

## The right evidence for the future

Vision: To take a long-term view on the development of the evidence base that can support HSE's long-term strategic approach

HSE's work is underpinned by robust scientific evidence. Our evidence base needs ongoing updates to reflect the rapid and complex changes in the workplace, workforce, working patterns and the working environment, and, as a result, the changes in HSE's priorities and intervention strategies. To ensure our evidence gathering systems continue to be effective and efficient - not only fit for current priorities and intervention strategies but also flexible enough to meet future challenges - we need to make our evidence base coherent, strategic, future-proofed, and focussed on priority areas.

We will keep abreast of the advances in measurement science and technology to improve evidence gathering. We will make best use of new data collection, data-mining, modelling and analytical techniques to provide insight for our decisions on prioritisation, targeted intervention, tracking progress and evaluation of impact. We will, where appropriate, publish our data and methods and share technical expertise in data analytics and measurement science with other regulators and enhance our regulatory intelligence networks.

Work in this science hub links to the following key actions in HSE's Business Plan:

- Lead and engage with others to improve workplace health and safety
- Provide an effective regulatory framework

### What did we deliver in 2020/21?

- We took forwards a range of new projects, including COVID-19 specific work (see section on 'Science and evidence needed to underpin HSE's work as a result of COVID-19')
- Published a comprehensive suite of health and safety statistics, to time and quality standards and with further enhanced presentation
- Mapped activities against our Measuring Strategy framework, using the health and work programme as a model, to ensure we have the appropriate mix of measures to assess the impact of the programme and its key interventions.
- Captured workplace exposure-control intelligence from health-related inspection visits

- Modelling for predicting chorine dispersion in the ‘Jack Rabbit II’ experiments to provide the right evidence base for land-use planning
- Developing an occupational exposure-control intelligence system in GB, using Respirable Crystalline Silica (RCS) as an example – A feasibility study
- Turning the Risk Profile in construction project into an Intervention – A feasibility study

### **Our priorities for 2021/24**

- Coordinate the delivery of the measurement plans and ensure the delivery joins up with other relevant areas of work across HSE
- Collect, compile and publish statistics on work-related ill health, injuries and associated impacts
- Provide appropriate statistical and analytical support to HSE’s policy, communications, sector and operational teams
- Develop further the Workplace Intelligence System for Exposure-control in Great Britain (WISE-GB)
- Continue to explore suitable approaches to meet challenges and opportunities of advances in measurement science and technology
- Informed by the Measuring Strategy deliver the measurement plans to assess the impact of the Health and Work Programme in the health and safety system

### **Our key projects for delivery 2021/24 and beyond**

#### **National statistics**

- Publish a suite of health and safety statistics

#### **Monitoring and evaluation of interventions**

- Implementation of the Measuring Strategy with the Health and Work Programme
- A longitudinal survey of employers and employees to measure changes in awareness, behaviours and control measures
- Map activities against the Measuring Strategy framework to ensure we have the appropriate mix of measures to assess the impact of the Health and Work Programme and its key interventions

### **Data collection**

- Management and further development of the National Exposure Database (NEDB)
- Data archiving for science

### **Measurement science and technology**

- The application of Next Generation Gene Sequencing (NGS) to support health impact assessment after workplace exposure to microorganisms
- Ensuring better isocyanate exposure assessment to better protect health at work
- Advancing measurement of occupational exposures to metals hazardous to health for effective risk control
- Advancing the measurement of occupational exposure to respirable crystalline silica (RCS)

### **Modelling and risk assessment**

- Development and maintenance of risk assessment models and guidance for land use planning

# The impact of social and workplace change on the health and safety of the future workforce

Vision: To provide a body of evidence that supports mitigating, preventing and managing the impact of social and workplace changes on the health and safety of the future workforce, informing interventions and solutions while positioning HSE as the thought leader in this area.

This science hub addresses the future health and safety challenges of managing the risks from social and workplace changes.

The aim of this science hub is to identify health and safety hazards and risks arising from changes in the Great British workforce and their work. The hub includes consideration of technological change and factors such as competency. It covers interactions between changes in the workforce, and changes to the work environment, location, patterns, and the way in which work is organised.

The longer-term aspirations for this programme of work are to mitigate, prevent and manage, the impact of adverse social and workplace changes on the health and safety of the workforce, and help optimise efficient and productive future working. The outputs from the programme will inform appropriate interventions and solutions, and position HSE as the thought leader in social and workplace change with respect to occupational health and safety.

Evidence will be used to support delivery of commitments in our sector action plans, and to inform policy making that is relevant for the future. It will support dutyholders to be better prepared, and to use appropriate interventions and solutions, to manage social and workplace risks.

Knowledge and evidence gaps and priority areas of research interest were identified at the inception of the demographics hub. These remain relevant, have been refreshed, and are now condensed and updated into four overarching areas of research interest:

- The inclusive workforce (e.g. impact of social change; risk attitudes and behaviours; competency)
- Inclusive work (e.g. changes in home working; ensuring responsibility for health at work for those with multiple jobs)

- The interaction between the workforce and their work (e.g. human/machine interaction; working patterns and practices; good work)
- Interventions (e.g. supporting health equity, equality and job quality; ensuring that the health and safety of those with existing ill-health conditions is not disadvantaged at work)

In the context of this hub, inclusive means that no one is disadvantaged from a health and safety perspective.

### **What did we deliver in 2020/21?**

- We took forwards a range of new projects, including COVID-19 specific work (see section on 'Science and evidence needed to underpin HSE's work as a result of COVID-19')
- We continued to engage widely - externally with academia, industry, other Government departments and others, to discuss collaboration, funding and potential to deliver joint research - and internally within HSE, engaging across Sectors and Divisions on cross-cutting topics such as work-related third-party violence and aggression, and fatigue
- We designed, planned and delivered cross-sector workshops to identify and agree priority areas for HSE. One of these areas is fatigue, which will be a focus moving forwards
- We continued to collaborate with the University of Manchester, and provided input to two externally funded pieces of COVID-19 research
- Through the Thomas Ashton Institute we undertook collaborative research with the University of Manchester to improve knowledge and understanding of work-related third-party violence and aggression

### **Our priorities for 2021/24**

- To maintain oversight, and maximise the benefits, of HSE's research on the topic of fatigue
- To continue to set up and deliver collaborative work with the University of Manchester and others as part of the Thomas Ashton Institute
- To continue engagement activity both within HSE and with external stakeholders
- To continue monitoring social and workplace research being undertaken by others, and to review gaps in knowledge and evidence about the impact of this change on the health and safety of the future workforce

- To continue using evidence generated from hub activity to anticipate and keep pace with social and workplace change, and to identify potential implications for HSE

**Our key projects for delivery 2021/24 and beyond**

- Reducing work-related third-party violence and aggression
- Improving knowledge and understanding about work-related fatigue, including optimising working patterns

# The right intervention strategy for the British industrial asset base

Vision: To have effective intervention strategies that enable innovation with the British industrial asset base whilst minimising risk and improving occupational health and safety.

Our work in this area supports all industrial sectors across Great Britain, including the many highly specialised industries which are strategically important to the country's economy and social infrastructure including oil and gas, chemicals, explosives, mining and the bioeconomy, and all operating assets within the major hazards sector.

This sector can potentially cause great harm to their workers, the environment and the public if associated risks are not properly managed. New technologies are also being introduced to secure the future energy supply and reduce carbon missions (e.g. renewables) and improve productivity. Work in this Science Hub will help ensure that HSE has the science and evidence needed to underpin our policy in key areas across the entire UK industrial asset base, to support HSE's operational activities now and in the future.

Our work will focus on developing our understanding of how materials and structures degrade over time (asset life extension and decommissioning); informing risk-based inspection using non-destructive and autonomous techniques and how designers and manufacturers contribute to improvements in occupational health and safety.

We aim to have improved evidence on the emerging risks from new technologies, advanced manufacturing methods and ageing infrastructure, giving duty holders and stakeholders a better understanding of their potential impact.

Work in this science hub links to the following key actions in HSE's Business Plan:

- Reduce the likelihood of low-frequency, high-impact catastrophic incidents
- Secure effective management and control of risk

## What did we deliver in 2020/21?

- The majority of this work is delivered through Shared Research with Industry partners (see section on Work with strategic stakeholders and key partners)

## Our priorities for 2021/24

- Support the key elements of leadership, worker involvement, competence and asset integrity across all major hazard sectors

- Focus on decommissioning and ageing infrastructure, and the integrity of new assets and emerging technologies
- Provide scientific support to securing improvement in the effective management of network assets including gas risers in high-rise homes
- Work with our cross-government partners and others with shared interests as appropriate to develop our understanding of how the health and safety risk profile is changing through the building life cycle as a result of Modern Methods of Construction and Enabling Technologies, including to identify opportunities to maximise risk reduction at the design stage

### **Our key projects for delivery 2021/24 and beyond**

#### **Flammable atmospheres and thermal effects**

- The testing of synthetic fire-resistant fluids to determine the effects of degradation

#### **Structural integrity**

- Factors affecting severity of vapour cloud explosions
- Investigate stainless steel corrosion cracking in offshore assets

# Taking responsibility for health at work

Vision: To identify, develop and analyse the evidence base needed to help people in the health and safety system ensure a healthy productive workforce.

We will commission work under this priority area to identify and develop the evidence necessary for HSE to implement its Health and Work Programme, and more widely, to help people in the health and safety system take greater responsibility for health at work. The Health and Work Programme will focus HSE's major efforts on those conditions that are widespread, have life-limiting or life-altering impacts, and those with the greatest economic consequences. Stress, musculoskeletal disorders (MSDs) and occupational lung diseases (OLD) are foremost amongst these.

Despite these occupational ill health conditions being extensively researched internationally, significant evidence gaps remain, particularly with respect to the contemporary situation in Great Britain, in respect of practical and effective control measures, and evidence-based evaluations of successful interventions. The rapidly changing nature of work in GB also means that in the future other health issues, such as ageing workforces, obesity, sedentary behaviour and cardiovascular disease, may become increasingly important.

Work in this science hub area links to the following key actions in HSE's Business Plan:

- Lead and engage with others to improve workplace health and safety

## What did we deliver in 2020/21?

- We took forwards a range of new projects, including COVID-19 specific work (see section on 'Science and evidence needed to underpin HSE's work as a result of COVID-19')
- Survey of the extent and nature of health surveillance provision in the construction sector
- Systematic review of respiratory health surveillance
- Analysed *Legionella* test data to better understand the potential role of enhanced monitoring, including PCR-based rapid testing, in interventions to control *Legionella* risk in industrial cooling water systems.
- Feasibility study for an epidemiological investigation of the respiratory health risks from exposure to polyhalite dust

- Current Control Practice and Exposures to Noise and Hand Arm Vibration in the Construction Industry
- Participated in a collaborative assessment of noise exposures experienced by chain saw operatives to determine whether the noise data provided by manufacturers is a reliable indicator of the noise hazard during intended use
- Evaluation of timing devices for assessment of hand-arm vibration exposure along with an assessment of hand-arm vibration from battery operated tools

### **Our priorities for 2021/24**

- Provide evidence and analysis to support the development, implementation and evaluation of new interventions to tackle priority health risks in support of the Health and Work programme and sector plans
- To expand our collection of exposure and health outcome data using digital tools and data sharing agreements with occupational health providers, duty holders and other stakeholders. These data, along with similar data gathered through targeted workplace survey, will contribute to HSE's measuring plans for occupational health
- Continue to improve our understanding of the future nature and burden of work-related ill-health, taking account of the changing patterns and nature of work, new and emerging risks, and changing demography
- To continue monitoring occupational health research being undertaken by others and to identify the potential policy or operational implications of such research for HSE
- To continue to engage and work with other government departments to share evidence and identify opportunities joint research

### **Our key projects for delivery 2021/24 and beyond**

#### **Occupational lung disease**

- Longitudinal study exposure and respiratory health in brick manufacturing, foundries and stone workers
- The use of biological monitoring to evaluate the sustainability of control improvements in electroplating
- Ambient levels of asbestos in current workplaces

- Evaluation of rapid test methods for detection of *Legionella* in industrial cooling water systems
- A comparison of welding fume emission rates and welders exposure
- A pilot study to survey work-related ill-health effects in the fish and shellfish processing industry

### **MSDs**

- Review of MSD risks in construction

### **Stress**

- Understanding what motivates dutyholders to undertake risk assessments for work-related stress and implement appropriate interventions and the factors that help or hinder them in this process

### **Other health conditions and cross-cutting**

- Occupational health fitness standards for divers
- Virtual population disease modelling of chronic occupational ill-health conditions
- Economic valuations of the benefits of health and safety interventions and investments: updated values of a prevented fatality (VPF), life year (VOLY) and quality adjusted life year (QALY)

## Lessons learned from investigations

Vision: Equip HSE with a lesson learning strategy that makes a tangible contribution to the prevention of death, injury and ill health in GB workplaces

HSE receives information on around 70,000 reportable health and safety incidents each year and around 4,000 of these incidents are subsequently investigated. In addition, our inspectors carry out approximately 20,000 proactive workplace inspections each year, generating intelligence on prevailing working practices and areas of health and safety concern. The potential for us to use these data sources to learn lessons, including why different failures in health and safety occur and how they might be prevented, is substantial.

Recent developments in, and increased use of, data analytic tools and applications, such as text mining, natural language processing, predictive analytics and statistical machine learning, has meant that the task of generating data-driven insights and learning from health and safety data sources, particularly free text sources, is now more achievable.

The aim of this science hub is to maximise the generation of lessons learned insights from our routine sources of health and safety data, and use these lessons across HSE and the wider health and safety community. Benefits will include the development of more effective, targeted risk control strategies and guidance provided to industry. There will be opportunities for us to better engage with, and influence, stakeholder groups, particularly SMEs.

### Technical support for investigations, inspections and enforcement

HSE's focus is on the health and safety of workers, but our regulatory interest extends to cover the impact on the general public, consumers and the environment. Of the inspections and investigations undertaken each year, a significant proportion require science or engineering knowledge to identify the causes of problems and to identify reasonable and practicable solutions. We have specialists from over 20 disciplines who provide expert technical knowledge in support of investigations.

Work in this science hub links to the following key actions in HSE's Business Plan:

- Secure effective management and control of risk

### What did we deliver in 2020/21?

Supported regulatory colleagues to improve the timely completion of investigations; these included:

- Specialists at HSE's Science and Research Centre led the integral mathematical consequence modelling of hydrocarbon release from an offshore well blowout. This work supported HSE's case for prosecution
- A multi-disciplinary investigation team from across HSE worked diligently on supporting a high profile incident. The incident killed four people and left another with life changing injuries. For this investigation, scientific support was provided and consisted of several disciplines including, technical and analytical imaging support (enabling the collection and transportation of liquid, solid and gas chemical samples in a safe manner for analysis by HSE's Scientific teams). Colleagues from the analytical sciences team reviewed organic and inorganic content, volatile content, flashpoints and potential pyrophoric activity. Assessment of the design of the failed equipment together with metallurgical tests and stress calculations were undertaken. Pressure testing and electrostatic assessment of hoses and equipment were also carried out. Explosive specialists reviewed the explosion dynamics. Also, the provision of expert opinion on employee working patterns at the incident site was provided. This work supported HSE's case for a high-profile prosecution and an overview of the incident and the underlying causes of the explosion have now been published on HSE's website
- A high-pressure gas cylinder investigation relied heavily on scientific forensic evidence and support to enable HSE to present a case for prosecution. The specialisms involved consisted of technical support of evidence, metallurgical examinations, pressure testing and combustion testing. Analytical sciences were also able to provide detailed analysis of samples
- Scientific forensic support was provided to a fatality involving high pressure water jetting. The technical support team were able to collect the evidence and the advanced imaging team were able to provide forensic stills. Mechanical examination and measurements of the hoses were also carried out. This work supported a successful prosecution

### **Our priorities for 2021/24**

- Technical support for investigations, inspections and enforcement including a focus on fairground activities such as sealed inflatables and including management of evidence and expert witness input.
- Sustain improvement in the provision of timely/immediate technical support to incident investigations, anywhere in Great Britain
- Development and deployment of appropriate new techniques and technologies that improve the effectiveness and efficiency of the enforcement process

- Improve methods of capturing, recording and storing of knowledge generated by investigation activities, particularly how it is brought together and synthesised, maximising the potential to generate wider learning
- Enhance our ability to share knowledge, insights and learning, internally and across the wider health and safety system

# Science and evidence needed to underpin HSE's work as a result of COVID-19

Vision: Development of the science and evidence which will underpin HSE's understanding and response during the current pandemic and in the future world of work post-COVID-19

As a result of the COVID-19 pandemic, the world has experienced disruption on a scale not seen since World War Two. People, systems, processes and procedures have had to adapt rapidly to cope with the challenge the virus has presented. In the aftermath of this event, significant change to how we think, function and operate is likely to be apparent and we need to understand how this will impact on the future world of work post-COVID-19.

To support the government's response to the COVID-19 pandemic the Chief Scientific Adviser's office ran an internal 'Competition of Ideas' to identify HSE's science and evidence requirements. A set of themes or thought starters were used to facilitate this that were informed by horizon scanning activities conducted by our Foresight Centre.

The response to this call was unprecedented with over 120 ideas identified. The ideas have been assessed against the following general criteria:

- Ability to fill evidence gap in support of HSE's COVID-19 response
  - Ability to fill evidence gap using data/information held only by HSE
  - Urgency for evidence
  - Uniqueness (work not identified as part of another funded programme e.g. UKRI)
  - Opportunity for funding as shared research
  - Opportunity to join with existing work funded by others
- Around 50 of these ideas have been identified as time-critical work packages that are needed to support the current pandemic, or future waves/pandemics, and these will be our priority. Given the national (and international) efforts and interest in this work, we also intend to work with others through, for example, national programmes and other appropriate means.

Our work will focus on the following key themes:

- Quantified risk assessment and understanding of the pathways for workplace transmission
- Use and efficacy of personal protective equipment (PPE), respiratory protective equipment (RPE) and engineering controls in the workplace
- The impact of the COVID 19 pandemic on health and safety management in high hazard industries
- Occupational health consequences of the COVID 19 pandemic, particularly in relation to the potential impacts of changes in work practices such as remote working on mental health and musculoskeletal disorders
- Factors influencing a successful return to work and the leadership required to manage the post-COVID workforce

Work in this science hub links to the following key actions in HSE's Business Plan:

- Secure effective management and control of risk
- Lead and engage with others to improve workplace health and safety

### **What did we deliver in 2020/21?**

- Supported the Environment and Modelling Subgroup of the Scientific Advisory Group for Emergencies (SAGE) in understanding the transmission of the virus in the environment, and potentially critical aspects of controlling transmission
- Provided rigorous technical reviews of billions of items of protective equipment. This ensured that front-line workers could be assured that the PPE they were using was going to deliver the protection required
- Delivered two rapid evidence reviews in collaboration with the University of Manchester. The first identified what research had been done on the impact of COVID-19 on construction sector workers relating to health and safety risks in different demographic groups. The second identified evidence on employers' attitudes, behaviours and competencies around communicating with workers about health and safety in light of COVID-19
- Report outlining initial recommendations for guidelines to facilitate 'long COVID' patients to return to work. It summarises the scientific literature on the impact of long COVID on work, the workplace, and return to work interventions
- Development of an agent-based model for workplace transmission of SARS-CoV-2

- Review of the potential impacts of changes in remote working practices on musculoskeletal disorders
- Changes in risk attitudes and behaviours following COVID-19 - A rapid evidence assessment
- A method was developed and implemented to visualise droplets from a simulated human cough using fluorescent markers and use this to assess the level of protection to the wearer afforded by different face shields fitted to a breathing manikin. The results can be used to advise face shield manufacturers. This work was co-funded by the World Health Organisation

Overall, HSE has made a significant contribution to the UK's response to COVID-19 both at a very practical level and informing government policy decisions.

### **Our priorities for 2021/24**

- Scoping study to identify the evidence gaps related to how workers are being supported in terms of mental health during the COVID-19 pandemic
- COVID-19 Health and Safety consequences of Offshore Wind Workforce – Risk Assessment Tool
- Assessing Transmission of SARS-CoV-2 in the Workplace Including Mitigation of Risks for Infection
- Further development of an agent-based model for workplace transmission of SARS-CoV-2 and application to outbreak investigations and evaluation of control and mitigation measures
- Review of SARS-CoV-2 PPE-Related Data
- Workplace Communication and Noise Risk Challenges Following COVID-19
- Fit testing of Respiratory Protective Equipment
- Safety critical maintenance backlogs and understanding process safety and human factors risk during and after COVID-19
- Development of qualitative and quantitative risk assessment methodologies to assess COVID-19 control measure effectiveness
- The Use of Positioning Technologies to Support Physical Distancing Measures in Workplaces

- Investigating the Droplet and Splash Protection of Eye Wear Worn for Protection Against SARS-CoV-2
- A risk-based 'Heat Map' – Identifying areas where workplace infection risk of COVID-19 could be high in England

# Enabling society to benefit from the appropriate regulation of chemicals

Vision: As a globally respected Competent Authority, support the UK to prosper through science-led regulation of the effective and safe use of chemicals and associated technology

HSEs Chemicals Regulation Division (CRD) operates a number of regimes relating to the classification, registration and trade in chemicals (with certain regimes focussing on particular classes of chemicals). The programme of work in this science hub is to optimise the regulation of chemicals, ensuring that our regulatory regimes and other processes are based on an up-to-date understanding of scientific, technical and other information.

Research in this hub will be developed to help understand how well current regulatory frameworks reflect current understanding, insight, practices (such as those driven by new technologies) and factors such as a changing environment. The research will largely be focussed at improving the efficiency and effectiveness of regulatory regimes and processes. We will aim to develop evidence for innovative approaches to regulation through collaboration across HSE and other government departments, to make sure we maintain our world-class reputation for regulatory excellence.

Work in this science hub links to the following key actions in HSE's Business Plan:

- Lead and engage with others to improve workplace health and safety and protect the environment
- Provide an effective regulatory framework
- Secure effective management and control of risk
- Enable improvement through efficient and effective delivery

## What did we deliver in 2020/2021?

- We successfully engaged externally with academia, industry and other Government departments to secure funding for joint research to develop the next generation of environmental regulatory scientists (EcoRisc). HSE CRD will be providing placements for PhD students as they work on projects to inform and develop the environmental risk assessment
- We collected compiled and published statistics on pesticide usage

### **Our priorities for 2021/24**

- To refine the strategic approach to identification and prioritisation of research and development/evidence needs
- To seek opportunities to develop a more agile/'smarter' approach to chemicals regulation
- Further improve approaches to human health and environmental risk assessment, reducing areas of uncertainty and revising models where required
- Through concepts such as the Regulatory Intelligence Hub, develop links between different parts of HSE and other regulators where data and intelligence can be shared to improve efficiency and effectiveness
- Develop relationships with research organisations to bid for funds for research projects that will develop practical solutions to managing chemicals and their interaction with the environment
- Work with independent science-based research organisations and others to maximise opportunities to keep the regulatory framework up to date and fit for purpose. This will range from exploring trends and drivers for change in regulatory approaches, to formalising specific requirements

### **Our key projects for delivery 2021/24 and beyond**

- Operator exposure during application of pesticides to tunnel grown crops and herbicides applied through weed wipers
- Analysis and refinement of the model for predicting concentrations of herbicides applied to hard surfaces in water
- Collect, compile and publish statistics on pesticide usage
- Sensitivity and Uncertainty Analysis of HardSPEC for application of pesticides to hard surfaces
- Continued involvement in the EcoRisc project and the development and training of the next generation of environmental regulators

# Work with strategic stakeholders and partners

HSE's Shared Research Programme supports external investment and collaboration in our research portfolio to address Areas of Research Interest (ARI). This allows resources and expertise to be shared for the benefit of all.

Proposed projects seek to address recognised knowledge gaps within ARIs, that are important to both HSE and other stakeholders, to enable us to better understand and manage health and safety challenges. Through workshops with regulatory, industry and other stakeholders, a consensus focus and approach are agreed, and a summary project opportunity document is developed. Partners are then sought to fund the work alongside HSE. Typically, several sponsors will work with us to ensure that we can undertake a comprehensive programme of work to address the identified requirements.

By supporting the shared research approach, contributing partners will not only be able to help shape the focus of the research activity, but also gain ongoing access to emerging findings and have early sight of outputs.

The Programme will benefit further from the skill base of the [Thomas Ashton Institute](#).

Work in this area links to the following key actions in HSE's Business Plan:

- Lead and engage with others to improve workplace health and safety

## What did we deliver in 2020/21?

- Integrity of engineered composite repairs on pipework. Reports from the work will be made openly available in the future
- An assessment of slip-resistant footwear for NHS healthcare workers. The report has been published by the [National Institute for Health Research](#) (NIHR)
- Escalator safety - Human behaviour and design features - findings from the work will be published in scientific papers in the future

## Our key projects for delivery 2021/24 and beyond

### Bolted joints

- Integrity of corroded bolted flanged joints on offshore installations

### **Flammable mists**

- Generation of flammable mists from high flashpoint fluids

### **Remote visual inspection**

- Consideration of the role and value of remote inspection techniques

### **HyTunnel-CS**

- Work to consider the safety of hydrogen driven vehicles and transport through tunnels/confined spaces

### **MultHyFuel**

- Work to help with the effective deployment of hydrogen as an alternative fuel by developing a common strategy for implementing multifuel refuelling stations

### **Thomas Ashton Institute**

- Deliver two industry/government/academia engagement events to identify collaborations with new research partners

### **New shared research**

- Deliver two campaigns to widen the reach of our Shared Research work

## Foresight

Changes within the workplace and workforce are ongoing. Many factors are driving these changes and shaping the future world of work.

Our Foresight Centre will continue to support HSE and the broader health and safety system to anticipate and keep pace with these changes, and to be better placed to tackle new health and safety challenges. It will fulfil its core foresight, futures and knowledge-sharing functions, by identifying potential threats, risks, emerging issues and opportunities for the health and safety system.

We will ensure that we identify and monitor trends that are shaping the future world of work, so that potential health and safety issues can be considered early – demonstrating that the health and safety system is an enabler of innovation and contributor to the UK's aims to 'Build Back Better: our plan for growth'.

We will continue to carry out foresight and futures activities and identify change across a range of broad areas, including societal, technical, economic, environmental and political trends, and identify issues with potential for impact on occupational health and safety and building safety. This intelligence will be used to inform strategy, our areas of research interest and future research requirements.

Work undertaken in the Foresight Centre links to the following key action in HSE's Business Plan:

- Provide an effective regulatory framework
- Lead and engage with others to improve workplace health and safety

### **What did we deliver in 2020/21?**

- Produced and disseminated regular internal communications and sector-focused information, to raise awareness of sector-specific issues and enable HSE colleagues to keep pace with change in the world of work
- Produced a high-level synthesis of how accelerated transformation due to the COVID-19 pandemic influenced a wide range of trends affecting HSE and the future working world to build understanding of potential new workplace risks in a time of great uncertainty

- Contributed futures intelligence to help HSE understand potential regulatory impacts arising from HM Government's plans to achieve net zero carbon emissions by 2050
- Informed HSE science planning themes with a futures perspective on the potential impact of these themes across different sectors and likely timescales involved
- Presented at the UK Health and Wellbeing at Work conference on the topic of emerging occupational health and safety risks and opportunities in a digital working world, including the longer-term impact of COVID-19
- Informed HSE's response to an All-Party Parliamentary Group on equity in the Science, Technology, Engineering and Maths (STEM) workforce, relating to the potential impacts of COVID-19

### **Our priorities for delivery 2021/24 and beyond**

#### **Reporting**

- Deliver targeted foresight intelligence to inform HSE strategies and policies
- Deliver agreed foresight deliverables e.g. presentations, reports, newsletters

#### **Engagement**

- Communicate and engage widely with key stakeholders in order to consider challenges and opportunities arising from our foresight and futures activities
- Engage across HSE and government to help embed futures thinking in business-as-usual activities
- Promulgate the use of futures and foresight methods across HSE to build wider capability that enables the organisation to identify new and emerging health and safety opportunities and risks

# Capability and capacity

We continue to develop and maintain our scientific capability and capacity to optimise the contribution science makes to delivering HSE's mission. Development of our staff is aligned with the Government Science and Engineering (GSE) Profession Strategy through:

## **ASPIRE – Science Excellence Programme**

This Programme of work aims to provide the environment and professional capability for the delivery of HSE's Science, Engineering and Evidence (SEE)

The Programme's themes are:

- Professional Development - To develop a confident, competent scientific professional leadership that provides strong, positive direction and influence on the workplace and inspires and empowers the workforce to achieve the best
- Pride in our science – To ensure that we provide the governance and programme environment that enables us to produce robust science, engineering and evidence that underpins both HSE's regulatory activities and supports the commercial agenda
- Profile – To determine and undertake the most effective dissemination and engagement approaches to ensure that the data and knowledge generated from our SEE activities is promoted and utilised to best effect

We manage and develop the capabilities of our staff and facilities we invest in:

- Staff – in their knowledge and skills, in line with the GSE Career Framework, to ensure we have the capability to meet current and emerging science and evidence needs
- New facilities, techniques and technologies, and maintain facilities unique to HSE to meet the organisation's current and emerging needs
- Information and knowledge management to ensure the full value of this important asset can be released

Our scientists demonstrate important values and behaviours. They:

- Keep up to date, anticipating new challenges from workplaces and research

- Are innovative, ethical, professional, methodical, focus on quality and demonstrate curiosity
- Use their knowledge and skills to solve problems for end-users in the real world of work

Work in this area links to the following key action in HSE's Business Plan:

- Enable improvement through efficient and effective delivery

### **What did we deliver in 2020/21?**

- Joined and became fully active within the STEM Futures Partnership (with government, academia and industrial partners) and its technical hubs, to provide an easy mechanism for developing technical skills, knowledge and experience through on-the-job learning via placements or secondments, potentially supplemented by further education
- Contributed to the development of the GSE Career Framework, GSE skills assessment tool and the further refinement and development of apprenticeship offerings
- Supported professional capability development through our Academic Learning Programme

### **Our priorities for 2021/24**

- Champion the GSE Career Framework for our GSE staff and affiliate colleagues and embed this into performance management arrangements where this is possible
- Contribute to the continued development of the GSE skills assessment tool and GSE induction materials through GO-Science Learning and Development Champions network
- Work with GO-Science to refresh the GSE Profession Strategy
- Support further professional capability development through our Academic Learning Programme and the STEM Futures Partnership

## Governance, assurance and engagement

HSE's Science, Engineering and Evidence Assurance Committee, a panel of independent external experts and a sub-committee of the HSE Board, provides assurance to the HSE Board on the relevance and quality of our science and evidence strategy and delivery. HSE's science governance processes are underpinned by science hub governance groups providing oversight and prioritisation of research. The Science, Evidence and Research Advisory Group enables the Chief Scientific Adviser to ensure that the research activity commissioned for HSE end-users is aligned to HSE's strategy and plans.

HSE's Workplace Health Expert Committee, a formal scientific expert committee, provides expert opinion to our Chief Scientific Adviser and gives HSE access to independent, authoritative, impartial and timely expertise on workplace health.

Publication of our scientific and analytical work in peer-reviewed journals and conference proceedings is used as part of maintaining the credibility of our scientific capability, in its capacity to inform and underpin operational regulatory and policy making functions. Demonstration of science quality is also provided by challenge through the courts for expert witness evidence.

HSE's [Ethical Statement](#) for science sets out our commitment to the highest possible ethical standards of behaviour and conduct throughout all facets of the work we do whilst meeting all legal requirements. We have a Research Ethics Panel for work involving human tissue, subjects or data which is accredited to the University of Sheffield Medical School Research Ethics Panel (REP) and for potentially higher risk research we obtain ethical review from either this REP or an NHS REP as appropriate.

We will build understanding of HSE's use of applied science through the dissemination of our [Annual Science Review](#) containing case studies of impact. We will provide a high-level summary of our wider research interests, presented as Areas of Research Interest (ARIs), which either HSE or other organisations – sometimes working in partnership – could usefully address. We will advance knowledge of potential emerging risks and issues for health and safety through our Foresight Reports. We will continue to extend opportunities for further external communications and engagement via digital and social media and through our annual science lecture.

We will engage with stakeholders through involvement in HSE Board and stakeholder events and attendance at conferences. We will also work with appropriate Government Professions and international scientific networks such as the Partnership for European Research in Occupational Safety and Health ([PEROSH](#)), the International Commission on

Occupational Health ([ICOH](#)) and the International Association for Hydrogen Safety ([IAHySafe](#)).

Work in this area links to the following key actions in HSE's Business Plan:

- Lead and engage with others to improve workplace health and safety

### **What did we deliver in 2020/21?**

- Presented the annual Science Review 2021 at the HSE Board meeting - March 2021
- [Science and analysis publications](#) (research reports, national statistics, articles in trade and professional magazines, book chapters, and articles etc in peer-reviewed journal and conference proceedings)
- Launched the new [HSE Science and Research E-Bulletin](#)

### **Our priorities for 2021/24**

- Using our enhanced external science communication channels, share our learning from our expert science and research with those who can influence health and safety improvement
- Use our existing cross-government science communications network to raise the profile of HSE science
- Publish HSE's updated Areas of Research Interest
- Contribute to the development and delivery of a cross-government GSE Science Conference

### **Our key projects for delivery 2021/24 and beyond**

#### **Engagement and dissemination**

- Linking to British Science Week, publish a series of case stories within the Annual Science Reviews 2021-24 which support HSE's annual campaigns

- Launch Annual Science Reviews with public seminars for national and international stakeholders
- Disseminate findings from COVID-19 National Core Study 'PROTECT' Transmission and Environment
- Revitalise our in-house Chief Scientific Adviser's seminar programme and make these accessible to the GSE community across government
- Continue publication of our science and analysis (research reports, national statistics, articles in trade and professional magazines, book chapters, and articles etc in peer-reviewed journal and conference proceedings)
- Collaborate with the Thomas Ashton Institute in the delivery of the Ashton lecture

### **Governance**

- Continue to hold meetings of HSE's external and internal science governance groups







## Further information

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