



SEPA Research Strategy 2008-2012

SEPA's mission statement is to be an excellent
environmental regulator
and an effective and influential authority
on the environment.

The tables of research priorities in this strategy are available as online "wikis". This is to encourage a debate about the direction and focus of SEPA's research. Please feel free to comment if you are aware of research that would inform some of our priorities, or if you feel that we have missed an important aspect:

www.sepa.org.uk/wiki

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SEPA's Research Strategy 2008–2012

SEPA's Research Strategy 2008–2012 defines our aims, needs and interests in research and development. We define 'research' as the discovery of fundamental new knowledge and understanding and 'development' as the process by which new knowledge and understanding is applied. This strategy provides an overview of the principles we will apply in fulfilling those aims, and focuses on the key themes and priorities that will influence our research activity over the next four years.

The strategy will facilitate links between SEPA and the wider research community. It is intended to help anticipate and drive change, by providing evidence for and promoting the measures needed to achieve the desired environmental outcomes. It will also enhance SEPA's reputation as Scotland's environmental champion.

Our research needs

As an agency established to protect and enhance the environment and protect human health, it is essential that SEPA has a sound science and knowledge base. This helps us to deliver best value practices in our powers and duties and to inform the development of effective policies that contribute to better regulation and the Scottish Government's goal of sustainable economic growth.

This means that SEPA should implement environmental regulations in ways that do not impose unnecessary burdens on those that it regulates and are proportionate to the actual or potential harm to the environment. SEPA's mandate for research and development activity, as required by our founding legislation, is detailed in Annex 1.

We need to continually improve our understanding and our decision-making processes, responses and interventions. This way, we can ensure that Scotland's environmental capacity is managed sustainably, and maintain the wealth of benefits that a healthy and productive environment provides, including economic and social well-being.

We need to inform and advise a range of stakeholders with varied and sometimes conflicting interests on environmental and human health risks, uncertainties, options and consequences.

What we will have to do

To meet these needs we will have to develop tools and techniques to help assess and predict environmental change, risks and impacts. We will have to foster a culture of innovation and effective knowledge exchange, to be proactive in influencing policy and to integrate a wide range of socio-economic considerations, such as land-use, business needs etc into our core activities of environmental science and regulation.

Therefore, SEPA's Research Strategy needs to span a broad spectrum, from investigative and interpretive science, to the development of innovative tools and techniques. To ensure best value in the delivery of our needs, we have to engage in a wide range of research activities. This includes direct commissioning, in-house delivery, collaboration with and learning from others, and must apply within the research community and across regulated industry and the public sector at large.

What does the strategy aim to achieve?

SEPA's Research Strategy aims to:

- improve monitoring, analysis and the assessment of environmental processes, signals, interactions and dependencies, existing and future pressures on and risks to the environment and human health;
- develop innovative and sustainable options for environmental protection, including methods, tools and techniques that will lead to better regulation;
- improve understanding and help influence values, attitudes, behaviours and decision-making processes that affect the environment and human health.

SEPA needs to be at the forefront of providing an effective and timely response to environmental change and the challenges brought about by social and economic drivers. To achieve this we must have a framework in place that helps organise and channel our research activity and ensures that research needs are targeted and prioritised. Our research programmes should result in the delivery and adoption of meaningful outputs that help realise the desired outcomes and benefits, especially the Scottish Government's aim of sustainable economic growth and its vision for a 'greener' Scotland.

Research and innovation are at the hub of this framework and are driven by three key cornerstones:

Futures assessment

This includes predictive processes such as horizon scanning, scenario planning and identifying emerging issues.

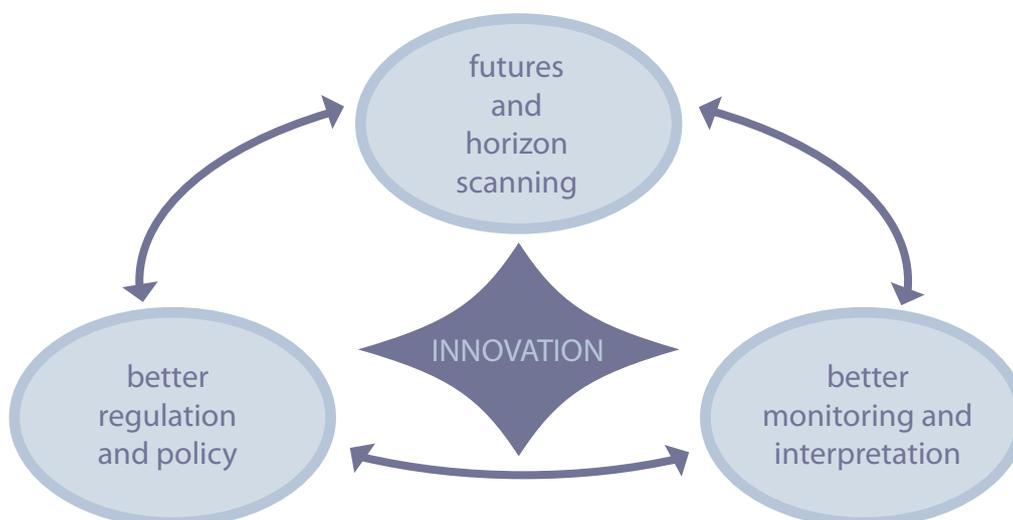
Improved monitoring and interpretation

Through innovative tools and techniques, new modelling methodologies, integrated assessment of environmental processes and adopting emerging science to assist and stimulate smarter analysis.

Better regulation and policy

This means regulation that responds to a changing environment and that helps inform and influence policy in response to dynamic socio-economic conditions.

SEPA works with the private and public sectors on horizon scanning and scenario planning to help ensure that we can predict and develop timely responses to new challenges and opportunities. This activity both informs and is informed by our needs for environmental information and the development of new techniques and technologies for environmental monitoring and assessment. Improved understanding of the environment helps inform better regulation and policy development and drives innovation.



What is the scope of our strategy?

This strategy provides an overview of the major issues facing Scotland's environment and the consequences for human health. It sets the context for SEPA's research and development needs and identifies research and development priorities for SEPA for the period 2008–2012.

The strategy defines themes that reflect our corporate priorities and environmental outcomes set out in SEPA's Corporate Plan 2008–2011, which align themselves with priorities identified within SEPA's planning horizons, state of the environment reports and emerging issues activities.

Delivery of the strategy, including governance, collaboration and knowledge exchange are discussed below. The principles of sustainable development and better regulation are implicit throughout.



How will we deliver?

This strategy will form a focus for SEPA's corporate annual research programmes during the period 2008–2012. Bids for funding and opportunities for academic sponsorship will be assessed against the priorities identified by the strategy. As we have previously adopted a bottom-up approach to building our annual research programme, we do not intend to restrict funding solely to strategic priorities. Where a good case can be made to justify expenditure in another area, it will be considered in light of any evolving issues. SEPA will conduct a mid-term review of the strategy in liaison with other key agencies and partners, to ensure that it maintains relevance and capacity to respond to changing priorities.

Specific SEPA cross-directorate working groups and lead champions will take responsibility for identifying and developing programmes aligned with each strategic theme. Each programme will demonstrate business value, proposals for phased delivery and implementation, and measures for auditing and performance review.

Each annual programme will be formulated as a coherent business case for consideration by SEPA's Research Advisory Panel. Satisfactory progress will be reviewed on an annual basis by the panel.

Collaborating with others

Although we fund research directly, this constitutes a relatively small programme of work. There is a wealth of common environmental interests across significant areas of the research agenda for the academic and public sector research community both within Scotland and across the rest of the UK and Europe. We seek to gain added value to our work by collaborating and networking with these sectors to influence the public research agenda and exchange knowledge and outputs. This strategy serves as a tool to communicate SEPA's research and development focus and priorities for the next four years, and we hope that it will foster close collaboration and improved sharing of knowledge with interested parties.

Working with other environment agencies

Significant common interests arise between SEPA and the other UK environmental regulators; the Environment Agency for England and Wales, and the Northern Ireland Environment Agency. SEPA collaborates with both these organisations in the Environmental Research Programme, which is co-ordinated by the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER). The three agencies also garner other opportunities for joint-collaboration and sharing of knowledge on their respective research agendas, programmes and outputs. We will continue to support this cross-agency approach and identify other means of improving communications and our effectiveness.

Working with the Scottish Government

SEPA contributes to the Scottish Government's strategic environmental research initiatives, including current programmes on land-use and rural stewardship, and on the impacts on human health. Along with all the Scottish Government's rural and environmental delivery partners, SEPA is part of a project team that is taking forward a 'science framework' which will assist in the development of the Scottish Government's next environmental research strategy.

SEPA is a member of the Scottish Government's Environmental Research Funders' Liaison Group (ERFLG), which helps to promote collaborative programmes of work for the key environment agencies across Scotland. The members are SEPA, the Scottish Government, the Forestry Commission Scotland and Scottish Natural Heritage. SEPA always works closely with Scottish research institutes (Macaulay Land Use Research Institute, Moredun Research Institute, Rowett Research Institute, Royal Botanic Garden Edinburgh, Scottish Agricultural College and Scottish Crop Research Institute) who carry out a research programme on behalf of the Scottish Government.

Other memberships

SEPA is also a partner to the UK Environmental Research Funders' Forum, which aims to maximise the coherence and effectiveness of environmental research, and the Living with Environmental Change Partnership (LWEC). This is a major interdisciplinary research and policy partnership of research councils, government, business and other stakeholders. As well as bringing added value to SEPA's research activities and funding, the membership of both these groups allows SEPA to:

- engage with the wider UK and European research agendas;
- influence national and international research initiatives that will improve the evidence base for policy development and future regulatory needs;
- raise awareness of environmental protection and improvement issues across the wider research community both at home and internationally.

This final point is becoming increasingly important, as the global nature of environmental issues and impacts have increasing implications for Scotland's environment and socio-economic development.

Exchanging knowledge

SEPA will make all thematic programmes and relevant outputs publicly available (subject to contractual/confidentiality/Intellectual Property Rights constraints). We will also publish a periodic review of research and development, including highlights and lessons learned.

We will publicise a series of seminars and other dissemination events and extend invitations to relevant and interested parties.

We will use all appropriate methods of exchanging information, including conferences, media campaigns and workshops to disseminate key research outputs and findings. We will also generate improved and informed public debate and participation in future considerations of the environmental and human health research agenda.

SEPA will communicate its research priorities and mechanisms to both existing research partners and to the wider research and academic community, in order to:

- help forge new opportunities for collaboration on multi-disciplinary programmes;
- avoid duplication of work;
- identify key knowledge gaps;
- demonstrate value for money by optimising delivery options including opportunities for collaboration.

Such delivery options include:

- promoting themes and projects;
- collaborating with partner organisations;
- influencing the scope and focus of research activities and programmes of other organisations to complement or supplement SEPA research and development activities and outputs;
- supporting academic or industry sponsorships, awards, placements and secondments.

Strategic themes

SEPA's four strategic research and development themes are:

- Human pressures on the environment
- Climate change
- Environment and human health
- Ecological protection

An overview of the drivers, pressures and key issues is presented for each theme.

In order to help prioritise future funding, we have assigned key knowledge gaps and needs to one of three principal categories within each theme. Opportunities for collaboration with partner agencies, research providers and stakeholders are also suggested for each priority, where relevant.

The three principal categories are:

- Improving scientific assessment, monitoring, analyses and interpretation.
- Developing innovative and sustainable options for environmental protection, including the development of methods, tools and techniques that will lead to better regulation.
- Enhancing understanding and influencing values, attitudes, behaviours and decision-making processes that affect the environment and human health.

Human pressures on the environment

Scotland's environment is subject to continuous change, partially as a result of the natural forces acting upon it, but mainly because of human activities. Some of these changes are very obvious, such as sewage disposal and pollutant emissions from industrial processes, and have been under increasing control from environmental laws over recent years. However, other changes and pressures are less obvious, such as:

- land-use change;
- run-off from agricultural land, leading to nutrient enrichment of surface waters;
- soil erosion;
- the presence of harmful chemicals at extremely low concentrations, which can lead to environmental changes (eg in reproductive biology of communities);
- unknown impacts related to the development of new technologies, such as nanotechnology.

It is these changes, generated by human activity, that are of greatest concern, particularly when they occur at such a rapid rate that the environment may not be able to adjust.

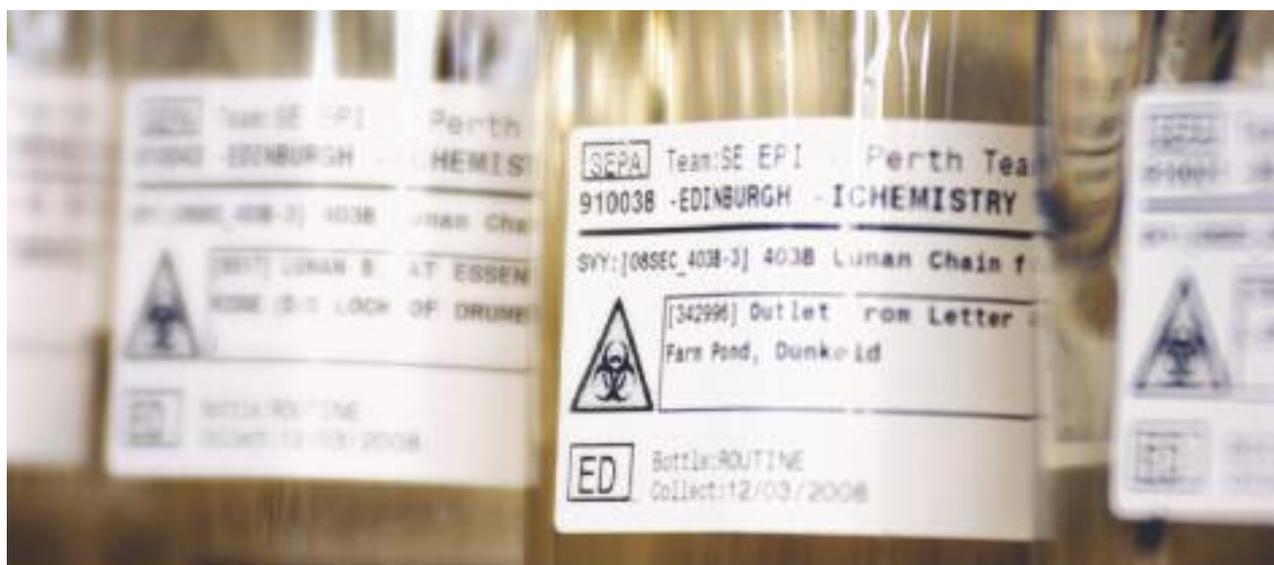
The impact of human activities on the environment is a key area of work for SEPA, and is perhaps most easily considered in the following inter-related subtopics:

- Catchment management, diffuse pollution and soil functioning
- Energy, waste and resource management
- Hazardous chemicals

Catchment management, diffuse pollution and soils research priorities

Category	Priorities
Improving understanding and scientific assessment, monitoring, analysis and interpretation	<p>The differences in soil structure and biodiversity across Scotland between ecological systems</p> <p>How to minimise soil carbon loss and use the ecosystem to store carbon</p> <p>Soil movement and links to flooding</p> <p>The impact of peat erosion on climate change</p> <p>Source pathway attribution for diffuse pollution and placing within holistic setting – understanding catchment scale processes</p> <p>Impacts of radiation on ecosystems</p> <p>Information required to support SEPA's regulatory regimes (eg assessing hydromorphological impacts upon the water environment)</p>
Developing innovative and sustainable options for environmental protection, including the development of methods, tools and techniques that will lead to better regulation	<p>The impact of predicted land use change, including the impact of development and infrastructure change on soil systems</p> <p>Coastal erosion and landslides</p> <p>Diffuse pollution and the effectiveness of regulatory regimes</p> <p>The promotion of sustainable flood management</p> <p>The development of environmental standards to support regulation</p>
Enhancing understanding and influencing values, attitudes, behaviours and decision-making processes that affect the environment and human health	<p>How to maximise the uptake of environmentally supportive behaviours</p>

For an online wiki version of this table, visit: www.sepa.org.uk/wiki



Energy, waste and resource management research priorities

Category	Priorities
Improving understanding and scientific assessment, monitoring, analysis and interpretation	<p>The impacts of large structures in near-shore coastal waters</p> <p>Improved understanding of peat systems and their hydrology</p> <p>Environmental impacts of different energy technologies on landscape, biodiversity, marine systems</p> <p>The development of environmental monitoring tools to support regulation and state of environment reporting</p>
Developing innovative and sustainable options for environmental protection, including the development of methods, tools and techniques that will lead to better regulation	<p>Carbon footprint of energy production and supply</p> <p>Environmental and human health risks of waste treatment processes</p> <p>Economic and social benefits of increasing renewable energy production</p> <p>Full life cycle costing – taking account of technology developments and consumer demand to better understand the infrastructure investment required to ensure renewable energy supply</p> <p>Methodologies to determine viability of different locations for particular forms of renewable energy production</p> <p>Where best to concentrate resources within the regulatory cycle to ensure maximum value is recovered from waste with minimal disposal without energy recovery</p> <p>The methodologies required to support SEPA's regulatory regimes</p>
Enhancing understanding and influencing values, attitudes, behaviours and decision-making processes that affect the environment and human health	<p>How to minimise future waste growth and consumption of raw materials and efficient resource use</p>

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Hazardous chemicals research priorities

Category	Priorities
<p>Improving understanding and scientific assessment, monitoring, analysis and interpretation</p>	<p>Identifying sensitive and vulnerable communities in Scotland with respect to chemical stressors</p> <p>'Hotspots' of chemical usage and contamination in Scotland</p> <p>Accumulation of chemicals in sediments and soils following release to air, land and water and long-term legacy of contamination</p>
<p>Developing innovative and sustainable options for environmental protection, including the development of methods, tools and techniques that will lead to better regulation</p>	<p>Key sources and pathways and critical levels of hazardous chemicals and how these relate to predominant chemical industries in Scotland (agriculture, food and drink, electronics, oil and gas, chemicals and textiles)</p> <p>Knowing what are safe 'no effect concentrations' and what 'environmental quality standards' should be set</p> <p>Rising environmental concentrations of a number of newly identified chemicals, such as chlorinated paraffins, perfluorinated compounds and flame retardants</p> <p>Subtle impacts, such as food chain contamination and the accumulation of persistent chemicals</p> <p>How different pieces of legislation protect the environment with respect to hazardous chemicals (critical levels, implementation, synergies between different media)</p> <p>How regulation needs to be changed/adapted to consider novel chemicals</p>
<p>Enhancing understanding and influencing values, attitudes, behaviours and decision-making processes that affect the environment and human health</p>	<p>How to respond to new issues that are of environmental consequence</p> <p>Changing use of chemicals by the public and their release into the environment, for example from the use of cleaning agents and transport</p>

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Potential partners

Potential partners for research on the human pressures on the environment include:

- Environment Agency for England and Wales;
- environmental health and health protection research organisations;
- European Commission;
- Fisheries Research Services;
- land-use research organisations such as The Macaulay Institute, Scottish Agricultural College, and the Centre for Ecology and Hydrology;
- local authorities;
- manufacturing sectors;
- Northern Ireland Environment Agency
- other Scottish and UK regulatory agencies;
- regulated sectors;
- research councils;
- Scottish Agricultural Science Agency;
- Sustainable Development Research Network;
- Scottish Government;
- Scottish Natural Heritage;
- sector-specific trade associations;
- non-governmental organisations.



Climate change

Climate change is causing a wide range of impacts across Scotland, including changes in the growing, breeding and migration seasons, shifts in species abundance and diversity, and changing weather patterns that increase the potential for more floods and droughts. Human-induced climatic change is underway and, if global emissions of greenhouse gases continue at current rates, there is an increasing risk of reaching a tipping point whereby human emissions cease to be the main driver and are overtaken by emissions resulting from disturbances to natural systems. The impacts of such dangerous climate change are potentially devastating, with consequences for human health, biodiversity, water quality and supply, agriculture and food supply, transport, coastal erosion and flooding.

Adapting to a changing environment

Scotland needs to consider climate change in all aspects of its risk management and assessment, and prepare for unavoidable climate change over the next few decades that will result from recent emissions. SNIFFER's Handbook of Climate Trends Across Scotland (2006) includes significant analysis of the past century's data and confirms significant changes in rainfall patterns, which – if trends continue – will increase the risk of flooding and periods of summer drought, particularly in the east of Scotland. This will put pressure on sources of water for drinking, irrigation and maintenance of ecosystems.

Limited knowledge of how climate change will impact at a regional level is a major obstacle to understanding what aspects of the environment will experience greatest change. We need to understand which aspects of the environment are most sensitive to change and extreme events, and where and how we can intervene to minimise threats and maximise opportunities.

We also need to understand the implications for ecological systems and environmental services, as well as the wider socio-economic consequences. We need to know where to focus our efforts in helping Scotland build resilience and adapt sustainably to climate change. We need higher resolution models to improve our ability to predict the impacts of:

- climate change at a national, regional and sub-regional level;
- the associated social and economic costs of climate change;
- the vulnerability and adaptability of living systems.

Minimising greenhouse gas emissions

The majority of greenhouse gas emissions in Scotland arise from the combustion of fossil fuels for heating, power and transport. SEPA regulates a significant proportion of the industries responsible for emissions, and provides advice and guidance to other sectors. We need to improve our understanding and methodologies for:

- assessing and identifying beneficial interventions that minimise greenhouse gas emissions, without causing other unacceptable environmental impacts;
- developing sufficiently rigorous carbon accounting and other decision-making tools;
- developing protocols and processes for dealing with uncertainty and risk assessment.

Scotland has a significant source of carbon locked in peat and other organic soils, representing a net sink for land-use. However, changing climate, inappropriate agricultural measures, and other land-use activities, could result in Scotland having a net loss of carbon from soils. This would be in the form of carbon dioxide and methane emissions to air and the leaching of carbon into the water environment, which would give rise to the formation of carcinogenic precursors. There are significant gaps in our understanding of how such soil processes work, their sensitivity to change, and the best practice for managing and securing soil carbon.

SEPA must also explore and identify opportunities for reducing direct emissions of greenhouse gases from our own activities, for example from transport, estate management and waste management.

Climate change research priorities

Category	Priorities
<p>Improving understanding and scientific assessment, monitoring, analyses and interpretation</p>	<p>Understanding the key vulnerabilities and areas of impact of climate change for Scotland</p> <p>Finding out what can we learn from past climate and other countries, eg the development of climate analogues</p> <p>Ecological, economic and environmental consequences of ocean acidification</p> <p>Analysing and interpreting historic datasets and developing indicators of change</p>
<p>Developing innovative and sustainable options for environmental protection, including the development of methods, tools and techniques that will lead to better regulation</p>	<p>Investigating risks of carbon capture and storage to the natural environment Using scenario planning to build predictive capacity and impacts on environment infrastructure and economy</p> <p>Developing multi-criteria assessment techniques and other 'cost/benefit' techniques to assist the determination of environmental permits with respect to greenhouse gas emissions</p> <p>Investigating options for incorporating more rigorous consideration of climate change issues into planning and strategic environmental assessments</p> <p>Improving knowledge, measurement and analysis of greenhouse gas emissions in Scotland</p> <p>Determining SEPA's emissions and a means of reducing our impact</p> <p>Developing a climate change checklist for SEPA policies</p>
<p>Enhancing understanding and influencing values, attitudes, behaviours and decision-making processes that affect the environment and human health</p>	<p>Methodologies to promote behavioural change and help achieve mitigation</p> <p>Adaptation responses, eg responses to flooding, commuting and travel patterns</p> <p>Tools to help small and medium-sizes enterprises (SMEs) assess and reduce their carbon footprint</p>

For an online wiki version of this table, visit: www.sepa.org.uk/wiki

Potential partners

Potential partners for research on climate change include:

- Environment Agency for England and Wales;
- Fisheries Research Services;
- local authorities;
- marine environmental research organisations;
- Natural Environment Research Council and other research councils;
- non-governmental organisations;
- Northern Ireland Environment Agency;
- Scottish Climate Change Impacts Partnership;
- Sustainable Development Research Network;
- Scottish Government;
- Scottish Natural Heritage;
- Scottish research institutes, eg The Macaulay Institute & Scottish Agricultural College;
- UK Climate Impacts Programme;
- Universities and research organisations eg Tyndall Centre for Climate change;
- other Scotland and UK-wide bodies, including conservation agencies, water industry, other UK regulators, climate change and energy advisory bodies.



The environment and human health

The quality of Scotland's environment affects the health and quality of life of individuals and communities across the country. However, the relationship between the environment and health are complex, as exposure to environmental pollutants can come from many different sources and be expressed through many different routes. This may be the air we breathe, the food we eat, the water we drink or through our work and homes. Conversely, the creation of good quality green space can be particularly beneficial to the health of people and wildlife living in our urban environments.

SEPA will work with others to improve its understanding of the relationships between human health and the environment and will take account of this in future environmental monitoring, assessment and regulation. SEPA welcomes the Scottish Government's initiative to develop a Strategic Framework for Environment and Health and will continue to work with others in promoting a common understanding of the environmental factors that affect human health and the actions that can be taken to address these.

We also recognise the need for improved signals and indicators for environmental reporting and we will critically review both our monitoring and that done by others with respect to health. Building on this, we will promote the development and delivery of a national monitoring programme, which better addresses health and which provides the evidence required to influence future policy and practice on planning, development and regulation.

Issues that require better understanding include:

- the positive and negative impacts of the environment on human health;
- environment and human health signals and indicators to inform future monitoring, assessment and regulation;
- the effects of airborne pollutants on human health, particularly with respect to substances arising from transport (SEPA needs to build on a good knowledge base and better target action, particularly in relation to particulate matter);
- the identification and prioritisation of emerging pollutants where background concentrations are increasing and are considered to be potentially detrimental to human health. Research should strengthen the evidence base of health effects to support the inclusion of these substances in future monitoring programmes where appropriate;
- the influence of climate change on the environment with respect to health, particularly in relation to the psychological effects of flooding.



Human health research priorities

Category	Priorities
<p>Improving understanding and scientific assessment, monitoring, analyses and interpretation</p>	<p>Developing a better understanding of the fate, behaviour and potential health effects of 'novel' substances in the environment (eg nano-materials and endocrine modulating substances)</p> <p>Identifying and prioritising pressures (eg emissions, activities and substances) of concern to human health in Scotland</p> <p>Developing methodology to create environmental quality standards and appropriate monitoring and assessment techniques (signals, indicators and analytical methods) to describe the state of the environment with respect to human health</p>
<p>Developing innovative and sustainable options for environmental protection, including the development of methods, tools and techniques that will lead to better regulation</p>	<p>Developing models for the assessment of environmental exposure and human health risk (particularly for airborne pollutants) to identify potential problems and focus regulatory action</p> <p>Improving methods and tools for the protection of bathing waters and recreational waters, and for assessing the potential health impact of abstraction from drinking water sources</p> <p>Exploring the benefit to health of environmental improvement 'activities' (eg creation and management of green space)</p>
<p>Enhancing understanding and influencing values, attitudes, behaviours and decision-making processes that affect the environment and human health</p>	<p>Developing our advisory and influencing roles, particularly with regard to sustainable development, alternative technologies, and the potential benefit to health</p>

For an online wiki version of this table [LINK](#)



Potential partners

Potential partners for research on the environment and human health include:

- academic institutions;
- Defra;
- Department of Health;
- Environment Agency for England and Wales;
- Greenspace Scotland;
- Health Protection Agency;
- Health Protection Scotland;
- NHS Health Boards;
- Northern Ireland Environment Agency;
- Scottish Government;
- Sustainable Development Research Network;
- Sustainability through Environment, Nature, Communities and Enterprise (SENCE) partners;
- UK Interdepartmental Steering Group on Environment and Health.

Ecological protection

Human impact on the environment has led to significant declines in Scotland's ecological quality and biodiversity (especially from intensive land-use in the last 250 years). In 2005 nearly 32% of habitats and 18% of species identified under the UK Biodiversity Action Plan were declining, although around 32% of habitats and 39% of species were either stable or showing signs of recovery. Impacts of climate change, however, are already evident, with some species ranges declining, others extending, and evidence of disruption to food chains. This means that attainment of the EU target to halt loss of biodiversity by 2010 will become increasingly challenging. Active management will be necessary to maintain many habitats and species in Scotland, and the Scottish Biodiversity Strategy helps to provide a framework for this.

The conversion of farmland and semi-natural habitats to housing or industrial developments results in a loss of habitats and associated species. Transport corridors can lead to fragmentation of habitats and isolation of populations of rare or threatened species.

While we recognise that other organisations, particularly Scottish Natural Heritage, will take a lead on many of these issues, SEPA also has important duties related to protecting and improving biodiversity and ecological functioning. We will, therefore, undertake in-house research to inform the delivery of those duties.

Focusing research and development interest at a UK level

It is likely that the pressures on ecosystems will increase in the future, but the rate of change and its consequence for ecosystem services and biodiversity are unclear. Understanding the structure and functioning of ecosystems is a large and complex problem, and we need to determine the ecological and environmental consequences of human interventions in freshwater, marine and terrestrial ecosystems in an integrated way.

Ecological protection research priorities

Category	Priorities
<p>Improving understanding and scientific assessment, monitoring, analyses and interpretation</p>	<p>Understanding the ecological impacts of alien species on UK habitats, particularly aquatic and riparian habitats, including those species of risk to Water Framework Directive (WFD) status</p> <p>Improving existing, and developing new, methods for monitoring and classifying the impacts of invasive, non-native species, particularly for aquatic and riparian habitats</p> <p>Improving the modelling and monitoring of large-scale spatial and temporal processes affecting soils, catchment and other large-scale management, and biogeochemical cycling</p> <p>Developing a Scottish wetland inventory</p>
<p>Developing innovative and sustainable options for environmental protection, including the development of methods, tools and techniques that will lead to better regulation</p>	<p>Understanding the processes that lead to habitat degradation, loss and fragmentation (pollution, enrichment, climate change, development, land-use change, agricultural practice/policy)</p> <p>Understanding the role of river basin management planning in developing ecological networks through delivery of WFD objectives, and identifying opportunities to demonstrate wider environmental benefits</p> <p>Understanding the extent, nature, cost and likely impacts of responses to, or measures to address, invasive non-native species, particularly for aquatic and riparian habitats</p> <p>Developing and testing screening tools and regulatory decision-support mechanisms for assessing potential impacts on Special Areas of Conservation and Special Protection Areas (under the Habitats and Birds Directives) and of Sites of Special Scientific Interest, and for likely impacts on biodiversity priority habitats and species</p> <p>Modelling habitat restoration and improved ecological networks, following adoption of more sustainable flood management practices</p>
<p>Enhancing understanding and influencing values, attitudes, behaviours and decision-making processes that affect the environment and human health</p>	<p>Valuing ecosystem services to allow incorporation into regulation and wider environmental decision-making</p> <p>Understanding the relationships between environmental quality, the connectivity and use of greenspace and effects on health and well-being</p>

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Potential partners

Potential partners for research on ecological protection include:

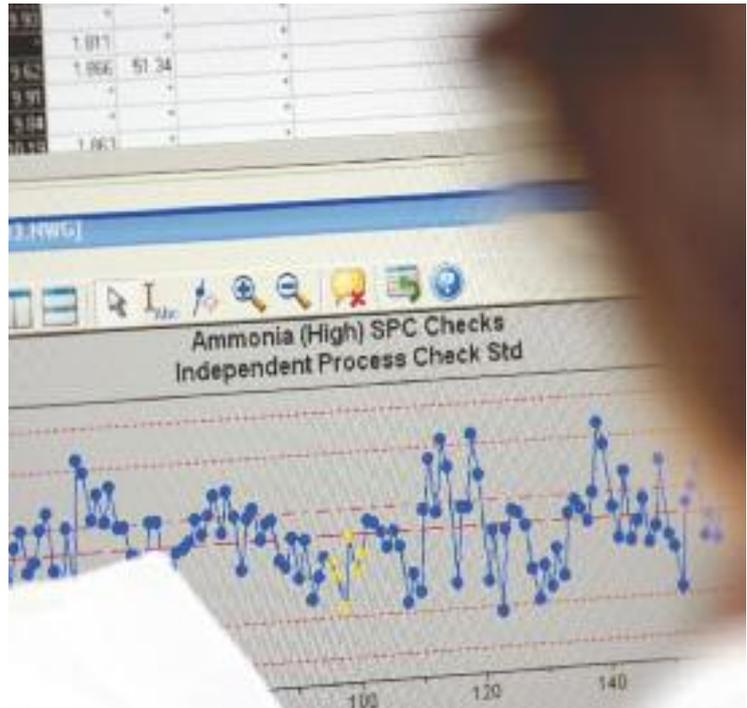
- Defra;
- Forestry Commission Scotland;
- Environment Agency for England and Wales;
- Environmental research institutions;
- Northern Ireland Environment Agency;
- Scottish Biodiversity Strategy Implementation partners;
- Scottish Environment Link;
- Scottish Government;
- Scottish Natural Heritage (SNH);
- Scottish Working Group on Invasive Non-Native Species;
- UK research councils.

How will we assess the effectiveness of our strategy?

We will carry out a mid-term review of our strategy in 2010 to ensure that it remains relevant and responsive to changing needs. We will also monitor the delivery of outputs and development of outcomes.

Over time, a successful strategy will improve:

- our understanding of the Scottish environment, the human pressures on it and how we might better manage these pressures;
- SEPA's partnership working and influence on other research programmes and activities;
- the means by which SEPA prioritises, commissions and promotes research outcomes, in order to deliver faster, smarter and more effective results.



SEPA's mandate for research and development

The Environment Act 1995 is SEPA's founding legislation and it states that we will make arrangements to carry out research and related activities (whether by itself or others) in respect of matters to which our functions relate.

This is reflected in SEPA's 2005 management statement from the (then) Scottish Executive, which states that one of our main objectives is:

- to operate to high professional standards, based on sound science, information and analysis of the environment and of processes which affect it;

and also that SEPA has a duty to:

- carry out, promote or collaborate with others on research related to its regulatory activities;

and more specifically that:

- SEPA should liaise with the Environment Agency for England and Wales and with the Northern Ireland Environment and Heritage Service [now called the Northern Ireland Environment Agency] to co-ordinate research activities and to promote consistent standards of environmental protection, regulation and management. This shall not preclude the ability to pursue different approaches in Scotland where that is justified.

Thus, there is a clear mandate and requirement for SEPA to be involved in a wide range of research and development activities. SEPA has a part to play in achieving the Scottish Government's purpose 'to focus the Government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth', and on its five strategic objectives to make Scotland 'wealthier and fairer', 'smarter', 'healthier', 'safer and stronger', and 'greener'.

In particular, SEPA works closely with the Scottish Government's Rural and Environment Research and Analysis Directorate and Environmental Quality Directorate. It is important that actions and decisions are based on best possible knowledge and understanding of science, processes, pressures, risks, values and attitudes. It is also important that SEPA develops and maintains an innovative approach to delivery, to ensure best practice and value for money.

One means of achieving this evidence-based and innovative way of working is to be directly involved in a wide range of research and development activities. This will include the commissioning of research, either alone or in collaboration, and engaging with research and academic communities that are working on issues relevant to SEPA's remit.



Annex 2

Further reading

You may find the following links of further interest, in relation to this document:

Guidance to SEPA made under the Environment Act 1995

This document provides guidance to SEPA on the contribution it should make towards attaining the objective of achieving sustainable development by performance of its functions.

www.scotland.gov.uk/Publications/2005/01/20481/49408

SEPA Facts: Better regulation

This leaflet explains how we try to reduce the administrative burden on industry, and achieve high environmental standards through modern and risk-based approaches to regulation.

www.sepa.org.uk/about_us/publications/corporate_leaflets

Environment Research Funders' Forum

ERFF comprises major UK public-sector funders of environmental research. It aims to maximise the coherence and effectiveness of UK environmental research funding.

www.erff.org.uk

Natural Environment Research Council

'Living with Environmental Change' is a major interdisciplinary research and policy partnership of research councils, government, business and other stakeholders.

www.nerc.ac.uk/research/programmes/lwec

SEPA's Corporate Plan 2008–2011

The plan sets out SEPA's priorities and goals for the three financial years 2008–2009 to 2010–2011, showing how we intend to progress six long-term environmental outcomes, together with a new outcome that focuses on the running of the organisation.

www.sepa.org.uk/about_us/publications/corporate_plan

A Handbook of Climate Trends Across Scotland 2006

This handbook, prepared jointly with the Scottish Government and Scottish Natural Heritage, includes significant analysis of existing Scottish data over the last century.

www.sniffer.org.uk/climatehandbook/index.html

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