

**PROTECTING PEOPLE
AND PLACES**



Annual Science Review 2023



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Foreword



Professor Andrew Curran CBE
*Director of Science, Chief Scientific
 Adviser and Head of GSE Profession*

WELCOME TO OUR 2023 Annual Science Review, which is presented in the context of our new HSE strategy: *Protecting People and Places*.¹ In his guest foreword, my colleague Rick Brunt outlines the breadth of evidence requirements which the new strategy presents. This Annual Science Review gives some examples of work that we have carried out in these important strategic areas.

We have given a particular focus on our activities aimed at enabling industry to innovate safely to prevent major incidents, supporting the move towards net zero. The internationally renowned expertise which our scientists and engineers have developed over the last 20 years is critical in understanding and effectively controlling the risks associated with hydrogen as an important fuel 'vector' to store and transport renewable energy. They have worked with innovators and regulators to develop the evidence needed, much of which is generated at our Science and Research Centre in Buxton. Our unique mix

of specialist skills and large-scale testing facilities has helped to provide information on preventing failure at, and beyond, normal industrial operating conditions. The ability to understand the regulatory requirements in the context of the issues faced by innovators can often help to support innovation at pace, and our work on hydrogen is a good example of this happening in practice. The range of applications researched by our specialists also enables cross-sector learning, for example the requirements for evidence to enable safe use of hydrogen in the transport sector are also relevant in the use of hydrogen for heat.

We hope that our approach also helps to support the public assurance of safety for these new technologies, as the knowledge we create, the knowledge we curate and the knowledge we collect during forensic incident investigations, helps to ensure that healthy and safe deployment is achieved by design and supported by proportionate, risk-based and evidence-informed policy and regulation.

Forensic incident investigation by specialists at our Science and Research Centre in Buxton has continued. In 2022, new investigations included the Kinghorn Beach scuba diving incident; the Hammersmith Town Hall steelwork construction incident; the Gatwick Airport Station construction incident; the Flambards and Oakwood Theme Park ride incidents; the Thornton Heath gas explosion incident; and the Edinburgh retail park fragile roof incident. In all these tragedies, people were injured or lost their lives. In this Annual Science Review we include four case studies illustrating how the work of our forensic incident investigation specialists has identified causes and been used to help secure justice.

I hope that you find the case studies in our Annual Science Review informative, and that they help to illustrate that innovation can be enabled in a healthy and safe way.

Guest foreword

Protecting People and Places – Our new strategy



Rick Brunt
*Director, Engagement
and Policy Division*

IN MAY 2022 we launched *Protecting People and Places*,¹ our new strategy, committing HSE to delivering on five strategic objectives taking us forward through the next 10 years. The strategy also set out six strategic themes that underpin the way we work to deliver our objectives. The work of our scientists is the absolute embodiment of the themes and objectives; our scientific work is a key component of delivering our strategy, protecting our citizens and the environment they enjoy.

This review highlights the ways in which our scientists set the bar for tackling both new and ongoing risks, underpinning our strategic objectives. For example, their evidence is used to support the national agenda on decarbonisation, reduce health and safety risks in workplaces, and inform the wider remit of HSE in regulating chemicals to safeguard people and the environment.

We see a rich picture of our science making an invaluable contribution as the world and our regulatory work evolves. Our science is forging ahead to deliver the evidence to enable safe deployment of net zero technologies to meet the UK's decarbonisation objectives. Two decades of scientific work on hydrogen, alongside newer work in areas such as batteries and carbon capture and storage, enabling the safe deployment of innovative net zero technologies.

As HSE's remit expanded, taking on the role of Building Safety Regulator and responsibility for the country's chemical safety regime, we can see our scientific work at the heart of securing and growing the trust of citizens to ensure they feel safe at home, at work and in their environment.

In other areas of HSE's remit, protecting workers' health and safety, and incident investigation to secure justice, our science and

evidence is a solid foundation for our regulatory activity and we can see the clear pathways to impact it has on improving workplace standards.

All of this is possible because of the exceptional people sitting at the centre of our scientific work – dedicated, committed and delivering at their very best. Our scientists are a prime example of HSE functioning as a highly skilled organisation perfectly positioned to meet current and future needs.

The HSE Science and Evidence Cycle in action: Enabling the safe deployment of net zero energy technologies

We catalyse engagement by others and improve performance, including:

- Working with IGEN² addressing decarbonisation of the UK gas grid with 20% and ultimately 100% hydrogen.
- Contributing to IET, *Transitioning to hydrogen*³ with the Institutions of Mechanical, Chemical and Electrical Engineers and IGEN, providing analysis and thought leadership.
- Contributing to UK Government Hydrogen Strategy⁴ and Road Map.⁵
- Advisory roles to UKRI-funded HyRES Hydrogen Research coordination,⁶ with University of Bath, and to EPSRC-funded Hydrogen and Fuel Cells 'Supergen' Hub.⁷
- HSE scientist president of IA-HySAFE, 2018-2022, shaping hydrogen safety, including international conferences in 2019⁸ and 2021⁹ in partnership with the South Australian and Scottish governments respectively.

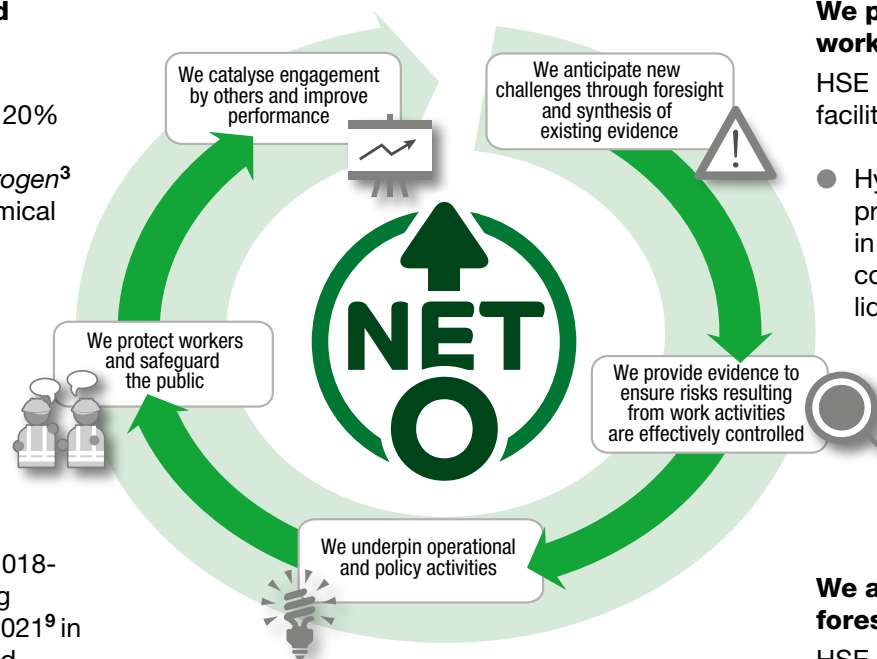
We protect workers and safeguard the public

- Leading role in OFGEM 'HyDeploy' and 'HyDeploy2' projects demonstrating safe introduction of 20% hydrogen into the gas distribution grid in trials.¹⁰
- Technical support to updating key IGEN standards such as Hazardous Area Classification.¹¹
- Key partner in OFGEM-funded 'H21' programme addressing repurposing the gas grid for hydrogen including major industry investment⁴ in unique test facility at HSE's laboratory.¹²
- Working with industry to understand potential

- safety issues associated with CCS introduction.
- HSE training course Fundamentals of Hydrogen^{13 14} for those looking to use hydrogen.

We underpin policy and operational activities

HSE scientists engage with inspectors and policymakers to ensure that regulatory decisions on enabling the safe development of the hydrogen economy are informed by best evidence. For instance, working with BEIS within the Hydrogen for Heating¹⁵ programme to develop evidence to inform decisions on UK trials.



We provide evidence to ensure risks from work activities are effectively controlled

HSE scientists employ unique experimental facilities and expertise. Includes:

- Hydrogen: key roles in major international projects HyTunnel-CS¹⁶ on hydrogen vehicles in tunnels, MultHyFuel¹⁷ on refuelling on conventional forecourts, and PRESLHY¹⁸ on liquid hydrogen leading to an ISO standard.
- Lithium-ion batteries: key contribution to Faraday Challenge LIBRIS project.¹⁹
- CCS: development of decision support tools for pipeline risk assessment and publication of best practice guidelines.²⁰

We anticipate new challenges through foresight and synthesis of existing evidence

HSE scientists have engaged with policymakers, industry and researchers internationally for over 20 years to identify and tackle emerging safety challenges to enable the safe introduction of net zero energy technologies. Our scientists have actively shared and shaped new knowledge into UK and international standards. For example: HSE's Foresight Centre energy report,²¹ report on international research priorities for hydrogen safety²²; and contribution to ATI 'Fly Zero' programme to understand safety challenges of liquid hydrogen as an aviation fuel (see case study on page 13).



Further information:

- See case studies on pages 08–13.
- For HSE science publications on net zero energy technologies: hydrogen; lithium-ion batteries and carbon capture; storage and use see *HSE science and research publications*²³
- The HSE Science and Evidence Cycle is part of the HSE Science Strategy

Abbreviations

- ATI** – Aviation Technology Institute
BEIS – Former Department for Business, Energy and Industrial Strategy
CCS – Carbon Capture and Storage
IA-HySAFE – International Association for Hydrogen Safety
IET – Institute of Engineering Technology
IGEM – Institute of Gas Engineers and Managers
ISO – International Organisation for Standardization
OGEM – Office of Gas and Electricity Markets
UKRI – UK Research and Innovation



(above) Aerial photo of the HyTunnel test area at HSE's Science and Research Centre, Buxton

(left) Still capture from high speed footage of hydrogen ignition during a HyTunnel test

Case studies





Enabling the safe introduction of offshore carbon capture and storage

CARBON CAPTURE AND storage (CCS) is a new net zero technology which is being developed internationally. The aim is to capture carbon dioxide (CO₂) that would otherwise be emitted and transport it by pipeline to storage in secure geological formations deep underground. The UK Government, funded HyNet and East Coast Cluster projects are exploring potential CO₂ injection into offshore saline aquifers and depleted gas reservoirs.

To enable the safe introduction of CCS, it is essential to understand potential risks to people and how

to effectively control and mitigate them. This includes during onshore and subsea pipeline transportation, processing onboard an offshore platform, and subsea injection.

In 2022, stakeholder engagement by HSE specialist inspectors and scientists included:

- A workshop in Aberdeen with industry to consider offshore safety. An HSE scientific presentation covered some CCS hazards, lessons learned from global incidents, and the physical behaviour of CO₂

such as gas dispersal. The workshop discussions included protecting workers in the event of a CO₂ release on a platform, and potential impact on the platform structure.

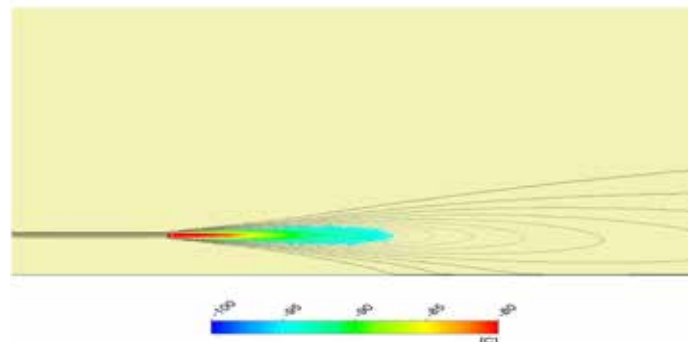
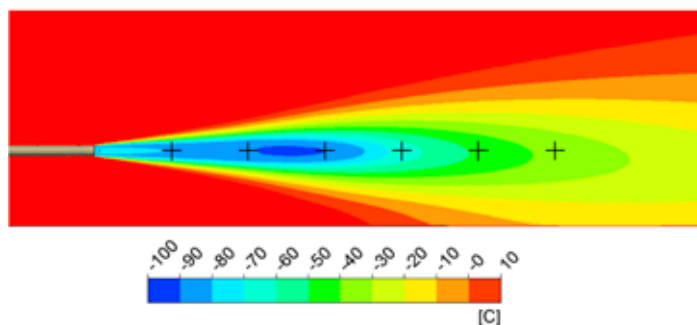
- Ongoing engagement with the industry CCS Association (CCSA) Health and Safety Task Subgroup, and the Energy Institute (EI) CCS Working Group.
- A presentation at a CCS Research Centre (UKCCSRC) workshop for universities. The presentation covered HSE's Areas of Research Interest.

What were the benefits?

Engagement with industry is allowing HSE to determine what dutyholders will need to do to demonstrate effective arrangements for safe offshore CCS operations. Engagement through UKCCSRC is raising awareness in universities of areas of research interest for safe CCS operations that they could address.

Further information

- HSE research report: *Overview of carbon capture and storage projects at HSE's Buxton Laboratory*²⁴
- HyNet website²⁵
- East Coast Cluster²⁶
- UKCCSRC industry- and policy-led 'What are our research needs' workshops²⁷



CO₂ jet release research at HSE's Science and Research Centre showing (left) experimental releases and (right) computational fluid dynamics modelling



Enabling safe deployment of lithium-ion batteries for storage and use of net zero energy



HSE scientist Gemma Howard with the equipment she designed for experiments to drive a nail into a battery sealed inside a gas-tight pressure vessel

LITHIUM-ION BATTERIES are increasingly used as part of net zero technologies to allow storage of renewable energy, such as solar and wind generated, and its use for transport. If batteries are subjected to abnormal conditions such as impact, extreme environment changes or overcharging, they may fail dangerously, resulting in fire or explosions. To enable the safe deployment of lithium-ion batteries it is important to understand the conditions that can cause failure so that effective prevention and mitigation measures can be deployed to prevent harm.

HSE's laboratory has unique purpose-built battery-testing facilities²⁸ which are used for controlled experiments to initiate and monitor the failure of lithium-ion batteries, and examine the consequences and impact of failure conditions and the effectiveness of any mitigation techniques. The facilities allow failure initiation through various methods with real-time gas analysis, residue analysis, specialist thermal imaging and high-speed videography.

The Government's 'Faraday Battery Challenge'¹⁹ aims to support a

What were the benefits?

HSE's experimental research is providing robust evidence to enable safe deployment and scale-up for use of lithium-ion batteries in net zero applications.

Further information

Journal publications:

- Comprehensive gas analysis of a 21700 Li(Ni_{0.8}Co_{0.1}Mn_{0.1}O₂) cell using mass spectrometry²⁹
- Characterizing and predicting 21700 NMC lithium-ion battery thermal runaway induced by nail penetration³⁰
- Combined numerical and experimental studies of

21700 lithium-ion battery thermal runaway induced by different thermal abuse³¹

- Numerical and experimental characterisation of high energy density 21700 lithium-ion battery fires³²

Conference papers:

- Smoke, sparks, flames or explosions? An experimental study into how lithium-ion cell failure varies in open field³³
- Experimental understanding of gas volumes and forces generated due to swelling during lithium-ion pouch cell failure³⁴

world-class scientific, technology development and manufacturing scale-up capability for batteries in the UK. As part of this work, HSE scientists, in collaboration with partners including Warwick Manufacturing Group, Jaguar Land Rover Ltd and 3M, are contributing their expertise and facilities to provide experimental evidence to enable safe deployment of this scale-up. For instance,

recent experimental research inducing thermal runaway in cells has improved understanding of the hazards associated with the flammable gas released.

Funding source

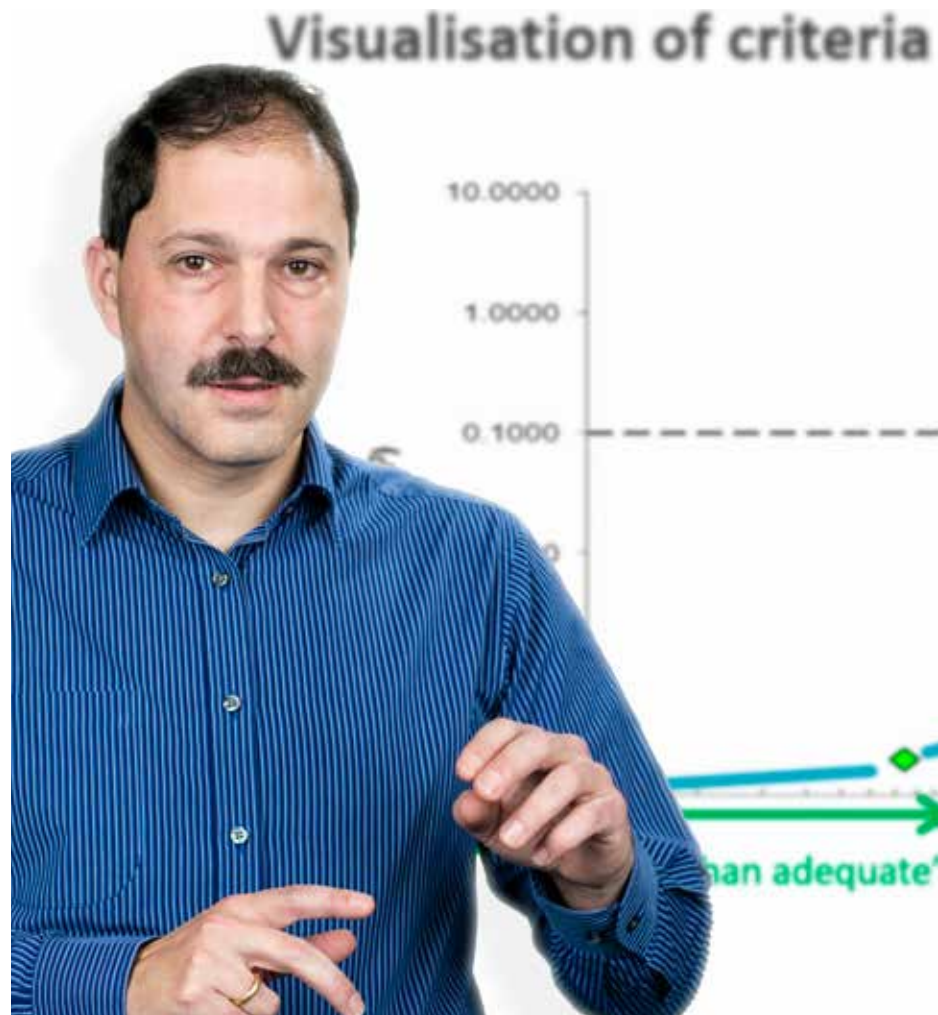
LIBRIS project under the Government's 'Faraday Battery Challenge'



Enabling industry to achieve a safe net zero: Hydrogen safety training course

HYDROGEN HAS THE potential to be used as part of a future net zero energy system that does not release carbon dioxide. Hydrogen can be used as a fuel 'vector' to store and transport renewable energy such as solar and wind generated. For over 20 years HSE's laboratory has carried out collaborative research that is providing evidence being used to underpin the safe introduction of hydrogen as a fuel vector. More novel applications for hydrogen are anticipated as the UK makes progress towards its 2050 net zero deadline.

In 2022, HSE launched a new training course, 'Fundamentals of Hydrogen'. The course helps provide a baseline level of understanding of the behaviour of hydrogen as well as an introduction to the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR). The aim is to aid delegates to identify hazards posed by the introduction of hydrogen into their own applications; an essential step to deployment of effective risk controls to protect people. Following the pilot in August 2022, the course ran four times to March 2023.



Philip Lees, HSE risk assessment and process safety specialist

What were the benefits?

Professor Stuart Hawkworth, Head of the Centre for Energy at HSE's laboratory, and President of HySafe, the International Association for Hydrogen Safety, from 2018 to 2022, says: *'Hydrogen is seen as a key replacement for a number of difficult-to-decarbonise applications. Looking to 2035, and beyond to 2050, we foresee massive growth in its use and for this to happen safely, it is essential that we grow a workforce with the necessary skills and knowledge. This unique training from us at HSE is key to help society achieve this at pace.'*

Further information

- 'Fundamentals of Hydrogen' training course.¹³
- 'Fundamentals of Hydrogen' training course launch video, Two-minute launch video with Professor Stuart Hawkworth.¹⁴

Funding source
Commercial Training



Developing the evidence base to underpin the safety of hydrogen vehicles in tunnels: HyTunnel-CS



Experimental setup for HyTunnel project, showing internal view of the 70m test tunnel with the hydrogen release vessel and ignition instrumentation in the foreground, sensor arrays down the centre of the tunnel to monitor progression of the release.

THE USE OF hydrogen as a fuel in the transport sector, including vehicles, has the potential to contribute to delivering the UK net zero targets. To ensure that current safety levels are maintained, it is important to have scientific evidence on the challenges posed by hydrogen-fuelled vehicles in tunnels and other confined spaces.

HSE scientists were part of the three-year international HyTunnel-CS project, which carried out interdisciplinary research aimed towards

the safe use of hydrogen-powered vehicles through tunnels and in confined spaces. The collaboration brought together researchers, emergency services specialists and standards development organisations, which collectively gave extensive experience. HSE's researchers carried out a large experimental programme including hydrogen jet fires, and ignition and explosion tests in a scale-tunnel facility at HSE's laboratory. This allowed the consideration of fire and explosion mitigation strategies,

What were the benefits?

The scientific evidence generated by the international HyTunnel-CS project has provided key information to underpin the development by industry and other stakeholders of effective prevention and mitigation strategies to maintain safety using the 'safety by design' approach. The major outputs were disseminated through the July 2022 project conference in Brussels, Belgium.

Further information

- The HyTunnel website¹⁶
- Final report on analytical,

numerical, and experimental studies on hydrogen dispersion in tunnels, including innovative prevention and mitigation strategies. HyTunnel, 2022³⁵

- Final report on analytical, numerical, and experimental studies on fires, including innovative prevention and mitigation strategies. HyTunnel, 2022³⁶
- Final report on analytical, numerical, and experimental studies on explosions, including innovative prevention and mitigation strategies. HyTunnel, 2022³⁷

the validation of new computational fluid dynamic models and finite element models for consequence analysis, as well as new engineering correlations for novel quantitative risk assessment methodologies. HSE's researchers also led preparation of the report from the project as a whole,³⁷ synthesising the practical research outputs and giving scientific recommendations for incident prevention and potential mitigation strategies to inform the development of standards, codes and regulations.

Funding source

The contribution by HSE researchers was funded by the European Union's Horizon 2020 Research & Innovation Programme, the Clean Hydrogen Partnership and Hydrogen Europe, the Rail Safety and Standards Board (RSSB), Network Rail, Department for Transport and HSE



Gas network conversion: Science and evidence gathering for the H21 project – flow-stopping methods

THE H21 PROGRAMME,³⁸ led by Northern Gas Networks (NGN), is tackling the challenges of converting the UK gas networks to carry 100% hydrogen. HSE scientists carried out research commissioned by NGN to provide safety-critical evidence to support the viability of a live community 100% hydrogen gas supply trial and to consider the overall feasibility of converting the existing natural gas distribution network to safely transport 100% hydrogen in the future.

To understand how the transition might change the way the gas distribution network is operated and managed, a procedural review was undertaken resulting in reports on:

- Pipeline purging and venting progress;
- Ignition considerations for network procedures;
- Electrostatic testing;
- Personal protective equipment;
- The escape management tool, operational safety distances and minimum evacuation distances;
- Gas characteristics;
- Human factors considerations;
- Evaluation of software tools for modelling; and
- Flow stopping.



An example of a 'squeeze off' flow-stopping method on a polyethylene pipe

To highlight one report on 'flow stopping', it began with a review of relevant procedures, making several recommendations for how stops could be used safely with hydrogen, which concluded that a new basis of safety for flow stops was required. Full-scale experiments were performed on existing network

assets using relevant flow-stopping techniques with hydrogen. Some existing techniques performed better than others, with many being demonstrated as likely to be suitable for future hydrogen use. Based on the results, a new criterion to judge the effectiveness of flow-stopping techniques was developed.

What were the benefits?

The work undertaken to date for H21 has provided a broad knowledge base of how network conversion to 100% hydrogen may occur and the safety implications of doing so. This knowledge and the reports generated are feeding into industrial procedure and standards, helping contribute to the net zero target.

Further information

- The H21 website³⁸
- The NGN YouTube channel³⁹

Funding source
Northern Gas Networks (NGN)



FlyZero: Supporting the safe potential introduction of liquefied hydrogen fuel for net zero commercial flights

THE AEROSPACE TECHNOLOGY Institute (ATI) is responsible for the UK's aerospace technology strategy and programme. As part of its FlyZero project, ATI studied options for zero-carbon-emission

commercial flights and identified that liquid hydrogen produced from renewable energy sources is the best potential option for powering future aircraft over longer distances.



ATI's strategy is focussed on the development of zero-emission commercial flights (Source: ATI)

As part of FlyZero, HSE specialists in process safety, human factors and the physics of liquid hydrogen provided technical support to help ATI understand the potential risks and safety implications of using liquid hydrogen to fuel aircraft, including storage and refuelling on ground. This included a review of regulations, codes and standards, guidance on safety distances, hazardous area classification, control of ignition sources and venting systems. The human factors specialists considered emerging staff task requirements in relation to the concept design, referring to benchmark standards for ergonomics and human factors integration in design.

HSE's scientists, in collaboration with an ATI team of specialists in aircraft-through-life engineering and airline/airport operations and requirements specialists, also carried out hazard identification workshops that looked at liquid hydrogen storage and refuelling operations. HSE's scientists undertook consequence modelling and hazardous area classification exercises considering equipment types that could fail, possible leak sizes and associated failure rates.

What were the benefits?

As a result of this work, ATI has developed a better understanding of the potential risks associated with using liquid hydrogen to fuel future aircraft, including within the airport environment. HSE's scientists also identified key gaps in scientific evidence that will be needed to inform decisions on the safe introduction of hydrogen-fuelled aircraft if this option is pursued.

Further information

- The Aerospace Technology Institute FlyZero website⁴⁰

Funding source
FlyZero – ATI



Development of an optimised Major Accident Hazard Pipelines data repository



Aerial view of pipes at a construction site of a natural gas plant

MAJOR ACCIDENT HAZARD Pipelines (MAHPs) such as the natural gas network have the potential to harm people in the event of an unplanned release of a dangerous substance. Dutyholders must implement effective control measures to prevent unplanned releases. As a statutory consultee for Land Use Planning (LUP) applications in the vicinity of

MAHPs, HSE provides advice aimed at mitigating the potential harmful effects in the event of an incident. HSE's LUP web app allows local planning authorities and developers to obtain pre-application and statutory advice on proposed developments.

HSE's advice requires the use of large volumes of data, both HSE

What were the benefits?

The efficiency gains provided by the modernised system have delivered faster turnaround times from operators notifying HSE of changes under the Pipelines Safety Regulations to updates going live on HSE's LUP web app.

Flexibility in the system also accommodates changing specifications to the natural gas pipeline network including potential repurposing for hydrogen as part of achieving the UK's net zero targets.

HSE's pipeline data specialists have also advised the Cabinet Office's Geospatial Commission on its National Underground Asset Register (NUAR) project.

Further information

- For other information on HSE's approach to land use planning for major accident hazard sites, see HSE website: Land Use Planning (LUP) - Public safety advice⁴¹
- HSE website: Pipelines health and safety⁴²
- United Kingdom Onshore Pipeline Operators' Association (UKOPA) UKOPA website⁴³
- Cabinet Office and Geospatial Commission: National Underground Asset Register (NUAR)⁴⁴

data and that provided by operators, on pipeline routes and associated LUP zones, which must be kept up to date and maintained to a high level of quality within HSE's MAHP data repository. Working with colleagues across HSE divisions, HSE data management specialists have modernised the MAHP data repository using technology to automate data transfer, matching

and processing, increase efficiencies and enable future development. This is underpinned by collaborative data-sharing agreements developed with the UK Onshore Pipeline Operators' Association (UKOPA) and pipeline operators.



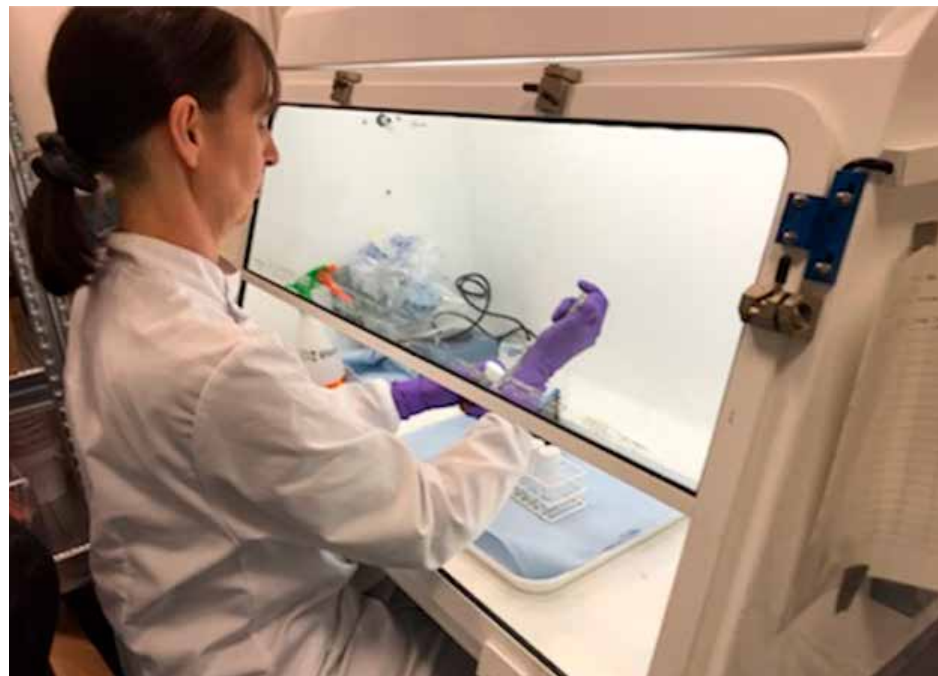
HSE's Biosafety Containment Level 3 training course

HIGH-CONTAINMENT BIOSAFETY laboratories are used for work with hazardous biological agents. These facilities are developed to protect people and the environment and can be found in a number of settings, ranging from research laboratories in universities to biotechnology industries and NHS diagnostic laboratories.

HSE's one-week training course for dutyholders on 'Biosafety - working practices and managing safety at Containment Level 3 (CL3)' is delivered in collaboration by HSE specialist inspectors and microbiologists at HSE's laboratory. The HSE experts are at hand throughout the week to provide their unique insights, advice and support to delegates. The course complements HSE's published

guidance⁴⁵ and primarily focusses on those with management responsibility including laboratory managers and Biological Safety Officers/Advisers. Delegates

from across the sector are fully immersed in a learning experience that delivers a full understanding of the practical design, operation and use of high-containment facilities.



HSE microbiologist working in HSE's Science and Research Centre laboratory

What were the benefits?

Delegates have found the regulatory insights and extensive first-hand experience of those delivering the course invaluable, and that the knowledge and skills they gained gave them greater confidence in their ability to carry out their role effectively in the workplace.

The delivery of this training enables HSE to engage and influence at the right level to promote good standards of practical risk control in the microbiology and biotechnology sectors. By doing so, it helps secure HSE's objective of improving major hazard risk management in these industries, protecting people and the environment from the release of hazardous microorganisms.

Further information

- Health and Safety Executive Biosafety - working practices and managing safety at Containment Level 3⁴⁶



Reducing occupational asthma: Methods for monitoring of airborne isocyanates in the workplace

ISOCYANATES ARE A group of highly reactive chemicals with many applications including the manufacture of foams and coatings. Exposure to airborne isocyanates has, for decades, been a leading cause of occupational asthma; this should be largely preventable if employers have effective control measures in place.

To protect workers, dutyholders' control measures must ensure that exposure to workers is below a legally binding Workplace Exposure Limit (WEL) and as low as reasonably practicable. In Great Britain, the WEL for isocyanates is not based on a single substance but on 'total reactive isocyanate group' (TRIG). The measurement

method currently used (MDHS 25/4) to monitor airborne isocyanates uses a chemical (1-(2-methoxyethyl) piperazine) which is subject to Home Office licensing controls under the Misuse of Drugs Regulations 2001. This creates challenges for anyone monitoring airborne exposures as they must comply with the Home Office licensing controls. As a result, there is a need for alternative measurement methods.

HSE researchers reviewed potential alternative measurement methods. They found that all the methods had shortcomings and that the current method remained the most appropriate one, although two are of interest. The first uses dibutylamine, instead of 1,2-MP, in a commercially available sampler. However, despite its increasing popularity, it cannot currently be considered a TRIG method and would therefore have limited use. The second uses diaminonaphthalene; however, this method is not validated, and practical issues were encountered with availability and stability.



Application of isocyanate-containing paints during motor vehicle repair

What were the benefits?

This review demonstrated that the current method for measuring airborne levels of isocyanates (MDHS25/4) remains the only suitable method for use in workplaces as part of protecting workers' health. The scientific findings were presented at AIRMON 2022, an international symposium on modern principles of air monitoring and biomonitoring.

Further information

- Health and Safety Executive (HSE). (2015) MDHS 25/4 Organic isocyanates in air⁴⁷
- Total Reactive Isocyanate Group (TRIG) Measurement – a Commentary AIRMON 2022 an international symposium on modern principles of air monitoring and biomonitoring. Bristol, United Kingdom 7–10 November 2022⁴⁸



Improving workplace exposure measurements for respirable crystalline silica

INHALATION OF WORKPLACE aerosols containing respirable crystalline silica (RCS) can cause silicosis and lung cancer. In workplaces, like quarries, mines and construction sites, the risk of exposure can vary depending, for example, on the proportions of RCS in materials, the tools used and the working environment. Rapid on-site exposure measurements could help identify where additional control



Exploded design for modified filter cassette holder for respirable sampler

measures are needed to protect workers. Currently, personal worker exposure results can take weeks to return from laboratories.

Portable Fourier transform infrared (pFTIR) instruments are potentially a useful and cost-effective first step to provide early on-site tests and reduce the time taken to improve controls. Two potential obstacles are the handling of delicate aerosol filters and the spectral interference of other minerals during measurement, which can cause errors. To tackle these, a multidisciplinary team including aerosol scientists, designers and researchers at HSE and the National Institute for Occupational Safety and Health (NIOSH) in the United States collaborated to test a modified filter cassette. The filter cassette, designed at HSE, allows a through-filter cassette measurement to be made without removing the filter from the case. Secondly, HSE researchers studied the use of chemometric methods to prevent errors due to the presence of other minerals.

What were the benefits?

This research has successfully tackled two obstacles to the use of portable instruments to provide early on-site measurements of worker exposures to respirable crystalline silica. Firstly, the modified filter cassette developed by HSE researchers removes the need for a person to dismantle the apparatus and reduces handling errors. Secondly, chemometric methods reduce the need for specialist interpretation of pFTIR spectra, enabling their wider use and improving accuracy by an average of 20%.

Further information

- Silicosis video, HSE's chief

medical advisor, Professor David Fishwick, provides an overview of the risks of silicosis caused by past exposure to respirable crystalline silica⁴⁹

- Journal publication: Application of a Fourier transform infrared (FTIR) principal component regression (PCR) chemometric method for the quantification of respirable crystalline silica (quartz), kaolinite, and coal in coal mine dusts from Australia, UK, and South Africa⁵⁰
- Journal publication: Multicomponent measurement of respirable quartz, kaolinite and coal dust using Fourier transform infrared spectroscopy (FTIR)⁵¹



FTIR instrument



Modified cassette and holder in a portable FTIR

Funding source

HSE and the National Institute for Occupational Safety and Health (NIOSH), United States of America



Reducing lung disease: expert workshop on metalworking fluid and use of compressed airguns in machining

WATER-MIX METALWORKING fluids (MWF) are widely used to cool machined parts in cutting and grinding machines. Employers must ensure effective exposure control measures are in place to protect workers from potential health risks. Potential risks include inhalation of small MWF droplets and mist, causing lung diseases such as severe asthma and hypersensitivity pneumonitis, and skin disease (dermatitis) from contact with MWF. The use of compressed airguns by machinists to clean machined components can generate MWF mist composed of droplets small enough to be inhaled. Therefore, the use of alternative cleaning methods that do not generate droplets and mist could help to reduce the risk of lung disease.

An expert workshop, including representatives from the machining industry and lubricant manufacturers, was



The deposition of fluorescent-labelled MWF onto the body of a test manikin after operation of a compressed airgun

used to elicit views on the use of compressed air-guns and barriers to adopting alternative cleaning methods. The workshop participants had four key conclusions:

- Industry was familiar with the risks of injuries from equipment and noise-induced hearing loss but was less familiar with the risks of lung and skin diseases.
- Experienced machinists regarded compressed airguns as the most effective tool to clean and prevent damage to the machined component.
- New airgun designs reduced aerosol formation, droplets splashed back onto the operator, and noise. However, their higher cost may be a barrier to wider adoption.
- Industry needed to share more evidence about alternative cleaning methods.

What were the benefits?

HSE is using the workshop findings, which were published in 2022⁵², to inform ongoing inspections and engagement with industry to protect workers.

Further information

- HSE research report: Metalworking fluid and use of compressed airguns in machining: Expert workshop⁵²



Supporting enforcement to protect the health of workers using hand tools

HAND-HELD POWER tools such as saws and drills can produce noise and vibration. Occupational levels of exposure can damage workers' health if they are not effectively controlled. Noise exposure can cause hearing damage and vibration can cause hand-arm vibration syndrome (HAVS).

The use of battery-powered hand tools at work is increasing, for example in construction, motor vehicle repair and grounds maintenance. Many manufacturers of power tools suggest that battery-powered tools have considerably less noise and vibration emissions. However, the accuracy of these suggestions is not known.

HSE scientists carried out research to compare noise and vibration emissions by battery-powered hand-held tools with those by traditionally-powered equivalents. The researchers made 'in-use' tests on a representative selection of tools: chain saws, cut-off saws, combi-drills, reciprocating saws,



Worker using a hand-held power tool

impact drivers/wrenches and angle grinders. The researchers found that the noise and vibration emissions of battery-powered tools can be higher or lower than those of traditionally powered equivalents.

These findings support the use of HSE guidance on 'Hand-arm Vibration' L140 (2019)¹⁰¹ and 'Controlling Noise at Work' L108 (2008)¹⁰² to protect workers. Dutyholders should:

- identify tools capable of doing the job efficiently; and then
- consider emission data to avoid tools that have unusually high noise or vibration emissions.

What were the benefits?

Chris Steel, HM Principal Inspector of Health and Safety, and noise and vibration specialist, said *'This means we can give solid advice to our inspectors on where battery-powered tools will and won't make a difference to HAVS risk. It will have a direct impact on the Noise and Vibration team's enforcement activities.'*

Further information

- HSE research report: Hand-arm vibration and noise emissions of battery-powered tools compared with equivalent traditionally powered tools⁵³



Protecting angle grinder users from ill health caused by noise and vibration

HAND-HELD ANGLE grinders are widely used across various industry sectors, including steel frame fabrication, where a high number of hand-arm vibration syndrome (HAVS) Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) reports have been submitted. HAVS

is a painful disabling disease of the hands affecting blood vessels, nerves and joints. These tools typically produce high levels of vibration, meaning that there may be a risk of ill health for operators. Angle grinders also produce high levels of noise and dust, making them a significant contributor to

occupational noise exposures, with sufficient dust output to contribute to respiratory illnesses.

The most effective way of controlling emissions from grinders is to reduce or eliminate their use. An HSE noise and vibration specialist investigated alternative processes to grinding as well as methods designed to reduce HAVS, and noise and dust emissions.

Vibration, noise and dust measurements were made on a selection of angle grinders and hand-held power tools designed as grinder alternatives for specific tasks. For the grinders, standard wheels suitable for each activity were compared with wheels the manufacturers claimed reduced vibration, noise or dust. Three activities assessed were: grinding of welds, bevelling of mild steel and cutting of rebar.

Measurements showed using alternative wheels could significantly reduce emission levels of vibration, noise and dust. Additionally, there are alternative tools available that can complete the tasks more quickly, so reducing the operator's exposure.



An angle grinder being tested for noise and vibration

What were the benefits?

Alternatives to angle grinders and alternative abrasive wheels will be promoted to HSE inspectors and wider industry through new guidance. In addition, HSE inspectors will be able to use this work as evidence of reasonably practicable controls when enforcing.

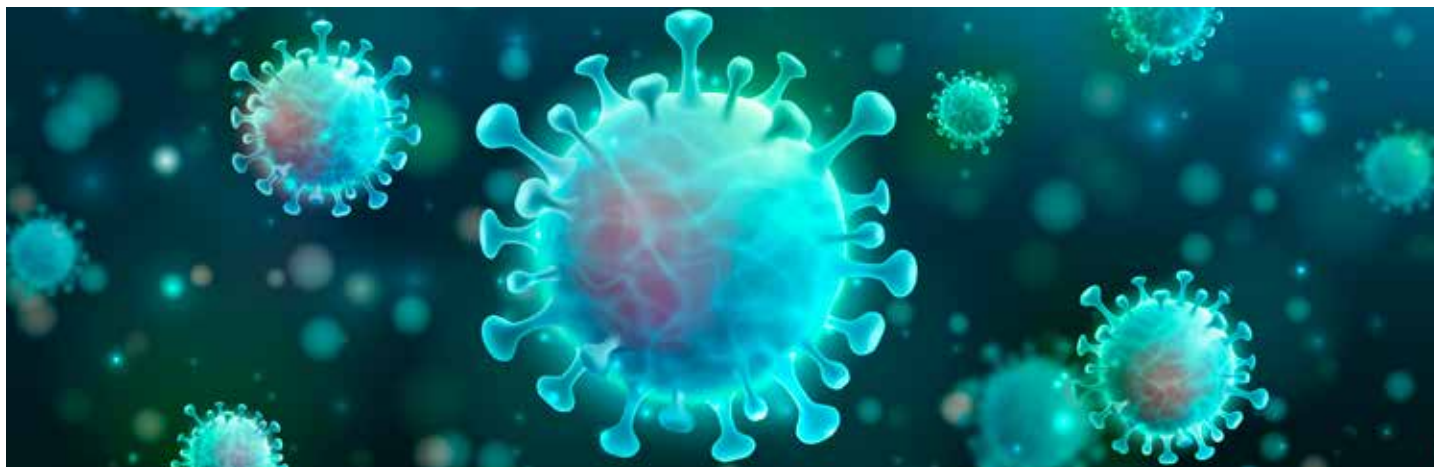
The data collected in the measurements will be useful to specialist inspectors when working on HAVS RIDDOR investigations.

Further information

- Trade and professional magazine article: Lower noise, vibration and dust emissions from angle grinding - recent HSE research⁵⁴
- Trade and professional magazine article: Lower noise, vibration and dust emissions from angle grinding⁵⁵
- Conference paper: Influencing companies to purchase lower noise consumables⁵⁶
- Case study on HSE website: Alternative processes to grinding in order to lower or eliminate risk to workers using angle grinders. Solutions from HSE⁵⁷



The PROTECT COVID-19 national core study



THE PROTECT COVID-19 National Core Study aimed to improve our understanding of how SARS-CoV-2 (the virus that causes COVID-19) was transmitted, and how this varies in different settings and environments. The intention was to enable more effective measures to stop transmission, saving lives and getting society back towards 'normal'.

The study was delivered by more than 200 researchers from 16 institutions across the UK including HSE. Beginning in October 2020 as part of the COVID-19 National Core Studies programme, it completed in March 2023. The final year of the programme focussed on

understanding what information our stakeholders needed and in what format, and ensuring the programme's legacy for future pandemic preparedness.

The programme has also delivered some important unintended benefits. Critically, we have created a globally unique interdisciplinary team of scientists, analysts and engineers who are all focussed on addressing a specific problem. In addition, our research community is drawn from academic institutions, public sector research establishments and the private sector. Working across these traditional boundaries has given

us rapid access to a much wider range of networks to help deliver a rapid route to impact. This mission-driven approach to delivering new knowledge, regardless of discipline or position in the UK science system, has enabled us to be innovative in our thinking and join separate pieces of information together. For example, the ability to undertake experiments which collected information about how close people are to each other in the work environment was critical for the development of the computational models, and the collection of real-world data through our investigation of outbreaks allowed the assumptions in the models to be validated.

What were the benefits?

This network of researchers will endure beyond the end of the study and will become one of the key legacy outcomes from this work, providing the UK with a national capability that can respond rapidly should future pandemics occur.

Further information

- PROTECT COVID-19 National Core Study News and publications – PROTECT COVID-19 National Core Study⁵⁸

Funding source

The PROTECT National Core Project is funded by HM Treasury and managed by HSE



Modern decontamination interventions may help to control SARS-CoV-2 transmission

MANY DEVICES FOR air cleaning and surface decontamination using germicidal ultraviolet (UV) irradiation treatment are available. During the COVID-19 pandemic, there was a focus on their potential to reduce the spread of the SARS-CoV-2 virus. HSE's microbiologists and aerosol scientists, who are experts in decontamination, examined the efficacy of these devices.

HSE's scientists assessed five different air-cleaning devices, containing high-efficiency air filters, for their ability to remove an airborne biological challenge under room-

scale conditions using the controlled atmospheric chamber at HSE's Science and Research Centre. The biological challenge test used a low-hazard bacteriophage surrogate for viral SARS-CoV-2. The results were compared with control tests where no air cleaner was present. The scientists also assessed the ability of four devices to deliver germicidal UV to surfaces in order to reduce levels of a bacteriophage challenge. Additional tests included determining the effectiveness of UV treatment for decontaminating respiratory protective equipment for potential reuse.



Close-up image of multiple impinger air samplers used for sampling during air cleaner testing



Multiple germicidal UV lamps located within one of the tested UV cabinets

Experimental set-up of multiple air samplers (left) and aerosol generator (right) as used during air cleaner chamber testing

What were the benefits?

The research by HSE scientists confirmed that automated decontamination technologies can help to control the levels of microorganisms in the air and on surfaces, under laboratory test conditions. They may offer infection-control benefits when used alongside other recognised control measures, such as chemical disinfection of surfaces and mechanical ventilation treatment of indoor air.

Further information

- Scientific Advisory Group for Emergencies Environmental Modelling Group: Potential application of air cleaning devices and personal decontamination to manage transmission of COVID-19, 4 November 2020 - GOV.UK⁵⁹
- Health and Safety Executive: Re-use of personal protective equipment (PPE) during the SARS-CoV-2 (COVID-19) pandemic: Evidence summary to August 2020⁶⁰
- Journal publication: Room based assessment of mobile air cleaning devices using a bioaerosol challenge⁶¹

The research showed that the air-cleaning devices gave measurable reduction in airborne bacteriophage. The best-performing machines achieved major reductions, amounting to the equivalent of removing tens to hundreds of thousands of bacteriophage from each cubic metre of room air over the test period. Devices with the highest airflow rates and containing high-efficiency filtration gave comparable results to those that combined

air filtration and UV treatment, with most machines offering measurable outcomes without high expense. Germicidal UV treatment of surfaces, including respiratory protective equipment, also reduced contaminating organisms.

Funding source

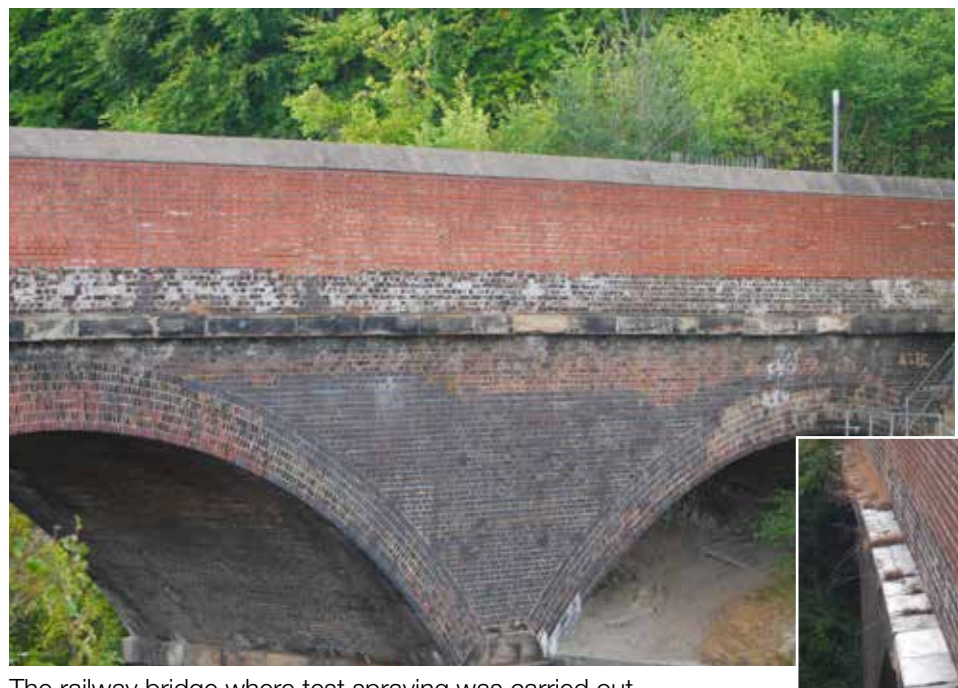
The PROTECT National Core Project is funded by HM Treasury and managed by HSE



Authorisation of first UK application of a pesticide using a drone

HSE'S CHEMICALS REGULATION Division (CRD) authorises pesticides for use in the UK including the method of application. The applicant must demonstrate that the proposed use is safe for people and the environment.

Railscape Ltd has developed a method to apply chemical herbicides to railway infrastructure using drones. The aims include removing the risks of working at height, predominantly at night, under artificial lighting in a restrictive area and under the pressure of time constraints. In consultation with CRD and the Civil Aviation Authority (CAA) and after conducting extensive development and testing, the company has designed and patented a method of applying herbicide using a drone in a precision manner to vegetation at height or in difficult-to-access areas. For its application to CRD for authorisation, the company worked closely with Harper Adams University and RUAS (a drone services and training provider) to provide information on potential drift of the pesticide.



The railway bridge where test spraying was carried out

Evaluation of the proposal by CRD specialists established that herbicides can be effectively applied directly to the target plant using this system, within the limits set for other application equipment, without the requirement

for rope-access or height-access equipment. In addition to the safety advantages to workers, the new application method is precise in pesticide targeting and delivery, and will use considerably less pesticide with less risk of spillage.

What were the benefits?

The evaluation by HSE specialists allowed the first authorisation for pesticide application by a drone in the UK. This evaluation enables dutyholders to improve safety for workers while maintaining effective application of a pesticide.

Further information

- [HSE's Pesticides website](#)⁶²

Funding source
Railscape Ltd



Improving fatal injury statistics: the importance of quality statistical information

STATISTICIANS HAVE WORKED with key stakeholders this year to improve the quality of HSE's data on fatal injuries and the efficiency with which it is acquired. This data forms part of a suite of National Statistics which are fundamental to ensuring HSE's mission.

Any work-related accident which results in a person being killed must be reported, either to HSE or to a local authority, under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR). HSE publishes annual statistics relating to these deaths, allowing trends to be monitored over time. HSE statisticians work closely with colleagues involved in the investigation of these accidents, to validate the underlying information and ensure that counts are based on the most complete and accurate information available.

For deaths reported to HSE, statisticians undertook a review of quality issues identified in their annual audit of the data. They worked with the HSE team responsible for business intelligence and internal stakeholders to improve support and guidance provided to those inputting the



data. Through this quality review and collaborative working, the team is now able to review decisions with colleagues and correct issues much earlier in the process.

For deaths reported to local authorities, improved processes for validating reports have been developed. Statisticians are now able to standardise responses from different local authorities and communicate with them clearly about the relevant regulatory policy that applies to potential cases.

What were the benefits?

The benefit of quality statistics comes from informing decisions across the health and safety system. HSE can be confident policy is based on robust science, while partners and the public are assured of the accuracy and reputation of HSE statistics.

Further information

- Work-related fatal injuries in Great Britain, 2022 ([hse.gov.uk](https://www.hse.gov.uk))⁶³
- Statistics - Quality guidelines ([hse.gov.uk](https://www.hse.gov.uk))⁶⁴
- Statistics - User engagement ([hse.gov.uk](https://www.hse.gov.uk))⁶⁵



Investigation into a fatal incident involving a mobile elevated work platform

AN ENGINEER CARRYING out a pre-delivery inspection on a mobile elevated work platform (MEWP) was killed when the machine toppled over, falling onto the M25 motorway. HSE regulatory inspectors visited the scene and made initial assessments of the circumstances. They subsequently engaged colleagues from the technical support team of HSE's Science and Research Centre, Buxton, to assist with the recovery and transportation of the MEWP to HSE's facilities in Buxton.

The investigative work carried out by HSE's Science and Research Centre, Buxton, was technically led by an electrical control specialist in major hazards. He was assisted by fellow specialists and supported during testing by specialists in the Advanced Imaging Solutions (AIS) Team from HSE's Science and Research Centre.

The extensive investigation focussed on systems involved in the calibration and measurement of the machine's boom angles. It was discovered that a mis-calibration of a boom angle sensor had allowed the MEWP's telescopic boom to

be extended while at a point in its range of motion, at which it should not, by design, have been able to. This resulted in the boom being able to be extended to a position beyond the machine's safe working limit, resulting in it tipping over.



Position of MEWP following toppling incident with the boom falling outside the confines of the premises, onto the M25

What were the benefits?

The investigative work by HSE's engineers provided evidence demonstrating that a mis-calibration of the boom angle sensor caused the incident, and that this occurred through incorrect data being manually manipulated and uploaded.

Further information

- HSE press release: Company fined after fatality involving a mobile elevating work platform⁶⁶



Investigation into fatal explosion at Briar Chemicals



Flammable gas monitors being tested in the HSE's Science and Research Centre Standard Atmosphere test facilities

THE TRAGIC EXPLOSION at Briar Chemicals in 2018 killed a welder who was carrying out maintenance work on a mixing vessel. The HSE investigation found that toluene residue had leaked into the vessel from faulty valves, producing a flammable atmosphere. Workers

had checked the atmosphere with a flammable gas monitor prior to their work beginning. However, the gas monitor had failed to detect the presence of a flammable vapour. Hot work had proceeded in the belief that there was no flammable vapour present.

Specialists at HSE's laboratory analysed the gas monitor's data logs and tested its response. This showed that the monitor had been incorrectly set up. As a result, the monitor took about 7 minutes to alarm on exposure to flammable toluene vapour. It should have taken less than 2 seconds. The laboratory tests included testing the incident gas monitor and other differently configured monitors against a variety of test vapours using HSE's Standard Atmosphere test facility. The analysis showed that a significant contributor to the failure of the monitor to detect the flammable toluene vapour was it being adsorbed on the inner surface of the sample tube. This meant that when the monitor was used during the incident, no flammable vapour had reached the detector before the monitor test was completed. Other factors included the incorrect flammable gas sensor and that the monitor was configured for methane rather than toluene. The issues with the monitor resulted in a false conclusion that the work area was free of flammable vapour.

What were the benefits?

During the prosecution, the impartial expert evidence, provided to the court by HSE's scientists, demonstrated that the gas detection monitor had been incorrectly set up. The firm pleaded guilty to a breach of regulations regarding major accident hazards and was fined £1 million. This incident has highlighted the importance of selecting the correct systems for gas detection and verifying the effectiveness of the detection system. HSE recommended that users should function test monitors with the gases they are being used to measure and not the standard calibration gases. This information was disseminated immediately via an HSE safety alert.

Further information

- BBC News article: Briar Chemicals fined £1m over fatal explosion⁶⁷
- HSE safety alert: Failure to detect dangerous gas/vapour due to incorrect specification of sample tube. Health and Safety Executive - Safety alert, CEMHD1 – 2020⁶⁸



Investigation of a fatality during training in the use of a pedestrian-operated powered trailer mover

AN EMPLOYEE OF the delivery firm Hermes was crushed to death while being trained to manoeuvre a loaded HGV trailer using a pedestrian-operated powered trailer mover. The employee was crushed between the arm of the trailer mover and another stationary HGV trailer present in the yard.

Specialists in the Advanced Imaging Solutions (AIS) team at HSE's Science and Research Centre assisted the HSE inspectors with the investigation. HSE support was

provided to the case at both the scene in Scotland and a test location in England. During the trailer mover tests, AIS assisted by videoing and photographing a number of tests and demonstrations of the machine to aid understanding by the court. The investigation found Hermes had failed to properly plan and assess the risks of training taking place in their yard. They had not implemented their own policy that suitably trained banksmen would be used while trailers were being moved – including during training.



Pedestrian-operated trailer mover undergoing HSE testing

What were the benefits?

HSE's specialists found Hermes had failed to properly plan and assess the risks of training taking place in their yard. The video evidence and images provided by HSE's advanced imaging specialists aided understanding by the court. Hermes Parcelnet Limited, Leeds, pleaded guilty on 23 May 2022 to breaching the Health and Safety at Work etc. Act 1974, Section 2(1)⁶⁹ and Section 33(1)(a)⁷⁰ and were fined £850,000. (Hermes Parcelnet is now called Evri.)

The lead inspector on the case said *'This was an example of real teamwork across HSE involving several staff in my team: specialists locally [central Scotland] and and at the test*

location in England to assist with the testing of the trailer mover; visiting officers locally and nearer Peterborough taking statements and authenticating documents, and Science and Research Centre specialists who produced some excellent video and photography work to illustrate the operation of the trailer mover, which helped the court to understand its operation.'

Further information

- HSE press release: Parcel company fined after employee crushed to death⁷¹
- Newspaper article: Croal S. Hermes fined £850k after Scots worker crushed to death at Eurocentral depot⁷²



Investigation into platform collapse during deconstruction of an oil rig



Collapsed platform seen from the main structure

A NORTH SEA oil rig had been brought to shore to be dismantled; this is known in the industry as deconstruction. During deconstruction, workers were cutting a platform on the structure, when the platform suddenly collapsed to the ground 15 metres below while they were standing on it. One worker was seriously injured.

An HSE construction specialist examined the collapsed platform and the main structure to identify the cause of the collapse. The dutyholder provided drawings of the structure, method statements and other documents to assist with the investigation.

What were the benefits?

The HSE construction specialist prepared an expert witness report for the court. The dutyholder pleaded guilty to health and safety offences.

The incident highlighted:

- the importance of obtaining relevant information about the structure prior to starting the work;
- the need for structural surveys and analysis to be carried out;
- a sequence of work to be identified and adhered to; and
- ensuring safety procedures are implemented and adhered to.

These lessons learned have been disseminated through presentations to industry and trade bodies, including the Institute of Demolition Engineers and through engagement with stakeholders during HSE interventions on offshore and other high-risk demolition sites.

Further information

- HSE press release: Company fined after a worker falls from height when platform collapses⁷³
- BS6187 Code of Practice for Full and Partial Demolition⁷⁴
- Managing Health and Safety in Construction – Construction (Design and Management) Regulations 2015⁷⁵

The construction specialist concluded there had been several factors which caused the unplanned collapse:

- The platform was different to others on the structure, having been retrofitted using a mixture of bolted connections and welding to the main structure.
- The bolted connections were not

identified during planning stage.

- The bolts were severely corroded, reducing their strength further.
- The cutting sequence was incorrect and placed excess load from the platform onto the, unaccounted for, bolts and remaining steel connections, resulting in the unscheduled collapse.



Protecting freight container workers at ports and distribution centres from hazardous atmospheres

PORT AND DISTRIBUTION workers who play a crucial role in making sure items are delivered to buyers could be putting their health at risk. These containers are opened on arrival by workers at Great Britain's ports and distribution centres around the country. Workers who open or enter the containers could be exposed to dangerously low oxygen levels, or to hazardous substances in the air which have built up as a result of limited ventilation while they are sealed.

To learn more about the potential risks to workers, HSE occupational hygienists carried out research which involved visits to six ports and two distribution centres. The research confirmed that there is the potential for exposures when opening freight containers that could lead to asphyxiation or ill health if effective control measures are not in place. It identified a range of good-practice control measures at the six ports. However, the researchers did not find adequate safe systems of work at the two distribution centres: as this was only a small sample size, the findings cannot be considered representative of the distribution sector.



What were the benefits?

Nicola Jaynes, from HSE's Transport and Public Services Unit, said *'This important research underlines the need for suitable and sufficient risk assessment when conducting this type of work. HSE is using the findings to inform and engage with the industry and local authority regulators.'* HSE issued a press release in October 2022 which was widely covered by national and international trade and professional magazines and online bulletins.

Further information

- HSE research report: Freight containers: Potential worker exposure to hazardous atmospheres at ports and distribution centres⁷⁶
- HSE press release: Freight containers – Potential worker exposure⁷⁷



A 'one-stop-shop' for trusted information on home improvement including health and safety

SMALL COMPANIES represent 98% of the construction sector and have the highest levels of risk to workers and non-compliance with legal requirements. The improvements in workplace health and safety in medium and larger construction businesses have not been replicated in smaller businesses where, in addition to inspection,

HSE relies on communication channels and messaging.

HSE collaborated with the Construction Industry's Advisory Committee (CONIAC) to deliver a four-year programme of insight and service design on small- and medium-sized enterprises (SMEs). HSE specialists:

- generated insight on issues and needs – through a literature review, internal workshops and qualitative research with smaller construction businesses and clients;
- developed new concepts and potential intervention approaches - through co-creation workshops with CONIAC stakeholders; and
- iterated and improved intervention design and communications – through commissioned user-testing.

One outcome from the work was to target and empower those who have significant influence on small-scale project work carried out by SMEs – namely homeowners. HSE specialists, with support from our products and publications partner, The Stationery Office (TSO), developed a working prototype for a mobile application (an app): a 'one-stop-shop' for information on typical home improvement projects - including safety considerations. This prototype was taken on by TrustMark (a leading home improvement social enterprise), who funded and developed a functional app which is now publicly available. The app will be further improved following user feedback.



Graphics from the TrustMark: Home Improvements app

What were the benefits?

The 'Home Improvements' app is designed to:

- improve homeowners' knowledge and skills in hiring tradespeople/contractors and managing the process for refurbishment, ensuring health and safety is considered throughout; and
- drive up standards of professionalism and health and safety practice among tradespeople/contractors at the smaller end of the construction industry.

Further information

- The first iteration of the app is freely available to download on Android and Apple Stores. Search TrustMark: Home Improvements.⁷⁸

Funding source
HSE and TrustMark

Meet the staff





Sara Peacock

Fire Safety Information Assessor

BEFORE JOINING HSE'S shadow Building Safety Regulator, Sara worked with Humberside Fire and Rescue Service and Cleveland Fire Brigade as a Business Safety Inspector.

She studied at the Fire Service College, obtaining a Fire Safety Diploma among other qualifications, and is a member of the Institute of Fire Engineers.

Sara inspected fire safety measures within business premises and assessed building plans to ensure access and facilities for the fire and rescue services were suitable.

Now, Sara is part of HSE's Planning Gateway One team (PGO), a newly established statutory consultee



service in relation to fire safety for high-rise residential buildings. Sara is part of a small team of Fire Safety Information Assessors (FSIAs) and support staff. As an FSIA, Sara reviews fire safety considerations in planning applications and advises the local planning authority of any concerns. PGO forms the first of three 'Gateways' that are being established following the recommendations made in the Independent Review of Building Regulations and Fire Safety.⁷⁹

PGO is providing an indication about what a more stringent regime will look and feel like. The message to industry is to understand the new fire safety design landscape and respond positively to the regulatory changes. Only by doing this can industry restore confidence in its developments to residents, firefighters, regulators and the general public.

Sara says: 'I really enjoy working within Planning Gateway One. I'm passionate about the work that I do, as I strongly believe we're helping shape the future of building fire safety supporting our fire and rescue services, and residents of high-rise buildings.'



Steve Parncutt

Civil engineer and Head of Operations

STEVE STARTED OUT in the construction industry in 1985 as a trainee civil engineering technician with a local authority. Here he was involved with the full range of local authority civil engineering projects such as drainage schemes, road improvements and pedestrian safety. After becoming chartered in 1997 Steve joined the structures team of a large international consultancy, where he designed and delivered bridge and highway schemes across the UK. He also had a spell working in Hong Kong helping to develop local civil engineering graduates.

Steve joined HSE's Civil Engineering Specialist Team in 2008, where he provided day-to-day technical support to front-line inspectors and expert witness testimony in courts and at inquests.

Throughout his career Steve has maintained close links with the Institution of Civil Engineers (ICE). In 2016 he developed a scheme that would allow existing HSE staff who already had the appropriate qualifications to progress through a structured programme that would see them become chartered civil engineers and full members of



the ICE. In 2017 the scheme was accepted by the ICE and HSE's Construction Division became an ICE Approved Employer.

Steve says: 'I am extremely proud of the work I have done to help the professional development of my HSE colleagues. By developing a route to chartered civil engineer status we are able to provide opportunity for eligible staff to contribute to the important work our civil engineering specialists undertake.'



Iwona Rosa

Exposures and Health Consequences
Bio-scientist

IWONA GRADUATED IN Poland, gaining a Master of Food Technology and Nutrient Sciences. She started at HSE in 2015 as a microbiology technician within the Science and Research Centre in Buxton. She had limited microbiology knowledge and English as a second language, but a great deal of enthusiasm, determination and willingness to get involved and learn from others paid off. She has progressed to a band 4 Bio-scientist.



During the seven years HSE has provided many opportunities for Iwona to increase her knowledge and develop technical skills. She has been involved in a wide range of projects looking at workers' exposure to airborne microorganisms. From 2020 her main focus since has been evaluating a method, for the Animal and Plant Health Agency, for testing disinfectants against *Mycobacterium bovis* - a hazard group 3 pathogen that is endemic in the UK and causes significant disease in cattle, thereby causing financial hardship for the agricultural industry. In an unusual project done for Thales Alenia Space, she was responsible for the analysis of samples to inform their work to ensure none of the Earth's microorganisms would contaminate Mars via Mars Rover parts.

She has not stopped developing and continuously looks for areas where she can improve and broaden her knowledge to become a more experienced scientist.

Iwona says: *'I think it is important to have a positive attitude, talk to others, ask questions and be open to new adventures, even when they look very challenging.'*



Sofia Sangiorgi

Regulatory Scientist and Ecotoxicology
Specialist

SOFIA HAS A DEGREE in Marine Biology with Oceanography and a master's degree in Environmental Science and Management. Sofia joined HSE's Chemicals Regulation Division, York, in 2021 and works in the Ecotoxicology Team, which is responsible for ensuring that plant protection products and biocides do not have unacceptable effects on the environment.

Her day-to-day role involves the ecotoxicological assessment of pesticide and biocide active substances and products by scientifically assessing relevant studies on non-target organisms and carrying out environmental risk assessments for organisms in the terrestrial and aquatic environments.

Sofia's work so far has mainly been on plant protection products in the context of Regulation 1107/2009⁸⁰ for placing plant protection products on the market. She is developing her knowledge of the relevant regulations and how they translate into scientific testing and principles. She is undergoing extensive training to become experienced in all the areas that the team works on. The role is very varied as every product has its own set of challenges and



requires a balance of regulatory and scientific considerations.

Sofia says: *'I am excited by the opportunities for development that my role presents. Working in the ecotoxicology team is extremely fulfilling. The day-to-day job is varied and full of opportunities to interact with scientific experts in other technical areas. Knowing how impactful my work is in terms of environmental protection gives me a sense of purpose that I do not think I would find outside of my role.'*



Rory Hetherington / Liam Gray

Computational Fluid Dynamicists

RORY AND LIAM work at HSE's Science and Research Centre and have been contributing to research into the mechanisms of transmission of the SARS-CoV-2 virus. Both are relatively new to the organisation and were involved in COVID-19 research using Computational Fluid Dynamics (CFD) at the University of Leeds immediately before starting at HSE.

Rory joined the Fluid Dynamics team in September 2021 after working as a researcher at the University of Leeds studying SARS-CoV-2 transmission using CFD.⁸¹ Before this, he had done a maths degree, and a PhD in Fluid Dynamics.

Since joining HSE, Rory has worked on a variety of research areas including in the PROTECT COVID-19 UK National Core Study.⁵⁸ Rory did CFD simulations to study particle dispersion when a person is coughing or speaking within a typical office environment. He also studied the potential mitigation effects of desk dividers, computer monitors and ventilation. Rory has also done research into modelling the dispersion of toxic gases: this modelling is important to understand potential releases from industrial sites. His research is part of the Jack

Rabbit III international project.⁸² This involves investigating the dispersion of pressure-liquified toxic substances and is helping to understand which parameters are critical in modelling such releases. The research Rory has contributed to has been presented at international conferences.

Rory says: *'My role within HSE as a fluid dynamicist is incredibly varied, not only in the areas we work, but also with the methods utilised. There is a direct connection between the science we undertake and the consequences of our analysis. It is therefore incredibly rewarding.'*

Liam joined the Fluid Dynamics team in March 2022 while pursuing a PhD in sprays generated from deodorant-type aerosol cans at the Centre for Doctoral Training in Fluid Dynamics at the University of Leeds. Previously Liam had completed a Masters in Maths from the University of East Anglia modelling the motion of vortex rings.

Liam's main specialism is the modelling of droplets and aerosols. Before joining HSE, Liam had undertaken a COVID-19 research project with the UK Health Security



Rory Hetherington (left) and Liam Gray

Agency looking at optimising aerosol sampler positions in a novel 'cough box' isolator.⁸³ Liam has continued in this field of research while at HSE through the PROTECT project. He has been studying the effectiveness of mitigation strategies such as screens on the different-sized droplets generated during talking and coughing.⁸⁴ His research involves running highly complex CFD simulations that account for the effects of the interaction of different-sized particles with the ventilation flow, deposition and particle evaporation.

Liam is also involved in a project modelling the spreading of large pools of highly flammable liquid. This work is being used to inform the advice given by HSE in Land Use Planning assessments.

Liam says: *'After only recently joining HSE I've already been able to touch on a variety of new and exciting research areas. The diversity at HSE is great and I'm looking forward to the future projects I'll be working on and opportunities for collaboration both inside and outside of HSE.'*



Martyn Sime

Explosives Engineer and Principal Inspector

MARTYN IS A CHEMIST and a fellow of both the Royal Society of Chemistry and the Institute of Explosives Engineers.

After obtaining a degree in Chemical Sciences Martyn joined the Ministry of Defence's forensic capability. He started as a trace analyst, developing equipment and analysing samples for the presence of traces of explosives, before becoming a case officer working with the police and foreign governments to investigate terrorist incidents.

Martyn's early career sparked his interest in how science and the law interact. As an HSE specialist inspector he uses his scientific skills to decide whether dutyholders' safety controls are adequate and reflect the likelihood and consequences of an



event involving the explosives they are working with. He has undertaken technical roles such as leading a fundamental review of explosives licensing, acting as the technical lead for the consolidation of Great Britain's explosives legislation and writing the supporting guidance.⁸⁵ He has represented Great Britain at several regulatory and standard setting bodies including the United Nations.

Martyn's current role brings his different competencies together to support colleagues in HSE and elsewhere in government and public service in applying their technical knowledge and discretion to the operational and permissioning challenges they face. This has become particularly important, interfacing with his work with senior leaders across the civil service on building the UK's explosives competencies and capabilities, because the explosives sector is going through a step change in technology that will result in new manufacturing techniques, new molecules and more powerful explosives.

Martyn says: *'I love my job because every day brings new challenges, new problems to solve and new people to help.'*



Akilah Walker

Regulatory Scientist and Efficacy Specialist

AKILAH COMPLETED AN MSc in The Biology and Control of Parasites and Disease Vectors at the Liverpool School of Tropical Medicine. She then went on to work in a range of industries including banking, lettings and sales before returning to science as a Medical Laboratory Assistant in the NHS during the pandemic.

Akilah joined HSE's Chemicals Regulation Division (CRD) in 2021 and is part of the Efficacy Team, based in Bootle, where she considers applications from industry for biocide products. She analyses the scientific studies sent in by product applicants to ensure that they meet the standards set out in the Biocidal Products Regulation Guidance. Her role also involves being aware of guidance from other organisations such as the World Health Organization (WHO) to inform her analysis. To keep up to date with changes in the industry, Akilah attends industry events such as the British Pest Control Association's regional forums.



Akilah says: *'My job covers a wide range of products from repellents for use on horses to bait products for cockroaches to disinfectants. This means every day is different and I have developed a broad breadth of knowledge. I enjoy knowing that my work ensures the general public, including my friends and family, use products that are safe and work as they are supposed to, allowing me to have a direct impact on people's lives.'*

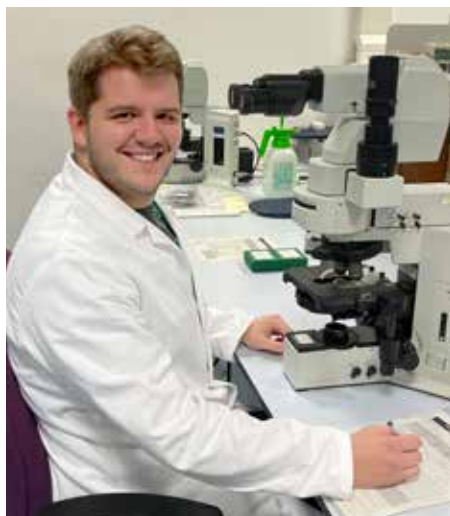


Jack Smith

Fibres and Minerals Scientific Technician

JACK JOINED THE Fibres and Minerals Team at HSE's Science and Research Centre in May 2022, before graduating from Staffordshire University with a first-class honours degree in Forensic Science in July, with the highest mark in his cohort. During his studies, Jack specialised in chemistry and biology, specifically DNA profiling, and was employed as a DNA Analyst.

As a Scientific Technician, Jack's role is to assist in the production of samples for the asbestos proficiency testing schemes operated by the Science and Research Centre. These schemes test the ability of



analysts worldwide to measure the six regulated asbestos types in a variety of sample types. Jack has also been involved in site visits for asbestos-related incidents, where his knowledge of forensic investigations is useful in evidence gathering. These visits involve sampling of materials, which are analysed at the Science and Research Centre to determine the presence of asbestos.

Jack is currently studying for two British Occupational Hygiene Society certificates: Identification of Asbestos in Bulk Samples, and Air Sampling and Fibre Counting. He hopes to build on the microscopy and fibre identification skills he gained during his degree.

Jack says: *'Working at HSE is interesting because of the huge variety of work. I look forward to more workplace visits, as well as further developing my skills with the training opportunities provided by HSE, in addition to learning from knowledgeable and friendly colleagues. I enjoy being able to apply a wide range of the skills I began to develop during my time at university, such as evidence gathering and analytical techniques.'*



Chloe Blackham

Regulatory Scientist and Environmental Fate and Behaviour Specialist

CHLOE GRADUATED IN 2017 with a BSc in Environmental Science from the University of York. She had a particular interest in environmental contaminants. After graduating, she worked as an analytical chemist extracting and analysing pesticide residues in food at Fera Science Ltd, before moving to their environmental fate team. Prior to joining HSE, Chloe's work involved planning and carrying out regulatory studies, commissioned by the manufacturers, on the fate and behaviour of veterinary medicine and pesticide in the environment. The knowledge and technical skills gained in the lab were directly applicable when she joined HSE as a Regulatory Scientist in the Environmental Fate and Behaviour team in 2021.

Chloe's day-to-day role involves ensuring that the dossier of study data, submitted by pesticide manufacturers, is of a high enough standard to meet regulatory guidance criteria. The applicant carries out and submits a set of modelling outcomes using the data derived from the studies, and Chloe validates the results to determine the environmental impacts of a pesticide and subsequently, the approved use criteria. Chloe has been supported



through a thorough regulatory training programme and had the opportunity to take part in various conferences on environmental risk assessment research and pesticide behaviour in soils, water & air. She shared what she does in her team with the Government Science and Engineering Profession at their conference in May 2022.

Chloe says: *'I work in a team of incredibly knowledgeable colleagues and have felt supported every step of the way. I love that my job is directly relevant to protecting our environment and, as with most areas of science, there is always something new to learn.'*



Jon Perrett

Regulatory Scientist and Chemistry and Residues Specialist

AFTER GRADUATING FROM the University of York with a Master's degree in Chemistry, Jon worked as a geophysical researcher at the University of Bath looking at atmospheric dynamics and climate change.

Jon joined HSE's Chemicals Regulation Division in January 2021 as a regulatory scientist, working in the Chemistry and Residues team. He undertakes evaluations of a range of data relating to the chemistry, methods of analysis, metabolism (animal and plant)

and residues of pesticides in food and feed to carry out associated consumer exposure assessments and set maximum residue levels. He makes regulatory decisions on the approval, sale and safe use of pesticides in the UK for both professional and amateur use. Jon uses scientific studies submitted by applicants and manufacturers, manufacturer information, policy and legislation to come to decisions, and works closely with other specialist teams such as Environmental Fate, Ecotoxicology, Toxicology and Operator Exposure within CRD.



Rachel Cruise

Building Safety and Major Accident Risk Scientist

RACHEL JOINED THE Risk Team at HSE's Science and Research Centre in November 2020. She has a degree in Architecture and a PhD in Structural Engineering, and has previously worked in the construction industry on projects such as housing for the Greenwich Millennium Village and the extension of King's Cross Station. She has also spent 13 years in academia teaching and undertaking research projects across the disciplines of architecture and structural engineering.

Since joining HSE, Rachel has worked on a number of projects supporting the shadow Building Safety Regulator as it prepares to regulate to ensure the safety of people in or about buildings and to improve the standard of buildings. Rachel has been especially focussed on higher-risk buildings.

She has worked on projects which have collated evidence to inform decisions on the definition of higher-risk buildings. She is developing a risk-based approach to the transitioning of existing higher-risk buildings to the new regulatory environment. She has contributed to workshops to develop a supportive approach for owners



of higher-risk buildings, to help them engage and understand the requirements that will apply under the new regulatory regime. She is starting to work on a project identifying the particular hazards linked to higher-risk buildings which contain other uses in addition to residential accommodation.

Rachel says: *'The Grenfell fire was a shocking and tragic event and I'm really proud to be working on projects that support change towards a safer construction industry. The building construction industry faces a number of significant challenges which require different sectors to work together to provide safe, sustainable, wellbeing-conscious places to live and our work at HSE is focussed on enabling this to happen.'*



Further professional development of staff

HSE's Science and Research Centre continues to support further development of staff in science, technology, engineering and maths. This includes Dane Woolford, Rhiannon Williams and Gemma Howard, who successfully combined work and study to obtain degrees in 2022. Carlos Sanchez successfully completed a part-time PhD in Stress Corrosion.

Diversity and inclusion – benefits of chartership

Louise O'Sullivan and Dan Howard have successfully gained their chartership from the Royal Society of Chemistry (RSC). Louise writes:

'When we think of professional awards like chartership we think of professional success and showing the great science we do here at HSE every day. However, chartership and chartered status is much more.'

'I recently achieved my chartered status from the Royal Society of Chemistry, and whilst undertaking the process I learned chartership is much more than what I do for a day job, it's about what I bring as a person and how I use my knowledge to benefit others.'

'There is a strong requirement in all chartership schemes to show how you treat others fairly, without prejudice or bias. How we create and foster inclusive workplaces whilst achieving excellent science.'

'In HSE we have a group of wonderful diversity and inclusion networks: Carers, Equal, Faith & Belief, Gender Equality Network,



(top, l to r) Louise O'Sullivan, Carlos Sanchez, Rhiannon Williams
(bottom, l to r) Gemma Howard, Dane Woolford, Daniel Howard

LGBT+, Magnet and Social Mobility. The Government Science and Engineering profession also have a diversity and inclusion working group, DIAG.'

'The volunteers in the networks work passionately to make HSE and Government Science a great place to work. The lived experiences of the volunteers and the staff they represent make a huge difference, whether that is: changes to IT to make adaptive

solutions possible, Accessible for All facilities, or providing STEM subject mentors to young people who were the most disadvantaged through the COVID pandemic.'

'I am an active member of DIAG. I learned that alongside my hydrogen science, which brings a new adventure every day, diversity and inclusion are important to me. Ensuring workplaces are open and accessible to all makes them great places to work.'

Awards, achievements, honours and events





Awards, achievements, honours and events

● **Chris Keen**, the Technical Lead for Occupational Hygiene at HSE's Science and Research Centre in Buxton, became president of the British Occupational Hygiene Society (BOHS) in May 2022.⁸⁶ Chris is leading the Society's efforts to promote sustainable workplace health during her 2022-2023 presidential term.

Chris is a passionate advocate of the role that occupational hygiene should play in protecting the health of workers globally, and is focussing on BOHS interfacing more extensively with stakeholder groups and communicating the value occupational hygiene adds in helping to manage health risks at work effectively.



Chris Keen



Mary Trainor's talk at the G7 event: Artist's impression by Tobias Wieland, bikablo. Image used by kind permission of bikablo, Germany

Chris commented on her new role: *'I'm so pleased to take over the Presidency of BOHS. The Society have done so much to protect workers' health in the UK, and globally, for almost 70 years. It's an absolute honour to become the President of the society, and I'm looking forward to helping us achieve even more over the coming year'.*

● **Dr Mary Trainor**, Head of Science Impact and Quality, spoke at the G7 event 'Climate Change meets Occupational Safety and Health', which took place in Dresden, Germany, in October 2022.⁸⁷

Her presentation included HSE researchers' work on net zero energy technologies, evidence used by HSE to support innovation, and the safe introduction of new technologies.

● **HSE's Science and Research Centre** in Buxton welcomed 14 new policy colleagues in October 2022 as part of their induction to HSE. They undertook a thought-provoking horizon-scanning exercise which introduced them to important concepts and tools to help future-proof policy development. They met scientists, visited facilities for forensic incident investigation and

experimental research, and heard about how this work is used to underpin HSE's regulatory activity.

'The whole experience was a massive positive for both policy and science colleagues. It left a lasting impression on everyone, the event captured the attention and imagination of all delegates, and many were really excited about how their own work could be seen in tangible perspective. This will help to promote future engagement and enhance policy outcomes.' Chris Rowe, HSE Policy Profession Development



HSE Scientist Andy Garrison welcomed new HSE policymakers to the H21 hydrogen experimental facility at HSE's Centre for Science and Research, Buxton

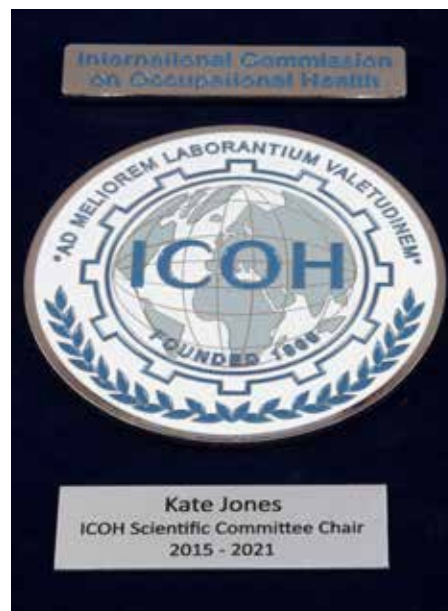


Chris Barber

● **Dr Chris Barber**, HSE Principal Medical Adviser and NHS Consultant Respiratory Physician, chaired the national group that produced the British Thoracic Society Position Statement on Air Quality, launched in June, to mark Clean Air Day 2022. This new statement encapsulates the belief that every person has the right to breathe clean air at home, outside, and at work.⁸⁸

● **Kate Jones**, biological monitoring specialist, has been nominated as UK National Secretary for the International Commission on Occupational Health (ICOH).⁸⁹ Kate takes over from Professor

David Fishwick, who also works at HSE. Kate was previously the Chair of the Scientific Committee for Occupational Toxicology within ICOH and has been awarded a medal in appreciation of fulfilling the role. HSE's involvement in ICOH allows us to network with and influence like-minded occupational health professionals from across the globe, sharing best practice and collaborating.



Kate Jones' Chair of the Scientific Committee for Occupational Toxicology, ICOH medal



(left) Keith Moodie standing next to the new signpost at HSE's Science and Research Centre, and (right) Keith and colleagues standing next to the Moodie Way signpost



● **Keith Moodie**, one of HSE's longest-serving colleagues, retired after a remarkable 54-year career in HSE. Keith originally joined the Safety in Mines Research Establishment, part of the Ministry of Power, in February 1968, based at Buxton and Sheffield. This became part of HSE on its formation in 1974. Keith's initial specialism was fluid mechanics and he later expanded this to other areas of fire and explosion science. He led significant forensic incident investigations, including seminal work on the 1987 King's Cross Fire and the Channel Tunnel fires. He became Head of the Fire and Explosion Group at Buxton.

Over the last 15 years Keith has provided highly valued scientific

expertise and engineering advice into major experimental projects related to the use of hydrogen, notably for risk of hydrogen explosions in the nuclear industry, use of hydrogen in gas turbines, and risks of hydrogen leaks from vehicles in tunnels.

Laurence Cusco, Head of Major Hazards Group at HSE's Science and Research Centre, said:

'Keith is hugely knowledgeable, encouraging and always helpful in sharing his insights, so will be greatly missed by his colleagues. We wanted to make sure that Keith's contributions for so many years were marked appropriately, so we have named the site road at Buxton that leads to our major test areas after him as Moodie Way'

● The **Workplace Health Expert Committee (WHEC)** held its first public seminars this year. These engagement events allowed a wide range of stakeholders to hear directly about the work of WHEC. The recorded seminars 'Evaluating interventions in work-related ill health and disease' and 'Work-related suicide', are available to view on the WHEC webpage.⁹⁰



WHEC report cover

● For the last few years, **Micah Stocks-Greaves**, one of HSE's scientists, has been promoting social mobility and helping pupils experience work in HSE's Buxton Science and Research Centre and encouraging them to think about science, technology, engineering and maths (STEM) as a future career. This year pupils joined HSE for a packed week where they spent time with scientists, learning about the huge range of work: from ergonomics to fire and explosives, chemicals analysis and cough testing.

The feedback was extremely positive:

'My week at HSE Buxton allowed me to look into various possible career pathways and overall was a great work experience week'.

'It showed me how wide the variety of jobs is in the scientific field, and it wasn't all to do with chemicals in a lab'.

● **Peter Baldwin**, an HSE Senior Occupational Hygienist, was elected to the board of trustees for Workplace Health Without Borders (WHWB), in the UK and International Branches. WHWB is an international charity to develop occupational



Peter Baldwin

health in developing countries: Workplace Health Without Borders – Imagine a world where workers do not get sick because of their work.⁹¹

● **Professor Cath Noakes**, who played a key role in the pandemic response, leading a sub-group of SAGE (UK Scientific Advisory Group for Emergencies), was appointed chair of a new HSE committee in October.

Professor Noakes will chair the new Science Quality Assurance Group (SQAG), which will provide HSE with independent assurance on the relevance and quality of its scientific research. The advisory group will ensure important research into workplace health and safety is relevant, robust and fit for the future.

Cath said: *'It's a real honour to be appointed to this role as chair of a new committee that I believe can play an important part in ensuring science-based evidence used to protect people and places is of the highest quality.'*

Read more in HSE's press release.⁹²



Professor Cath Noakes



Vicky Warbrick on stage at the GSE Conference

● The 2022 Government Science and Engineering (GSE) Conference – **Science & Engineering Career Paths in Government** brought together decision-makers, scientists and engineers from across government to share their experiences, engage with other professionals, and celebrate the scientific and engineering community.

Several HSE science and engineering staff shared their work by presenting posters.

Dr Vicky Warbrick from HSE's Chief Scientific Adviser's Office was part of the small organising committee for the conference; they were thanked by Sir Patrick Vallance for what he said was 'a terrific day' which had a 'great atmosphere'.

● **Dr Arthur de Carvalho e Silva**, a postdoctoral fellow funded by the UK Food Standards Agency (EFSA), co-supervised by HSE's Head of Computational Toxicology, Dr George Loizou, and Professors Mark Viant and John Colbourne



Dr Arthur de Carvalho e Silva

of the University of Birmingham, won the Lush Prize Young Researcher Award. The award was for his work in the development of New Approach Methods (the replacement of animals in toxicological studies). Arthur applied a workflow, developed by HSE and supported by the European Partnership for Alternative Approaches to Animal Testing, to derive a human-based guidance value for the environmental pollutant perfluorooctanoic acid.⁹³

● Many of HSE's **scientists and engineers** gave virtual and 'in-person' presentations at conferences and workshops with a global audience, for example:

– The British Toxicology Society organised a series of three events held through autumn 2022 under the theme of 'understanding probabilistic exposure modelling'. Dr Kevin McNally was invited to deliver



Dr Paul Johnson presenting at AIRMON10

the first lecture in this series, on probabilistic exposure modelling in the occupational setting.⁹⁴

– Several HSE scientists presented their work and facilitated workshops at AIRMON10, an international symposium on modern principles of air monitoring and biomonitoring, this year organised by HSE scientists Kate Jones and Owen Butler.⁹⁵

– **Matt Birtles**, one of HSE's ergonomics and human factors specialists, contributed to the Partnership for European Research in Occupational Safety and Health (PEROSH) webinar on musculoskeletal disorders.⁹⁶

– **Martyn Sime**, Explosives Inspectorate, gave several presentations at the Explosives Propellants and Pyrotechnics Conference, Redstone Arsenal, Alabama, USA^{97 98 99} and at Fulmination 2022, Reading,¹⁰⁰ where he was also presented with the Institute of Explosives Engineers' 'Manager of the Year' Award 2022.

● In a ceremony hosted by the State Mining Authority, Katowice, Poland, **Paul Bradley**, a chartered

engineer, scientist and manager, Fellow of the Institute of Materials, Minerals and Mining and HSE's Energy Division Head of Operations, was honoured. The honour was in recognition of special merits for safety in mining, in the field of activities aimed at improving safety, especially in the area of designing, introducing and popularising new technical solutions and research works and the long-term cooperation aimed at raising the standards of work safety in mining.

HSE's Mines Inspectorate has collaborated with the mining heads of Europe for many years, sharing lessons learned, technological advances, operational mining



Martyn Sime receiving his award



Paul Bradley receiving his honorary sword from the President of the Polish State Mining Authority

techniques, and projects and scientific research in both underground and surface mining and quarrying activities.

The official part of the ceremony ended with the presentation of honorary mining swords to five people including Paul.

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For a full list of details from previous years and a list of COVID-19 reports HSE staff have contributed to, see HSE Science and Research Publications ([hsl.gov.uk](https://www.hse.gov.uk)). HSE also commissions reports from researchers in other institutes; for a full list of research reports published by HSE, see HSE Research Report Series.

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