

Areas of Research Interest

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Introduction

About HSE

HSE's mission is **protecting people and places**, helping everyone lead safer and healthier lives¹.

- **Working better as one** - with a set of shared objectives, we help to keep Great Britain one of the safest and best places to live and work. Bringing people and organisations together, sharing knowledge, expertise and data, we make a real impact on reducing death, ill health and injury.
- **Future change and innovation** - the world is changing, with new and emerging risks. We inspire and influence everyone to keep pace with future change and collectively tackle the most serious risks to our society.
- **Valuing our people** - our people are at the heart of delivering an efficient and effective public service. We are proud that they are our core strength and value each other's work and professional contribution.

Science, Engineering and Analysis (SEA) in HSE

Science, engineering and analysis (SEA) underpin the work of HSE and provide a basis for robust decision-making. It is a requirement for HSE under the Health and Safety at Work etc. Act 1974 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'.

HSE's 10-year strategy, Protecting People and Places, sets out how HSE's role and responsibilities are growing, particularly in the areas of building safety, chemicals regulation and supporting sustainable, healthy, workplace practices. The science and evidence generated by HSE's scientists, engineers and analysts, and through our collaborative programmes with industry, academia, and our network of international partners, provides the expert evidence supporting HSE's vision which is dedicated to protecting people and places. We work to ensure people feel safe where they live, where they work and in their environment.

Our Areas of Research Interest (ARIs) details HSE's forward-looking research priorities that helps to ensure, within an ever-changing world, that HSE remains a modern, enabling regulator, within one of the most successful health and safety systems in the world. Our

¹ <https://www.hse.gov.uk/aboutus/assets/docs/the-hse-strategy.pdf>

ARIs will continue to develop and be refreshed over the coming years as the evidence required to support the delivery of HSE’s strategy becomes clearer.

HSE’s portfolio of SEA work is considered in terms of HSE’s strategic objectives:

- Reduce work-related ill health, with a specific focus on mental health and stress;
- Increase and maintain trust to ensure people feel safe where they live, where they work and in their environment;
- Enable industry to innovate safely to prevent major incidents, supporting the move towards net zero;
- Maintain Great Britain’s record as one of the safest countries to work in.

Addressing future research needs

In this document, HSE has identified and outlined the forward-looking research that helps to ensure, within an ever-changing world, that it remains a modern, enabling regulator, within one of the most successful health and safety systems in the world.

This is a high-level summary of our wider research interests, presented as ARIs, which either HSE or other organisations – sometimes working in partnership – could usefully address. HSE’s Shared Research Programme² supports external investment and collaboration in HSE’s research portfolio. This allows resources and expertise to be shared for the benefit of all.

We recognise the mutual benefit from working with the Scottish and Welsh governments, in sharing evidence for relevant policies, and in joining up activity where we have shared objectives, to achieve more together. Through our participation in the GO-Science ARI community of interest and practice, which involves representatives from the Devolved Nations, specific topics of shared interest are discussed and ways forward agreed.



We cooperate and collaborate with the Department for Work and Pensions (DWP) and Department for Health and Social Care (DHSC) Joint Work and Health Directorate (“the joint unit) on matters concerning their respective health responsibilities.

Prof Andrew Curran CBE

Director of Science, Chief Scientific Adviser and Head of GSE Profession

² <https://www.hse.gov.uk/aboutus/shared-research-programme.htm>

The Challenge



12k

Lung disease deaths each year estimated to be linked to past exposures at work



1.7 million

Working people suffering from work-related illness



142

Workers killed at work



0.4 million

Workers sustaining a non-fatal injury (Labour Force Survey)



0.8 million

Workers suffering from work-related stress, depression or anxiety in 2020/21



0.6 million

Workers suffering from a work-related illness caused or made worse by the effects of the pandemic



12.5k

Buildings in scope in preparing for the Building Safety Regulator



17%

Amount of UK CO₂ produced by domestic gas boilers



20k+

Chemical substances on the GB market requiring regulatory oversight



340+

Offshore installations and onshore pipeline networks regulated to ensure they are operating in compliance with their accepted safety cases



300

Biocide and pesticide active substances notified for GB review following EU Exit



1627

Major hazard installations with the potential to cause significant harm to workers, communities and the environment

Reduce work-related ill health, with a specific focus on mental health and stress

Overall aims

To increase our understanding of the extent, harm, costs and preventability of work-related ill health. Specifically, focussing on the most common causes of work-related ill health in GB – work related stress, musculoskeletal disorders and respiratory ill health.

DWP and DHSC Joint Work and Health Directorate (“the joint unit”) and HSE cooperate and collaborate on matters concerning their respective health responsibilities. This includes matters of mutual interest such as research with employers into demographics, occupational psychology and behavioural science, specific conditions and the workplace, work-related stress and mental health at work and musculoskeletal conditions. DWP, DHSC and HSE also collaborate on horizon scanning and foresight work in terms of considering work-related ill health outcomes.

Questions and identified needs arising within this area of research interest include:

On themes applicable across all priority health areas

Health and work data and impact - to tackle and prevent work related ill health, it is essential that we utilise and understand the best information available to inform our work and make the case for driving employer action.

- How can existing (and ongoing) data sets be linked to provide richer data to understand the relationship between exposure to hazards, the effectiveness of control measures and work-related ill health?
- Does work-related ill health have any impacts and consequences for individuals and society, including human costs, costs of ill health and impacts upon productivity and employment?
- What is the occupational health profile of the GB workforce and how do different work (e.g. trade/tasks) and demographic factors contribute to this?
- Which interventions best support health equity and equality across different groups of workers, including those with health conditions and/or disabilities and/or caring responsibilities?

Changing ways of working - as ways of working evolve, particularly in the post COVID-19 pandemic landscape and with the emergence of the Net Zero agenda, what does this mean for how people work and the impact this has on health and work.

- How can new health risks be identified before they become workplace health problems?
- How will the changes in working practices following the COVID-19 pandemic, such as increased hybrid and homeworking, escalation in the gig economy, and changes in the demographics of the work force affect work-related ill health?
- How will future changes in technology, and the way in which workers interact with these new technologies (e.g. Artificial Intelligence, Net Zero technologies), affect the health of workers and what can be done to mitigate any work-related ill health?

What works - we need to develop our understanding of what works to prevent work related ill health and look for proven approaches to support employer action.

- As individuals may have health conditions that interact with exposures in the workplace, what needs to be undertaken to develop understanding of what work-related ill health then looks like in workplaces and support employers in tackling this in a more holistic way?
- How do employers go about accessing appropriate occupational health advice, such that occupational health risks are appropriately managed?

On work-related stress, anxiety and depression

- What interventions and workplace controls can employers use to successfully prevent or design out the risk of work-related stress and support good mental health at work?
- To what extent are workers experiencing violence and aggression in their workplaces (with a particular focus on health and social care and customer services)? What affect does this have on the health of workers, particularly in terms of work-related stress, anxiety and depression and what controls can be put in place to reduce these risks?

On occupational lung disease

- What is the feasibility of developing an Occupational Exposure and Control system to provide intelligence on trends over time in exposure to respiratory hazards and control measures, with a particular focus on Respiratory Crystalline Silica (RCS)?
- What impact could wider changes in the built environment, like decarbonisation, have on the pattern of removal of asbestos?

On physical health including musculoskeletal disorders

- What contribution and impact does work-related physical ill health make to work-related stress or poor work-related mental health?

Increase and maintain trust to ensure people feel safe where they live, where they work, and in their environment

Overall aims

To enable strategic and transformative advances in health and safety across the diverse construction sector through technology and innovation and the new opportunities and risks arising from it.

To underpin construction and building safety regulatory regimes with evidence-based approaches and enable effective oversight across the whole built environment.

To inform standards and guidance development to improve the safety and standard of buildings and develop effective strategies to measure and build competence across the construction and building safety sectors.

To ensure that our approach to regulating chemicals and microbial control agents: is effective, efficient and agile, reflecting current and developing scientific understanding and technical knowledge; reinforces our position as an internationally influential regulator; and enables society to derive the benefits of access to safe and sustainable use of chemicals; and ensure there is no harm to workers, bystanders and consumers or unacceptable effects on the environment.

Questions and identified needs arising within this area of research interest include:

Building Safety and Construction

On Innovation – Implications for Worker Health and Safety and Building Safety

- A changing world of work: Are there significant implications for worker health and safety and for building safety of widespread adoption across this diverse sector of: Modern Methods of Construction (MMC); AI, Autonomy and the Internet of Things; Robotics; Advanced materials and additive manufacturing?
- Net Zero innovation: Are there significant implications from carbon reduction for construction workers health and safety and for building safety involving: retrofitting domestic and commercial buildings; constructing, altering or decommissioning high hazard infrastructure / plants; low carbon heat solutions; zero emission vehicles and

plant; reduced carbon materials; climate adaption to existing buildings and infrastructure?

- Digitisation: How can digital innovation (e.g. digitisation of CDM) be harnessed to improve building safety and to better structure, share and use construction health and safety data to best inform health and/or safety decisions during the design, construction and use of an asset or building?
- Innovative design: Are there opportunities to improve worker health and safety and building safety outcomes through inherently safer design that reduces risk through the building life cycle from construction through occupation and refurbishment to demolition?

On Oversight - Demonstrating regulatory assurance and impact

- Metrics: What metrics provide the best leading indicators for building safety and construction health and safety performance at both an industry and project-specific level?
- Influences: What influences construction activity in the sector, and which have the most impact on a project's health and safety management (both at the small and larger project scale)?
- Benchmarking: What asbestos remains in the built environment, at what rate is this currently being disturbed and how will industry trends impact on this?

On Competence – Skills and Engagement

- Building competence: Is there opportunity to transfer knowledge into and across the diverse construction and building safety sectors to build competence levels aided by appropriate benchmark standards?
- Building engagement: Are there effective ways to ensure construction workers (particularly in small businesses) are appropriately engaged with and competent in relevant health and safety matters?

On Standards – keeping the safety and standard of buildings under review

- Building standards: What evidence is available to improve the safety and standard of buildings and people in or about buildings to inform the evaluation of the Building Regulations and the associated guidance?

Regulation of Chemicals

- How can it be ensured that our regulatory approach accommodates future trends in new technologies and health and environmental hazards?
- Are there alternative regulatory models to encourage innovation and minimise chemical use and regulatory burdens?
- How can it be ensured that there is sufficient evidence to support an effective and efficient approach to regulatory policy and risk assessment e.g. for the management of existing, new and emerging health risks from chemicals and to enable the safe and sustainable use of chemicals?
- How can it be ensured that our regulatory approach accommodates future trends in work demographics, working patterns, new technologies, health hazards and new uses for old substances?

Chemical Regulation – Particular interests

- A changing world of chemicals: How are chemicals and the way they are used changing and what are the potential human health and environmental challenges arising from this? What possibilities are there for Government efficiency savings, for example by standardising approaches across regulatory regimes?
- New Methods of Assessment: How are new methods of determining and managing risk being developed and what is their potential impact on regulatory assessments carried out for chemicals? How might these new methods be evaluated and introduced into assessments to increase efficiency and effectiveness of that work whilst ensuring maximum benefits to society?
- New Technologies: How are new technologies and work practices being adopted by those using chemicals (e.g. next generation crop protection, variable rate application, genetic modification and biological pesticides etc) and which emerging innovations are considered most viable (e.g. digital agriculture, field monitoring, robotics, etc) and likely to become mainstream and transformative? How can we ensure appropriate regulation ensuring chemicals are used safely whilst promoting the adoption of technologies with the potential to improve the sustainability of chemical use?

Enable industry to innovate safely to prevent major incidents, supporting the move to net zero

Overall aims

To apply our expert knowledge and capability to enable businesses to understand both known and unknown risk and to innovate safely as we transition to net zero.

To develop our understanding of the future asset base and the role key stakeholders (e.g. designers, manufacturers, operators, etc.) play in managing risk and maintaining safe operations.

To work with industry to prevent major incidents around new technologies and applications that come with the government's commitment to achieve net zero greenhouse gas emissions by 2050 through working with others to understand changing risks and challenges to ensure regulatory framework remains fit for purpose.

We recognise that development of net zero technologies will present challenges that businesses and society are less familiar with. We will work to make sure that health and safety legislation does not prevent safe innovation and progress.

To help manage risk, we will focus our attention on the breadth of activities that net zero encompasses. This will provide evidence to inform any policy, regulatory and operational changes needed to support business. We will achieve this by working partnerships with stakeholders, communication activities, regulatory interventions and enforcement.

To bring together science, policy, and regulation, we will help businesses in Great Britain establish themselves as world leaders in net zero.

Questions and identified needs arising within this area of research interest include:

The safe operation of industrial assets

- What will the future industrial asset base look like and what will the key health and safety challenges be?
- What is needed to ensure that the asset base is robust enough to reduce the likelihood of low frequency, high impact catastrophic events or major accidents?

- How can any key long-term challenges and threats to the current ageing asset base be identified?
- Where applicable, what is needed to understand how assets can operate safely beyond their original design life?
- How can the effect of climate change on the safe operation of industrial assets best be determined?
- What is needed to understand whether the original design life of assets remains valid in the face of changing use and creeping change?
- How can the role that human factors may play in the effective operation or failure of the asset base be effectively understood?
- How can it be ensured that the health and safety challenges presented by repurposing and decommissioning are appropriately addressed?
- How can it be ensured that repair and replacement strategies (and the technologies used) are suitable?
- How does the performance of materials and structures change over time? Can this be accurately predicted and measured in service? How does this impact on the thresholds for safety (remnant life etc.)?
- How can it be ensured that evidence is used appropriately for completing effective safety checks, calibration and testing requirements for existing and new materials and structures?
- What evidence is needed about the use of new technologies - e.g. new and emerging energy technologies, use of novel materials, new manufacturing processes, etc. - to develop an appropriate, effective strategy for their better regulation, enabling their rapid and safe introduction?

New and emerging net zero technologies

- Are there significant hazards and risks associated with the deployment and scale-up of new and emerging technologies for Net Zero?
- What role does HSE have in assuring the trust of communities in new and emerging technologies in the energy transition?
- What can be learned from the deployment and scale-up of more mature industries (such as planning and consequence modelling) that will help us manage safety outcomes for the emergence of new technologies?
- Is there opportunity to transfer knowledge and skills from hydrocarbon technologies to operators of new and emerging technologies in the energy transition?

Technology design and manufacture

- How can designers, consultants and manufacturers contribute to incorporating improvements in occupational health and safety when considering design of new technologies?
- How can it be ensured that technological advancements serve to maintain or improve existing levels of safety and health and do not present additional risks (either immediate or latent)?

New industries

- How can we ensure that new industries such as CCS, hydrogen and energy storage are designed with safety and health considerations in mind?
- What are the appropriate controls and mitigations that need to be built into new carbon capture infrastructure?
- Given the known effects that hydrogen can have on materials how can the long-term performance of hydrogen infrastructure be assured?
- How do operational fusion power plants compare in risk profile to industrial installations HSE are familiar with regulating?

Growing challenges

- Are there health and safety challenges associated with growing industries including the retrofitting of domestic and commercial buildings; installation of low carbon heat solutions & installation of electrical infrastructure for electric vehicles?
- Are there health and safety challenges related to maintenance and repair of aging low carbon energy infrastructure, such as offshore wind turbines?
- To what extent is climate change affecting health and safety of workers and communities how is this expected to change over time? How can the effect of climate change on the safe operation of industrial assets best be determined?

Understanding the risks of a decentralised energy landscape

- Are there risks associated with this new energy landscape and how could they be best controlled? Do co-located technologies pose new hazards and risks? What new hazards arise from how new energy systems are integrated and controlled?
- How many energy production sites will exist and what is the optimum scale they will operate at?
- How can the role of human factors in the safe and effective operation of a new energy system be effectively understood?

Maintain Great Britain's record as one of the safest countries to work in

Overall aims

To further develop understanding of the current and future world of work to ensure that our regulatory approach remains suitable and sufficient, including where our regulatory interests extend beyond preventing harm to workers, e.g. covering assessment of potential adverse impacts of chemicals on the general public, consumers and the environment.

To equip ourselves with new insights into the reasons why particular failures in health and safety occur.

To develop the existing system of ongoing data collection, analysis, interpretation and result dissemination so that it continues to support HSE's current priorities and prevention strategies and is flexible enough to adapt to change.

To identify health and safety hazards and risks arising from change in the GB workforce and their work.

Questions arising within this area of research interest include:

Regulatory Frameworks

- In the future, who will decide on the responsibility for 'risk' in a workplace that is becoming increasingly complex?
- Are there alternative regulatory models, interventions and instruments to improve/encourage innovation and improve health and safety outcomes whilst minimising regulatory burdens?
- How can it be ensured, that regulatory reform promotes safe workplace practices and does not introduce or amplify risks?

Data collection, analysis, interpretation and result dissemination

- How can health and safety systems be improved by effectively linking, utilising and analysing new and current data sets on accident and incident investigation activities?
- How should evidence be utilised to determine the significant changes in the work environment (including new technologies, new materials, changes in work practices

and changes in the workforce) that will have an impact on the risks to health and safety? How do these changing risks interact and how can they be mitigated?

- How is data and evidence used to identify and evaluate interventions that have appropriate and targeted impact on the health and safety system in the short, medium and long term?

Changes in the workforce and work

- How is social change impacting on change in risks to workforce health and safety (e.g. ageing workforce, gender profile, disabled people, vulnerable workers, precarious work, remote work)? What competence is required to ensure managers and supervisors can support the workforce?
- Are there indicators, that risk attitudes and/or behaviours are likely to change in the future: and for which groups of workers are they likely to change?
- What is the size and nature of the gig economy? What different models of employment are there and how will this change in different sectors in the future?
- What are the implications of changes in working patterns and the way in which work is organised? (e.g. fatigue and shift patterns):
- What are the longer-term trends in flexible, hybrid and home working and what are the positive and negative impacts on health and safety? What are the impacts of potential inequalities across sectors and groups of workers?
- Who has the accountability and responsibility for health and safety at work for those with multiple employment?
- What does good work look like and how does it support the health and safety of the work force?
- Is there opportunity to transfer knowledge and skills from experienced operators of hydrocarbon sites to a new generation of plant operators assuming responsibility in the energy transition?

On the interaction between the workforce and their work

- Keeping pace with the speed of technological change in the workplace, how will workplace digital technologies maintain or improve existing levels of safety, whilst encouraging the benefits they present both in terms of worker health and safety, and effective regulation?
- What is required to identify implications for worker health and safety from AI, ensuring it is used safely throughout its lifecycle, including consideration of the interaction between digital and physical systems?

- How can it be ensured that regulatory regimes and interventions are coherent, effective, proportionate, and agile, influencing transparency and understanding to enable effective regulation thus offering confidence to industry to innovate?
- How can effective accountability and governance through complex AI supply chains be achieved? How can joined-up approaches with AI/digital experts in industry and academia be encouraged to develop, share knowledge and resources in ways that leverage synergies and efficiencies? e.g., sandboxes and incorporate learning from international contexts?

Contact for further information

Please send any enquiries to: hseca@hse.gov.uk

Further information

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