HSE Summary Science Plan
2012–15
(Updated April 2014)
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Foreword

HSE’s Science Plan, developed by policy and operational staff in HSE, with support from scientists, engineers and analysts in HSE and our executive agency, the Health and Safety Laboratory (HSL), sets out how we will apply science and engineering resources to the delivery and realisation of the four main aims in HSE’s three year business plan: leading others to improve health and safety in the workplace; providing an effective regulatory framework; securing compliance with the law; and reducing the likelihood of low-frequency, high-impact catastrophic events.

HSE’s scientific and engineering skills and research programmes provide the robust evidence that underpins policy and delivery of operational activities, thus making a critical contribution to the delivery of HSE’s objectives and ensuring the effective use of public resources and value for money.

This is a three year rolling plan that describes how HSE’s use of science will bring about improvements within the health and safety system. It will facilitate continuity and support for longer term strategic research programmes beyond the next three years, including futures research. This will be important to ensure that HSE is prepared for future changes in the workplace that might give rise to new risks. The plan will be updated as circumstances dictate.

I very much welcome comments and views on this science plan which should be sent to science@hse.gsi.gov.uk.

Dave Bench, Director of Science, Engineering, Analysis and Chemicals Regulation
A. Lead others to improve health and safety in the workplace

Where improvements in health and safety standards are necessary and where HSE can make a distinctive contribution, we will work closely with individual companies, industry bodies, stakeholder groups and others to assist them to drive forward sector-led improvements. These improvements can be informed through research and information and advice, and working with local authority partners by inspection, investigation and enforcement.

A.1 Use evidence and knowledge to guide and prioritise our own actions and guide the actions of others

HSE’s statisticians develop statistical sources and analyse and interpret statistical data to provide up to date information on the incidence of work-related injuries and ill-health. Statisticians will also seek to use data from external sources where it can complement our internally collected statistics. These analyses help HSE to target and design interventions by identifying sectors and occupations where there is a relatively higher risk of injury and occupational ill-health.

Regular sources include:

• *Labour Force Survey* and associated Self-reported Work-related Illness (SWI) surveys - these surveys are managed by the Office for National Statistics and we will commission questions on ill-health and injury for inclusion in the surveys.

• *Data reported under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR)* regulations, for injury statistics.

• *Medical specialist and General Practitioner injury and ill-health surveillance schemes*.

A suite of health and safety statistics will be published annually in the autumn.

In addition to these data sources we may commission ad hoc surveys to support HSE’s initiatives with particular priority sectors. We will undertake some exploratory analysis of a database of measurements from individuals in noisy industries and further explore the usefulness of this database in obtaining health information on *hand-arm vibration syndrome* - data analysis starting June 2014. We will collaborate with the European Agency for Safety and Health at Work (EU-OSHA) on their 2014 European Survey of Enterprises on New and Emerging Risks (ESENER), to provide us with data on working conditions and the management of health and safety in UK workplaces – data available in 2015. There is also provision to undertake specific research on demand, in response to emerging issues.

HSE commissions economics research to inform the efficient use of resources, of both HSE and duty holders, in designing programmes, policies and projects. Topics planned over the next three years include:

• further technical updates to the method used for estimating the ‘Costs to Britain’ of workplace injuries and new cases of work-related ill health – starting mid 2013 ✓

• a valuation study of the impact of work-related injury and ill health on subjective well being – starting January 2014 ✓

• a pilot survey to investigate relative public perceptions about cancer and road fatality risks – final report1 due Summer 2013 ✓

We will also commission and use research and evidence, including social science research, to enhance our knowledge to support identification and delivery of HSE’s current and future priorities in the following areas:2

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1 Where ‘report’ is used in this plan, it refers to an HSE research report published and freely available on HSE’s website or research findings published in peer-reviewed journals.

2 The figures and dates given for report delivery and in figure 2 are based on the latest information and therefore subject to change.

✓ indicates that the milestone has been delivered.
• Asbestos – report on prediction of mesothelioma risks associated with current asbestos exposures by June 2014.
• Chronic Obstructive Pulmonary Disease (COPD) – a large scale epidemiological study to establish the principal causes of COPD– estimate of current burden and initial assessment of causes of work related COPD by June 2013 ☑; with final assessment December 2015. Produce a standard of care document for professionals treating patients with work-related COPD by December 2012 ☑
• Waste and Recycling –occupational exposures, ill health and effective control procedures to manage risks first reports by December 2015
• Ill health in construction – first reports (e.g. paint, diesel engine exhaust emissions ‘DEEE’) from end 2014
• Develop ‘CAREX’, an information system to gather occupational carcigen exposure in GB – first report by 2015
• Shift work – conduct a major epidemiological study examining the relationship between major chronic disease (including cancer) and shift work - report by end 2015
• Updating the evidence base for wood dust exposure risks in the construction and woodworking industries – report end 2016
• Take forward any HSE-led research requirements arising from the ‘Tackling Occupational Disease - Developing New Approaches’ stakeholder conference held in March 2013
• Commission a suite of projects on exposure to isocyanates – starting April 2013 ☑
• Understanding use of and future applications for collaborative robots – starting early 2014 ☑
• Asthma – examine the socio-economic impact of work-aggravated asthma. Commission research to review occupational asthma in cleaners - starting mid 2014
  Pilot pesticide usage survey – report spring 2015

A.2 Target and conduct inspections on those sectors and activities which give rise to the most serious risks or where risks are least well controlled

We commission science from HSL and external contractors to provide immediate and high quality support for our operational activities - investigations, inspections and enforcement activity. We will:

• Inspect where robust evidence and intelligence indicate health and safety performance is of serious concern and where inspection is the most effective intervention to secure compliance.
• Commission research requirements as identified in HSE’s sector strategies e.g;
  o conduct a review of the safety implications for storage of nitrocellulose in fireworks – report end 2014
  o development of a competency framework for supervisors and team leaders in roadside waste and recycling collection activities – preliminary report end 2013 ☑
• Examine current exposures and work practices in the licensed asbestos removal industry – report by end 2016
A.3 Provide guidance and support others to enable informed workplace health and safety decisions

We will commission and utilise scientific research, support and expertise to underpin our guidance and we will provide expertise to enable others to develop, produce and disseminate their own guidance and best practice. We will also fund research to encourage an increase in competence which will enable greater ownership and profiling of risk, thereby promoting sensible and proportionate risk management.

Specific projects include:

- **Construction** – Evaluate the design and leadership during demolition and decommissioning following the London 2012 Olympic and Paralympic Games - report by early 2014 ✓. Commission an analysis of underlying causes of falls through fragile materials – report mid 2014
- Understand the health and safety elements of effective leadership in the offshore industry – report by March 2013 ✓
- Develop a benchmarking tool for managing exposure to silica dust in quarries - by summer 2014
- Provide scientific support for Agriculture Safety and Health Awareness Days – deliver support for ~30 events over period 2012-15
- Develop a Health Risk Management Maturity Index for the construction industry - report by December 2013 ✓
- **Risk management** - develop an educational package in health and safety risk management for engineering students – by March 2016
- **Risk awareness** - develop an integrated approach for combined chemical exposure assessment to address requirements for regulatory cumulative risk assessments - starting 2014
- Evaluate the vocational education and training related to respiratory risks – report by December 2014
- Develop practical cost-effective solutions for dust control in SME bakeries – report end 2014
- Produce an interactive on-line tool to measure the effects of wear duration on hearing protection – by end 2013 ✓
- **Landlords’ gas safety duties** – research to look at levels of awareness and barriers to compliance amongst landlords in the private rental sector and ways in which we can influence this - end 2014
- Develop updated guidance to enable dutyholders to apply the Genetically Modified Organisms (Contained Use) Regulations 2014 to their areas of work – by autumn 2014
- Work with other government departments to explore the development of a ‘Mindspace for Business’ toolkit using behavioural insights. This will outline the most effective ‘behavioural insight’ tools and approaches that Government can use to influence the actions of businesses towards regulatory compliance - phase one feasibility report – mid 2014
B. Provide an effective regulatory framework

HSE will take forward the recommendations arising from the independent review ‘Reclaiming health and safety for all: An independent review of health and safety legislation’ (November 2011). This work will help to simplify and streamline the regulatory framework and make the legislation easier to understand. Science and research will be used to underpin how we do this. We will also continue to negotiate and secure the best possible outcome for British industry within Europe to minimise the burden on business and maintain protection for workers. HSE is alert to the implications for health and safety of new technologies and changes in the workplace and 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.

B.1 Simplify and consolidate domestic health and safety regulations to make the law easier to understand

- HSE will commission work which will enable a considered, evidence-based decision to be made on the consolidation of health and safety regulations – first report by July 2012  
- Undertake an evaluation of the amendment to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR) to move from the over three day lost time reporting requirement to over seven days. This research will inform further consideration of the need for any future review of RIDDOR and the wider assessment of the British occupational health and safety injury reporting system – final report from evaluation due autumn 2013  
- Harmonisation of explosives legislation – undertake a technical review of safety issues relating to activities undertaken subject to existing legislation – internal report by end 2012  
- Improve the evidence base for impact assessment analysis: combining analytical approaches to ensure the assumptions used in impact assessments are as accurate and robust as possible and
  - Undertake qualitative research to understand how small firms carry out and record risk assessments and whether there is a link between recording risk assessments and risk management practices – interim report June 2014, final report October 2014

B.2 Negotiate and secure the best possible outcome in Europe for British industry

Provision of underpinning scientific and technical evidence to contribute to the social dialogue process, proposals and negotiations on a number of Directives and EU Regulations as required, including:

- European offshore oil and gas regulations in line with the requirements of the Directive.
- Completing the work to support implementation of the Seveso III Directive into UK law by April 2015. This includes research into consequences for site operators under proposed changes to the current Seveso II Directive, impacts on the Competent Authority and development of a model of economic consequences to population and infrastructure surrounding COMAH sites of changes to the Directive - draft evidence required by beginning 2014
• Amendments to the Carcinogens and Mutagens Directive. A draft Directive with proposed changes is expected in June 2013 after which the impact assessment will inform UK negotiations on the final draft.
• Electromagnetic Fields (EMF) Directive by October 2013

B.3 Taking the wider perspective

We will work collaboratively with HSL, a range of contractors and leading industries to investigate new hazards associated with emerging and expanding technologies. We also recognise that we need to do more to identify what new research will be needed to help identify future occupational disease priorities and how we design effective mechanisms for stakeholders to tackle these and current disease priorities. HSE has commissioned a dedicated ‘Futures’ team at HSL to provide it with early intelligence about emerging new technologies and trends.

Science topics include:

**Emerging energy technology**: HSE will remain instrumental in ensuring the safe and efficient introduction of hydrogen fuel cell technology in the UK. In supporting the European ‘H2FC’ project, we will enable and facilitate the safe and efficient introduction of hydrogen and fuel cell technologies to the benefit of workers, the public, the environment, UK science and technology and business. HSE is involved in the H2FC work packages focusing on improvements to different fuel cell technologies, development of appropriate infrastructure and improved hydrogen storage solutions, and the development of software for risk assessment analysis of installations - first reports by late 2013

**Renewable energy**: Over the next decade and beyond the UK is set to take significant steps towards a new energy economy. From a health and safety perspective, the scale and speed of changes caused by the drive towards a new energy economy will pose a significant challenge. HSE’s current research in this area focuses on further enhancing our knowledge of the renewable energy sector and its possible future directions in the next 3-5 years, to ensure that our approaches for regulating this sector remain robust, help to deliver the Government's Green Energy Agenda, and coordinate effectively with those of other European Member States and the wider international arena - report summer 2014

**Complexity science**: Research to look at the feasibility of estimating impacts of HSE's interventions through complexity science. This work will look at the feasibility of using complexity framework and computational modelling approaches to understand and, where possible, estimate the impact of HSE on health and safety behaviour, given that intervention seldom impacts in a precise and linear way in complex systems such as the health and safety system. The research will be most useful in informing decision-making and building understanding of how HSE impacts on behaviour. This is an area of science being explored by other Government departments and HSE analysts are collaborating with counterparts - scoping phase during 2013/4

**Nanotechnology**: Work over the next three years will focus on exposure and the control of exposure in the workplace to manufactured nanomaterials. Future research commitment will concentrate on conducting research to identify the numbers of workers exposed to nanomaterials in UK industry – research ongoing

**Strategic Research Programmes (SRP)**: Three long term (up to 5 years) SRP are ongoing at HSL focusing on:

• **Health surveillance and health impact assessment** – this SRP will develop quantitative methodologies and an accompanying evidence base to allow effective intervention strategies to be planned, implemented and evaluated for long latency diseases such as COPD, asthma and silicosis. The work will
develop, pilot and evaluate the effectiveness of health surveillance tools in UK workplaces.

- **Exposure and response profiling** – this SRP will improve HSE’s intelligence of, and response to, emerging workplace health issues in an environment of constrained resources.

- **Mathematical modelling** – this SRP includes projects to develop dense gas dispersion modelling and the integration of Quantified Risk Assessment (QRA) in Geographical Information Systems (GIS) which will be used to support delivery of work in hazardous industries.

A further proposal for a long-term SRP on ‘Advanced materials and manufacturing’ will be developed in **2013** to begin work in **mid 2014**

**Reports on all SRPs produced annually with quarterly progress reports and publications in peer-reviewed journals.**

**Demographics:** Following a review of recent work by others in this area, some projects will be commissioned to begin work in **2014**. The long term approach in this area will be reviewed in due course.

**Next generation workers:** The aim is to take existing national data on obesity within the 6-16 age group and examine the probable impact on physical health and capabilities in the future and then assess the impact on HSE policies and guidance – **commission a PhD studentship by end 2014**
C. Secure compliance with the law
Firm, properly targeted and proportionate enforcement underpins the action we need to take to deliver a sustainable, long-term reduction in occupational injury and ill-health. Of the thousands of inspections and investigations each year, a significant proportion require particular science or engineering knowledge to identify the causes of problems and to identify solutions which meet the key criteria of being reasonable and practicable.

C.1 Investigate work related accidents, incidents and ill health and take formal enforcement action to prevent harm and secure justice where appropriate.

We have specialists (in both HSE and HSL) from over 20 disciplines that provide expert technical knowledge in support of investigations. This corporate expertise and knowledge, and the facilities available at HSL, are unparalleled and it means that our inspectors can call on immediate support at any time.

Our continuing science and engineering requirements are:

- Maintaining and developing capability (equipment and facilities) and staff expertise for a range of core scientific disciplines necessary to support incident investigation and other mandatory activity associated with all industries and sectors regulated by HSE (and Local Authorities).
- Maintaining provision of timely/immediate technical support to investigate incident investigations, anywhere in the UK.
- Learning and disseminating lessons learned from incident investigation.

All provided within agreed timescales

Types of technical work that support investigations and which are retained on a regular basis include:

- Evidence management and archiving of incident material – including transport and secure storage of large pieces of equipment.
- Evidence presentation. HSE’s experts provide high quality evidence for presentation in court cases. This is supported by the provision of excellent animations and physical models that make the evidence more understandable by the courts and lay people.
- Statutory schemes. Support for the Explosives Notified Board under the EU pyrotechnic articles directive. Support to HSE as the Competent Authority for work on biocides, pesticides and the REACH programme.
- Maintenance and calibration of instruments and equipment to support field activities.
- Provision of photographic services – including video, aerial photography, CCTV decoding etc.
- Access to data including GIS and mapping facilities, Ordnance Survey maps.
- The ability to buy in expertise not present in-house at short notice (in unusual disciplines).

All provided within agreed timescales.
D. Reduce the likelihood of low-frequency, high-impact catastrophic incidents

HSE’s function as an effective regulator of major hazard and specialist industries (including offshore and onshore petrochemicals and chemicals, gas and pipelines, facilities handling human and animal pathogens, explosives and mines), requires a high degree of expertise and experience. For each industry sector there is a requirement for specific scientific and engineering competencies to enable us to meet our regulatory objectives. These are met by HSE’s own staff but also through the commissioning of appropriate practical support from HSL and other contractors.

D.1 Provide scientific and technical advice in relation to the Control of Major Accident Hazards (COMAH) Regulations 1999

The main aim of the COMAH Regulations is to prevent and mitigate the effects of major accidents involving dangerous substances, such as chlorine, liquefied petroleum gas, explosives and arsenic pentoxide, which can cause serious damage/harm to people and/or the environment.

Scientific support includes:

- Technical contributions to the assessment of complex Safety Reports submitted by operators under the COMAH regime - support provided within agreed timescales
- An operational intelligence project which will collect, collate and analyse information from a variety of sources to make recommendations to the Competent Authority Intelligence Review Group (CAIRG) on priorities for effective regulation of COMAH sites. This will also feed into further development of remodelling of the COMAH regime, and prioritisation of objectives (operational and science) by the COMAH Competent Authority – annual reports to CAIRG on regulatory performance and trends published in the autumn
- Development of an economic model for COMAH site accidents. This project will allow the development of a Graphical Information System (GIS) based tool to allow economic modelling of the cost of accidents at COMAH sites – report due mid 2014

D.2 Provide scientific and technical advice in relation to land use planning

HSE is a statutory consultee for land use planning (LUP) applications around major hazard sites and pipelines. HSE’s LUP advice is aimed at mitigating the effects of a major accident on the population around a major hazard site.

Scientific support includes:

- Support for delivery of 3-zone maps and LUP advice; utilising skills of the HSL GIS team to enhance the support to Local Planning Authorities and site developers using PADHI+ (Planning Advice for Developments near Hazardous Installations) and the information available to them on the LUP extranet - support provided within agreed timescales and in line with Government’s expectations for responding to applications
- Support to LUP policy and strategy development, for example development work to support assessment of societal risk presented by major hazard sites, and assessment of models for management of Hazardous Substance consents, with other Government Departments – ongoing support provided within agreed timescales
• Scoping study to assess available data and potential methods for an estimation of the economic impact of proximity to major accident hazard sites on property prices. If successful, this initial project should enable a fuller assessment of economic impacts to be taken into account in the land use planning process - **project to end early 2014**

• Finalising the project to quantify the impact of HSE LUP advice around major hazard sites. Two pilots have been completed, applying the proposed methodology to gas holders and gasoline pipelines. The methodology has since been peer reviewed. When trying to apply this methodology to a larger sample of major hazard sites it has become apparent that the availability of data from local planning authorities could be the limiting factor - **project completion expected by summer 2013 ✓**

• Specific advice and intelligence from HSL to frontline inspectors on failure rates at Major Hazard sites and technical support to develop LUP methodologies. These include the development of dispersion models and methodologies to predict behaviour for specific substances and/or conditions – **ongoing technical support provided by agreed timescales to update methodologies**

• Continuing to develop practical solutions in response to recommendations from the Buncefield Major Incident Investigation Board, e.g. understanding vapour cloud development and the characteristics of explosions following large fuel spillages and the interaction of explosions with vegetation - **report on vapour cloud formation early 2013; results of large scale explosion tests winter 2013, final project report December 2013, open presentation of results March 2014 ✓**

**D.3 Offshore and specialised industries**

Key priority areas for the offshore industry are: taking forward leadership, emphasising major hazard potential risks associated with poor asset integrity; and promoting a safety culture that encourages the active involvement of the offshore workforce, as a driving force for improvement. Specialised industry sectors (e.g. mines, biological agents, explosives and gas and pipelines) can vary greatly in terms of maturity and complexity, and also the size, distribution and resources of duty holders. This results in some very diverse needs from the science plan. Much of the work is commissioned under ‘call-off’ arrangement when required operationally. **All provided within agreed timescales**

Projects include:

• HSL support for delivery of major hazard objectives with regard to Safety Case assessment under the Offshore Regulations - **support for up to 100 cases provided within agreed timescales and in line with Government’s expectations for responding to assessments**

• Specific technical support in response to a wide variety of specific technical and engineering problems identified in the areas of fire and explosion, structural integrity, corrosion/fatigue failure and emergency response procedures – e.g. **composites degradation project starting autumn 2012 ✓ bolting corrosion and stress corrosion cracking – first report end 2015**

• **Ageing onshore infrastructure** – safety issues related to the working life extension of plant and equipment at onshore major hazard sites including – **first reports by March 2013 ✓; a report on sector performance in managing ageing plant by March 2014 ✓; and a report on the impact of HSE interventions and stakeholders’ work on sector performance by March 2014 ✓**.
• Participation in joint industry and European projects on Carbon capture and storage – risk management report completed early 2013, large scale CO\textsubscript{2} releases planned for mid/late 2014. Contractor reports due from mid 2013 to late 2014.

• Specific technical support to address scientific or engineering issues identified e.g. causal factors; flammability type assignments of organic peroxides; development of UN Test Methods for explosivity – first reports by June 2012.

• Support for future policy and strategy development in biological agents sector e.g. evaluation of new and emerging bio-technologies; development of safety performance indicators for biological agents industries - technical support provided within agreed timescales, development of a rapid detection method for Legionella - report by mid 2015.
How we will use our resources and funding

HSE’s mainstream budget for commissioned research and technical support for 2014/15 is approximately £25 million; this excludes funding for the research portfolio for pesticides that is funded by DEFRA.

Figure 1 shows indicative budgets for the period 2012/13 to 2014/15 for HSL and external work. Real terms savings include a reduction in external science spend by approximately 40%.

We will continue to publish an annual science report on our website which covers the use, efficiency and effectiveness of HSE’s investment in research and technical support commissioned from HSL and external contractors. We will continue to publish research findings in HSE’s freely available research report series and more of our peer-reviewed articles will be published in open access journals (for 2014/15 estimated numbers see Figure 2).

Figure 2: Research reports to be published by topic
We will develop and seek to implement a joint HSE/HSL approach to identify commercial opportunities with governments and public bodies outside the UK where they are willing to pay for our intellectual property and expertise. We will implement the strategy to enable HSL to deliver growth in external revenues and sustained profitability, whilst maintaining the quality and responsiveness of its service delivery to HSE.

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