

HSE's Summary Science Plan 2011 and beyond

Commissioning and using science over the next 3 years

Table of contents

	Page
Foreword	2
1 Introduction	3
2 Science Strategy	3
3 Finance/Resources	6
Supporting the HSE Strategy	
4 Improving the working environment	
4.1 Creating healthier and safer workplaces	7
4.2 Avoiding catastrophe	16
4.3 Investigations and securing justice	21
5 Taking Responsibility	
5.1 The need for strong leadership	23
5.2 Building competence	24
5.3 Involving the workforce	26
6 Transforming the approach	
6.1 Customising support for SMEs	28
6.2 Taking a wider perspective	29
7 Delivery of plan	
Annex 1 Criteria for commissioning science	32
Annex 2 HSE's Science arrangements	33
Annex 3 Glossary	39

Foreword by the Director of Science

In June 2009, the Health and Safety Executive (HSE) launched 'The Strategy for Health and Safety of Great Britain in the 21st Century'. The strategy invites all stakeholders within the health and safety system to bring about improvements in health and safety performance.

In the current economic climate the focus is ever more upon the effective use of public resources and value for money. HSE's scientific and engineering skills and expenditure on research provides the robust evidence which underpins policy and delivery of operational activities, thus making a critical contribution to the delivery of HSE's strategy.

HSE's Science Plan, developed by policy and operational staff in HSE, with support from scientists, engineers and analysts in HSE and the Health and Safety Laboratory, sets out how we will apply science and engineering resources to the delivery and realisation of each of the ten strategy goals.

This is a three year 'rolling' plan which aims to integrate and focus science needs to bring about improvements within the health and safety system. As such it will facilitate continuity and support for longer term (greater than 3 years) strategic research programmes, 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 annually or as circumstances dictate.

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



Dave Bench
Director of Science

1 Introduction

HSE's mission is to prevent death, injury and ill-health to those at work and those affected by work activities.

In 2009 we launched a new Strategy that reset the direction for the health and safety system¹. What HSE is doing to play its part in achieving the goals described by the strategy is laid out in the HSE Delivery Plan for 2011/2012 that sets out our key activities and performance measures.

The purpose of this 3 year rolling Science Plan is to summarise the contribution that our scientific and engineering resources will make to the delivery of our new Strategy, the Business Plan and to the development of future strategies.

As an independent, scientifically-based regulator, a high proportion of our science and engineering is technical support to frontline operational activities, including investigations and major incidents. The skills and resources needed to meet these requirements are relatively consistent from year to year. Having a three year plan enables us to have a clearer picture of these regular requirements and to schedule and deliver longer duration research projects.

It is intended that the plan will be reviewed and updated annually to take account of emerging priorities. In content, it encompasses:-

- our basic rationale or Science Strategy and
- major areas of scientific investment

2 HSE's Science Strategy

Our previous **Science Strategy** described our basic processes and governance in some detail and in this document we have aimed to retain essential elements and bring up to date any important changes.

Strategic Statement on Science.

The following paragraphs state how and why HSE uses its 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 15% of HSE's budget is devoted to commissioning scientific research and support. Although we use a wide range of institutions and contractors, our

¹ More information on the strategy (*The Health and Safety System of Great Britain\Be Part of the Solution'*.) can be found at [The Health and Safety of Great Britain - View the HSE strategy.](#)

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.

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 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 delivery targets
- supports frontline regulatory functions (e.g. incident investigation)
- looks ahead to identify future challenges

In more detail:-

This rolling summary Science Plan identifies and prioritises science to:-

- acquire evidence for policy development
- support delivery of operational objectives
- develop practical solutions
- understand new and emerging issues and
- evaluate impact

in support of the following key themes of the Board strategy:-

- Creating healthier, safer workplaces
- Avoiding catastrophe
- Investigation and securing justice
- The need for strong leadership
- Building competence
- Involving the workforce
- Customising support for SMEs
- Taking a wider perspective

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 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.

Our principles - 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

Annex 1 describes the criteria that we use to make decisions on the types of scientific work that it is appropriate for HSE to commission.

3 Finance/resources

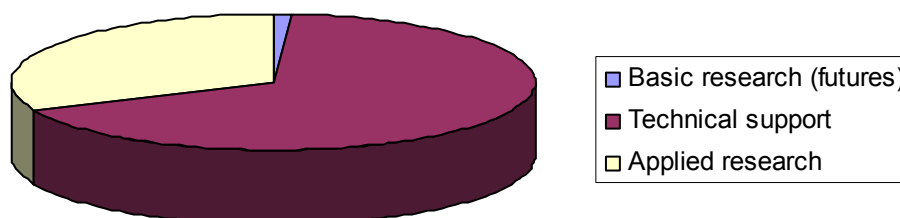
HSE's mainstream budget for commissioned research and technical support for 2011/2013 is approximately £33 million².

The table below provides indicative budgets that may be subject to review during the next spending round.

	Extramural	HSL
Yr 1 2011/2012	£5,344,000	£27,686,000
Yr 2 2012/2013	£3,457,000	£25,886,000
Yr 3 2013/2014	£3,255,000	£24,886,000

² This excludes funding for science to support the Nuclear Directorate, which has separate arrangements, and the research portfolio for pesticides that is funded by DEFRA.

The proportions of the budget allocated to different activities are represented by the pie chart below.



Supporting the HSE Strategy

What are the key challenges in 2011/2012 and beyond?

The following sections of the summary Science Plan provide an overview of HSE's emerging science requirements in support of the HSE Strategy. They describe projects that support specific individual business objectives as well as the fundamental analytical work that contributes to delivery across many of the Strategy's key goals and objectives.

4 Improving the work environment

4.1 Creating safer, healthier workplaces

Strategy goals
<ul style="list-style-type: none">• To specifically target key health issues and to identify and work with those bodies best placed to bring about a reduction in the incidence rate and numbers of cases of work-related ill health• To set priorities and, within those priorities, to identify which activities, their length and scale, deliver a significant reduction in the rate and number of deaths and accidents.

Reducing the burden of occupational disease continues to represent a major challenge. In numerical terms it is far greater than that presented by safety issues. HSE's outline plan of work for the next 18 months builds on our existing knowledge and experience across the range of occupational disease issues. It continues our commitment to building on the successes that we believe have been achieved through good management and partnership working. We will concentrate on:-

- long latency diseases
- common health problems such as musculoskeletal disorders (MSDs)

- noise and vibration

In this section of the plan we summarise the scientific research priorities to support this plan of work and also outline next steps for developing a longer term research agenda.

Long latency occupational diseases (associated with current and historical exposures to carcinogens, dusts, fumes and fibres).

We have some evidence of the scale of long latency occupational disease and we also have an increased understanding of how to change behaviours and practices to reduce exposure to substances and physical agents causing occupational ill-health. An initial analysis has helped to identify key industries and sector groups of highest risk where we will target interventions over the next 18 months. These are: construction workers, foundry workers, engineering and welding, quarry workers, stonemasons and building and maintenance activities where there is a risk of exposure to asbestos.

The science and research to support these interventions will concentrate on understanding the issues, developing solutions and evaluating outcomes.

Specific projects include:-

- Asbestos - measuring work-related airborne asbestos exposures in Great Britain, and determining the mesothelioma risk among people without recognised occupational asbestos exposure.
- Chronic obstructive pulmonary disease – undertaking a large scale epidemiological study to establish the principle causes of COPD and to review the potential extent of exposure to the most common airborne irritants within different occupations and industries in the UK. This programme will provide a more rigorous evidence base and support the development of appropriate interventions
- Silica – investigating the long term health impacts of exposed workers (and criteria for health surveillance).
- Woodworking – undertake a pilot occupational hygiene survey of woodworking premises to assess if standards of exposure control to wood dusts and isocyanates are improving.
- Understanding the effectiveness and limitations of control measures to reduce exposure to agents or materials that can cause or contribute to the severity of long latency diseases caused by carcinogens, harmful dusts, fumes and fibres.
- Foundries - to further reduce health risks in the foundry industry by improving substance control and illustration of good controls practice.
- Collection of statistically representative exposure data for specific hazards which cause the greatest harm and can be measured through air monitoring e.g. silica, isocyanates and flour, but we will consider how to improve exposure data in relation to asbestos and noise and vibration.

Musculoskeletal disorders (MSD)

We propose to focus our efforts on specific sectors and/or types of work that are particularly damaging. Our immediate science needs are for the development and validation of tools to support interventions. This includes validation and updating of the Manual Handling Assessment Charts and review of manual aids and automation to reduce the risks of repetitive handling tasks. We will also investigate those occupations and tasks requiring fixed postures and the use of 'hand-held' devices to identify the numbers of workers and MSD risks involved, together with prevention and control measures.

Noise and Vibration

On-going requirements are to improve the evidence base for Hand Arm Vibration (HAV), in particular the dose response relationship for HAVs and the prevalence of upper limb disorders in sectors with a high risk of developing HAV. We are also focussing on health surveillance for noise-induced hearing loss – assessing the current uptake of health surveillance, to allow us to target our efforts in those areas where uptake may be low; and working to develop more reliable methodologies for health surveillance, such as oto-acoustic emission testing. Additional work will assess the prevalence of noise-induced hearing loss and HAV in Great Britain.

Support to specific industries.

In 2011/12 we will concentrate on scientific research that supports the construction industry. This will enable us to take account of the opportunities for learning provided by the construction phase of the London 2012 Olympic and Paralympic Games, and in response to the **Donaghy report** into the underlying causes of fatalities in the industry.

Construction industry

Specific projects described in other parts of this plan include the construction statistical surveys, and work to strengthen director leadership.

Additional work will measure the impact and lessons learned from recent interventions and activities. For example:-

- Research to investigate the impact of particular interventions e.g. small sites and campaign initiatives.
- Development of an industry baseline standard for on-tool extraction for control of dusts.
- A programme of work on mobile elevated work platforms.
- London 2012 Olympic and Paralympic Games:
 - Demonstrating the safety culture legacy from the construction phase. This work will aim to produce a series of case studies and good practice exemplars based on application of a tailored version of HSE's Safety Climate tool for companies involved in construction of the Olympic park.

- CDM and temporary structures. This will aim to provide good practice standards for CDM dutyholders and event managers in the design and construction management of temporary structures.
- Research into occupational health performance at the Olympic Park during construction to represent best practice, and with a legacy as a beacon of excellence for the future for the UK construction industry
- Evaluation of design and leadership during demolition and decommissioning following the Olympic and Paralympic Games. To understand how the design of venues has taken account of the need for demolition, decommissioning and modification as the venues are modified to create a lasting legacy.

Reducing injuries - Slips and trips and falls from height

HSE has a good evidence base on the number and nature of work-related injuries and the occupations involved. We have commissioned extensive research to develop a range of tools and initiatives to reduce injuries associated with slips and trips and falls from height. Our future requirements are significantly reduced and will concentrate on assessing the value and use of these tools and measurement of their impact. We will continue to require scientific support for operational activities.

Evaluating and monitoring the effectiveness of interventions

Monitoring the effectiveness of our interventions (legislative and non-legislative, and including those delivered in partnership with Local Authorities) is essential to ensure that we continue to commit our resources effectively and to enable refinement of future activities.

For example the Vocational Education and Training project³ aims to ensure that when learners enter the workforce they are aware of risks from exposure to dust, gases, vapours and fumes. A pilot project developed targeted learning products and tools aimed at learners in the construction, stonemasonry, welding, engineering and motor vehicle repair industries. The pilot project will be evaluated to inform decisions about further large scale roll out. The evaluation will assess how effectively the project was implemented and aim to understand what factors contributed to its success or failure.

Proposals for other evaluations are described in relevant sections of this plan.

Longer term objectives

We recognise that we need to do more to identify what new research will be needed to help identify future health priorities and also to determine and design effective mechanisms for tackling these.

In 2011 two long term (up to 5 year) Strategic Research Programmes (SRP) were set up at HSL. One SRP will focus on health surveillance and health impact assessment and one on exposure and response profiling. The overall goals of the former programme are to develop quantitative methodologies and

³ <http://www.hse.gov.uk/research/rrhtm/rr803.htm>

an accompanying evidence base to allow effective intervention strategies to be planned, implemented and evaluated for long latency diseases of high concern, such as COPD, asthma and silicosis; and to help coordinate health surveillance across UK workplaces, increasing participation and promoting adoption of schemes with proven effectiveness. The SRP focussing on exposure will improve HSE's intelligence of, and response to, emerging workplace health issues in an environment of constrained resources.

Both programmes will ensure that HSL staff develop their capabilities and knowledge and that HSE is better prepared for future changes in the workplace that may give rise to new risks.

In order to deliver effective and efficient interventions.

Our future science and evidence needs are focused on:

1. Expanding and integrating data sources, ensuring that more types of businesses and individuals supply robust data and sharing data internationally so that health and safety data available to the HSE are broadened
2. Continuing to collect good quality statistics to demonstrate where most injuries and occupational disease are occurring, what groups are most at risk and how changing demographics are having an impact so that HSE interventions can be better targeted
3. Understanding better how work and non-work-related factors contribute to health and safety, what the attributable effects are and which factors have the biggest impact so that HSE policies are better informed
4. Researching new ways of tackling major health and safety problems so that more innovative and new approaches can be developed

Core topics are:-

- Understanding and interpreting statistical data
- Research that helps HSE monitor performance
- Economic research - understanding the costs and benefits of interventions
- Social research - understanding how to influence behaviour

Understanding and interpreting statistical data about the incidence of injuries and ill health

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. These analyses help HSE to target and design interventions by identifying sectors and occupations with high rates of injury and occupational ill-health.

We have access to a range of surveys and administrative data sources that provide regular, sustainable data series. We also commission shorter term ad hoc surveys that inform matters of interest to specific sectors, or topics and interventions with a finite timetable.

Regular sources include the following:-

- Labour Force Survey and associated Self-reported Work-related Illness (SWI) surveys - these surveys are managed by the Office for National Statistics – we commission questions annually on ill-health and injury for inclusion in the surveys
- Workplace Health and Safety surveys – we commission these from external contractors
- Data reported under the RIDDOR regulations for injury statistics – a by-product of an administrative system
- Medical specialist and General Practitioner injury and ill-health surveillance schemes that are funded by HSE.

Ad hoc surveys to support specific sectors

- In addition to the routine data sources we commission ad hoc surveys to support HSE's initiatives with particular priority sectors. Some of these will be identified early in the plan but there is also provision to undertake specific research on demand, in response to emerging issues.

Examples include the following:-

- **Construction Industry.** HSE has recently run a series of surveys targeted at the construction industry, to enable HSE to establish leading indicators of risk control and to obtain other information relevant to construction sites. This has proved to be a cost effective way of supplementing the type of information that we obtain through our employer workplace surveys. We will continue this survey on a triennial basis. We have also derived important information with which to gauge the success of our construction programmes from a rolling 'omnibus' worker survey.
- **UK Waste and Recycling industry.** Data acquisition and statistical analysis of sickness absence data for the industry. This survey will provide comprehensive sickness absence rates which will help inform on occupational ill-health issues for the industry, which in turn will inform future interventions and policy decisions for this industry. The information cannot be obtained from routine data sources. The project will be reviewed after one year to check that we are able to obtain sufficient response data from the sector.

New areas of research to improve statistical sources

- HSE's primary source of data on work-related ill-health is the Labour Force Survey. This is self-reported ill-health which the respondent attributes to their work. We are conducting research to understand the validity of such self-reported ill-health data to establish the extent to which self-reported conditions are genuine and assess the reliability of attribution of a condition to work-related factors.

Monitoring performance

We have recognised that it is not effective to concentrate solely on health and safety outcomes to monitor the impact of HSE's activities, particularly for long latency diseases where it can be many years before the impact of an intervention would be observed. In previous years (between 2005-2008) HSE conducted workplace health and safety surveys to collect a wide range of intermediate outcome data. These concentrated on a particular programme (the Fit3 programme: Fit for work, fit for life, fit for tomorrow). Subsequent analyses revealed the difficulty of using these data to measure change at the whole economy level. However, the new workplace health and safety surveys will address this issue. In addition, HSE is beginning work to identify how best to collect more representative data on leading indicators.

Emerging areas for research include:-

- Systematic collection of exposure data using in house resource (e.g. HSE's inspectorate, HSL experts and baseline data in the National Exposure Database).
- Regular collection and analysis of external data sources which are relevant to health and safety

Economics research - understanding the costs and benefits of interventions

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

Behavioural economics

- Feasibility study, based on a recent literature review performed by the University of Liverpool, to provide greater understanding as to whether the application of insights from behavioural economics theory can provide a viable alternative to the regulatory control of workplace health and safety risk, including catastrophic risk. To use this evidence gathered in policy making decisions, to support or rule out options for reducing health and safety risk using behavioural economics theories.
- Survey of the valuation of occupational and nuclear cancer risks to allow the development of safety cases and impact assessments involving cancer risk, and the calculation of the total cost of occupational cancer, to be conducted on the basis of more robust economic evidence.

Improving Impact Assessments of HSE interventions

- Assessing the Level of Compliance with Health and Safety Laws and Regulations: This project aims to improve HSE's knowledge of the measures of the degree of compliance with H&S interventions in order to develop a more consistent model of compliance to be applied to Impact assessments. It will be supported by a literature review to develop a usable methodology with which to estimate compliance.

- **Measuring the Public Reassurance Benefits of Interventions:** An increase in public reassurance may be suggested as one of the benefits (or the only benefit) associated with implementation of some of HSE's regulations and other policies. This project would consider possible approaches to measuring public assurance associated with specific health and safety risks.
- A pilot study to address the ongoing uncertainty around the value HSE and dutyholders should put on the reduction of cancer risk caused by particular occupations. To try to establish a new cancer value of a prevented fatality which HSE can use in its impact assessments.

The costs of health and safety failures

- **Feasibility study into valuation of the harm index:** The Harm Index has been developed to provide a single 'currency' (harm) for all health and safety outcomes, to enable comparison and resource prioritisation. This project will consider how to link the indices to money values and to consider the use of a valued harm index as an aid to prioritisation.

Social research – Understanding how to influence behaviour

What we know

Social research is concerned with improving our understanding of the drivers of people's behaviour and how the choices people make are influenced by what people think the implications will be.

We are aware of several theories that could be relevant in health and safety policy making. These include:

- the notion of a skewed perception of risk;
- that there is a cost associated with processing information;
- that compliance with health and safety might be affected by the level of stakeholder involvement and/or employees' perceptions of fairness;
- that the act of publicly committing to standards affects health and safety performance, and
- that the monetising of non-compliance through fines can affect health and safety outcomes.

There is also a growing evidence base which supports the view that work can be good for health.

Improving the evidence base

We now propose commissioning experiments to gather evidence to support these theories specifically in relation to health and safety, with the aim of providing guidance to HSE policymakers and FOD in relation to behavioural economics.

HSE commissioned a major survey on the Quality of Working Life (QWL) as experienced by employees, to explore how QWL influences outcomes such as physical and mental health, sickness absence, employee engagement and

productivity. These are important overarching questions that are relevant to a number of HSE programme areas. This will report during 2011/12.

We recently co-sponsored another major survey commissioned by the Department of Business, Innovation and Skills, to look at Workplace Employment Relations (WERS). This will provide us with a greater understanding of employment relations practices in workplaces across GB, to be able to inform our policy development and assess its effects.

Much, if not all of HSE's work is about influencing behaviour in ways that are beneficial for employees' health and safety. Key to this is effective communication with duty holders and workers. As well as evaluating the impact of individual campaigns (e.g. 'Hidden Killer' asbestos campaign), we are currently commissioning more strategic work to inform our future communications strategy. In recent years the HSE has commissioned an increasing number of electronic media-based tools (E-tools) for the use of duty holders, and others. A forthcoming human factors project will explore how visual information can be optimised to influence safety-related behaviours.

4.2 Avoiding catastrophe

Strategy goal:

To reduce the likelihood of low-frequency, high-impact catastrophic incidents while ensuring that Great Britain maintains its capabilities in those industries strategically important to the country's economy and social infrastructure.

This section sets out the science needs for Major Hazard industries including; offshore, onshore petrochemicals and chemicals, gas and pipelines, facilities handling human and animal pathogens, explosives and mines.

Our science reflects our need to support effective regulation by HSE, concentrating on:-

- Supporting operational and frontline delivery activities
- Taking forward the HSE strategy
- Dealing with emerging technologies
- Policy development
- Specific technical support

HSE's function as an effective regulator of these specialist industries 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 the HSL and other contractors. In particular we need to maintain sufficient capacity in specialised technical disciplines to be able respond effectively to low frequency but high consequence incidents and investigations. To address the need to do more to identify what new research will be needed to help identify future priorities in the major hazards industries, a long term (up to 5 year) Strategic Research Programme was set up at HSL focussing on mathematical modelling. Two projects will be developed over a number of years within this programme; these are the development of dense gas dispersion modelling and the integration of Quantified Risk Assessment (QRA) in Geographical Information Systems (GIS).

We participate in a number of joint projects with the regulated industries (and academic institutions). We work closely with national and international experts through a range of advisory groups and committees (e.g. the Energy Institute, Offshore Industry Advisory Committee, Industry Offshore Research Working group, International Committee for Regulatory Research and Development [ICRARD]).

The range of commissioned science topics described in this section reflects the maturity and diversity of the different industry sectors, their relevant competency in managing their own risks and how much we already understand about effective regulation in particular sectors.

Control of Major Accident Hazards (COMAH) Regulations 1999

The COMAH Regulations implement the Seveso II Directive, except for the land use planning requirements which are implemented under planning legislation (covered later). The main aim 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.

COMAH site operators are required to submit information to HSE to explain how hazards and risks are being adequately controlled. The information required depends upon the amounts of hazardous substance present on the site.

Scientific support includes:

- Technical contributions to the assessment of complex Safety Reports submitted by operators under the COMAH regime.
- 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;
- Support for future COMAH related policy development, e.g. research into consequences for site operators under proposed changes to SEVESO II Directive, and development of models for economic consequences to population and infrastructure surrounding COMAH sites of changes to the Directive;
- Development of an economic model for COMAH site accidents, phase 2. This work will build on a current feasibility study to develop a practical modelling methodology for COMAH sites. The project will allow the development of a Graphical Information System (GIS) based tool to aid the full economic modelling of the cost of accidents at COMAH sites.
- Support for narrow and specific scientific, technical and engineering problems, to inform HSE's frontline regulatory decisions. These include maintenance and degradation of maturing plant and equipment, eg. valves and polymer pipework; and assessment of behaviours of acetone cyanohydrin in relation to other substances;

Land Use Planning

HSE is a statutory consultee for land use planning (LUP) applications around major hazard sites and pipelines. It sets a consultation distance around major hazard sites and pipelines after assessing the risks and likely effects of major accidents at the installation or pipeline. The distances requiring consultation are expressed via 3-zone maps (i.e. maps with three zones of consultation around the site, in order of risk).

HSE's LUP advice is aimed at mitigating the effects of a major accident on the population around a major hazard site. PADHI (Planning Advice for Developments near Hazardous Installations) is the name of the methodology used by HSE to give land use planning advice. HSE has developed a software version of this methodology, PADHI+, which is available on-line to planning authorities, to enable them to consult HSE directly for advice on developments around major hazard sites and major hazard pipelines.

Scientific support includes:-

- Support for delivery of 3-zone maps and LUP advice; Utilising skills of the GIS team in HSL to enhance the support to Local Planning Authorities and site developers using PADHI+ and the information available to them on the LUP Extranet;
- Dispersion models
- 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.
- Understanding the regulatory impact of LUP by quantifying the economic cost of planning advice around major hazard sites. For example the GIS team at HSL will apply an accepted methodology to a large number of major hazard sites, classified according to land use type, in order to estimate a weighted average cost of HSE land use planning advice.
- The above project will also specifically focus on the cost of HSE LUP advice around gas holders in London, to inform analysis of the costs and benefits of bringing forward the decommissioning of these gas holders in order to free up land for development.
- 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, e.g. pipeline RISKAT model.
- Continuing to develop practical solutions in response to recommendations from Buncefield Major Incident Investigation Board, e.g. investigating gas/liquid phase processes in overfill accidents and effective tank gauging systems.

Offshore Industries

Key priority areas 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.

Our research priorities in 2011/12 therefore include:

- Research that can be linked to the four key themes of: Leadership, Asset integrity, Competency and Safety culture
- Urgent research arising from reactive work such as investigation
- Research required in response to new technology

The current science plan includes:

- HSL support for delivery of Major Hazard objectives with regard to Safety Case assessment under the Offshore Regulations. Commissioning this work with the laboratory also exposes HSL scientists to frontline Offshore Hazards activities and provides valuable development opportunities, enhancing understanding of Offshore hazards and bringing wider benefits to the quality of Offshore hazards science;
- Support for prioritisation of objectives. This includes, for example, specific work to analyse effectiveness of OD interventions; review of the Offshore structural integrity strategy and guidance in light of technical developments and ongoing project outcomes;
- Support for future policy and strategy development – e.g. investigation of leadership and human factors issues in relation to effective management of risks on offshore installations, and support for development of new standards and representation with industry sector groups;
- 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.

Specialised Industries

HSE regulates agents and process that have the potential to cause low frequency, high impact incidents in a diverse range of specialised industries and sectors including:

- Mines - managing the risks of fire, flood, explosion and collapse in underground mining sites;
- Biological Agents - safe management and containment of biological agents and human/animal pathogens across a range of industry sectors;
- Explosives – regulation of the manufacture, storage and transportation/importation of explosives, pyrotechnics and fireworks throughout the UK;
- Gas & Pipelines – controlling risks presented by Major Accident Hazard pipelines transporting natural gas, oil or other chemical substances presenting major accident hazards, research to ensure that the risks from the aging gas distribution network is properly managed;

These industry sectors can vary greatly in terms of maturity and complexity, and also the size, distribution and resources of dutyholders. This results in some very diverse needs from the science plan. This includes -

- HSL support for delivery of Major Hazard objectives e.g. support for operational staff via Call Off arrangements in response to a wide variety of specific technical problems arising in Biological Agents, Explosives and Mining industry sectors; representational support for Explosives; market surveillance of pyrotechnics;
- Support for future policy and strategy development – e.g. science to underpin the recommendation for a combined human and animal pathogens regime; review and harmonisation of Explosives legislation; evaluation of new and emerging bio-technologies; development of safety performance indicators for explosives and biological agents industries; human factors related to non-compliance with standard operating procedures in Biological Agents sector;
- Specific technical support to address specific technical, scientific or engineering issues identified e.g. causal factors and detection methods for fires in mines; flammability type assignments of organic peroxides; development of UN Test Methods for explosivity; development of sensor networks and software analysis in hazardous industries.

4.3 Investigations and securing justice

Strategy goal

To **investigate** work-related accidents and ill health and take **enforcement** action to prevent harm and secure justice when appropriate

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.

We have specialists (in both HSE and HSL) from over 20 disciplines that provide this technical knowledge. They are expert in their individual disciplines and in the application of their skills to occupational health and safety matters. This corporate 'body' of knowledge and the facilities available at HSL are unparalleled. 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

Types of 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 ENB (Explosives Notified Board) under the EU pyrotechnic articles directive. Support to HSE as the Competent Authority for work on biocides, pesticides and 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.
- Standards work and knowledge management.

- The ability to “buy in” expertise not present in-house at short notice (in unusual disciplines).

Other support services.

HSL provides HSE with field scientists, particularly occupational hygienists, who are co-located with HSE’s regional specialists and provide support (immediate if necessary and able to mobilise within 2 hours) to the frontline activities of local inspectors. Support involves, for example, visiting sites to take samples, visually recording activity, investigating ventilation control.

Investment in instrumentation

HSE supports HSL’s significant investment in real-time monitoring, e.g. development of gas sensors, photo-ionisation detectors for single solvents, Fourier transform infra red for solvent mixtures, light scatter detectors for inhalable and respirable dusts etc.

ELVis (Exposure Level Visualisation) is a powerful real-time tool which superimposes exposure levels over a video recording. This enables the employer or employees to see how their working practices and ventilation equipment can impact on exposure control.

5 Taking Responsibility

5.1 The need for strong leadership

Strategy goals

- To encourage strong leadership in championing the importance of, and a common-sense approach to, health and safety in the workplace.
- To motivate focus on the core aims of health and safety and, by doing so, to help risk makers and managers distinguish between real health and safety issues and trivial or ill-informed criticism

What we know

Strong evidence from HSE and externally commissioned research has shown the importance of leadership for improving health and safety in the workplace. Most of the existing leadership research has looked at what leaders can do in terms of effective behaviours and how this can impact on organisational performance. There is less research on what motivates directors to act on health and safety, and how that motivation can be translated into action.

HSE recognised the importance of encouraging strong leadership on health and safety and published HSE/Institute of Directors' (IoD) guidance for directors encouraging them to lead on health and safety in their organisations. HSE has been evaluating and reported how this guidance has been used. The findings will be used to develop a model of good practice for leadership behaviours which will assist HSE with encouraging stronger leadership for health and safety.

Other work

- Improving our understanding of individual motivation with regard to director leadership and improved understanding of safety leadership, in respect of the major hazard industries, particularly the offshore industries.
- Evaluation of the design and leadership during demolition and decommissioning following London 2012 Olympic and Paralympic Games.

We are also building into this plan a requirement:

- to evaluate the measures taken to strengthen director leadership on health and safety in the construction sector.

5.2 Building competence

Strategy goal

To encourage an increase in **competence**, which will enable greater ownership and profiling of risk, thereby promoting sensible and proportionate risk management.

Our science needs:

- working in partnership with professional bodies to develop appropriate tools/standards to promote sensible and proportionate risk management throughout all organisations, irrespective of their size.
- to explore approaches/develop tools/case studies that HSE can use to promote better understanding of risk
- to embed an understanding of health and safety risk management into undergraduate courses

What we know

HSE aims to ensure that a significantly greater number of people in every part of an organisation know how to manage their own risks and when and where to seek further advice. From previous research we understand that most directors place a high priority on health and safety. However we also know that people's perceptions of risks are often skewed.

We have undertaken a great deal of research to understand how best to communicate with different audiences about how to manage risk and to ensure that the necessary safe working practices are accepted and adopted.

Improving the Evidence Base

A major programme of work will explore the extent to which the lessons in competent risk management learned from the London 2012 Olympic and Paralympics Games can be replicated in future construction projects. We also rely on our research programme for the evidence based development of, and evaluation of our own tools to help different sectors make competent risk assessments; and evaluate our own competence through rigorous evaluations of HSE initiatives, such as competency requirements for amusement devices inspection. We are also working in partnership with the Royal Institute of British Architects to support architecture graduates, academics and newly qualified academics to develop better understanding of quality and variability of training in relation to the designers' role in eliminating health and safety risks to point to improvements.

Further work

Additional proposals for research to support the health and safety system's achievement of these goals may emerge in year.

Potential proposals include:-

- Developing and disseminating educational packages to embed an understanding of health and safety risk management into undergraduate engineering courses.
- Ensuring the competence of graduate engineers to manage risk.

5.3 Involving the workforce

Strategy goal

To reinforce the promotion of worker involvement and consultation in health and safety matters throughout unionised and non-unionised workplaces of all sizes.

What we know

One of the goals of HSE's strategy is 'to reinforce the promotion of worker involvement and consultation in health and safety matters'. There is a body of evidence which suggests that involving workers has a positive effect on health and safety performance. A direct outcome of the strategy has been the development of HSE's worker involvement initiative which aims to test approaches that seek to increase levels of worker involvement in organisations. Parts of the initiative have been targeted at specific sectors that survey data identified as having relatively low levels of worker involvement in H&S matters and relatively high risk.

To support the development of the worker involvement initiative, two pieces of qualitative research were commissioned to identify the perceptions, drivers and barriers that could prevent take up of the initiative.

The first looked at the experience of current health and safety representatives in non unionised workplaces in SME's in the target sectors. Workforce representatives perceived their role as very important in safeguarding the H&S of their colleagues. Concern for colleagues was a key motivator, combined with the opportunity for extra pay. Technical H&S training was viewed as important, but few had received soft skills training and many were ambivalent towards soft skills training. The research also indicated that workforce representatives were rarely elected into the post by the workforce.

The second sought views of Health and Safety Managers, Quality Managers and Directors/Partners in SMEs in target sectors. The research indicated that organizations wanted a proportionate way of consulting employees that dealt with practical issues. Whilst a significant number of organizations stated that there was nothing in particular that prevented effective consultation, geographic spread of the organization and organizational culture were identified as potential barriers. Those questioned stated that there were not many specific barriers to sending employees on the training course, although some did state that staff time was the biggest issue. However 2 days training spread over a number of weeks was appropriate. Most were extremely positive about the offer so long as it was well designed and was bespoke rather than generic. Improved culture, better feedback, and potentially easier access to markets were cited as potential benefits. The findings of these two projects have been fed into the design and delivery of the training that is currently being rolled out to industry and evaluated.

Improving the evidence base

To improve the evidence base, the worker involvement initiative and communications campaign will be evaluated to quantify their impact and to improve corporate knowledge of how best to increase worker involvement.

Other work includes:

A major project to investigate worker involvement in the 21st Century, is aiming to understand how our current guidance ('Involving your workforce in health and safety: Good practice guide for all workplaces' – HSG263) may need to change in response to a dynamic business environment with an increasingly flexible workforce and increased globalisation. An understanding of how these factors impact upon worker involvement is needed in order for HSE to provide an effective regulatory approach which takes account of employment demographics and so helps to ensure consultation continues to play an effective role in health and safety management.

6 Transforming the approach

6.1 Customising support for SMEs

Strategy goal:

To adapt and customise approaches to help the increasing numbers of SMEs in different sectors comply with their health and safety obligations.

What we know

Over recent years a body of research has been commissioned by HSE to assess the barriers to and drivers of SME compliance with health and safety best practice. We therefore have an evidence base from which we can learn about the characteristics of SMEs and the barriers and enablers affecting SME engagement with HSE initiatives.

Improving the evidence base

Additional research is currently underway to explore how duty holders in SMEs understand occupational health issues and manage occupational health risks. The research was motivated by anecdotal evidence which suggests that SMEs have more difficulty engaging with occupational health issues and managing health risks than they do engaging with and managing workplace safety. Through this research HSE will explore the difficulties and barriers faced by this group in relation to occupational health and identify potential solutions for better management of health risks in the workplace.

HSE will continue to commission appropriate research to explore the extent of SME compliance with health and safety legislation and identify suitable strategies for increasing compliance. It is hoped that by applying some of the key recommendations from the existing literature on SMEs and by using the themes from HSE's new strategy, that HSE can improve its influence upon SME health and safety outcomes.

6.2 Taking the wider perspective

Strategy goal

To take account of wider issues that impact on health and safety as part of our continuing drive to improve Great Britain's health and safety performance.

Science needs

- to identify emerging scientific and technological issues and advise on their future implications
- to prepare for future HSE strategies
- to utilise the expertise of HSE's well established Futures Team in the identification of wider cross cutting issues.

Specific topics are:-

Understanding the health and safety implications of new technologies

We work collaboratively with the Health and Safety Laboratory, a range of contractors and leading industries to investigate new hazards associated with emerging and expanding technologies. Examples with on-going science commitments are Emerging Energy and Nanotechnologies. We also plan research to inform policy on the health risks related to long term exposure to hypoxic atmospheres.

Emerging Energy Technology

Tackling the two long term energy challenges facing the UK, combating climate change and ensuring clean affordable energy, is a key Government priority and this is driving the emerging energy technology (EET) agenda. HSE facing increasing demands to give advice and make interventions on emerging energy technology issues. There is a pressing need for HSE to acquire sufficient knowledge to be an effective regulator and to influence the EET community.

HSE's research interests cover carbon capture and storage (CCS), natural gas and LNG storage, renewable energy, distributed generation and clean coal technology.

HSE commissions a dedicated 'Futures' team at HSL to provide it with early intelligence about emerging new technologies and trends. This team has undertaken a review of potential future and associated hazards from the use of new energy sources which has helped to inform the research strategy. CCS is already at an advanced stage of development for implementation in the UK and elsewhere. There are potential health and safety risks from both the capture process and the transport of CO₂ which are driving research projects both at HSL and externally. The growth in the size and distribution of wind turbines coupled with blade failures has led to research being commissioned to investigate the performance of such structures. Research is planned in 2011/14 in the main emerging energy technologies, informed by the knowledge gap and likelihood of growth.

Nanotechnology.

HSE has the Government lead on worker protection for nanotechnologies and has provided input on worker protection to the UK wide Strategy for the future development and use of nanotechnologies⁴.

Research

Following early horizon scanning activities on nanotechnology, HSE's contribution has now evolved into being part of a cross governmental programme to address the regulatory issues relating to nanomaterials. In 2004 a cross-Government group (lead by Defra) was formed to co-ordinate research efforts - the Nanotechnology Research Co-ordination Group (NRCG). HSE was an original member of this group and a key contributor on worker protection issues. HSE has also been involved in a coordinated Government approach through a number of other national and international groups.

Future Research Priorities

The UK Strategy sets out revised Government Nanotechnology Research Objectives and announced the renaming of the NRCG, which will be known as the Nanotechnologies Research Strategy Group (NRSRG). In keeping with HSE's regulatory role, the prime focus of future work will be on exposure and the control of exposure in the workplace to manufactured nanomaterials.

Our future research commitment will concentrate on:

- conducting research to identify the numbers of workers exposed to nanomaterials in UK industry,
- researching the level of use of nanomaterials in SMEs,

Work of the 'Futures' Group

The Futures team at HSL prepare reports for HSE's Futures Group which focuses on the scientific and technological aspects of outputs from the team. The Futures Group is made up of senior managers who are responsible for ensuring that emerging trends and alerts are considered as part of Directorate plans. Increasingly these Futures outputs will contribute to the development of HSE's future strategies.

HSL's many and varied technical experts also complement the work of the Futures team by keeping abreast of issues associated with new or rapidly expanding technologies – these can arise out of more routine support work. Funding research to understand their implications gives HSE the opportunity to be ahead of the game.

⁴ UK Nanotechnologies Strategy – Small Technologies, Great Opportunities. March 2010
HM Government URN 10/825.

7 Enabling Delivery – Implementing the Plan – Measuring and monitoring progress.

How we work

- HSE's Director of Science is responsible for the quality of HSE's science and engineering, supported by his Senior Scientific Adviser and the Corporate Science, Engineering and Analysis Directorate.

Implementing the plan

This summary plan gives an overview of new work to be commissioned over the next three years, excluding consideration of projects contracted in previous years and scheduled for completion during the next three years. Examples of projects due for completion in late 2011 and onwards include

- Longitudinal study into hand arm vibration
- Proposal for a study of the dispersion and explosion characteristics of large vapour clouds
- Statistical analysis of sickness absence data in the waste and recycling industry
- Occupational ill-health arising from exposure to hazardous substances in the construction industry
- Healthy Work Matters strategy - development of a strategy to improve the knowledge of occupational health in SME's.
- The relationship between shift work and major disease

From year to year we estimate that approximately £15m of commissioned science funding provides direct support to operational activities – this excludes essential capacity and competence maintenance to ensure that skills and equipment are available to meet HSE's requirements.

In terms of prioritisation of work, from year to year we ensure that funds are available to:

- Maintain operational support
- Meet contractual obligations associated with work commissioned in previous years
- Fund essential core requirements (e.g. statistical surveys)

Annex 1

Criteria for commissioning science.

These are the criteria for using science to deliver HSE's strategy.

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:
 - Frontline work (e.g. incident investigation; inspection; safety case and report assessment; standards & guidance)
 - Cross-cutting activity (e.g. horizon scanning; 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 with 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.