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Science Report 2015

Purpose of the paper

1. This is the seventh annual Science Report which covers the use and value of HSE's investment in science commissioned from the Health and Safety Laboratory (HSL) and external contractors. The Board is asked to note and comment on the report and the oral briefing from the Director of Science.

Background

2. HSE's budget for commissioned research and technical support in 2014/15 is approximately £27m[1]. HSE is a strongly evidence-based organisation with about 850 of our staff (HSE and HSL) being qualified scientists, engineers or analysts who use their expertise to contribute to the management of risks in workplaces and the development of evidence-based policy.

3. The research and technical support commissioned develops HSE's extensive knowledge base and intellectual property, which gets national and international recognition for its quality and potential market value. This work is essential underpinning for HSE's role an evidence based regulator.

4. This Report (Annex1.0) describes:

- HSE's scientific requirements;
- a review of HSL's reactive support capability;
- futures work and knowledge management;
- how HSE uses science and research in its work, with examples of recent innovative research and support;
- progress towards the rolling three year science plan;
- progress on HSE's Strategic Research Programmes; and
- the changing governance arrangements between HSE and HSL.

[1]. Excluding the Defra funded pesticides research programme that is managed by the Chemicals Regulation Directorate (CRD). This also excludes the Office for Nuclear Regulation.

Communications

5. HSE's press office will provide communications activity on the publication of the Science Report. We will issue a press notice to trade and national media confirming publication and highlighting achievements described in the report. We will promote the report via the HSE website and this will include the publication of a press notice. E-bulletins will be used where appropriate and social media activity on HSE's press office and HSL Twitter accounts will direct people to the Report on the website and will highlight achievements from its content.

Devolved Administrations

6. There are no implications for the devolved administrations.

Action

7. To note and comment on the Science Report. We would welcome the Board's views on the style of the report: although it is primarily for Board members, it is also a public document. Next year, we propose to reshape and shorten it, making it better suited to an external audience.

Paper clearance

8. This paper was cleared by SMT at its meeting on 7th January 2015.

HSE Science Report 2015

Science Report 2015: Contents

Annex 1.0

Science Report 2015

1. Executive summary

1.1 In the 2014/15 financial year, the Health and Safety Executive (HSE) budget for commissioned research and technical support is ~£27m[2]. During this year, HSE has commissioned 123 new research and technical support projects, in addition to the 339 that were underway at the start of the year. It is expected that 243 projects will be completed within the year. Topics include: off-shore human factors assessments, enhanced methods for identification of *Legionella,* occupational asthma in cleaners, leadership and worker involvement in the ports industry and stainless steel stress corrosion cracking in process vessels and pipework.

1.2 This year we reviewed HSL's reactive support capability in view of reduced demand for reactive support over the last few years. Demand for reactive support from HSE may increase slightly over the next few years in a number of areas including occupational health. An HSL capability programme is being developed to ensure that HSL's staff have sufficient experience of HSE's incidents, investigations and court work and develop capability in emerging technologies.

1.3 This year HSL established the Foresight Centre which brings together the HSL's Futures Team with knowledge sharing, innovation and consultancy staff. It is offering expert knowledge of futures issues and knowledge management techniques to help HSE and industry identify relevant business impacts and sustainable solutions to prepare for future changes in the workplace.

1.4 The quality of HSE's science continues to be recognised externally and a number of awards have been presented to HSE and HSL staff. The Government Chief Scientific Adviser, Sir Mark Walport acknowledged HSL's high quality science and engineering during his visit in September 2014. Internal evaluation of research and reactive work showed that it is of high quality and essential in underpinning regulatory outcomes.

1.5 From April 2015 there will be a new interface for commissioning work between HSE and HSL. The science budget will be retained by the Director of Science. HSL will be responsible for allocating funds and resources within a few broadly-scoped programmes of work.

1.6 The Specialist Resource Groups set up in 2012 have been active through 2014, bringing together senior managers to provide corporate oversight of specialist deployment, recruitment and professional issues. The Director of Science is developing plans to evaluate these groups during 2015.

[2] Excluding the Defra funded pesticides research programme that is managed by the Chemicals Regulation Directorate (CRD). This also excludes the Office for Nuclear Regulation.

2. Background

2.1 HSE commissions research and technical support to:

- support HSE's front line operational work, using forensic work and technical support for inspections, investigations and enforcement;
- acquire evidence to improve knowledge about occupational safety and health;
- apply new ideas and knowledge to regulations, policies, guidance, standards, inspections, enforcement methods and other interventions; and
- disseminate knowledge and information.

Technical support for operational and regulatory work

2.2 HSE's largest requirement for scientific, technological, engineering and medical support is for its operational and regulatory work. As in previous years, this requirement accounts for around two thirds of our expenditure on commissioned science. It includes support for investigations and major incidents conducted by both HSE and Local Authorities.[3]

2.3 HSL is HSE's principal provider of forensic scientific support. In 2014/2015 HSE expects to commission ~£2.7m reactive support for investigations and major incidents from HSL. HSE expects to commission ~£0.8m reactive support for investigations from other providers where HSL has limited or no expertise (e.g. civil and structural engineering, tree felling, and thermal imaging of concrete).

2.4 HSE also commissions ~£15m planned support (mainly from HSL) which covers a range of activities, principally running operational and policy projects and developing and maintaining HSL's capability. This is to make knowledge and information available to HSE to discharge its functions such as developing policy.

Review of HSL's reactive support capability

2.5 HSE's demand for HSL's reactive support capability has reduced in most of HSL's scientific and technical disciplines during the last three years, in line with changes in the number of investigations and inspections, and the approach operational staff take to completing this work. The HSL Partnership Board asked for a review of HSL's reactive support capability, including what HSE's future demands would be.

2.6 The review considered HSE's requirements from HSL for reactive support, covering incident and investigation work. This support is mainly used to:

- investigate a specific incident, or accident, and any subsequent enforcement activity; or
- investigate local issues and matters of evident concern identified at inspections of particular factories/premises.

2.7 The review indicated that while levels of demand from HSE may increase slightly over the next 3-5 years, in occupational health in particular, in some areas demand is unlikely to increase noticeably. The survey did not identify any areas where demand would cease altogether. This is creating a risk for HSL: that as experienced staff leave or retire, there are insufficient demands for reactive support for new staff to develop their experience in investigations and court work.

[3] Annex 1.1 includes a glossary of definitions of reactive support, planned support and research.

2.8 As a result of the review, an HSL capability programme, with direction from senior HSE and HSL staff, is being developed to ensure that HSE maintains its reputation as a world-leading regulator so that:

- HSL's staff have sufficient experience of HSE's incidents, investigations and court work;
- HSL has capability maintenance programmes (including succession plans and facilities maintenance) in areas where HSE's demand will continue but will not increase;
- HSL develops reactive support capability in emerging technologies either through new facilities and competencies and/or with other partners (such as forensic computing, electronic & control instrumentation);
- HSE keeps its requirements under review;
- HSL/E use their scientific capability to commercialise, wherever possible, the lessons learned from reactive support work, and the facilities and competencies that support HSL's reactive support capability.

Research

2.9 HSE has commissioned ~£8m of applied research in 2014/2015, mainly from HSL[4]. HSE does not normally commission academic or blue-skies research. Sometimes, HSE commissions research in partnership with relevant industries and stakeholders, and collaborates with national, international and EU programmes. HSL are investigating the feasibility of establishing a PhD programme to develop research capability in emerging topics and to strengthen links with academia.

Futures work

2.10 HSL's Futures work provides HSE with a mechanism to assess the potential of new and emerging technologies, as well as trends and scenarios that could impact on the UK health and safety system. For further details on this year's activities see Annex 1.3.

2.11 HSL's Foresight Centre was formally established in April 2014, bringing together HSL's Futures Team with knowledge sharing, innovation and consultancy staff. The Centre will offer easy access to HSL's knowledge of health and safety issues that need tackling today, those that will impact in the near term or those on the horizon. It will focus on five functional areas relevant to a range of sectors and disciplines - asset management; future risk and regulation; safe energy; advanced materials and manufacturing; and workforce trends.

2.12 The work of the Foresight Centre has included:

- delivering workshops for HSE and representatives from Public Health England, the Council for Work and Health and the Association of Occupational Health Nurse Practitioners to develop a shared understanding of health surveillance, the legal requirement for duty holders and the employee health surveillance experience.
- developing a comprehensive Prioritisation Tool which considers the impact of emerging issues on health and safety and the alignment with HSE/L's regulatory and commercial strategies and priorities.

[4] Annex 1.2 includes criteria for commissioning science.

3. Use of science in 2014/15

Research

3.1 The Science Plan 2012-15 supports the HSE Business Plan and commissioning of research and support is aligned with HSE's business objectives. From October 2014 the Director of Science will be accountable for all science spend, which will be managed through themed programmes (see paragraphs 5.1-5.7).

Finance and cost recovery

3.2 In 2014/15 HSE expects to spend ~£24.8m with HSL and up to ~£2.5m with external suppliers.

3.3 The science budget for each Directorate in 2014/15 is:

- Cross-Cutting Interventions Directorate (CCID) - £2.40m
- Chemicals Regulation Directorate (CRD) - £0.35m
- Corporate Science, Engineering and Analysis Directorate (CSEAD) - £6.87m
- Field Operations Directorate (FOD) – £8.45m
- Hazardous Installations Directorate (HID) – £8.25m
- Operational Strategy Division (OPSTD) – £1.02m

3.4 HSE recovers some costs incurred in HID's operation of permissioning regimes, either as costs attributable to an individual company or to the work of wider interest to the industry ('common good'). This year, this includes reactive work on incident support (~£750k), assessment of Offshore Safety Cases and COMAH Safety Reports (~£650k) and research work of wider interest to the industry (~£700k). The majority of this work is delivered by HSL.

3.5 There are some on-going science projects that are funded with industry or others and HSE has contributed to a cross-government project to develop a toolkit for identifying the most effective behavioural insights for influencing business.

Examples of work published or completed in 2014

3.6 The work includes a diverse range of topics and requirements[5], some commissioned from HSL and external contractors and some carried out internally by HSE analysts, including:

- Inadvertent control operations in excavator plant machinery
- Hydrocarbon releases offshore
- Work aggravated asthma
- Manual handling assessment
- Efficacy of hand cleaning products used in outdoor environments
- Standard of Care for Chronic Obstructive Pulmonary Disease (COPD)
- Sickness absence in the waste and recycling industry
- Animal handling in abattoirs
- Exposure to electromagnetic fields in welding
- Fee for Intervention evaluation
- INSPECT – behavioural insights tool

[5] Case studies for some of this recently completed work are at Annex 1.4.

- Asbestos management in schools

All published research reports can be viewed on HSE's Science, engineering and research webpages.

Demonstrating the use and value of work commissioned or completed in 2014

Reactive support

3.7 The contribution of support provided by HSL and external specialists to investigations that led to prosecutions has been examined. We approached investigating inspectors who provided feedback on the contribution that reactive support makes to regulatory inspection and some examples are provided at Annex 1.5. Support is requested for a small proportion of HSE's operational investigation work and for more technically complicated cases; the inspectors concluded that access to high quality forensic services was considered essential for a successful outcome.

Research and planned support projects

3.8 HSE routinely collects post-project evaluation and impact data from internal customers about timeliness, quality and delivery of research and planned support project outputs from HSL and external suppliers. Although there have previously been no specific performance targets related to these measures, from this year a new Key Performance Question on the delivery of HSE's Science Plan is being introduced.

3.9 Analysis from 53 completed projects sampled over the past year showed that 83% of customers considered the objectives of the work to be fully or mostly met. 85% of respondents felt that the business need/knowledge gap had been fully or mostly addressed and just under two thirds of respondents considered the work to be "good" or "excellent" value for money.

3.10 Around 80% of customers judged that the scientific quality and delivery of the project products to be 'excellent' or 'good' (rather than fair or poor) which is a comparable response to the previous year's results.

3.11 Three quarters of the respondents considered that the timescale of the work enabled them to use the results as originally planned and two thirds stated that the project did not exceed its original anticipated cost. Increased costs were associated with extension of scope by customer and variation beyond scope by the contractor.

3.12 Approximately three quarters of our commissioned research projects result in an openly published report or peer reviewed paper. Other deliverables include conference papers, internal and external guidance, electronic tools, and contributions to policy development.

3.13 The examples below give an indication of the diversity of work and illustrate the nature of feedback from customers on utilisation and impact:

- *Respiratory Protective Equipment (RPE)*
  Research over the past few years into the use of RPE[6] follows up workplace surveys that indicated RPE was not giving sufficient protection and that everyone involved in

[6] http://www.hse.gov.uk/research/rrpdf/rr746.pdf, http://www.hse.gov.uk/research/rrpdf/rr798.pdf

its selection, provision and use needs to be informed and motivated to a greater extent than might be the case with other forms of exposure control. These findings led to a greater provision of information on HSE's website including videos, toolbox talks and guidance, and in turn more interaction with partners in industry. Anecdotal feedback suggests that fit testing is now becoming more common which is an indicator of effective RPE programmes being put in place. However, further research[7] showed that most small employers obtain information and RPE from those who are further down the supply chain rather than organisations geared up to give advice, so future work will consolidate and build on our successes to find ways of influencing targeted links in the RPE supply chain.

- *Safety features of plastic fuel container spouts*
  This research investigated the effectiveness of commercially available petrol container spout inserts to prevent flame flash back and overfilling. The results demonstrated that the products tested were effective in preventing flashback but had some limitations in relation to overfill and spillage. This work has been used in the development of HSE's guidance in support of the new Petroleum (Consolidation) Regulations 2014.

- *Mobile elevated work platforms (MEWP)*
  As part of a multi-phase project, two pieces of work provided evidence to MEWP machine manufacturers of the need to improve design of the machine-person interface. The current phase of the research work is being conducted with an international manufacturers' body and will improve our knowledge of generic machine design processes and identify how best to influence improved compliance with the Essential Health and Safety Requirements (ESHRs) of the Machinery Directive. The outputs of this work have been used to underpin an inspection project and to develop enforcement positions.

- *Integrity of fairground rides*
  Over the past 3 years there have been at least four serious injury accidents, and a large number of minor accidents, on the Safeco Crazy Frog type amusement ride. Research was carried out to investigate design, manufacturing and operation issues related to this popular ride. The results have been the catalyst for significant changes to the control and pneumatic system on the Crazy Frog machine and have been the basis for a major part of the FOD proactive work plan on fairgrounds. Since publication of the research report there have been no accidents reported on the machine related to matters addressed by the work.

- *Ill health in the chemical industry*
  This research aimed to determine the incidence, prevalence and relative risk of ill health due to chemical exposure in the chemical industry sector. Feedback so far indicates that the work has helped the Chemical Downstream Oil Industry Forum better define the problem areas. As a consequence, the sector has proposed solutions and is working to agree collective action to secure improvements. HSE continues to support the industry working group and are confident that the initiative, along with possible regulatory activity, will reduce exposure and corresponding ill health in the sector.

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[7] http://www.hse.gov.uk/respiratory-protective-equipment/rpe-project-research-supply-services-research.pdf

Participation in research visits

3.14 In last year's Science Report, we noted a possible decline in the number of organisations volunteering for research visits following the introduction of Fee for Intervention (FFI) in October 2012, and we would keep this under review. Research visits help HSE specialists and HSL scientists understand work processes and maintain their understanding of current industry practices. Some organisations had expressed concern that they might be liable for chargeable work for material breaches discovered during a research visit. This year, we have monitored industry participation in new research visits in woodworking (construction and manufacturing), waste and recycling and painting (construction).

3.15 Recent experience shows that persuading companies to agree to participate in research visits requires hard work, but agreement to proceed can be reached. This effort has come from both HSE/HSL and from those industry representatives and trade bodies who have taken a more active lead in promoting the benefits of participating in research to their members. Once recruited, time is spent managing research visits with each volunteer, to ensure protocols are followed and potential FFI issues are managed effectively.

3.16 Despite a positive response to the invitation to participate in the woodworking research project, volunteers took longer than anticipated to confirm participation. The target for visits should be met in this sector which comprises mainly small and medium sized enterprises (SMEs). Conversely, in the waste and recycling sector, where volunteers mainly come from larger companies, the industry response has been more positive and the target for visits to volunteers on existing research projects should be met more readily.

3.17. With the painters' exposure research project, there has been a good response to the survey from the industry and the target number of visits to SMEs should be met. There may be resistance to participation in research by the larger companies, possibly because of a reluctance to acknowledge the consequences of known long-term health risks of exposure. An earlier project to monitor exposures to volatile organic compounds during specialised paint spraying was started in early 2012. After an initial good response, some companies withdrew their support at the time FFI was introduced. The remaining site visits were completed because of HSE's good relationship with the large retail companies who required their contractor to co-operate with HSE.

3.18 The exposure data, health risks and likely good practice benchmarks obtained from these research visits will be analysed and shared with participants and the wider community in due course.

3.19 The lesson for commissioning future projects is that while some companies will be sceptical about participating in research visits in whatever context, investing time and effort in managing relationships with the sector will be beneficial: for example in the woodworking project, the relationship between this sector and HSE has been positively reinvigorated.

Strategic Research Programmes

3.20 The HSE Strategic Research Programmes (SRPs) continue to address significant workplace health and safety issues in support of HSE's business objectives. Each SRP also allows for staff development, enhances HSL capability and promotes wider collaborative and partnership working. This model continues to be a successful platform for multidisciplinary research into emerging workplace issues.

3.21 In Spring 2014 HSE commissioned a new SRP – '*Advanced Manufacturing and New Emerging Materials*'. This will undertake research in partnership with leading companies in the high hazard sector as Joint Industry Projects which will secure industry funding and in-kind support. Industry stakeholder workshops in late 2014 will help develop this SRP.

3.22 The Strategic Research Committee had invited a proposal on '*Demographics*': however, this coincided with significant 'futures' reviews across government addressing aspects relevant to HSE (e.g. ageing population, the young worker). As these were due to report in late 2014 the decision was made to await the findings and commission a smaller-scale research project rather than an SRP at this time.

3.23 The Director of Science hosted a 'showcase' event in October 2014 at HSL to raise awareness of the SRP outputs at a senior level across HSE. This was an open meeting of the four governance boards joined by staff across all directorates, which highlighted synergies across the programmes and the contribution provided by the external academics.

3.24 Work has continued under the '*Exposome*' SRP on sampling and measurement in particular for isocyanates in air; the team are also working to identify a specific biomarker in urine and looking at evidence of dermal absorption of isocyanates. Silica continues to be a major cause of respiratory disease and an in-mask sampler to measure silica inside RPE has reached the in-the-field piloting stage. Exhaled breath condensate is being explored as a potential method to detect low levels of silica. If biomarkers which reflect the effects of silica in lung at an early stage can be measured cost-effectively in non-invasive samples, then it could assist identification of work practices for interventions and be influential in worker behaviours.

3.25 The *'Mathematical modelling'* SRP has provided an infrastructure of standards and best practice to the other SRPs - assisting with modelling reverse dosimetry in '*Exposome*', modelling COPD in '*Health Surveillance*' and validating finite element models of composites in the '*Advanced Manufacturing and New Emerging Materials*' SRP. The mathematical modelling team have probed the capabilities of models, their validation and evaluation. The Geographical Information Systems (GIS) team have worked on providing more accurate workplace mapping and intelligence on population scenarios. This work has enhanced confidence in mathematical modelling for health and safety applications e.g. safety cases, land-use planning or area classification.

3.26 The '*Health Surveillance and Health Impact Assessment*' SRP continues to model forecast changes in future burdens of long latency occupational disease, building on and complementary to 'The burden of occupational cancer in Great Britain' study. The model combines economic analysis, workplace psychology and epidemiology. Work on longitudinal surveys across stonemasons, brick manufacturing and foundries has focussed on the health end points of COPD, silicosis and asthma and has contributed robust intelligence to the evidence base on GB levels of exposure and control. This SRP is probing the most effective forms of health surveillance and contributing evidence to improving compliance. It is on track to provide a suite of tools and an evidence base to help plan and evaluate the impact of

interventions. HSE believes these resources will make a significant contribution to the understanding of occupational ill-health in selected industries.

3.27 Each SRP continues to generate peer-reviewed articles, conference papers and extensive collaborative working across academia and industry both nationally and internationally.

Communicating science and results

3.28 The communication of results from scientific work uses many approaches including engagement with industry bodies and health and safety professionals, the HSE website, articles for trade and professional magazines, research reports and scientific papers. Publication in peer-reviewed journals is an indicator of the quality of scientific work, and is recognition of the status of HSE and HSL in the science of health and safety at work. Publication discharges a statutory duty to share lessons with the wider health and safety community. It also has the benefit of demonstrating HSE's and HSL's research capability to the worldwide scientific community, and helps manage reputation.

3.29 HSL has continued to improve report writing and editorial review. Further bespoke courses were held on report writing and, following a successful pilot, new bespoke courses on report editing are being held.

3.30 From 1st January 2014, HSL-led peer-reviewed journal papers and conference papers describing research funded by HSE have been published with 'open access' meaning that these are available at no cost to the reader. This is part of the Government transparency agenda and should enhance the uptake and use of research findings by stakeholders.

3.31 Annex 1.6 lists HSL's scientific publications from December 2013 to the beginning of November 2014 and papers in press. These papers describe work undertaken for both HSE and external customers.

3.32 Publications prepared by external researchers following research commissioned by HSE with them, and those where HSE staff have contributed as co-author/sole author, are listed in Annex 1.7.

Recognition

3.33 This year the value of our science has been recognised by others and a number of HSE and HSL staff have been presented with awards:

- Ian Travers, deputy director of HSE's Chemicals Regulation Directorate, was awarded the Franklin Medal by the Institute of Chemical Engineering's (IChemE) Safety and Loss Prevention Special Interest Group, for personal commitment and leadership in the management of hazardous operations within the chemical and process industries.
- Duncan Rimmer, Head of HSL's Chemical and Biological Risks Unit, was made a Fellow of the Royal Society of Chemistry.
- Phoebe Smith, principal HSL psychologist, has been awarded an Honorary Visiting Fellowship by Sheffield Hallam University in recognition of joint work in patient safety training for healthcare professionals.
- Mike Clayton, HSL was made the president of the International Society for Respiratory Protection, ISRP.

- Kate Jones and John Cocker, HSL biological monitoring specialists, and Mark Piney, formerly HSE Principal Inspector, were awarded The Thomas Bedford Memorial Prize for the authors of the most outstanding paper published in the Annals of Occupational Hygiene over a two year period: 'Isocyanate exposure control in motor vehicle paint spraying' (57,200-209, 2013).
- Helen Pitts, HSL materials scientist, was made a fellow of the Institute of Materials Minerals and Mining in recognition of her '*contribution in the senior technical role to forensic investigations, including high-profile incidents*.'
- Nicola Stacey, risk education and assessment specialist at HSL, has been made chair-elect of the Safety and Reliability Society.

3.34 Sir Mark Walport, the Government Chief Scientific Advisor, visited HSL in September 2014. His visit included touring large-scale experimental facilities and meeting researchers including those working on: infection control for Ebola and winter vomiting virus, asbestos exposures, engineering and composites, clinical activities and GIS work for government. Sir Mark's feedback to HSL's Director, Eddie Morland, was that: *'The very high quality science and engineering that your team routinely apply was clear to see, and as we discussed, I am keen to use this expertise more in Whitehall as and when the need arises.'*

3.35 Other notable events at which our scientific expertise has been communicated included a presentation to the cross-government Natural Hazards Partnership Team and Sir Mark Walport in April 2014 by Helen Balmforth HSL's Technical Team Lead in Spatial Intelligence and Knowledge Analysis.

3.36 HSE was asked to join the advisory board of the All Party Parliamentary Carbon Monoxide Group (APPCOG) following the success of the Gas Safe behaviours project which successfully used HSE social research and the principles of behavioural economics to influence behaviour in respect of carbon monoxide. APPCOG are currently undertaking an inquiry aimed at producing an updated set of recommendations (guided by examples of effective behaviour change) to improve the effectiveness of interventions and raise awareness about the dangers of carbon monoxide poisoning.

3.37 In January 2014, HSE's Statistics and Epidemiology Unit hosted a statistics conference for external users (representatives from industry, Trades Unions, professional associations and academics and trainers/consultants). The programme was a mix of lecture sessions and discussion/Q&A opportunities, with an introductory session about HSE's data sources and a session on benchmarking data. 97% of attendees at this over-subscribed event said they would recommend it to a colleague.

3.38 This year, many HSE/L staff served on journal editorial boards and as peer-reviewers for journals and scientific conference committees, e.g. chair of the Toxicology Group of Royal Society of Chemistry, chair of the Occupational and Environmental Specialist Advisory Group of the British Thoracic Society; committee members of ACGIH (US Industrial Hygiene) Committee on Biological Exposure Indices; editor of Occupational Medicine and Health Affairs; assistant editor of the Annals of Occupational Hygiene.

3.39 Some staff hold honorary senior/visiting lectureships for example at the Centre of Occupational and Environmental Health at the University of Manchester and at the Centre for Occupational Health, University of Birmingham. Also staff from HSE's Corporate Medical Unit, hold Faculty of Occupational Medicine positions - Regional Speciality Advisor and Faculty Examiner.

3.40 Many HSE/L staff are involved in STEM activity (Science Technology Engineering and Mathematics), encouraging young people to study STEM subjects and helping them to understand the range of STEM careers available. This involvement covers a range of activities e.g. being a formal 'STEM ambassador' for school children; volunteering for events for undergraduates; working through professional bodies on events and providing information for early-career STEM individuals.

Knowledge Management

3.41 Work this year has concentrated on the promotion and use of the techniques developed in previous years, and the capture and re-use of business critical knowledge, for example, supporting the knowledge transfer of the thinking behind the HID regulatory model.

3.42 Knowledge management tools have been used to support a programme of cross-HSE activities on silica, including “an audience with” style panel discussion and knowledge captures from 10 individuals either leaving HSE or moving across HSE providing knowledge recipients with important ‘additional insights’. We continue to develop the methodologies used to ensure that the techniques and reports best meet the business need. The tools have been shared with the Higher Education Academy’s engineering lead, with some public sector research establishments and with other Knowledge and Innovation Network members.

3.43 HSE’s Knowledge Council (chaired by the Director of Science) is a forum for sharing and discussing practice across HSE and HSL. It reviewed the suitability of using ‘Maturity Matrices’ to assess HSE’s current knowledge management capability. This approach will focus work in the coming year. Knowledge management activity at HSL has now been incorporated into the work of the Foresight Centre (see paragraphs 2.11-12).

HSL’s Investment Research Programme

3.44 The Investment Research Programme (IRP) enables HSL to undertake innovative research and develop links with other institutes in order to develop new capabilities and experimental approaches. In 2014, the focus was to reshape HSL’s scientific capabilities in line with HSE’s evolving needs, as well as growth areas for external work.

3.45 Funding of £1.5m is allocated to IRP strategic research programmes, product development and tactical projects including research, scientific publications and scientific activities to underpin development of training courses delivered by HSL.

3.46 New and on-going research includes projects to:

- develop chemical measurement Proficiency Testing services including air testing and asbestos.
- develop a facility to test fuel tanks to the requirements of ECE Regulation 34 (Prevention of Fire Risks);
- lead collaborative research with members of the Partnership for European Research in Occupational Safety and Health (PEROSH) into wellbeing and work; and
- develop enhanced biological monitoring techniques to determine inorganic elements in lung tissue and fluids.

3.47 Recent IRP work has allowed HSL to:

- develop a methodology for determining the acute toxicity classification of chemicals and mixtures under the Globally Harmonised System of Classification and Labelling of Substances in the context of the UK Regulations for COMAH. This now underpins an HSL service for industry which includes classification and training courses;
- enhance expertise in biological monitoring for pesticides;
- strengthen expertise in population vulnerability and impact modelling for GIS applications for central government including emergency response to natural hazards;
- launch the 'STRapp' smartphone application to help operators of commercial vehicles to make sure the loads they carry are safe and secure.

4. Science Plan for 2015 and beyond

4.1 The Science Plan for 2012-15 was first prepared in 2012 and an updated version was published on HSE's website in July 2014. It sets out how HSE will apply science and engineering resources to the delivery and realisation of its business plan. HSE's Business Plan 2012-2015 explains how HSE will deliver its part of the strategy *'The Health and Safety of Great Britain: Be part of the solution'*.

4.2 At the end of July 2014, the Director of Science issued a call for proposals from HSE Directorates, science customers and HSL, to be considered within the 3 year rolling science plan from 1st April 2015. Proposals must articulate the links to delivery plans and the benefit of the work. The Science Plan draws on ideas from policy makers and specialists from HSE and HSL. The Director of Science provides overall scientific assurance for the plan.

4.3 The Director of Science has reviewed ~60 proposals, most of which will be commissioned subject to consultation on scope and methodology and clearance for procurement. Proposals in key topics include: offshore oil and gas, long latency disease and various new data management and retrieval methods.

HSE2020

4.4 The recently published HSE2020 strategy statement outlines the direction for HSE over the next five years to build on HSE's strengths and reduce costs to the public purse. Science is likely to underpin many future opportunities for HSE and some of the more recent research we have conducted, including that within HSL's Investment Research Programme, has exposed several global companies to the capabilities of HSL which may generate commercial work.

Science and Policy Partnership Group (SPPG)

4.5 To help HSL staff better understand what the priorities and challenges are for HSE and help deliver more targeted research proposals, a Science and Policy Partnership Group (SPPG) was formed this year, comprising HSE policy staff, staff from CSU and HSL. The group arranged a series of seminars at HSL under the '*View from HSE'* banner, in which HSE senior managers representing a range of directorates, including the Director of Science, articulated HSE's key drivers.

4.6 The SPPG also launched '*HSL Open Door'* events to help share HSL capabilities with HSE staff. The first event on commercialisation was delivered to policy staff in July 2014. Early evaluation suggest that both HSE and HSL staff have found the events organised by the SPPG to be of benefit to both organisations.

5. Governance

Changing the Interface between HSE and HSL

5.1 Following the Triennial Review of HSE this year, we reviewed the governance arrangements for HSL. The HSE Board now has direct oversight of HSL activities following the abolition of the HSL Board.

5.2 Following these changes, the internal interfaces are being simplified and improved to improve delivery, reduce effort and increase efficiency. This will change the way that HSE manages and delivers much of the work in the Science Plan through HSL.

5.3 The responsibility for developing HSE's Science Plan, and the accountability for its delivery, continues to be with HSE's Director of Science. The science budget will be retained by the Director of Science, but the responsibility for allocating funds and resources to deliver specific programmes of work at HSL will be delegated to HSL.

5.4 HSE will commission a small number of programmes from HSL. HSE will use these programme arrangements to set strategic direction, make connections between requirements and agree priorities for the projects in each programme. Devolving the funds at a programme level will provide HSL with greater flexibility to manage resources.

5.5 Using a strategy deployment matrix system, which links HSL's delivery of the programmes to the strategic aims of HSE's science plan, should facilitate rapid resolution of issues through systematic discussions with individuals accountable for delivery and with customers. This will be piloted and reviewed in April 2015.

5.6 Progress reviews will provide HSE with finance and project progress information, which will contribute to answering the Key Performance Question: "Is HSE delivering its Science Plan?"

5.7 We are piloting an integration of the HSL project manager and HSE project officer roles to test whether this is feasible. A decision will be made following the completion of the pilot study, due in April 2015.

Internal Scientific Audits

5.8 HSL has initiated an internal audit of its scientific teams. This is being carried out by HSL's Head of Science and members of the HSL Council of Fellows[8]. The aim is to audit progress against delivery of the HSL Strategy for Science, Engineering, Technology and Incident Investigation and, where appropriate, make recommendations to the HSL Senior Management Team.

[8] The HSL Council of Fellows is a group of eight scientists who are internationally recognised experts, whose terms of reference include benchmarking HSL's scientific performance against other organisations, promoting technical offerings to external bodies, providing professional advice and identifying emerging issues of potential commercial and scientific interest.

Specialist Resource Groups

5.9 The Specialist Resource Groups (SRGs) set up in 2012 have been active throughout 2014, bringing together senior managers to provide oversight of specialist deployment and professional issues. SRGs cover defined disciplines in three groupings: Health, Safety and Human Sciences.

5.10 The interests of each SRG have continued to focus primarily on resource and deployment matters. They are working to ensure that the range of important strategic and frontline work that HSE needs from its specialists is delivered, supported by a combination of targeted specialist recruitment and flexible working solutions. The SRGs will continue to operate in 2015, whilst keeping their priorities under review. The Director of Science will evaluate the SRG arrangements during 2015.

Annex 1.1

Glossary

Scientific and technical support

Scientific and technical support for operational activities generally involves the utilisation of existing information and/or provision of such information in a usable form. Most support work is characterised as meeting relatively short term, immediate operational demands. It is categorised as reactive or planned support.

Reactive support
Support is classified as 'reactive' if it is used to:

- investigate a specific incident, or accident, and any subsequent enforcement activity;
- investigate local issues and matters of evident concern identified at inspections of particular factories/premises; or
- answer specific questions about HSE's policies e.g. Parliamentary Questions, Freedom of Information requests etc.

Planned support
This includes a range of activities to deliver HSE's requirements, principally operational and policy projects and developing capability. Most is supplied by HSL. Planned support includes:

- work to assimilate information and knowledge (through research, statistical analysis, attendance at professional events etc.) and make it available to HSE to develop early thinking on policy formulation, work planning, focusing customer contacts etc.;
- technical, social and economic advice for any topic area that falls under HSE's remit e.g. during negotiations and delivery of legislation;
- test method development;
- representational role at technical meetings;
- production of draft Approved Codes of Practice, sector guidance, guidance on the interpretation or application of legislation; and
- advice to the general public on scientific issues relating to health and safety

Research
HSE commissions little basic, blue skies research. Our requirement is for applied research, which, in contrast to support work, is generally original investigation in order to acquire new knowledge, but directed to a practical aim or objective.

HSE commissions applied research:

- to provide independent advice for regulatory purposes;
- where industries lack the relevant scientific and technological expertise;
- where industries require new ideas to stimulate and encourage improvement; or
- where availability of results could be restricted if research can be conducted by only one company.

Annex 1.2

Criteria for commissioning science.

HSE will:

- Use science to meet its role as a modern regulator to understand the most effective and efficient ways of securing improved health and safety outcomes.
- Use science with a strong focus on health and human and organisational behaviour, having regard for equality issues, and ensuring that money and resources are targeted at the delivery of the strategic priorities.
- Improve the linkages between science, policy and delivery and promote a better collaboration between scientists, policy makers and deliverers.
- Contribute to the development of Government science policy and apply it to all its work.
- Use its in-house resource, supported by external expertise where appropriate, to deliver its regulatory functions and contribute to the evidence base for the development of policy. This will be achieved through:
- front line work (e.g. incident investigation; inspection; safety case and report assessment; standards & guidance)
- cross-cutting activity (e.g. futures work; generic guidance)
- Continue to apply research:
- where independent advice is required by HSE on the extent and nature of the hazards and risks involved
- where there is a need for informed HSE participation in national and international standards making
- where information is needed in the light of incident experience or to support specific enforcement activities or policy initiatives
- where projects are too risky for firms to go ahead with themselves, though there are clear health and safety benefits; for example, when timescales are long and/or the technical risks are high
- when the particular part of industry lacks the relevant scientific and technological expertise
- when entry costs are high for manufacturers of safety-related equipment and the industry is small and fragmented
- where industry is complacent or not innovative and requires the stimulus and competition of new ideas to encourage improvement
- when the potential beneficiaries are too diffuse for any one company to undertake the research on its own or the availability of results will be restricted
- Provide support for HSE's regulatory activities through the commissioning of scientific support, with HSL as primary supplier to:
- understand the causes of incidents and ill-health
- propose remedial measures
- contribute to the evidence base to develop and deliver its priorities and programmes
- make the knowledge gained widely available
- have regard to, and use, relevant science activities in Britain and internationally. Where appropriate, HSE will seek opportunities to collaborate with others
- make publicly available information on our science programmes, subject to over-riding considerations for national security and/or HSE's intellectual property policy

Annex 1.3

Futures activities

HSE Activities

The refreshing of HSE's Sector Intervention Plans (SIP) during 2014 provided the basis for a thorough review of potential issues. This included looking outside the HSE designated sectors to ensure that there were no new areas that required HSE's attention. Working closely with HSE's Policy Profession, and with HSE's Sectors, there are an on-going series of events to provide colleagues with an understanding of what techniques and approaches are available, how they can help at different points in the policy cycle and the support that the Futures Team can provide. The logistics sector has described the techniques as an "excellent tool to help sector teams to broaden thinking". During the SIP refresh the scenarios exercise was used to help them think more clearly about how they might deliver the strategy from 2015 onwards. As a result horizon scanning activities are now included in the logistics strategy implementation plan through to 2018.

A review of Futures activity has been undertaken and this is almost complete. This has asked a range of staff how futures work could be better focused on HSE's business need, where the balance lies between providing short-term and long-term horizon scans and the best way of communicating these findings to key players. The preliminary results of this, and the development of the Foresight Centre, will lead to the introduction of a more structured plan of activities for the Futures Team in 2015 and beyond.

Central Government Activities

The work of the Cabinet Secretary since July 2013 has revitalised interest in Futures and Horizon Scanning and led to an increase in central government thinking in this area. HSE's position on the Heads of Horizon Scanning Group (a cross departmental group) is critical in maintaining line of sight on these developments. The Foresight reports into the Future of Manufacturing and Cities are being reviewed for any potential for health and safety issues to be drawn out from them. Additionally, HSE/L have contributed an impact assessment of future trends on the Health and Safety system to an overview of the impact of the "Eight Great Technologies" on government.

International Activities

Following the publication of the EU-OSHA report on the project 'Foresight of New and Emerging Risks Associated with New Technologies in Green Jobs by 2020', carried out by HSL and partners, HSL and SAMI Consulting facilitated two workshops designed to introduce the use of futures techniques to EU stakeholders. The first, held in Bilbao, was aimed at EU-OSHA Focal Points. The second, held in Brussels, was for members of the Electricity Committee of the EU Social Dialogue. Good feedback on both events was received and reports on the workshops have been published on the EU-OSHA website. HSL is also participating in the "Futures Project" being carried out by PERSOH to strengthen the PEROSH networks capability to support projects looking forward to 2010. This project will run through to 2016 and is using a Delphi study (using topic experts to develop a consensus opinion of developments within their areas) to identify research priorities.

Annex 1.4

Examples of work published or completed in 2014.

Case study 1: Inadvertent operation of controls in excavator plant - insight, analysis and recommendations for prevention by design

Analysis of HSE data revealed a significant number of incidents where serious injuries and fatalities have occurred by excavator operators inadvertently operating the controls (IOOC). In a five-year period to March 2010 there was one fatality and eleven major injury accidents involving IOOC. There is also extensive anecdotal information available from large construction contractors, which suggests that IOOC is a significant issue. This qualitative study was commissioned by HSE to gather evidence in the form of views, experiences and perceptions of both excavator operators, and subject matter experts working for both excavator manufacturers and for a major training provider.

The aims of the research were to:

- gain insight into the differing ways IOOC might occur;
- identify the full range of control measures to prevent or mitigate the impact of IOOC; and
- seek expert and end-user views on the likely efficacy of different design control measures.

The research identified that operators perceived IOOC as a problem and it was their view that IOOC risks could be reduced through improved excavator design and the introduction of new technology e.g. cab layout. They did not see usability, productivity and reliability issues as being barriers to introducing design and technical changes aimed at reducing IOOC risks.

Subject matter experts considered that more could be done to better manage the risks of IOOC using new technical solutions. Some manufacturer based subject matter experts associated the risk of IOCC with operator error and context of use, rather than being additionally linked to control and system design. Manufacturers are possibly under-utilising the potential of technological, ergonomic and human factors expertise to address IOOC risks.

View the full report: RR1000 - Inadvertent operation of controls in excavator plant - insight, analysis and recommendations for prevention by design

Case study 2: Flammable mists from accidental hydrocarbon releases offshore

Offshore oil and gas installations store and process large inventories of different hydrocarbon mixtures. Crude oil/natural gas is pumped from the seabed and separated by distillation at different pressures and temperatures. The installations need to heat and pressurise the crude – this requires other hydrocarbons for fuel and to act as lubrication and heat transfer fluids. An accidental release of any of these fluids is hazardous because of their inherent flammability. This research investigated offshore hydrocarbon releases in an attempt to identify whether mists of hydrocarbon droplets were formed, and if these mists presented a flammability hazard.

The scientific literature was searched to determine the current knowledge of the physics of two-phase mist generation. An empirical correlation was used to model the reported hydrocarbon releases for a five year period and estimate whether flammable mists could have been generated. It was found that 95% of reported liquid releases (45% of total reported releases) could have formed flammable mists. It was also noted that there were 35 cases of high flash point diesel and machine oils igniting as flash fires in five years.

Having established that flammable mists were being generated, the state of computational modelling and its validity was reviewed to identify whether the industry is able to characterise this risk in order to enact measures to control it. This review found that computer programs existed to model mist generation. Validation studies of jet breakup are continuing but are focused on characterisation of single component flashing releases, not mechanical breakup of multiple component mixtures.

View the full report: RR1001 - Flammable mists from accidental hydrocarbon releases offshore

Case study 3: Review of work aggravated asthma

Seven percent of the adult population have asthma, a condition commonly made worse by inhaling irritant exposures at work; termed work-aggravated asthma (WAA). In May 2012, HSE, together with the Asthma Partnership Board, reviewed its current approach to occupational asthma (OA); although they agreed that HSE's suite of interventions and focus of activity in relation to OS was appropriate, it was agreed that there was a potential evidence gap in relation to WAA.

A variety of factors that cause WAA have been identified by this review, including inhaled irritants and allergens, physical factors and behavioural issues. WAA is common. A recent comprehensive review identified that more than 1 in 5 workers with asthma have this condition. There are, however, no GB based prevalence estimates. It is an unpleasant condition where workers complain of cough, wheeze, chest tightness and shortness of breath that is aggravated at work. These symptoms are likely to influence work absence, presenteeism and work efficiency. Their presence is also associated with significant adverse socio-economic impacts for workers and workplaces. A variety of medical tests may be needed to help make a diagnosis of WAA and distinguish this from OA. These tests are normally only available in specialised units with a particular interest in OA.

Very little GB data exists about interventions to reduce the associated burdens to the individual and the workplace of WAA. These include improving asthma treatments, worker education and training and assessing risks posed by various known hazards with particular relevance to asthma.

View the full report: RR1005 – Work aggravated asthma – a review of reviews

Case study 4: Further development of the Variable Manual handling Assessment Charts tool (VMAC)

Manual handling when picking orders is common in warehouses but the weights handled and rates of handling are typically very variable. This is also the case in other sectors, such as parcel sorting, trailer loading/unloading and parts delivery in manufacturing.

During an inspection of a picking warehouse, it was evident to the Local Authority (LA) Environmental Health Officer involved that the Manual handling Assessment Charts (MAC) were not suitable for assessing such tasks because these assume that the load weight and frequency of handling are both fixed. Following the visit, HSE funded a project under the LA Science and Technology Initiative to develop a method of assessing the risk from variable load/variable frequency manual handling operations. The outcome of this project was the development of the V-MAC (Variable MAC) for use by both HSE and LA inspectors and duty-holders.

This research describes further development of the V-MAC to extend its scope to include shifts of up to 12 hours duration and low frequency handling tasks. A pilot intervention study was carried out to test the usefulness of the V-MAC to duty holders when deciding how to control risks in very variable manual handling situations. The V-MAC should be seen as a targeted tool only for use in defined complex circumstances as it is a more intricate assessment method than is needed for many manual handling operations.

View the full report: RR1003 – Further development of the Variable MAC tool (VMAC)

Case study 5: The efficacy of hand cleaning products in industrial use as an alternative to hand washing

The aim of this research was to review data from the published literature on the efficacy of currently available alternatives to soap and water for hand washing in the context of removal of contamination typical of that experienced in a range of outdoor activities, workplaces and related environments.

The project included the consideration of hand cleaning in commercial waste and recycling activity, agriculture (including animal visitor attractions), outdoor events, construction sites and other work away from permanent welfare facilities.

The review contains the following evidence-based statements that:

- the use of soap and warm running water for hand washing remains an effective method for reducing the levels of hand borne microbiological contamination.
- the use of soap and cold running water has also been shown as effective for hand decontamination, though is likely to be marginally less effective than soap and warm water.
- alcohol preparations based on either gels or liquid hand rubs can offer a significant reduction in microbiological hand contamination, with some studies claiming multi-log reductions under specified conditions that are greater than hand washing approaches. However, there are important limitations to how alcohol rubs and gels should be used, and these may introduce uncertainties regarding their efficacy.

Little published data exists on the performance of hand hygiene methods in the context of variable to heavy organic loading.

View the full report: RR1007 - A review of the data on efficacy of hand cleaning products in industrial use as an alternative to hand washing

Case study 6 - Occupational Chronic Obstructive Pulmonary Disease (COPD): a Standard of Care

Chronic obstructive pulmonary disease (COPD) is characterised by progressive airflow obstruction that is only partly reversible, inflammation in the airways, and systemic effects. Its primary cause is cigarette smoking and COPD is the fourth leading cause of death worldwide. The prevalence of COPD is difficult to determine, because the condition does not usually manifest until mid-life, may be confused with other conditions and normally requires lung function assessment to confirm a diagnosis. In England and Wales, it is estimated that there are currently 900,000 diagnosed cases, and an estimated 2 million people are thought to have the disease but remain undiagnosed.

Other environmental risk factors for COPD have been identified and the roles of coal, cadmium, silica and biomass in the causation of COPD are relatively well established. The role of exposures in the workplace to inhaled vapours, gases, dusts and fumes (VGDF), are supported by evidence from a number of studies. The cause of COPD in an individual case is likely to be multifactorial, with multiple personal risk factors and exposures influencing its development and progression

A standard of care (SoC) document was commissioned by HSE and developed by HSL, in collaboration with staff from HSE's Corporate Medical Unit, external clinical experts and in association with the British Thoracic Society Standards of Care Committee. It is intended primarily for health care professionals caring for patients and workers with COPD, or dealing with working populations at risk of developing COPD. Aspects of this guidance may also be of interest to workers, their representatives and Trades Unions, employers, occupational hygienists and workplace legislators. Along with examining the evidence base surrounding occupational COPD, this SoC intends to provide evidence-based guidance for the management of workers with early or established COPD. Whilst there is now a wealth of literature about COPD and occupation, there remains a lack of practical guidance for health care workers in this area. The intent of this document was therefore to be practically focussed, and to assist all health care professionals, and others, to understand what the evidence supports in terms of practice, and where evidence is still lacking. Where no evidence was available, guidance was based on consensus agreement between an expert working multidisciplinary group[9].

Standard of Care document submitted for publication in *Occupational Medicine;* publication date to be confirmed

[9] FISHWICK, D., et al. COPD Causation and workplace exposures: An assessment of agreement among expert clinical raters. COPD: *Journal of Chronic Obstructive Pulmonary Disease,* 2013,10[2], 172-79.

Case study 7: National survey of the burden of sickness absence in the waste and recycling industry

Sickness absence is widely recognised to exert a significant burden on UK industry, both public and private. The Waste Industry Safety and Health (WISH) Sickness Absence Survey, commissioned by HSE, commenced in 2010 with the aim of providing HSE and the waste and recycling industry with reliable estimates of rates of sickness absence for specific categories of ill health and for key work tasks undertaken by workers.

A nationwide survey of 32 different organisations provided data on the spells of sickness absence taken by their workforce, 28 local authorities and 4 private sector organisations, collectively employing approximately 7,700 workers. The contribution of local authorities and private sector organisations to the total person years of follow up in the study was 41% and 59% respectively. Data was collected on 17,613 spells of absence taken by such workers, 8949 spells taken by local authority workers and 8664 taken by private sector workers.

The average number of working days lost to sickness absence in the waste and recycling workers surveyed as part of this study was 10.3 days. This equates to a working days absence rate of 4.0%. Approximately 60% of all working days lost to absences were attributable to long term absence spells (20 or more working days) with the main causes relating to mental ill health, physical injuries and musculoskeletal disorders. The sickness absence rates of the individual organisations participating in this survey varied widely, even when considering in isolation the rates for those organisations operating in the same industry sector and of similar size. For example, average local authority absence rates varied between a low of 7.8 days per worker per year up to a high of 24 days.

View the full report: RR1008 - National survey of the burden of sickness absence in the waste and recycling industry

Case study 8 - Reducing the risk of kick injury of cattle in abattoirs

The aim of this research was to provide information on the ergonomic risk factors associated with the humane slaughter of cattle in abattoirs, in order to establish safe working methods to reduce the risks of operatives being kicked during the shackling and sticking process.

The slaughter operations in abattoirs vary considerably due to different technical design, different stun systems and different killing rates. The shackling and sticking tasks place the operative at a high risk of being kicked during the slaughter task, as the operative is required to work predominantly within the kick envelope, i.e. within the functional reach of the animal's limbs. It is impossible to stop animals from kicking during slaughter with a stun/kill protocol based on captive bolt stunning. Furthermore, it is difficult to predict which animal will have post stun convulsions and how strong those convulsions will be. This uncertainty makes it difficult to directly control the risk of kicking during the shackling and sticking tasks.

The purpose of this research, conducted in association with abattoirs, trade associations and the Food Standards Agency, was to investigate the shackling and sticking tasks, in order to find ways to eliminate or reduce the risk to the operator by redesigning the work task. The report outlines several possible solutions that may be taken forward by industry that could help reduce the level of risk to the operator performing these tasks.

View the full report: RR1014- Reducing the risk of kick injury during the shackling and sticking of cattle in abattoirs

Case study 9 – Electromagnetic fields (EMF) in the welding environment

The Electromagnetic fields (EMF) Directive (2013/35/EU) was adopted in June 2013. Member States are required to bring into force any laws, regulations and or administrative provisions necessary to comply with the Directive by July 1st, 2016. The Directive contains 'action levels' (ALs) and exposure limit values (ELVs). Meeting these values can be used as one way to demonstrate compliance with the Directive.

This research, which was jointly funded by The Welding Institute considered various types of welding and the requirements of the Directive. Measurements of magnetic fields in a position where a worker is likely to stand were carried out for a number of different welding processes.

The research report provides:

- a review of available literature using the TWI 'Weldasearch"' database and other sources
- measurements of the EMF emissions welders may be exposed to during the welding processes
- understanding where welding fits in with the requirements of the EMF Directive
- a proposal for an EMF emission risk assessment procedure and
- guidance on compliance for the welding industry.

The work carried out in this project has shown many of the commonly used welding processes should not expose welders and operators to magnetic fields in excess of the ALs, but some process options, for example resistance welding, may lead to ALs being exceeded. The research measurements, information and risk assessment procedures outlined in this report could be used by employers who undertake welding activities, to help them with their risk assessments and work towards compliance.

View the full report: RR1018 Electromagnetic (EMF) fields in the welding environment

Case study 10: Fee for Intervention (FFI) evaluation

HSL were commissioned to explore issues in relation to regulatory decision-making following the introduction of FFI.

The first tranche of the research was conducted with Field Operations Directorate (FOD) to explore consistency and accuracy in relation to the recording of material breaches (MBs), any changes in inspectors' behaviours with respect to the make-up of operational activity and the use of specialist resource. The second tranche of research was conducted with duty holders including those who have had a visit under FFI (both those in MB and those not found to be in MB) and those who had not had a visit under FFI.

Both research projects involved HSL working closely with a steering group from HSE, which included the policy lead, analysts from the Economic and Social Analysis Unit. Corporate Science Unit and Statistics and Epidemiology Unit (SEU). SEU also provided quantitative analysis of data to provide further context, including analysis of any changes in operational outputs since the introduction of FFI and analysis of consistency across different visit types or inspector groups.

The findings from the research were considered by the independent FFI review panel and by FOD management board. The findings have been used by FOD to implement a number of actions in response to the recommendations contained in the reports. These actions included providing management information on performance to managers for use at review meetings, increased use of peer reviews incorporating work recording behaviours, changes to the IT system, simplified guidance and FFI team members attending operational team meeting (surgeries) to address local issues. Full details are provided at Annex D of the report which has been published as Appendix 1 of the Independent FFI Review Panel report.

View the evaluation: Research into Regulatory Decision-Making in HSE's Field Operations Directorate Following the Introduction of Fee for Intervention

Case study 11: INSPECT Behavioural Insights tool

In recent years government recognition of the potential for strongly influencing individuals' actions using behavioural 'nudges' has increased enormously, with the setting up of the Behavioural Insights Team in the Cabinet Office, and increasing enthusiasm for using behavioural economics and psychology across UK government departments.

HSE's Economic and Social Analysis Unit (ESAU) have explored the potential for using 'nudging' techniques in the health and safety context, drawing on what is known about the following levers for effecting behavioural change: Incentives, Norms, Salience, Priming, Emotion, Choice structure and Trust. This produces a bespoke 'nudge' checklist for HSE with the mnemonic 'INSPECT'.

The INSPECT model was trialled in joint workshops with HSL colleagues and in policymakers' workshops to discuss how behavioural insights can be used to gain traction with persistent health and safety issues, such as those in the agriculture sector. It has since been used with external stakeholders. In June HSE chaired the Noise and Vibration stakeholder working group, which included representatives from the construction and manufacturing industries, trade unions and health organisations, and other stakeholders. After a presentation of INSPECT by ESAU, all attendees worked in groups which used the INSPECT 'nudges' to develop innovative solutions to persistent problems with the control of noise and vibration.

In September 2014, Chemicals Northwest invited HSE to present a workshop to develop new 'nudges' to improve 'housekeeping' 'loading and unloading forklift trucks' and issues with handheld grinders.

Case study 12: Asbestos management in schools

The Control of Asbestos Regulations (CAR) 2012 place duties on those who have responsibilities for the maintenance of work premises, including schools, to manage the risk from asbestos. Over the course of 2013/14 HSE undertook an inspection initiative in schools outside of local authority control, following the same protocol as a previous initiative undertaken in 2010/11. The aim of the initiative was to assess levels of compliance with CAR in a carefully structured random sample of 153 schools across England, Scotland and Wales.

HSE statisticians had been involved in the previous initiative and were again invited to provide assistance this time. Statistics and Epidemiology Unit (SEU) were provided with a list of schools from which to draw a random sample, stratified in such a way as to ensure sufficient representation of different school types and different geographical locations.
Following the inspection campaign, SEU was involved again in collating the responses and providing an evaluation of the findings. The evaluation demonstrated that overall, the duty holders' awareness of their legal responsibilities was higher than the level found in the 2010/11 inspection programme, with 95% of schools having a full or broad understanding of the requirements. The majority of schools that were inspected (71%) required either no further action or were given straightforward advice. However, 44 schools (29%) received written advice, with enforcement action taken in 20 of these schools (13%) - an Improvement Notice was served on each of these 20 schools.

Duty holders' awareness of their legal duties is a useful indicator of compliance – and raising awareness has been an important element of ensuring on-going management of asbestos. Much work has been carried out by stakeholders across the school sector to raise awareness of the duty to manage asbestos. However, while good awareness and good compliance was noted in the majority of schools inspected in 2013/14, there are some key lessons that can be shared across all schools.

The results of these inspections should make clear to schools that managing asbestos requires on-going attention. Schools have access to a wealth of guidance setting out clear and straightforward steps to achieve and maintain compliance. Where duty holders fall below acceptable standards HSE has taken, and will continue to take, enforcement action.

Annex 1.5

Case studies highlighting reactive support assistance in investigations

We have assessed the value of reactive support and the cases summarised here give examples of how this type of support contributes to regulatory inspection:

Case study 1: Gas Specialist assistance at HSL

A Crown Court sentenced a heating engineer to 300 hours' community service after being found guilty of four health and safety offences. The sentencing came at the end of an extensive investigation into the death of a homeowner who was found collapsed at her home in December 2012. She later died in hospital.

The Police and HSE launched a joint investigation after a *post mortem* examination showed that the 72 year-old had died as a result of carbon monoxide poisoning. The investigation found that the heating engineer had failed to service and repair the heating system at the deceased person's home correctly, which resulted in poisonous carbon monoxide building up in the home. This included failing to clean debris from the flue and chimney soot-box, failing to ensure adequate ventilation to an oil-fired ducted air heater and failure to check the integrity of a flue pipe. As a result, the engineer faced four health and safety charges relating to the deceased person and other customers. He denied these charges but was found guilty.

HSL's gas support specialist assistance was requested for this investigation and they attended the scene as soon as possible; two further site visits were made, one to witness dismantling of equipment and one to conduct further tests. A comprehensive report (covering oil combustion, the formation of carbon monoxide, operation and installation of oil fired heaters, testing of burners and solenoids, gas analyses and flue and pressure gauges) was provided by HSL. it included photographs, recommendations and conclusions. The investigation at HSL was completed to time with separate reports produced for HSE and the Police.

FFI costs totalling £25,000 were invoiced to the heating engineer during the investigation process and paid in full. HSL's gas support specialist evidence was crucial to the prosecution and HSL were commended by the judge for the professional and clear way the evidence was provided.

Case study 2: Caterpillar excavator accident

A worker sustained life-changing injuries when he was struck by a reversing excavator. HSE discovered the duty holder had not carried out a proper assessment of the risks on site and so had failed to ensure a safe system of work was in place, including the use of a trained banksman. In addition there was no segregation or barriers between dangerous moving plant and pedestrians. The investigation also found workers had not been provided with information or instructions about working around excavators. The duty holder also failed to ensure that work on the site was properly supervised. A prohibition notice was served on the duty holder as they had failed to provide and or maintain adequate devices to ensure sufficient all round vision on the excavator.

An independent external specialist familiar with this make of excavator was contracted to carry out a joint inspection of the vehicle with an HSE specialist. The inspection revealed that the excavator did not have adequate rear view mirrors or other visual aids, and its warning beacon was not working. In addition, the operator's direct field of vision was obscured by the counterbalance on the vehicle. The contribution of the external specialist was valuable in the progress of this case.

FFI costs totalling £10,230 were invoiced to the duty holder during the investigation process. The duty holder was fined after pleading guilty to a breach of the Health and Safety at Work etc. Act 1974 section 2(1) and ordered to pay a £12,000 fine and £913 in costs.

Case study 3: Forklift truck maintenance

During a routine health and safety inspection at a meat wholesalers an HSE inspector asked to see the vehicle examination records for the company's 2.5 tonne counterbalance forklift truck. A document was later emailed to the inspector but appeared to be, and was later proven to be, a fraud. HSE found the forklift truck had never been examined, as required by safety rules for lifting equipment, since being purchased in August 2011. An independent external specialist familiar with this make of forklift truck was contracted to carry out a joint inspection of the vehicle with an HSE specialist and they found more than 40 faults, including some that could have endangered its operator. The contribution of the external specialist was valuable in the progress of this case. HSE served a prohibition notice on the duty holder to stop any use of the vehicle until it was safe to use.

FFI costs totalling £3,342 were invoiced to the duty holder during the investigation process. The company was prosecuted and fined a total of £18,000 and ordered to pay £2,314 in full costs for single breaches of the Health and Safety at Work etc. Act 1974; the Provision and Use of Work Equipment Regulations and the Lifting Operations and Lifting Equipment Regulations after admitting three breaches of safety legislation.

Case Study 4: Asbestos

A firm and two of its directors were fined along with a second company after redundant steel work was removed, putting workers at risk of exposure to asbestos. A metal-recycling business agreed to remove the steel work from the premises of another duty holder, on the basis that the metal-recycling business would take the value of the scrap metal as payment for the work. However, the steel included several pipe work systems covered in lagging containing potentially-dangerous asbestos fibres, which were removed by workers without the firm putting any measures in place to prevent the spread of the fibres.

HSE inspectors visited the site in February 2013 following a complaint from a worker at a neighbouring premises and a joint investigation was carried out by HSE's Construction Division and Hazardous Installation Division. Inspectors saw the metal-recycling business directors on site. Whilst on site there was a significant amount of pipe work and damaged insulation scattered on the ground. A mechanical excavator with a grab was also being used by the junior director to move steel work from the ground into a skip.
A Prohibition Notice was served on the metal-recycling business to prevent further work. An Improvement Notice was also served on the second duty holder that required it to carry out an asbestos survey and develop a system to ensure the results were shared with those likely to disturb any asbestos. HSL's field science services team attended the site and took samples. Asbestos analysis and analytical results confirmed that the insulation debris found lying on the ground did contain asbestos, meaning workers and those on neighbouring sites were exposed.

The court was told that the senior director had negotiated the arrangement to remove the steel work with the site manager. The court heard that the second duty holder failed to ensure information about location and condition of asbestos materials was provided to those liable to disturb it. The metal-recycling business had conducted the work without carrying out the necessary assessment to determine whether asbestos was present and had failed to take any measures to prevent the spread of asbestos fibres. The personal involvement of both directors meant they too had been prosecuted as individuals.

The second duty holder had to have the site environmentally cleaned.

FFI costs totalling £13,379.54 were invoiced to the duty holders and directors during the investigation process. The metal-recycling business was fined a total of £12,000 and ordered to pay £3,804.20 in costs after pleading guilty to breaching Regulations 5(a) and 16 of the Control of Asbestos Regulations 2012. The senior director of the metal-recycling business was fined £1,000 and ordered to pay £204.80 in costs after pleading guilty to breaching Regulation 5(a) of the same legislation. The junior director was fined £650 after pleading guilty to breaching Regulation 16 of the same legislation. The second duty holder was fined £10,000 with £2,243.40 costs after pleading guilty to breaching Regulation 4 of the same legislation.

Annex 1.6

HSL Papers and Editorials in Peer-Reviewed Journals, Papers in Conference Proceedings and Other Publications

January to end October 2014

A) Papers and Editorials published in peer-reviewed scientific journals

A.1) Papers and editorials in peer-reviewed scientific journals - Published

1. AYLWARD, L., HAYS, S., SMOLDERS, R., KOCH, H.M., COCKER, J., JONES, K., WARREN, N., LEVY, L., and BEVAN, R. Sources of Variability in Biomarker Concentrations. Journal of Toxicology and Environmental Health, Part B, 2014, 17(1), 45-61. http://dx.doi.org/10.1080/10937404.2013.864250

2. BARBER, C., BURTON, C., HENDRICK, D., PICKERING, A., ROBERTSON, A., ROBERTSON, W., and BURGE, P.S. Hypersensitivity Pneumonitis in Workers Exposed to Metalworking Fluids. American Journal of Industrial Medicine, Aug. 2014, 57(8), 872-880. http://dx.doi.org/10.1002/ajim.22337

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8. DANIELS, K., GLOVER, J., and MELLOR, N. An Experience Sampling Study of Expressing Affect to Others, Daily Affect and Mediators. Journal of Occupational and Organizational Psychology, Dec. 2014, 87(4), 781-805, http://dx.doi.org/10.1111/joop.12074

9. FISHWICK, D. and BARBER, C. Non-Malignant Asbestos Related Diseases: a Clinical View. Royal College of Physicians Clinical Medicine Journal, Feb. 2014, 14(1), 68-71. http://dx.doi.org/10.7861/clinmedicine.14-1-68

10. FORDER, J. Simply Scan - Optical Methods for Elemental Carbon Measurement in Diesel Exhaust Particulate. Annals of Occupational Hygiene, Aug. 2014, 58(7), 889-898. http://dx.doi.org/10.1093/annhyg/meu037

11. FROST, S., MOGRIDGE, R., and ROFF, M. Fit of Filtering Facepiece Class 3 (FFP3) Respirators Part 1: A Comparison of Fit Test Methods Journal of the International Society for Respiratory Protection, 2014, 31(1), 57-72.

12. GANT, S., NARASIMHAMURTHY, V., SKJOLD, T., JAMOIS, D., and PROUST, C. Evaluation of Multi-Phase Atmospheric Dispersion Models for Application to Carbon Capture and Storage. Journal of Loss Prevention in the Process Industries, Nov. 2014, 32286-298. http://dx.doi.org/10.1016/j.jlp.2014.09.014

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21. OKUNRIBIDO, O. and GINGELL, A. Delivering Meat Carcasses/Cuts to Craft-Butcher Shops: an Investigation of Work Characteristics and Manual Handling Hazards. Applied Ergonomics, Nov. 2014, 45(6), 1530-1539. http://dx.doi.org/10.1016/j.apergo.2014.04.016

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23. PALTRINIERI, N., WILDAY, A.J., WARDMAN, M., and COZZANI, V. Surface Installations Intended for Carbon Capture and Sequestration: Atypical Accident Scenarios and Their Identification. Process Safety and Environmental Protection, Jan. 2014, 92(1), 93-107. http://dx.doi.org/10.1016/j.psep.2013.08.004

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2. BUTLER, O., FORDER, J., and SAUNDERS, J. Analytical Protocol for the Sensitive Determination of Mannitol, Sorbitol and Glucose Containing Powders in Pharmaceutical Workplaces by Ion Chromatography Using a Pulsed Amperometric Detector. Journal of Pharmaceutical and Biomedical Analysis, 2014 http://dx.doi.org/10.1016/jpba.2014.10.006

3. COCKER, J. A Perspective on Biological Monitoring Guidance Values. Toxicology Letters, 2014 http://dx.doi.org/10.1016/j.toxlet.2014.09.010

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5. FROST, G. Letter to the Editor: Response to Comment on 'The Latency Period of Mesothelioma Among a Cohort of British Asbestos Workers (1978-2005). British Journal of Cancer, 5 Aug. 2014 http://dx.doi.org/10.1038/bjc.2014.441

6. GARNER, F. and JONES, K. Biological Monitoring for Exposure to Methamidophos: a Human Oral Dosing Study. Toxicology Letters, Oct. 2014 http://dx.doi.org/10.1016/j.toxlet.2014.10.008

7. HALL, J., HOOKER, P., and WILLOUGHBY, D. Ignited Releases of Liquid Hydrogen: Safety Considerations of Thermal and Overpressure Effects. International Journal of Hydrogen Energy, 25 June 2014 http://dx.doi.org/10.1016/j.ijhydene.2014.05.141

8. HEDLEY, D., HAWKSWORTH, S., RATTIGAN, W., BRENTNALL, R., and ALLEN, J. Large Scale Passive Ventilation Trials of Hydrogen. International Journal of Hydrogen Energy, Oct. 2014 http://dx.doi.org/10.1016/j.ijhydene.2014.05.120

9. JONES, K. Case Studies of Hydrogen Sulphide Occupational Exposure Incidents in the UK. Toxicology Letters, 8 Aug. 2014 http://dx.doi.org/10.1016/j.toxlet.2014.08.005

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12. SMOLDERS, R., KOCH, H.M., COCKER, J., JONES, K., WARREN, N., LEVY, L., BEVAN, R., HAYS, S., and AYLWARD, L. Inter- and Intra- Individual Variation in Urinary Biomarker Concentrations Over 6-Day Sampling Period. Part 1: Metals. Toxicology Letters, June 2014 http://dx.doi.org/10.1016/j.toxlet.2014.08.014

13. STAFF, J., HARDING, A.-H., MORTON, J., JONES, K., GUICE, E., and MCCORMICK, T. Investigation of Saliva As an Alternative to Blood Sampling for the Biological Monitoring of Inorganic Lead. Toxicology Letters, Sept. 2014 http://dx.doi.org/10.1016/j.toxlet.2014.09.018

B) Conference Papers

B.1) Conference papers - Published

1. BELL, J., GHANEM, W., and LEKKA, C. Multiple Perspectives on the Role of Safety Leadership in Major Hazard Organisations. 2014 Spring Meeting & 10th Global Congress on Process Safety ,New Orleans, LA, 2 Mar.-2 Apr. 2014, 47a

2. BELL, J., BINCH, S., and SUGDEN, C. Problems Encountered in the Development of a Process Safety Climate Tool. 2014 Spring Meeting & 10th Global Congress on Process Safety, New Orleans, LA, 30 Mar.-2 Apr. 2014, 47cw
3. BELL, J. The Management of Human Factors in UK Major Hazard Sites: Drawing on the UK Regulatory Perspective. 2014 Spring Meeting & 10th Global Congress on Process Safety, New Orleans, LA, 30 Mar. -2 Apr. 2014, 13a

4. BETTERIDGE, S., HOYES, J.R., GANT, S., and IVINGS, M. Consequence Modelling of Large LNG Pool Fires on Water. Hazards XXIV, Edinburgh, UK, 7 -9 May 2014

5. HEWITT, S. and MASON, H. Establishing the Exposure-Response Relationship for Hand-Arm Vibration - Realistic Prospect, or Just a Pipe Dream? 49th United Kingdom Conference on Human Response to Vibration, Health & Safety Laboratory, Buxton, UK, 9-11 Sept. 2014

6. HOOKER, P., HALL, J., and HOYES, J.R. Accumulation of Hydrogen Released into an Enclosure Fitted With Passive Vents - Experimental Results and Simple Models. Hazards XXIV, Edinburgh, UK, 7-9 May 2014

7. KELSEY, A., GANT, S., MCNALLY, K., and BETTERIDGE, S. Application of Global Sensitivity Analysis to FDS Simulations of Large LNG Fire Plumes. Hazards XXIV, Edinburgh, UK, 7-9 May 2014

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9. SHANKS, E. Sound Pressure Level and Sound Power Level Declarations: Navigating the Maze. Proceedings of the Institute of Acoustics, NEC, Birmingham, UK, 15 -16 Oct. 2014, 244-252.

10. WILDAY, A.J., FRASER, S., FULLAM, B., ASHCROFT, S., and MCCANN, R. Estimating Possible Impact of the Seveso III Directive for the UK to Inform Negotiation and Implementation. Hazards XXIV, Edinburgh, UK, 7 -9 May 2014

11. WILDAY, A.J., SAW, J.-L., WARDMAN, M., and BILIO, M. The CO 2 PipeHaz Good Practice Guidelines for CO2 Pipeline Safety. Hazards XXIV, Edinburgh, UK, 7 -9 May 2014

B.2 Conference abstracts – Published

1. SHANKS, E. Sound Pressure Level and Sound Power Level Declarations: Navigating the Maze. Proceedings of the Institute of Acoustics, NEC, Birmingham, UK, 15 -16 Oct. 2014,

2. TAN, E., BARBER, C., FISHWICK, D., and WARREN, N. A Model Based Evaluation of the Effectiveness of Health Surveillance for Silicosis. 8th UK & Ireland Occupational & Environmental Epidemiology Meeting 2014

C) Other publications - trade & professional

1. BALDWIN, P. Are You Falling Asleep? The Decorator, 1 Apr. 2014,18

2. COCKER, J. Session 5a: Isocyanates: A Complex and Sensitising Issue. BOHS Exposure, June 2014, 3 15-16

3. HEALTH AND SAFETY LABORATORY Award Winning Research into Chronic Obstructive Pulmonary Disease (COPD): Causation, Exposure and Impact on Workers. PEROSH Newsletter, Feb. 2014, 12 9

4. HEALTH AND SAFETY LABORATORY Load Safe Road Safe: Accident Reduction in Action. PEROSH Newsletter, 2014, Summer 2014

5. KEEN, C. There's Something in the Air. Waste Planning, Apr. 2014, 104 19

6. LUNT, J., SMITH, P., and BELL, N. Health and Safety in a Shrinking World. Safety and Health Practitioner, July 2014, 32 (7) 36-37

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8. SHANKS, E. Noise in the UK Printing Industry: Then and Now. Acoustics Bulletin, 2014, Sept-Oct 2014 42-44

9. SHANKS, E. STEM in the Spotlight: Lights, Camera and Action. Acoustics Bulletin, Mar. 2014, 39 (2) 8

Annex 1.7

Representative publications associated with extramural research contracts – 2014 and/or including HSE authors

HSE does not maintain a record of all publications associated with extramural research contracts. Some of the following references were identified by HSE's Information Management Unit (end October 2014) by searching Databases for references to research that acknowledged funding, co-funding or sponsorship from HSE. Publications prefixed with # indicate papers including HSE staff.

1. Foster, R. (2014). SWeRF- a method for estimating the relevant fine particle fraction in bulk materials for classification and labelling purposes' by Pensis, Luetzenkirchen, and Friede. Annals of Occupational Hygiene; doi:10.1093/annhyg/meu032
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3. #E. Cauda, M. Sheehan, R. Gussman, L. Kenny and J. Volkwein (2014) An evaluation of sharp cut cyclones for sampling diesel particulate matter aerosol in the presence of respirable dust. Annals of Occupational Hygiene *doi: 10.1093/annhyg/meu045* First published online: July 24, 2014
4. Carder M, Money A, Turner S and Agius R. (2014) Estimating incidence rates of work-related illness for GB occupational physicians. Occupational Medicine 64(4): 271-8
5. Money A. Carder M, Noone P, Hayes J, Bourke J, Turner S, Agius R. Work-related ill-health: Republic of Ireland, Northern Ireland, Great Britain 2005-2012. Occup Med, advance online doi: 10.1093/occmed/kqu137
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7. Wang, XS; Tipper, S; Appleby, PN; Allen, NE; Key, TJ and Travis, RC (2014) First-morning melatonin and breast cancer risk in the Guernsey Study. American Journal of Epidemiology, 1;179(5):584-93. doi: 10.1093/aje/kwt302.
8. Kokkarinen, N; Shaw, A; Cullen, J; Pedrola, M; Mason, A; Al-Shamma'a, A. Investigation of audible carbon monoxide alarm ownership: Case study. *Smart and Sustainable Built Environment 2014, 3(1) 72 - 86*
9. Boon, P.E.; van Donkersgoed, G; Christodoulou, D; Crépet, A; D'Addezio, L; Desvignes, V; Ericsson, B; Galimberti, F; Ioannou-Kakouri, E; Jensen, B; Rehurkova, I; Rety, J; Ruprich, J; Sand, S; Stephenson, C; Strömberg, A; Turrini, A; van der Voet, H; Ziegler, P; Hamey, P; van Klaveren, JD. (2014). Cumulative dietary exposure to a selected group of pesticides of the triazole group in different European countries according to the EFSA guidance on probabilistic modelling. Food and Chemical Toxicology 2014. http://dx.doi.org/10.1016/j.fct.2014.08.004
10. Kennedy, M; Glass, C, Bokkers, B, Hart, A; Hamey, PY., Kruisselbrink, JW., de Boer, WJ; van der Voet, H; Garthwaite, DG; van Klaveren, JD. (2014). European model and case studies for aggregate exposure assessment of pesticides. Food and Chemical Toxicology http://dx.doi.org/10.1016/j.fct.2014.09.009
11. S De Matteis S; Ruston, L; Jarvis, D; Wheatley, M; Azhar, H; Cullinan, P. A new, efficient web-based tool to collect and code lifetime job histories in large population-based studies: the COPD project in the UK Biobank cohort.*1st Young Researchers Conference on Environ. Epidemiology-ISEE (Barcelona). 20-21 Oct 2014*
12. Sadhra, S; Fishwick, D; Kurmi,O; Chambers, H; Lam, H; Hutchings S; Jarvis, D; De Matteis, S; Rushton, L; Ayres, AG; Cullinan, P. Development of a Job Exposure Matrix for SOC 2000 listings to identify occupational causes of COPD. BTS Winter Meeting 3-5 December 2014.
13. Pye Tait Consulting . Competence in Construction. http://www.citb.co.uk/documents/news%20and%20events/competence-construction-report-september-2014.pdf. September 2014, CITB

Annex 1.8

Strategic Statement on Science

The following paragraphs state how HSE uses it scientific and engineering resources in support of our mission to prevent death, injury and ill-health to those at work and those affected by work activities.

HSE is a strongly scientific and evidence-based organisation with about a quarter of our staff being qualified scientists or engineers. Approximately 19% of HSE's budget is devoted to commissioning scientific research and support. Although we use a wide range of institutions and contractors, our principal supplier is the Health and Safety Laboratory, which is an agency of HSE and a world-class facility. It provides vital technical and research level experience and problem solving skills. HSE is both owner and major customer of HSL, and will continue to maintain a strict separation between these roles.

Our scientific activities enable us to gather evidence, identify and develop practical solutions, and monitor and evaluate their success in supporting our Strategy and business delivery plans. At all stages the ability to anticipate and evaluate the importance of future challenges is critical to maintaining HSE's position as a forward-thinking regulator.

What do we do?

HSE's Science:-

- supports delivery of the Strategy (*The Health and Safety of Great Britain: Be part of the solution*) and associated business plan
- supports front line regulatory functions (e.g. incident investigation)
- looks ahead to identify future challenges

The Summary Science Plan sets out how HSE will apply science and engineering resources to the delivery and realisation of its business plan. HSE's Business Plan 2012-2015, demonstrates how we will deliver our part of the strategy *'The Health and Safety of Great Britain: Be part of the solution'*.

Forensic support for incident investigation is essential to enable HSE to carry out its enforcement activity with a high degree of confidence and success. HSE invests in the skills of its laboratory staff to document evidence, keep up to date with analytical and technological innovations and research, and develop new techniques and models as appropriate. HSE will maintain the capability and readiness to future incidents in critical areas.

HSE is alert to the implications for health and safety of new technologies and changes in the workplace. We seek to advise and inform so that GB is well placed to capitalise on innovation without detriment to our mission to prevent death, injury and ill health to those at work and those affected by work activities.

Why do we do it?

We have a strong tradition for scientific method, use of experts, advisers and committees in the development of HSE's policies and regulations. This is drawn from our duty to commission and publish appropriate research and to provide training and information in connection with this, duties enshrined in the Health and Safety at Work (etc.) Act 1974.

We procure individual projects in accordance with best practice and continually strive to improve the management of commissioned science to improve efficiency and effectiveness by:

- working in partnership with industry, research councils and professional bodies to share funding,
- working with academics, other experts, industry groups and international regulators to improve the quality of research proposals and research outputs,
- applying best practice with regard to procurement.

HSE will continue its policies to attract and retain high quality professional scientists and engineers and develop appropriate scientific career structures – in line with the guidance of the Government's Chief Scientific Adviser

We aim to improve the understanding, communication and utilisation of the results of our scientific research through:

- closer working between scientists and policy makers,
- greater emphasis on peer review, research evaluation and publication in the scientific literature,
- better knowledge management to enable easier identification of existing research.