

OFFICE OF SCIENCE
AND INNOVATION

SCIENCE REVIEW

OF THE DEPARTMENT
FOR ENVIRONMENT,
FOOD AND RURAL AFFAIRS





Foreword

by Sir David King, Government Chief Scientific Adviser



As the Government's Chief Scientific Adviser, I have a functional responsibility for maintaining the quality and vigour of science in all Government departments. Accordingly an Office of Science and Innovation (OSI) team was established in 2003 to take forward a rolling programme to review Government-funded science, including social science, with the broad aims of developing a corpus of information across Whitehall and to provide an external driver for improvement in the way departments obtain and use science.

This review of the management, quality and use of science in the Department for Environment, Food and Rural Affairs (Defra) is the third in the series.¹ In addition to being the first of the larger departments to be reviewed, Defra is in some respects considered to be in the vanguard of Government science practice and use. As has been my intention from the outset, our report therefore contains examples of both good practice for others to adopt as well as areas for improvement. Many of our findings and recommendations have a wider relevance and I urge other Government departments to consider them in the light of their own circumstances.

I am most grateful for the advice of the expert Steering Panel members (see page 63) who have been instrumental in focussing the work of the review on the key issues and in advising us, in particular during the detailed case studies and peer reviews on which much of the review is based. On behalf of the review team (OSI staff and our consultants from Arthur D Little), I would also like to thank all our interviewees and correspondents, including many Defra and Defra Agency staff, for their help, openness and patience in providing us with the detailed evidence for the review.

¹ Following reviews of the Department for Culture, Media and Sport and of the Health and Safety Executive.

*And this our life, exempt from public haunt,
Finds tongues in trees, books in the running brooks,
Sermons in stones, and good in everything.²*

² *Duke Senior* Act II, scene i of *As You Like It*, William Shakespeare



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Summary

1. Review Terms of Reference

1.1 The Government's Chief Scientific Adviser (CSA), Sir David King, has set up a rolling programme of reviews to assess the quality and use of science by Government departments.³ For the purposes of the reviews a broad definition of 'science' is used, which includes natural sciences, social science, economics and statistics – see Glossary.

1.2 The overall aims of the review programme are to:

- a) **Maintain and improve the quality and use of science in government.**
- b) **Review existing departmental systems** for assuring the quality, management and use of their science;
- c) **Disseminate** examples of **good practice** from within the UK and abroad;
- d) **Inform and support the Government's CSA** in his role of "advising the Prime Minister and the Cabinet on the overall health of science and scientific research funded by Government departments".

1.3 To formulate a view on the quality and use of science in the Department for Environment Food and Rural Affairs (Defra), the review focused on ten success criteria that underpin good practice in the use of science by Government departments (see Introduction), to identify both areas of good practice, especially those that could be adopted elsewhere, as well as areas for improvement.

1.4 Defra is the third department to be reviewed under the programme, after the Department for Culture, Media and Sport and the Health and Safety Executive. The review of Defra was carried out in the period January 2005 to July 2006.

³ The reviews build on the work of the Government's published strategy for science, engineering and technology, Investing in Innovation, July 2002 (http://www.hm-treasury.gov.uk/Spending_Review/spend_sr02/spend_sr02_science.cfm) and the Cross Cutting Review of Science and Research, March 2002 (http://www.hm-treasury.gov.uk/media/3A7B0/science_crosscutter.pdf).

2. Defra and Defra Science

Strategic Aims

2.1 Defra's stated core purpose is "to improve the current and future quality of life" ... by bringing together "...the interests of farmers and the countryside; the environment and the rural economy; the food we eat, the air we breathe and the water we drink." This is to be achieved "by integrating environmental, social and economic objectives – putting sustainable development into practice every day, and by championing sustainable development as the way forward for Government."

2.2 Defra has five strategic priorities:

- a) Climate change and energy
- b) Sustainable consumption and production
- c) Protecting the countryside and natural resource protection
- d) Sustainable rural communities
- e) A sustainable farming and food sector including animal health and welfare

Cutting across these areas "a significant part of Defra's work is concerned with preparedness for emergencies and contingencies which fall within the remit of environment, food and rural affairs."

Science Spend

2.3 To help address these priorities, Defra spends over £300M annually on research, monitoring and surveillance activities, of which about £160M is for research.

In-House Scientists

2.4 A large majority of Defra's science is funded through programmes run by Directorates General (DGs) covering each of the five areas listed above. Following his arrival in 2002, the Defra Chief Scientific Adviser (CSA) decided that most of the scientists in Defra were to be 'bedded out' with sectoral policy colleagues in each DG and their role is to advise on the identification, commissioning and management of science programmes in their respective areas. Defra's CSA is supported by a small central team of scientists, economists and social researchers whose remit includes: development of Defra's Evidence and Innovation Strategy; quality assurance of science; horizon scanning; promoting good practice in appraisal and evaluation; facilitating knowledge sharing and capacity building; and coordination of economic and social research across the department.

Scientific Advice

2.5 Defra has about thirty direct science advisory bodies.⁴ Their status varies but many are formal advisory committees that conform to the Nolan rules for public appointments. The work of most of them is relevant to a specific policy sector or topic but the Science Advisory Council in particular is responsible for advising on the science of Defra as a whole.⁵

⁴ <http://www.defra.gov.uk/corporate/delivery/agents/list.htm>

⁵ <http://www.defra.gov.uk/science/how/advisory.htm>

Delivery of Science

2.6 A large proportion of Defra's science is obtained via its three main Executive Agencies: the Central Science Laboratory,⁶ Centre for Environment, Fisheries and Aquaculture Science⁷ and the Veterinary Laboratories Agency⁸. Defra also provides grant-in-aid to the Environment Agency⁹ and funds work at the Meteorological Office's Hadley Centre¹⁰ and Research Council Research Institutes (RIs) such as the British Geological Survey,¹¹ the Centre for Ecology and Hydrology,¹² the Institute for Animal Health,¹³ the Institute for Grassland and Environmental Research (IGER)¹⁴ and Rothamsted Research.¹⁵ These organisations are some of Defra's main science providers but there are many others, presently more than 800 in all.¹⁶

2.7 OSI's review of science in Defra is not concerned with how these various science providers operate but it is concerned with the quality of science obtained, the effectiveness of Defra's relationship with such organisations and the extent to which the department makes effective use of the science they provide.

3. Review Methodology

(see Annex 10 for details)

3.1 The review of Defra has been carried out by staff in OSI and consultants from Arthur D Little Ltd., overseen by a Steering Panel of senior officials, academics and other experts (see Annex 11 for information on the Steering Panel).

3.2 The review consisted of an analysis of information from various sources, including: external consultation (Annex 1), interviews with Defra stakeholders (Annex 2), interviews with Defra staff (Annex 3), detailed case studies (Annexes 4-8) and a peer review exercise (Annex 9).

3.3 The report of OSI's findings, conclusions and recommendations has been approved in discussion with the Steering Panel and checked for factual accuracy by Defra staff.

⁶ <http://www.csl.gov.uk/>

⁷ <http://www.cefas.co.uk/>

⁸ <http://www.defra.gov.uk/corporate/vla/default.htm>

⁹ <http://www.environment-agency.gov.uk/>

¹⁰ <http://www.met-office.gov.uk/research/hadleycentre/>

¹¹ <http://www.bgs.ac.uk/>

¹² <http://www.ceh.ac.uk/index.html>

¹³ <http://www.iah.bbsrc.ac.uk/>

¹⁴ <http://www.iger.bbsrc.ac.uk/default.asp>

¹⁵ <http://www.rothamsted.ac.uk/>

¹⁶ Defra note to Steering Panel: SP Paper 9, June 2005.

4. Main Findings, Conclusions and Recommendations

4.1 The main issues arising from the review can be summarised under three headings:

- a) Maintenance and use of scientific expertise
- b) Commissioning and use of science
- c) Good practice: key messages for Other Government Departments (OGDs)

The first two parts primarily set out areas in which Defra can improve, in many cases building on what is already a sound base. The third section highlights areas in which Defra generally does well and where there may be lessons for OGDs to learn. References to numbered recommendations are to the full recommendations as set out in the 'Findings, Conclusions and Recommendations' chapter of this report.

a) Maintenance and use of scientific expertise

4.2 The review has considered scientific expertise both within 'core' Defra and among its science providers. Within the department, there is a good cadre of staff with a science background. Most of these have been dispersed to sit alongside policy colleagues and this has clear benefits in terms of the department being an intelligent customer for science and using such knowledge to meet policy needs. However, a dispersed approach can impede effective cross-sectoral thinking and we highlight the need for Defra to **strengthen the sense of a Defra science community and ensure a strategic approach to planning and co-ordination of science** (Recommendations 1, 2(c) and 4(b)).

4.3 Turnover of experienced Defra science staff is viewed by its stakeholders as a problem. Defra has acknowledged the need for better succession planning, along with the achievement and maintenance of the right balance of scientific expertise to meet the department's changing needs, including a requirement for more expertise in social research. The review supports the **need for Defra to: maintain existing in-house expertise** (Recommendation 13); **be fully aware of where such expertise lies** (Recommendations 10(b) and 13(d)); **ensure it is used** (Recommendations 9 and 13); and **identify and address areas where more or greater in-house expertise is required** (Recommendations 2(a) [: social research], 4(a) and 13).

4.4 As indicated above (see part 2 of this summary), Defra is strongly dependent on a large number of scientists among its Agencies, the Research Council Institutes and other science providers. **Defra needs to ensure it consistently identifies, engages with and makes best use of external scientific expertise and advice**, regardless of its source, provided that potential conflicts of interest are declared openly at the outset (Recommendations 2(b), 3 and 11). As an intelligent customer for science, Defra should readily be able to meet these recommendations.

4.5 The corollary to Defra being a major science customer is the obligation this places on the department to help maintain the external science expertise and infrastructure on which it relies now and will do in the future, for example by implementing the Research Council Institute and Public Sector Research Establishment Sustainability Study (RIPSS) recommendations.¹⁷ **Defra urgently needs to reach agreement** with other funding organisations on how best **to sustain the science expertise and infrastructure required to deliver the department's policy and delivery needs** (Recommendation 14).

¹⁷ <http://www.dti.gov.uk/science/science-funding/ripss/page22675.html>

b) Commissioning and use of science

4.6 Defra has put a lot of effort into identifying its science needs and how these are changing. The review and many of the stakeholders we consulted concur with **Defra** on the areas it **has identified for further development with regard to strategy and horizon scanning** (see Recommendations 4 and 5 respectively). These include the need for a cross-sectoral approach to avoid gaps or overlaps in strategy and the commissioning of science.

4.7 **The review commends Defra's recent approaches to ensuring the quality of its science and increasing use of peer review** at all stages of its science projects (Recommendation 7); and supports **the commitment to increase the evaluation** of completed work (Recommendations 8 [and 9]). We also note that a clear benefit of dispersing most of its scientists to the policy divisions is that Defra is an intelligent customer for the substantial amount of science it commissions. We suggest **possible improvements to the commissioning and management processes for science** (Recommendation 6), in particular with regard to small or short-term projects.

4.8 **Defra has a good record of publishing the science** it commissions, or of encouraging its science providers to do so. However, Defra **needs to improve the awareness of, and accessibility to, the underlying data** on which the science is based **and develop and maintain its knowledge information systems** (Recommendation 10).

c) Key messages for Other Government Departments (OGDs)

4.9 As one of the main science-using departments in Government, it was to be expected that the review would find aspects of the management and use of science in Defra that OGDs could usefully copy or adapt for their own purposes and this has indeed been the case.

4.10 Two of our recommendations in particular highlight examples of good practice which most OGDs should at least consider, with regard to:

- **Quality assurance and peer review** (Recommendation 7).¹⁸
- **Having an overall Science Advisory Council** (Recommendation 12).¹⁹

4.11 Beyond these formal recommendations, our report also includes many examples of good practice in Defra or parts of the department, which some OGDs may also usefully consider.

Particular areas where Defra is probably one of the leading departments include:

- **Development of an overall Evidence and Innovation Strategy**, using a ‘top-down’ and multidisciplinary approach to look at how to obtain the evidence and innovation required to meet the department’s needs. Recommendation 4 flags up a few aspects which Defra needs to address or is in the process of doing so.
- **Engagement with the department’s sectoral stakeholders.** Although we emphasise the need for Defra to engage still more with its stakeholders (see Recommendation 3), there are several specific examples where Defra has done this well, including via the Environmental Research Funders’ Forum; the Sustainable Farming and Food Research Priorities Group; and in the development of various sectoral-level strategies.
- **Publication of science** commissioned by the department. At this early stage in the cycle of reviewing departmental science, we cannot say that Defra does better than most OGDs but it does generally have a good record. The main area for improvement is the accessibility and management of data on which Defra-funded science is based (Recommendation 10).
- **Horizon scanning.** Although Defra’s activities in this field have had mixed success so far, its commitment to the need for such work is noted and OGDs could learn from Defra’s experience of various approaches (Recommendation 5).

4.12 A few of our other recommendations are made with Defra in mind but apply equally to OGDs, namely:

- **Dispersal of scientists.** In common with some OGDs, Defra has tended to disperse its scientists across the department, placing them alongside policy-makers and other colleagues who rely on them for advice or the commissioning of science. Our report identifies the advantages to this approach and some of the potential difficulties, and how the latter might be minimised or avoided (see Recommendation 1). This does not mean that dispersal of scientists need always be the best approach.
- **Scientific advisory bodies.** Where set up to advise Ministers these should, as a matter of course, report via the departmental CSA (Recommendation 11). There are examples where this has not happened and advice has been incomplete or out of context, with unfortunate consequences.
- **Maintaining external scientific expertise and infrastructure.** Departments that commission a significant amount of science have a duty to play a part in maintaining the scientific expertise and infrastructure on which they rely, now or in the foreseeable future (Recommendation 14). Departments should not be expected to supplant the Research Councils but neither can they expect the skills they need to appear without their contribution, both strategic and financial.

¹⁸ The QA Code was developed jointly by Defra, the Food Standards Agency, BBSRC and NERC

¹⁹ MoD also has a well-established Defence Science Advisory Council



Introduction

How to Read this Report

1. This chapter sets out the background and rationale behind the Science Reviews, together with an overview of the Department for Environment, Food and Rural affairs (Defra) – the third Government department to be reviewed.
2. The main findings emerging from the review, and the recommendations made in relation to them, are set out in the next chapter: Findings and Recommendations, which summarises: the evidence made available to the review by Defra and some of its main stakeholders; the issues the review aimed to examine; and main findings and recommendations which have emerged from the review. Detailed evidence supporting the main findings is presented in a set of supporting Annexes (1-9) which are available via our web-site¹ as pdf files:

Annex 1	Summary of written consultation responses;
Annex 2	Summary of external stakeholder interviews;
Annex 3	Summary of Defra evidence from interviews and documents;
Annexes 4-8	Detailed case studies on: Antimicrobial resistance Wheat genetic improvement Soils Monitoring Air quality: particulate matter Radioactive substances and contaminated land
Annex 9	Peer review of a selection of Defra-funded science projects

3. The remaining Annexes set out how the review was conducted (Annex 10), and provide information on the terms of reference and membership of the Steering Panel (Annex 11).

¹ <http://www.dti.gov.uk/science/science-in-govt/works/science-reviews/review/defra/page24808.html>

The Science Reviews

Background

4. Government departments have responsibility for funding and carrying out the science they need to support their policy, regulatory and other activities. In general, this system works well but there are concerns that standards and practices vary from department to department more than can be justified by the particular circumstances of the individual departments. Furthermore, crises such as the Bovine Spongiform Encephalopathy (BSE) and Foot and Mouth Disease (FMD) outbreaks have heightened concern about the quality of Government science and science-based policy.

5. In December 2001, the Ministerial Committee on Science Policy agreed that the Government's Chief Scientific Adviser (CSA) – Sir David King, should have functional responsibility for maintaining the quality and vigour of science in all Government departments. Accordingly, the Government's '**Cross-Cutting Review of Science and Research**' (March 2002)² and its strategy for science, engineering and technology '**Investing in Innovation**' (July 2002)³ recommended that a new team (the Science Review team) should be set up in the Office of Science and Technology (OST, now the Office of Science and Innovation: OSI) to take forward a new rolling programme of external scrutiny and benchmarking of the ways in which Government departments use science and manage research and to reinforce good practice and high standards across departments.

Aim of the Science Reviews

6. The aim of the OSI Science Reviews is to maintain and improve the ways in which Government departments use science and manage research.

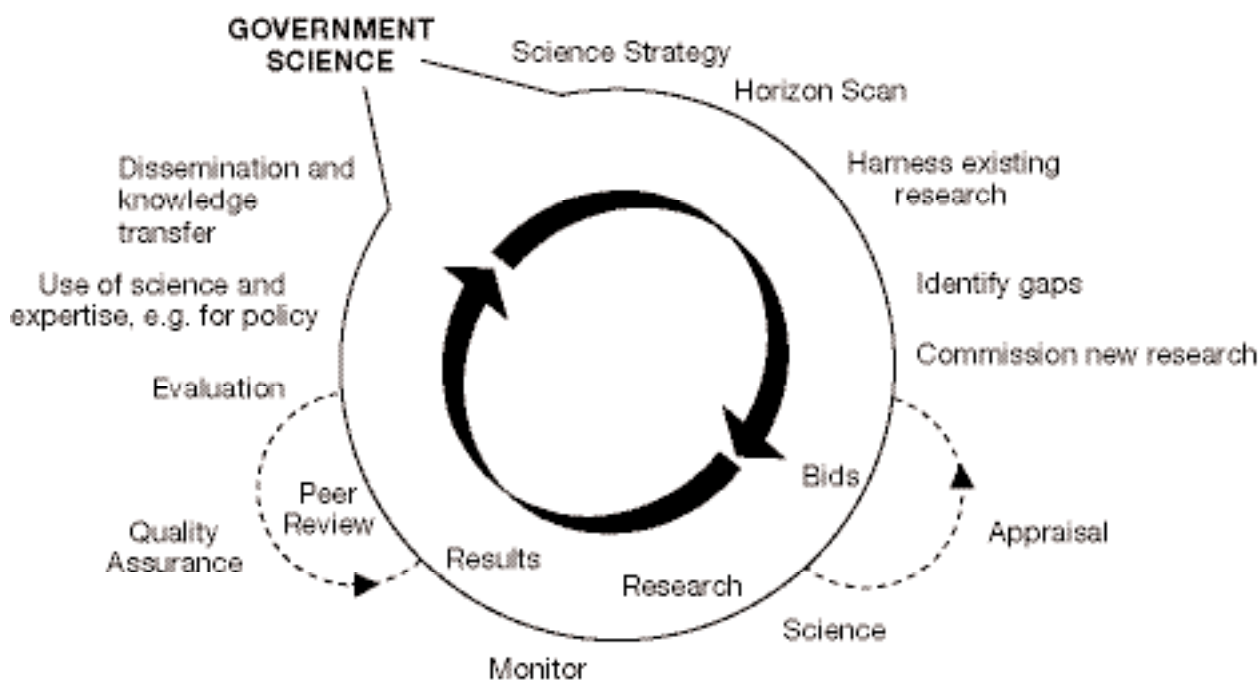
7. For the purposes of the Science Reviews the term 'science' includes physical, natural and social sciences, research and data collection (monitoring and surveillance) activities.

² Cross Cutting Review of Science and Research: Final Report, March 2002, Section C (http://www.hm-treasury.gov.uk/media/3A7B0/science_crosscutter.pdf).

³ Investing in Innovation – A strategy for science, engineering and technology, July 2002 (http://www.hm-treasury.gov.uk/spending_review/spend_sr02/spend_sr02_science.cfm).

Focus

8. To formulate a view on the quality and use of science in Defra, the Science Review focused on ten attributes that underpin good practice in the use of science by Government departments, as identified by the Cross-Cutting Review (illustrated in the diagram below). The rationale behind each of the attributes is set out in Table 1.



9. For the purposes of this review it has been helpful to consider simultaneously the issues addressed under Section 4 'Commissioning and managing new research' and Section 5 'Ensuring quality and relevance of science'.

Order of Science Reviews

10. 'Investing in Innovation' outlined the Government's long-term vision for science in the UK, including the intention to undertake a rolling programme of reviews looking at the quality and use of science in the main science-using Government departments. Defra is the third department to be reviewed in accordance with this strategy (after the Department for Culture, Media and Sport and the Health and Safety Executive).

Table 1 Science Review Criteria

Rationale

To effectively manage science and research, departments should:

1. Develop a clear, overall science strategy

Departments should take a strategic approach to setting R&D budgets, and should publish science and innovation strategies that set out the broad framework within which research programmes and other science-related activities are carried out. This is an important step in linking research and development to the effective delivery of a department's objectives.

2. Horizon scan – to identify future science-related issues

Horizon scanning is defined as the systematic examination of potential threats, opportunities and likely future developments, which are at the margins of current thinking and planning. Horizon scanning may explore novel and unexpected issues, as well as persistent problems or trends. Departments should regularly undertake horizon scanning to improve the robustness of their evidence base and policies.

3. Review and harness existing science and identify gaps and opportunities for future research

To demonstrate effective use of resources, departments should have in place arrangements for deciding what current or potential science could benefit the department's delivery and hence whether new research is needed or where it would best be targeted. In particular, departments should actively manage existing knowledge, synthesise existing research, and work with Other Government Departments (OGDs) and the research bases in the UK and internationally.

4. Commission and manage new science and

5. Ensure the quality and relevance of the science they carry out and sponsor

As part of the drive for evidence-based policy and improved service delivery the Government needs to use, and be seen to use, high quality science and the most appropriate new technologies. Science programmes funded by Government departments make a very important contribution to policy formulation. Even though the outcomes of the science itself cannot always be predicted, departments must be able to commission the right science, assess its quality, and use it effectively. The credibility of departmental policy-making generally will be undermined if individual policies are perceived to be based on poor, or the wrong science.

6. Use science and scientific advice

Departments need scientific advice to underpin their policy making and regulatory activities. Such advice can be provided by external or internal experts, and / or informed by the output of research programmes commissioned by the department. There needs to be an effective communications bridge between the experts and the policy makers.

7. Publish results and debate their findings and implications openly

In accordance with the Freedom of Information Act⁴ and to ensure robust interpretation of scientific findings and their policy implications, departments should publish and openly debate scientific results.

8. Share, transfer and manage knowledge

Knowledge transfer should be treated by departments as a strategic goal and enjoy highlevel focus.

9. Implement Guidelines 2005⁵ and the Code of Practice for Scientific Advisory Committees⁶

Guidelines 2000 is a high-level document aimed at the way Government departments obtain and use scientific advice in policy-making. Its key messages are that departments should: think ahead and identify early the issues on which they need scientific advice; get a wide range of advice from the best sources, particularly where there is scientific uncertainty; and publish the scientific advice and all relevant papers. The Guidelines have been drawn upon in formulating the ten key criteria for the OSI Reviews.

The purpose of the Code of Practice is to provide more detailed guidance specifically focused on the operation of scientific advisory committees and their relationship with Government and to help them translate the principles in the Guidelines into day-to-day practice.

10. Use, maintain and develop scientific expertise (including both capacity and capability building)

Whether a department has its own dedicated research unit, or commissions work from outside organisations, it needs to ensure it has long-term access to experienced scientists who are able to understand and interpret issues at the science-policy interface, taking into account the full range of scientific opinion as appropriate.

⁴ <http://www.opsi.gov.uk/ACTS/acts2000/20000036.htm>

⁵ Office of Science and Technology. Guidelines 2005: Scientific advice and policy making, October 2005 (<http://www.dti.gov.uk/files/file9767.pdf>).

⁶ Office of Science and Technology. Code of Practice for Scientific Advisory Committees, December 2001 (<http://www.dti.gov.uk/files/file9769.pdf>).

The Department for Environment, Food and Rural Affairs (Defra)

11. This section sets out the department's areas of responsibility, the areas in which science is important, and the particular circumstances and conditions that relate to Defra and its use of science.

12. Defra's stated core purpose (currently under review) is "to improve the current and future quality of life" ... by bringing together "...the interests of farmers and the countryside; the environment and the rural economy; the food we eat, the air we breathe and the water we drink." This is to be achieved "by integrating environmental, social and economic objectives – putting sustainable development into practice every day, and by championing sustainable development as the way forward for Government."

Strategic Aims

13. Defra's strategic aim is "sustainable development – defined as: development which enables all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations." Under this overall aim, the two key themes for the department are 'environmental leadership' and 'putting sustainable development into practice'.

14. Defra's five strategic priorities (also under review) are as listed below :

- a) Climate change and energy
- b) Sustainable consumption and production
- c) Protecting the countryside and natural resource protection
- d) Sustainable rural communities
- e) A sustainable farming and food sector including animal health and welfare

Cutting across these areas "a significant part of Defra's work is concerned with preparedness for emergencies and contingencies which fall within the remit of environment, food and rural affairs."

15. Outcomes Defra aims to achieve in each of these areas are summarised in Table 2:

a) Climate change and energy

Making a full contribution, domestically and internationally, to addressing the long-term threats presented by climate change and unsustainable energy use and to ensure adequate mitigation of the consequences which are already unavoidable.

- Reduction in the UK's contribution to global climate change by cutting our greenhouse gas emissions
- Reduction in global greenhouse gas emissions to avoid dangerous climate change and international promotion of adaptation to unavoidable climate change
- UK successfully adapting to unavoidable climate change
- Every home adequately and affordably heated
- Improved air quality
- Risk from flooding and coastal erosion managed in a way which furthers sustainable development

b) Sustainable consumption and production

Breaking the link between economic growth and environmental degradation and resource use through promoting and enabling more sustainable patterns of consumption and production.

- Programmes in place to decouple economic growth from environmental degradation and unsustainable resource use
- Protection of human health and the environment by minimising amounts of waste produced and getting as much value as possible out of what is left by re-use, recycling or composting and the recovery of energy

c) Protecting the countryside and natural resource protection

Creating a robust policy framework and evidence base in order to promote the sustainable use and enhancement of the country's natural heritage and ecosystems.

- Protect and enhance the natural environment, now and for future generations, and establish a robust framework for future development decisions that respect environmental constraints
- More and better access to the natural environment, especially for those who find it difficult to enjoy the health and well-being benefits which access to nature can bring
- Good water quality and a good water environment, with a sustainable balance between water supply and demand

d) Sustainable rural communities

Encouraging sustainable regeneration in disadvantaged areas, promoting social inclusion and reducing deprivation, ensuring higher quality, more accessible public services to rural communities.

- Vibrant enterprise across rural England, with resources better targeted to help reduce the gap in productivity between the least well performing quartile of rural areas and the English median; rural social exclusion tackled, with fair access to services and affordable housing

e) A sustainable farming and food sector including animal health and welfare

Helping create a sustainable food and farming supply chain serving the market and the environment, putting in place systems to reduce risks of animal diseases, and being ready to control them when they occur.

- For the Strategy for Sustainable Farming and Food, the key strategic outcomes are:
- More customer focused, competitive and sustainable farming;
- More competitive and sustainable food industry;
- Further CAP reform

For the Animal Health & Welfare Strategy the key strategic outcome is:

- Animal health and welfare of kept animals improved, and society, the economy and the environment protected from the impact of animal disease, through sharing the management of risk with the industry

Defra Science

16. To help achieve these outcomes, Defra spends over £300M annually on research, monitoring and surveillance activities, of which about £160M is for research.

17. A large majority of science is funded by Defra through programmes run by Directorates General (DGs) covering each of the five areas set out in Table 2 above. Following his arrival in 2002, the Defra Chief Scientific Adviser (CSA) decided that most of the scientists in Defra were to be 'bedded out' with sectoral policy colleagues in each DG and their role is to advise on the identification, commissioning and management of science programmes in their respective areas.

18. The CSA continues to be supported by a central Science Directorate, responsible for ensuring that Defra invests in the right science, that this science is of high quality and fit for purpose, and that it is used effectively in policy making; specifically:

- the development of Defra's Evidence and Innovation Strategy (E&IS)
- quality assurance of science across the department
- Defra's horizon scanning programme
- development of the CSA's role as Head of Profession for science
- Secretariat for the Science Advisory Council (SAC)
- international research and collaboration through the EU Framework Programme
- strategic economic, social research, analysis and advice
- promoting good practice in appraisal, evaluation and economic and social research
- facilitating knowledge sharing and capacity building in economics and social research
- coordination and coherence of economic and social research evidence across Defra
- science communication
- the CSA's strategic R&D budget of £9-10M per year

In addition, the Chief Economist and his Central Analytical Directorate now also report to the CSA and the two Directorates work closely together on evidence and innovation issues.

Scientific Advice

19. Defra operates or has links to almost a hundred ‘delivery agents’⁷, most of which include science as part of their remit and many of them provide Defra with scientific advice. About thirty are direct science advisory bodies. Their status varies but many are formal advisory committees that conform to the Nolan rules for public appointments. The work of most of them is relevant to a specific policy sector or topic but the Science Advisory Council (SAC) in particular is responsible for advising on the science of Defra as a whole:

Defra Science Advisory Council (SAC)⁸

The SAC was established in February 2004 to provide Defra with expert, independent and published advice on science policy and strategy. The SAC communicates this advice to Prof. Howard Dalton, the Chief Scientific Adviser (CSA), and through the CSA to Ministers.

The SAC’s terms of reference are to: ensure the quality and appropriateness of Defra’s various scientific activities and use of science, by providing strategic advice on all of Defra’s science activities and their relationship with both Defra’s policy goals and the wider UK and international science base and horizons.

To achieve this it aims to:

- provide independent and published advice to the CSA, and through the CSA to Ministers, on:
 - the strategic direction of, and priorities for, Departmental science;
 - the balance, relevance and adequacy of science activities supporting Departmental objectives;
 - broad strategic issues, priorities and policies from a science perspective;
 - the design of procedures relating to science advice; and
 - pressing science issues facing Defra.
- identify emerging challenges and opportunities, develop possible responses, and participate in horizon-scanning and long-range planning exercises;
- act as an important source of advice to the CSA on national emergencies in Defra’s areas of responsibility, including acting as a conduit to specialists in the science community; and
- provide independent review of Defra’s scientific activities, including its response in emergencies.

⁷ <http://www.defra.gov.uk/corporate/delivery/landscape/bodies/index.htm>

⁸ <http://www.defra.gov.uk/science/how/advisory.htm>

Delivery of Science

20. As indicated above, Defra spends about £300M a year on science. A large proportion of this is obtained via its three main Executive Agencies:

- Central Science Laboratory (CSL)⁹;
- Centre for Environment, Fisheries and Aquaculture Science (CEFAS)¹⁰; and the
- Veterinary Laboratories Agency (VLA)¹¹.

Each of these presently obtains two-thirds or more of its funding from Defra.¹² In addition, Defra provides £100M per year of grant-in-aid to the Environment Agency (EA).¹³

21. Defra also funds significant amounts of work at the Met Office's Hadley Centre¹⁴ and Research Council (RC) Research Institutes (RIs) such as the British Geological Survey,¹⁵ the Centre for Ecology and Hydrology,¹⁶ the Institute for Animal Health,¹⁷ the Institute for Grassland and Environmental Research (IGER)¹⁸ and Rothamsted Research.¹⁹ The department presently spends about £20M per year with BBSRC RIs and £7M per year with NERC RIs.

22. The organisations mentioned above are some of Defra's main science providers but there are many others, presently more than 800 in all.²⁰ OSI's review of science in Defra is not concerned with how these various science providers operate but it is concerned with the quality of science obtained, the effectiveness of Defra's relationship with such organisations and the extent to which the department makes effective use of the science they provide.

⁹ <http://www.csl.gov.uk/>

¹⁰ <http://www.cefas.co.uk/>

¹¹ <http://www.defra.gov.uk/corporate/vla/default.htm>

¹² CSL: ~67%, CEFAS: ~75%, VLA: ~92%.

¹³ <http://www.environment-agency.gov.uk/>

¹⁴ <http://www.met-office.gov.uk/research/hadleycentre/>

¹⁵ <http://www.bgs.ac.uk/>

¹⁶ <http://www.ceh.ac.uk/index.html>

¹⁷ <http://www.iah.bbsrc.ac.uk/>

¹⁸ <http://www.iger.bbsrc.ac.uk/default.asp>

¹⁹ <http://www.rothamsted.ac.uk/>

²⁰ Defra note to Steering Panel: SP Paper 9, June 2005.



Findings, Conclusions and Recommendations

Introduction

0.1 This Chapter presents the main findings, conclusions and recommendations from the Science Review of the Department for Environment Food and Rural Affairs (Defra). The material is presented under the headings of the ten key criteria for the effective management of science and research within government (strategy, horizon scanning, etc.) but is prefaced by a few overarching themes that apply to several of the review criteria.

0.2 It is important to note that the focus of the review is on Defra and, where it is relevant to the quality and use of science in the department, its relationship with its science providers such as its Laboratory Agencies. It is not a review of the science providers themselves.

0.3 For all ten review criteria, areas of good practice have been identified, along with suggested areas for improvement and, in some cases, proposals for how such improvements might be achieved. Some of the main examples of good practice are noted here, especially those that may be transferable, across Defra or to Other Government Departments (OGDs). Further details are provided in Annexes 1 to 9 and in the written submissions of evidence. Partly as a result of such examples, not all the Review's recommendations are aimed at Defra.

How to read this Chapter

0.4 Each of the ten main sections in this Chapter opens with a recap of why each heading is important; a summary of the evidence submitted by Defra at the start of the review; and the main issues arising that the Review sought to address. The bulk of each section is taken up by the main review findings and the corresponding conclusions and recommendations. The findings draw on information from all the various sources used in the course of the review: external consultation (Annex 1), interviews with Defra stakeholders (Annex 2), interviews with Defra staff (Annex 3), detailed case studies (Annexes 4-8) and a peer review exercise (Annex 9).

0.5 The footnotes are mainly used to indicate sources of evidence using acronyms for the various organisations that wrote to us. The letters (a) to (z) (and numeric codes in Annex 3) are used to indicate information provided by external and Defra interviewees (unattributably). Put together, these help to provide an indication of the importance of some of the issues raised.

0.6 As with all the Chapters, it is important to note the following definitions that have been used in the review:

- other than where specified, 'science' is used as an all-encompassing term, which includes the natural sciences, social sciences, statistics and research (see Glossary);
- natural science is used as short-hand to cover all scientific activity outside the social sciences; and
- the distinction is made between the 'Government's Chief Scientific Adviser' (GCSA) and departmental 'Chief Scientific Advisers' (CSAs).

Overarching Themes

1. This part of the report highlights issues that are relevant to several of the ten review criteria. This does not mean that they are necessarily more important than the other issues raised.

Roles of Scientific Staff within core Defra

Findings

2. The appointment of Defra's Chief Scientific Adviser (CSA) is said to have had an important and positive role to play²¹: specifically in developing Defra's science strategy²² (section 1), reviewing and harnessing existing research²³ (section 3), improving the quality of the department's science²⁴ (section 5), accessing external sources of expertise²⁵ (section 9) and as head of profession.²⁶

3. A common concern is the need for better co-ordination between Defra policy divisions, for example on strategy²⁷, use of science in policy-making²⁸ and knowledge management.²⁹

4. Many interviewees commented on the effects of dispersing scientific staff, and the research budgets that they manage, to policy sectors. This has clear benefits, for example in terms of the intelligent customer function for science³⁰ and closer interactions with policy staff, improving understanding of evidence needs and take-up of findings³¹ but has reportedly given rise to a disconnection between the central science team (including the Chief Scientific Adviser (CSA)) and the policy sectors,³² loss of 'community' among scientists in Defra and the increased difficulty of thinking more strategically about evidence needs.³³ In some areas this has resulted in fragmented research that is inefficient to administer and which can overlook issues that fall between policy sectors or are cross-cutting.³⁴

5. Although Defra states that the number of scientific staff in the department has been maintained in recent times, there is a strong external perception of a shrinking base of science expertise in Defra, with experienced staff being replaced by others who are more junior or less knowledgeable.³⁵ Frequent staff turnover is said by some external stakeholders to cause problems for Defra in maintaining an intelligent customer function in some areas and threatens to do so in others.³⁶ This impacts on all aspects of the management and use of science and is frustrating for the department's science providers.³⁷ See section 10, paras.137 onwards for further discussion and Recommendations 10(b) and 13.

²¹ BF, BES, IFR, NERC, RR, RS

²² IFR, NERC, RS

²³ RR

²⁴ BF, RS

²⁵ RR

²⁶ BES

²⁷ BF, BGrassS, FARM, MBA, MO, NIAB, NHM, RR, SEERAD

²⁸ BBSRC, BES, BGrassS [see detailed examples provided in follow-up response, with regard to upland grasslands, biodiversity on grassland farms and diffuse pollution and greenhouse gas emissions], BSAS, BW, FC, NBN, NERC, ZIC, ZSL

²⁹ NERC and similar from RSPCA, SAC, UKWIR

³⁰ (f),(g),(i),(q)

³¹ Annex 3, para.2.26

³² (b), (c), (g), (h), (n), (q)

³³ Annex 3, para.5.23-.29

³⁴ See Annex 2, para.4.2: (a), (b), (d), (n), (w), (z); paras.3.4, 3.10 and 6.1: (j)

³⁵ Defra has some statistics on how many scientists the department employs but these do not capture the seniority or expertise of such staff, nor how they change with time: see Recommendation 13(d).

³⁶ ARF, BF, BSAS, HDC, NHM, (a), (g), (p), (y), and see Annex 3, paras.4.58-.59 for Defra staff views.

³⁷ ARF, BF, BSAS, HDC, IGER, NHF, NHM, NIAB, RR, VLA, (a), (b), (c), (d), (e), (f), (g), (h), (p), (y)

6. There is recognition, within the department and outside, that Defra's requirements for in-house science expertise change with its priorities over time (see para.147 and Recommendation 13), for example that the department needs to complement its present natural science expertise with greater expertise elsewhere, in particular social research, see para.7 and Recommendation 2 below.³⁸

Social Research

7. As indicated throughout this report, social research has a greater part to play in most aspects of Defra's use and management of science, including:

- implementation of its Evidence and Innovation strategy³⁹
- horizon scanning⁴⁰
- reviewing and harnessing existing research⁴¹
- commissioning new research^{42,43}
- use of science^{44,45}
- knowledge transfer⁴⁶
- use of scientific advice⁴⁷
- balance of in-house expertise⁴⁸

Conclusions and Recommendations

8. We agree that the role of the CSA (and the central science team, which includes the social sciences) is key to many aspects of Defra's effective use of science and some specific points are dealt with elsewhere (e.g. see Recommendations 1 and 11 below). We concur with the RS's view that "it is vital that the CSA is involved in all the key strategic decisions within Defra" and our attention has been drawn to specific examples where problems have arisen where this has not been the case from the outset.⁴⁹ The following extract from Guidelines 2005 sets out the desired position that: "CSAs will work in partnership with policy makers ... to ensure appropriate scientific input into policy decisions."⁵⁰

9. We concur with the views, as set out in para.4 above, that there are undoubted benefits to Defra having scientists dispersed to the policy sectors, in terms of the department being an intelligent customer for science, closer interactions with policy staff, improving understanding of evidence needs and take-up of findings. However, given that Defra has adopted the dispersed model, there is also a need to recreate the advantages of a centralised approach, for example by maintaining a sense of a science 'community' and a strategic approach to research planning and co-ordination. In other parts of the report we have drawn attention to examples of good practice that the department could build on, e.g. use of seminars, workshops, secondments and the Environment Agency's approach to line management of dispersed scientists (see section 10).

³⁸ ESRC, IoD, SAC, Annex 3, para.4.45-.57 and Defra CSA presentation to Steering Panel, June 2005.

³⁹ See table below para.25 and ESRC, OFWAT, SA, (f), (i), (s), (u), (y), Annex 3, paras.2.16, 2.26-.27, 2.86, 3.15, 3.85, 4.18

⁴⁰ See para.37, FHRC, NFU, SNH and see Annex 3, para.3.15

⁴¹ See para.42 and Annex 3, paras.2.16, 2.26-.27, 2.86, 3.15, 3.85, 4.18

⁴² See para.62, ESRC, (u), (q), (s)

⁴³ See para.65, (q), (y), Annex 3, para.3.112

⁴⁴ See para.93, ESRC and similar from OFWAT

⁴⁵ SA, (f), (i), (s), (u)

⁴⁶ See para.113, ESRC

⁴⁷ See para.130: role of the SAC and Annex 2, table below para.9.1

⁴⁸ See para.139, ESRC and similar from SAC

⁴⁹ E.g. with regard to bovine TB and radioactive waste.

⁵⁰ <http://www.dti.gov.uk/files/file9767.pdf>

Recommendation 1

Defra should build on existing good practice (seminars, workshops, secondments, etc.) to strengthen links between scientists across the department, including with the central science team. The role of the CSA and central science team is key in facilitating and implementing this.

10. The natural sciences are essential to Defra's business and this is widely recognised within and outside the department. Economics and statistics are also well-established. What has only more recently been acknowledged is the extent to which Defra also needs to make greater use of research in the social sciences more generally.⁵¹ The present centralisation of social researchers in Defra seems appropriate given the much smaller cadre of staff with such expertise. This encourages best use of a limited resource and helps ensure both quality and appropriate career development. In the longer term, more devolved arrangements may be appropriate.

Recommendation 2

Defra should:

- a) continue to develop its social research resource;**
- b) further develop contact with the wider social research community; and**
- c) provide guidance to policy and implementation teams to ensure that social science considerations are fully integrated into science projects from the beginning.**

External Scientific Advice

Findings

11. The Science Advisory Council (SAC) is said to be “another important strand of Defra's science strategy. To be effective SAC must be involved in all major policy issues involving scientific evidence and include a sufficient number of internationally recognised scientists (covering an appropriate range of disciplines) in addition to other stakeholders.”⁵² In particular the importance of SAC's roles in development of strategy, horizon scanning, reviewing and assessing the quality of science (at programme level) are stressed.⁵³ See para.130 and Recommendation 12.

⁵¹ Including: economics, human geography, social anthropology, social psychology, sociology, political / policy sciences and planning.

⁵² RS

⁵³ RS and similar from BBSRC, IFR, NFU

12. Defra's consultative approach is commended by many⁵⁴ but the department is encouraged to make still more use of external sources of expertise, for example Other Government Departments (OGDs), Research Councils (RCs) / academia and abroad, for aspects such as: science strategy development⁵⁵, horizon scanning⁵⁶, reviewing and harnessing existing science⁵⁷, collaboration on new research⁵⁸, knowledge transfer⁵⁹, sources of scientific advice⁶⁰ and maintenance of the research base⁶¹.

Conclusions and Recommendation

13. Defra is probably a 'market leader' among Government departments in terms of consulting with stakeholders, i.e. inviting views. However, there is room for improvement in some areas in terms of how effectively the department engages with its stakeholders, i.e. makes contact with stakeholders and maintains a constructive dialogue with them. Successful examples of engagement include the Environmental Research Funders' Forum and Sustainable Farming and Food Research Priorities Group.

14. Defra makes extensive use of scientific advisory bodies. However, it may not always draw on the best scientific advice in some areas, for example not always involving Laboratory Agency staff because they might not be thought sufficiently independent of the department. One of the advantages of Defra being an intelligent customer for science is that it should be able to avoid such difficulties and make the best use of expertise, regardless of its source, provided that interests are declared openly at the outset.⁶²

Recommendation 3

Defra should:

- a) **more consistently play a lead role in engagement with its stakeholders;** examples of good practice to copy more widely include the Sustainable Farming and Food Research Priorities' Group and the Environment Research Funders' Forum; and
- b) **ensure that it is aware of, and draws on, the best possible sources of advice;** regardless of whether this happens to be from among its Executive Agencies, academia, or internationally.

⁵⁴ ACoP, ARF, BAA, BBSRC, BES, BF, BGS, BGrassS, BSAS, CCW, DEPC, EN, ESRC, FC, FHRC, GCT, HDC, IAH, IFR, IoH, IGER, LGC, MLC, MO, NFU, NHF, NIAB, NERC, RI, RR, RES, RS, RSPCA, SEERAD, SEPA, ZSL. See also Annex 5, para.11 for examples of successful collaboration.

⁵⁵ DEPC, FARM, IoH, JNCC, NIAB, NHM, RS, SAC

⁵⁶ NERC, RES, RS, SEERAD, VLA

⁵⁷ NIAB, P, RR, SAC, SGM, UKWIR, ZSL

⁵⁸ BAA, BGrassS, BW, FARM, IFR, JNCC, SEPA, SNH, ZIC

⁵⁹ ARF, BF, BW, FHRC, HDC, IGER, LGC, MBA

⁶⁰ BES, BGS, RR, RS

⁶¹ BBSRC, ESRC, IFR, IGER, MO, NERC, NFU, RI, RR, RS

⁶² This is in line with the Phillips BSE inquiry report: <http://www.bse inquiry.gov.uk/report/volume1/chapt142.htm#648816> "Potential conflicts of interest should not preclude selection of those members otherwise best qualified, but conflicts of interest should be declared and registered."

Resources

Findings

15. The point is often made that Defra needs to not only identify issues but provide the resources to deal with them. This applies to areas such as developing strategy,⁶³ horizon scanning,⁶⁴ reviewing science and identifying gaps,⁶⁵ and formulating research questions.⁶⁶

MAFF / DETR legacy issues

Findings

16. The point is made in written evidence that Defra is still “a relatively new department. The component departments (MAFF and DETR) had rather different approaches to R&D and to commissioning, managing and assessing it. Given the duration of most research projects, there is still an R&D footprint representative of the old structures and this leads inevitably to a range of performance against [OSI’s] main criteria. ...there are still ‘relic’ issues.”⁶⁷ The different approaches among Defra sectors are thus reflected in variations in: how existing science is reviewed and gaps across Defra are identified,⁶⁸ how new science is prioritised⁶⁹ and managed,⁷⁰ the relevance of Defra’s research programmes,⁷¹ the use of scientific evidence in policy-making⁷² and the extent to which the department is reliant on its Agencies for science and scientific advice.⁷³

Conclusions

17. Although some differences in approach may be justified, the indications are that the legacy issues are more extensive than they should be. There may need to be a change of culture towards querying why different parts of Defra do things differently, rather than questioning the need for changes to what has been done in the past. In this respect, the development of an overall Evidence and Innovation Strategy (E&IS) is a step in the right direction: see Section 1.

⁶³ BES, FARM, IAH, JNCC, NFU, NERC, RR, RES, SEPA, VLA, (g), (k)

⁶⁴ ARF, BES, DEPC, ESRC, FC, JNCC, LGC, MO, NIAB, NHM, RES, RS, VLA, (c), (e), (f), (k), (m)

⁶⁵ BGS, FC, NFU, SA, (d)

⁶⁶ BGS, MO, SGM, VLA, (a), (h), (k), (n), (w), (z)

⁶⁷ IGER and similar from NERC, RI

⁶⁸ (d) Annex 3, paras.2.29-.31 and 3.56-59

⁶⁹ EN and similar from JNCC, RS, SEERAD, SA and Annex 3, para.3.136

⁷⁰ NERC, (h) and Annex 3, para.3.136

⁷¹ (h), (k), (z)

⁷² NERC, (c)

⁷³ (d), (v)

Role of Agencies / Other Science Providers

Findings

18. Defra's arm's length relationship with its Laboratory Agencies and attempts to broaden its science contractor / adviser base have led to some dissatisfaction among both Defra Agencies and their external counterparts. Some external providers see the relationship between Defra and its Agencies as being 'too cosy'⁷⁴ and would like to be able to bid for a greater proportion of the department's science budget.⁷⁵ On the other hand, Agencies believe that Defra does not always make best use of the expertise available, with an uneven playing field for: bidding for some contracts;⁷⁶ provision of advice to the department;⁷⁷ or (peer-) reviewing past, current or future science activities.⁷⁸ There is general agreement that in some areas there is a need to maintain long-term science capability and knowledge, regardless of who provides it,⁷⁹ and that Defra needs to know where to access such capability and knowledge.⁸⁰

See Recommendation 14, section 10.

⁷⁴ ESRC, LGC, NERC, RI, RR, UKWIR, (g), (r)

⁷⁵ ACoPack, BBSRC, IAH, LGC, RES, SGM, ZIC

⁷⁶ (d), (b), (w)

⁷⁷ (b), (e), (f)

⁷⁸ (b), (e), (f)

⁷⁹ BGrassS, CIRIA, CCW, HDC, IGER, LGC, MBA, MO, NBN, NFU, RI, RR, RS, VLA, ZSL, (b), (f), (h), (k)

⁸⁰ Annex 3, para.4.88

1. Science Strategy

Rationale

19. Departments should take a strategic approach to setting R&D budgets, and should publish science and innovation strategies that set out the broad framework within which research programmes and other science-related activities are carried out. This is an important step in linking research and development to the delivery of a department's objectives and showing how value for money is achieved.⁸¹

Defra Submissions

20. In The Forward Look 2003,⁸² Lord Whitty stated that:

“All areas of our policy programme are underpinned by Science, Engineering and Technology. It informs and influences policy agendas in the UK and, increasingly, the EU and internationally. Activities in our three areas of environment, food and farming, and rural communities and economy range from tackling global climate change to the prevention of animal disease. ...

Defra's Science and Innovation Strategy (S&IS), “Delivering the Evidence”⁸³, published in May 2003, describes Defra's visions for a three year period, including our science activities and the methods we will use to procure them and assure their quality.”

21. Since then, in July 2004 Defra followed up on the S&IS with a forward look at its needs from science over the next ten years.⁸⁴ This identified the six strategic priorities, under the overarching aim of sustainable development:

Climate change and energy (including stratospheric ozone and air quality)

Sustainable consumption and production

Natural Resource protection

Sustainable rural communities

Sustainable food and farming (including animal health and welfare)

Emergency preparedness

⁸¹ Cross-Cutting Review of Science and Research: Final Report (March 2002), page 87, HM Treasury, Department for Education and Skills, Office of Science and Technology and Department of Trade and Industry.

⁸² Lord Whitty, The Forward Look 2003; Government funded science, engineering and technology (July 2003), OST.

⁸³ Delivering the Evidence – Defra's Science and Innovation Strategy (2003-06)
http://www.defra.gov.uk/science/documents/Delivering_The_Evidence.pdf

⁸⁴ Evidence and Innovation: Defra's needs from the sciences over the next ten years
<http://www.defra.gov.uk/science/documents/forwardlook/ScienceForwardLook3rd.pdf>

22. Defra is now in the process of producing its next Evidence and Innovation Strategy (E&IS), with a public consultation having been completed in January 2006.⁸⁵ The E&IS has adopted a ‘top-down’ and multidisciplinary approach to looking at how to obtain the evidence and innovation required to meet Defra’s needs.⁸⁶ In his foreword to the consultation, Lord Bach stated that “Decisions on our evidence and innovation strategy have to be informed by a clear understanding both of the potential for working more closely with others in order to deliver such new requirements, and of the implications of reduced areas of activity.”⁸⁷ In the same publication Defra’s CSA added that “The process has involved a close partnership between, on the one hand, policy makers and, on the other, a range of specialists (scientists, economists, social scientists, statisticians, engineers and others) across the department, working together in a genuinely interdisciplinary way.”

23. In producing its overall strategies, Defra is moving away from a sectoral approach, although a number of sectoral strategies remain in the meantime. For example:

Sector	Link to strategy
Agriculture	http://www.defra.gov.uk/farm/policy/sustain/strategy.htm
Air quality	http://www.defra.gov.uk/environment/consult/airquality/pdf/airstrat.pdf
Animal health & welfare	http://www.defra.gov.uk/animalh/ahws/strategy/ahws.pdf
Biodiversity	http://www.defra.gov.uk/wildlife-countryside/biodiversity/biostrat/index.htm
Marine environment	http://www.defra.gov.uk/environment/water/marine/uk/stewardship/pdf/marine_stewardship.pdf
Plant health	http://www.defra.gov.uk/planth/strategy/strategy05.pdf
Radioactive waste	http://www.defra.gov.uk/environment/radioactivity/government/discharges/pdf/rad_dischargestrat1.pdf
Rural	http://www.defra.gov.uk/rural/strategy/default.htm
Soil	http://www.defra.gov.uk/environment/land/soil/pdf/soilactionplan.pdf
Waste	http://www.defra.gov.uk/environment/waste/strategy/cm4693/pdf/wastv2_1.pdf
Water	http://www.defra.gov.uk/environment/water/internat/sustainable-water/pdf/trade-strategy.pdf

Evidence sought

24. Both Defra’s S&IS and E&IS are high-level documents, which aim to cover the breadth of Defra’s interests. OSI therefore sought to establish how and how effectively the strategies are set and science is prioritised and organised in the department. The review also looked at how effectively Defra’s overall strategies linked to those of its component sectors.

⁸⁵ see <http://www.defra.gov.uk/science/how/strategy.htm>

⁸⁶ Defra CSA’s presentation to the Review Steering Panel, June 2005.

⁸⁷ <http://www.defra.gov.uk/science/how/documents/PDFs%20in%20Parts/Foreword.pdf>

Findings

25. There is considerable support for Defra's development of its overall strategies in recent years.⁸⁸ In its current form, the Evidence and Innovation Strategy (E&IS):

- has been subject to wide consultation,⁸⁹ including via improved stakeholder consultation,⁹⁰ although some would like to have been involved more⁹¹ or sooner⁹²
- represents a gradual shift towards an approach based on risk, systematic prioritisation and evidence needs rather than on history⁹³
- is looking at the department as a whole, top down, rather than parts of it, bottom up⁹⁴
- is being developed as a basis for resource allocation⁹⁵
- is work in progress⁹⁶

Defra has identified (with support from many of its stakeholders) that aspects which the overall strategy still needs to address include:

- more effective engagement and joint strategic planning both across Defra⁹⁷ and with external stakeholders, including devolved administrations and other Government departments (OGDs),⁹⁸ the Research Councils (RCs)⁹⁹ and European and wider international sources of expertise,¹⁰⁰ with cross-cutting approaches: across sectors¹⁰¹ and disciplines¹⁰²
- making clear how higher-level commitments will be implemented,¹⁰³ including how Defra's conflicting aims, of environmental exploitation and protection and nature conservation, can be resolved¹⁰⁴
- recognising that many issues have a very long life and, therefore, the science also needs to be long-term¹⁰⁵
- informed sun-setting of lower priority areas¹⁰⁶ and handling of new or emerging issues which may lack (vocal) support and budgets¹⁰⁷
- wider use of risk-based approaches to prioritisation¹⁰⁸
- greater social science input to complement that of the natural sciences¹⁰⁹

⁸⁸ BF, BBSRC, BGS, BGrassS, BSAS, DEPC, ESRC, FC, GCT, IAH, IFR, IGER, MLC, NFU, NHF, NIAB, NERC, RI, RR, RES, RS, RSPCA, SEPA, ZSL, (e), (f), (g), (h), (m), (t), (r), Annex 3, paras.2.8-.10, 3.60-.64

⁸⁹ Annex 3, paras.2.25-.39

⁹⁰ BGS, BGrassS, ESRC, HGCA, IFR, NFU, NERC, RSPB, SEPA, (c), (d), (f), (h), (k), (l), (m)

⁹¹ (f), (g)

⁹² (e), (g), (k)

⁹³ BGS & Annex 3, paras.2.17-.20

⁹⁴ Annex 3, para.4.16

⁹⁵ Annex 3, paras.2.22-.24

⁹⁶ Annex 3, paras.2.16, 2.86-.88

⁹⁷ BF, BGrassS, FARM, MBA, MO, NIAB, NHM, RR, SEERAD, Annex 3, paras.2.28, 2.38-.39

⁹⁸ DEPC, FARM, IFR, IoH, JNCC, MO, NIAB, NHM, RS, SAC, Annex 3, paras.4.20-.25

⁹⁹ RR

¹⁰⁰ JNCC [especially in the area of biodiversity], RR and see Annex 3, paras.3.43-.45

¹⁰¹ (b)

¹⁰² (y)

¹⁰³ See Annex 1, para.1.5 and BES, FARM, IAH, JNCC, NFU, NERC, NHM, RR, RES, RSPB, SEPA, VLA, (b), (h), (t)

¹⁰⁴ (i), (j)

¹⁰⁵ BGS, BGrassS, MBA, VLA: "Defra science strategy is in many cases relatively short term and reactive to immediate events and political pressures.", ZIC: "administrative expediency should not overwhelm the timescales for data provision", (e): includes maintaining a capacity for emergency response, Annex 3, para.2.73

¹⁰⁶ Annex 3, para.2.23, 3.115. In 4.19, work on indoor air pollution is one of few examples of successful sun-setting.

¹⁰⁷ Annex 3, paras.2.20 and 2.66-.68

¹⁰⁸ BGS

¹⁰⁹ ESRC, OFWAT, SA, (f), (i), (s), (u), (y), Annex 3, paras.2.16, 2.26-.27, 2.86, 3.15, 3.85, 4.18

Specific Policy Area Science Strategies

26. Responses received are generally supportive of Defra's strategies in particular areas.¹¹⁰ In contrast to the E&IS, it is noted that sectoral strategies are formulated by, or with an element of, a 'bottom up' approach.¹¹¹ There is also support for Defra's consultative approach¹¹² but criticism of the lack of communication and co-ordination between sectors¹¹³ to achieve:

- more effective handling of cross-cutting issues;¹¹⁴ and
- greater awareness of who is doing what science across the department, thus avoiding duplication or gaps¹¹⁵

27. Specific criticisms are levelled at Defra's sectoral strategies in a few particular areas.¹¹⁶

Conclusions and Recommendation

28. Whereas most OGDs are still starting the process, we commend Defra's progress with its E&IS. We concur with the general support for Defra's approach to development of its E&IS and the areas still to be addressed, identified above (see table below para.25). In particular:

Recommendation 4

To complete the successful implementation of its E&IS, Defra needs to:

- a) prioritise its science activities on the basis of risk**, e.g. to policy and other evidence needs, measured in terms of economic, human and environmental costs and benefits (see para.58)
- b) avoid gaps or overlaps between and within sectors by:**
 - **engaging across all its internal DGs and with all its key external stakeholders** (Agencies, OGDs (including devolved administrations), RCs, RCIs and industry): see Recommendation 3(a); **and**
 - **marrying higher level strategy and sector-level priorities**

29. Implementation of Defra's E&IS could help to address many of the overall issues raised above, for example: with regard to avoiding a DG/CSA disconnect; as a means of thinking strategically about evidence needs; and identifying gaps across Defra.

30. Even when the overall E&IS is fully implemented, there will still be a need for Defra to maintain a strategic view at a sectoral level, i.e. elements of 'bottom-up' thinking will continue to be needed as well as a 'top-down' approach.

¹¹⁰ ARF, BGrassS, FARM, HGCA, NFU, RS, (c), (e), (f), (m)

¹¹¹ RR, SEERAD and Annex 4, paras.23-26

¹¹² ARF, BES, BGrassS, HDC, NHF

¹¹³ BF, BGrassS, MBA, MO, NIAB, NHM, RR, SEERAD, ZSL

¹¹⁴ IFR, IoH, JNCC, MO, NHM, (a), (b), (c), (g), (n), (w), (y)

¹¹⁵ Annex 3, paras.2.16, 2.55-.58, 3.18, 3.41

¹¹⁶ See Annex 1, para.1.10 and Annex 2, paras.1.5-1.10 and evidence from ARF, BSAS, IoH, NHF, NHM, RSPCA, VLA, (y)

2. Horizon Scanning

Rationale

31. Horizon scanning is defined as the systematic examination of potential threats, opportunities and likely future developments, which are at the margins of current thinking and planning. Horizon scanning may explore novel and unexpected issues, as well as persistent problems or trends. Departments should regularly undertake horizon scanning to improve the robustness of their evidence base and policies.

Defra Submissions

32. Defra has said that:

“We also look forward, to anticipate and prepare ourselves for future challenges. Horizon scanning is a new initiative, initially funded at £2 million per year, which actively promotes our forward looking approach to SET. It will improve Defra’s capability to address new risks and opportunities in our longer-term strategy.”¹¹⁷

33. Following a consultation exercise earlier in the year, Defra published a horizon scanning strategy in December 2002.¹¹⁸ After a period of staff turnover, the horizon scanning and futures programme in Defra is presently being reviewed and re-launched with a new strategy and new programmes of work based on models of good practice and incorporating lessons learned from the original programme.¹¹⁹

Evidence sought

34. OSI sought to determine: how horizon scanning is carried out by Defra; the extent to which Defra encourages its science providers to horizon scan; how the results of horizon scanning activities are used by the department; and how Defra evaluates its horizon scanning activities.

¹¹⁷ Lord Whitty, The Forward Look 2003: Government funded science, engineering and technology, (July 2003) OST.

¹¹⁸ <http://www.escience.defra.gov.uk/HorizonScanning/documents/FL70/FL70.pdf>

¹¹⁹ <http://horizonscanning.defra.gov.uk>

Findings

35. Horizon scanning (HS) has been done informally for a long time by individual Defra sectors. For the original, central, formal HS programme (started in about 2002), there was a good deal of scepticism among sectoral policy staff: some did not participate and some others did not find it useful.¹²⁰ Variations in understanding / definition of HS may have inhibited enthusiasm for, and effectiveness of HS. Progress also suffered from the turnover of HS managers. As a result, there was a loss of momentum and there are few examples of how the results of HS have actually been used. Formal HS is now getting back on track, and a dedicated manager is in place. A project to learn lessons from past HS activity has been started but it is too early to comment on its effectiveness.¹²¹

36. A considerable number of external responses recognise the need for horizon scanning (HS)¹²² and for the most part support Defra's approach in recent years,¹²³ with a few suggested examples of good practice to build on.¹²⁴ There were also some criticisms of the earlier approach to horizon scanning and most of these are being addressed by Defra:

- the consultation exercises could draw on a wider audience¹²⁵
- “the Defra horizon scanning web site does not give the impression that this is a very active programme.”¹²⁶ [See para.33: a new Defra HS web-site has recently been launched]
- “... it has seemed that HS exercises have been one-offs that have not been followed up with ongoing dialogue with the organisations consulted.”¹²⁷
- the scientists involved were not sufficiently pressed to look to the future and tended to produce old, familiar ideas.¹²⁸ [The Horizon Scanning Team has suggested that “not all teams had sufficient futures expertise There is a general lack of futures skills in the UK at large and as such project teams composed mostly of scientists naturally used their scientific expertise at the expense of futures. This has been recognised and a model of best practice is currently being developed which recommends that teams are composed of a futurist, an expert(s) in the subject under study and a policy translator.”]

¹²⁰ Annex 3, paras.2.46 (and paras.2.41-2.50 generally) and 3.20 and Annex 9, para.2.2 (rural evidence base peer review).

¹²¹ Annex 3, para.3.28

¹²² ACoP, ARF, CIRIA, FARM, IAH, IGER, IoH, LGC, MBA, MO, RGS, SEPA, SGM, VLA, ZIC, (n)

¹²³ ACoP, BBSRC, BES, BGS, DEPC, ESRC, EN, FC, HDC, IGER, JNCC, MO, NERC, NHM, RS, RSPB, SEPA, SEERAD, SNH, SGM, (d), (n)

¹²⁴ e.g. ACRE; Global atmospheres with the Hadley Centre; SEAC with FSA and DoH; see Annex 3, para.2.42

¹²⁵ NERC, RES, RS, SEERAD, VLA, (h)

¹²⁶ IAH

¹²⁷ NHM. Defra has said that: “Follow-up of the HS exercises is occurring now to some extent, where project outputs are appropriate to take further.”

¹²⁸ (n), (u)

37. Several areas are suggested for Defra HS to look at¹²⁹ and several responses suggested how HS might be made more effective¹³⁰, including the need to:

- consider further a range of social, economic and political influences beyond the natural sciences¹³¹
- broaden the range of external involvement¹³²
- look beyond the UK for some issues¹³³ and approaches to dealing with them¹³⁴
- further develop methodological understanding of HS to undertake more strategic HS activities¹³⁵

Conclusions and Recommendation

38. Defra has been in the vanguard of HS amongst Government departments. It deserves to be commended for this but the disadvantage of being amongst the first is a lack of established practice on which to build. Various approaches to HS have been tried and there have been some successes but there is also some confusion over past HS activities and what they have achieved. The department's new HS team is now re-launching this activity and we commend this renewal of HS and the intention to learn lessons from past activities. To be effective, Defra's HS needs to be sustained and resourced as a long-term strategic commitment.

Recommendation 5

Defra should build horizon scanning (HS) into its strategic framework so that effort on HS is sustained as a primary resource commitment.

¹²⁹ See Annex 1, para.2.9 and evidence from: BES, BF, CIRIA, EN, LGC, SGM, VLA, ZSL and Annex 2, para.2.5: (d), (e), (y)

¹³⁰ See Annex 2, para.2.4: (c), (e), (f), (g), (j), (k), (m), (n), (u)

¹³¹ FHRC, NFU, SNH and see Annex 3, para.3.15

¹³² Annex 3, paras.3.21-.25

¹³³ BGS, LGC

¹³⁴ RS, VLA

¹³⁵ Annex 3, paras.3.7, 3.52

3. Reviewing existing research and identifying gaps and opportunities

Rationale

39. To demonstrate value for money and effective use of resources, departments should have in place effective arrangements for deciding what current or potential science could benefit the department's delivery of its objectives and hence whether new research is needed or where it would best be targeted. In particular, departments should actively manage existing knowledge, synthesise existing research, and work with OGDs and the research bases in the UK and internationally.

Defra Submissions

40. Defra has said that:

“To deliver our mission we will need to rely much more on the joint planning of programmes, secondary analysis of information and the sharing of costs within the UK, the EU and internationally. To achieve this we will increasingly need to build strategic alliances and other forms of co-operation with others.”¹³⁶

The department “draws on existing science for policymaking and identifies and commissions new research to fill gaps and opportunities.”¹³⁷

“We have developed (with help from the other funders) an External Funders Mapping database of research activities relevant to Defra's policy priorities”¹³⁸

Evidence sought

41. OSI sought to determine: how existing science is reviewed by Defra; how gaps in knowledge are identified and then addressed; how issues are prioritised by the department; and how existing and emerging scientific knowledge influences strategy and priority setting within the department.

¹³⁶ Howard Dalton, Evidence and Innovation: Defra's needs from science in the next 10 years, 2004. <http://www.defra.gov.uk/science/documents/forwardlook/ScienceForwardLook3rd.pdf>

¹³⁷ Defra paper for Review Steering Panel, SP9, June 2005.

¹³⁸ <http://externalfundere.defra.gov.uk/>

Findings

42. Many responses suggest that Defra is in general effective in reviewing natural science knowledge, identifying gaps and opportunities and prioritising, including by making use of external experts.¹³⁹ This is much less the case for social sciences.¹⁴⁰

Several particular examples of good practice are mentioned:¹⁴¹

- “The recent report of the Sustainable Farming and Food Research Priorities Group demonstrates Defra’s commitment to identifying gaps and opportunities for future research.”¹⁴²
- “... heather burning is a good example of Defra calling together independent scientists to review current practice to help Defra decide on whether changes to current codes of practice are necessary. In the absence of good science, Defra has identified gaps in the knowledge and will hopefully now put in place research to fill these gaps. Defra are to be congratulated on this, especially as it has come in the face of contradictory statements, not based on science from their advisory body and others.”¹⁴³
- “The department also takes part in other reviews and conferences ... for example the Joint Funders Transmissible Spongiform Encephalopathy Conference, these give them the opportunity to take on board the latest results and ideas for the future.”¹⁴⁴
- “.. the Biodiversity Research Advisory Group which identifies research priorities in relation to the conservation of UK biodiversity and which endeavours to facilitate the filling of identified gaps, and the Global Biodiversity sub-committee of the Global Environmental Change Committee (GECC).”¹⁴⁵ [although NERC “is looking forward to the GECC working more effectively following its recent reorganisation and would welcome closer links between GECC and ERFF”]
- “Defra is a committed and active member of the Environment Research Funders’ Forum (ERFF). This forum allows funders collectively to identify and take strategic action on any gaps in environmental research and training.”¹⁴⁶
- In marine science, “Defra has worked positively, imaginatively and effectively with NERC, SEERAD and various agencies and industry to explore future research needs [... in the area of sustainable marine fisheries and ...] has provided successful leadership of the Inter-Agency Committee on Marine Science and Technology (IACMST), an example of productive cross-departmental working.”¹⁴⁷
- “Defra is a very intelligent customer in the climate change area.”¹⁴⁸
- “the work on odours appears well-researched”¹⁴⁹
- “There was an expectation (and funds) to conduct a desk-based scoping study prior to consideration of the full proposal.”¹⁵⁰
- “Conservation Management Division has performed extremely well engage with a wide variety of people, ensuring that the best possible potential ideas and contractors are engaged.”¹⁵¹
- In the social sciences, the Sustainable Development Research Network and the Rural Evidence Research Centre are examples for other parts of the department to build on.¹⁵²

¹³⁹ ACoP, ARF, BF, BSAS, FC, GCT, HGCA, HDC, IAH, IGER, MLC, MO, OFWAT, RGS, RSPB, SEERAD

¹⁴⁰ See Annex 1 para.6.8 and evidence from ESRC, OFWAT; Annex 2 para.6.1 (f), (i), (s), (u), (y); and Annex 3, paras.2.16, 2.26-27, 2.86, 3.15, 3.85, 4.18

¹⁴¹ See Annex 1, para. 3.1 and evidence from BF, BGrassS, GCT, IAH, JNCC, MLC, MO, NERC, OFWAT, SAC, SEPA, SNH, RGS, RSPB and Annex 2, para.3.2: (g), (k), (m), (o), (w)

¹⁴² BF & similar comments from BGrassS, MLC, SAC

¹⁴³ GCT

¹⁴⁴ IAH

¹⁴⁵ JNCC and similar from SNH w.r.t. BRAG

¹⁴⁶ NERC and similar from SEPA

¹⁴⁷ NERC

¹⁴⁸ MO and see Annex 3, para.3.57

¹⁴⁹ OFWAT

¹⁵⁰ RGS

¹⁵¹ RSPB

¹⁵² ESRC, (y)

43. In view of the examples above, it is not surprising that many welcome the opportunities for external experts to be part of the review process, although the need for careful selection of reviewers is stressed, to ensure they have appropriate expertise¹⁵³ (also see para.76 for peer review on completion). The case studies also provide examples where Defra, its Agencies, OGDs and other stakeholders have worked well together.¹⁵⁴

44. Many Defra policy and scientific staff sit on committees and attend conferences to help maintain an awareness of developments in their sectors¹⁵⁵ but “there is an impression among some scientists familiar with Defra funding that the identification of gaps depends on the capabilities of individual project officers”¹⁵⁶ and concern that Defra’s success in reviewing science and identifying gaps may diminish as its scientific experts retire and are not replaced at the same grade or level of expertise.¹⁵⁷

45. A review commissioned by Defra to look at the translation of science into policy¹⁵⁸ concluded that an area of concern is Defra’s use of existing science: managing, sharing and transferring knowledge across the department and avoiding the unnecessary repetition of work done previously.¹⁵⁹ Similarly, other responses suggest that problems occur in the recognition of gaps or overlaps between Defra sectors¹⁶⁰ and across disciplines.¹⁶¹ A particular difficulty arises when there is a need for science in an area that is new to Defra, where there is no existing ‘advocate’ for funding within the department.¹⁶²

46. As with HS, some responses see room for improvement.¹⁶³ For example, via

- greater external involvement in the review process,¹⁶⁴ including via the RCs,¹⁶⁵ OGDs¹⁶⁶ and internationally¹⁶⁷; and
- a commitment to act promptly on the outcomes of reviews, for example budgets need to be available to fund research in areas where gaps are identified.¹⁶⁸

47. Areas where more work may be needed to review the gaps and opportunities are identified.¹⁶⁹

¹⁵³ IAH, NERC, VLA. Also see paras.3.6-3.9 of Annex 2: evidence from (b), (j), (h), (z)

¹⁵⁴ e.g. the DARC group in the area of anti-microbial resistance (see Annex 4, paras.4.32-.40); and via the Hadley centre in the climate change area.

¹⁵⁵ Annex 3, paras.2.35, 4.48; and Annex 5, para.11

¹⁵⁶ RS

¹⁵⁷ BF, BSAS, HDC, IGER, NHF. See also section 10 on succession planning within and outside Defra.

¹⁵⁸ http://www.defra.gov.uk/science/documents/papers/2004/SAC%20_04_%2005_Tony_Taig.pdf

¹⁵⁹ (z) and similar from (u)

¹⁶⁰ (g), (j), (u), (z)

¹⁶¹ BGS, MO, NERC, SA, e.g. in areas such as flooding, marine ecosystem modelling and climate change, (a), (j)

¹⁶² Annex 3, paras.2.22, 4.10-.12, 4.15-.16, 4.33-.35

¹⁶³ IGER, NHF, P, RR, RSPB, SAC, SEERAD, UKWIR, VLA, ZSL, (u), (z) and Annex 7, para.57

¹⁶⁴ NIAB, P, RR, SAC, SGM, UKWIR, ZSL, (h)

¹⁶⁵ BAA, ESRC, IoH, MBA, NHM, RES, RR, UKWIR, ZIC

¹⁶⁶ BAA, ESRC, IoH, LGC, MBA, SNH [: including the devolved administrations], UKWIR, ZIC

¹⁶⁷ JNCC, RS, SAC

¹⁶⁸ BGS, FC, NFU, SA

¹⁶⁹ See Annex 1, para.3.11 and evidence from: CCW, ESRC, FARM, RSPB, SA, SGM, ZSL

Conclusions

48. Within individual sectors, reviewing science is generally an aspect that Defra covers well. The main concerns are that the department does not always effectively identify gaps and overlaps across sectors or take sufficient account of social science insights and that it is strongly reliant on key individuals (and therefore vulnerable to their loss when they move on). Implementation of Recommendations 2, 3 and 4 should ensure that the first two concerns are addressed. The staffing issue is covered by Recommendation 13 in section 10 below.

4. Commissioning and managing new research

and

5. Ensuring quality and relevance of science

Rationale

49. As part of the drive for evidence-based policy and improved service delivery the Government needs to use, and be seen to use, high quality science and the most appropriate technologies. Research programmes funded by Government departments make a very important contribution to policy formulation. Even though the outcomes of the research itself cannot always be predicted, departments must be able to commission the right research, assess its quality, and use it effectively. The credibility of departmental policy-making generally will be undermined if individual policies are perceived to be based on poor, or the wrong science.

Defra Submissions

50. Defra stated that:

“We have ring-fenced £153 million of our research and development (R&D) budget, which is fully protected in real terms across the 2002 Spending Review (SR2002) period, in recognition of the importance of science to Defra.”¹⁷⁰

“We commission and manage new science programmes in support of policy across the range of our activities. Defra has a wide science base and our research programmes amount to around £155 million a year.¹⁷¹ We also carry out substantial non-research science programmes (including monitoring, surveillance, analysis etc).

We have an active programme of independent peer-review for Defra funded research. In 2004, we launched a joint code of practice with the FSA, BBSRC, NERC and the UK devolved administrations to assure the quality of the research processes used by our contractors. We have a rolling programme of independent science audits for our three laboratory agencies, the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), the Veterinary Laboratories Agency (VLA) and the Central Science Laboratory (CSL). Audits take place at five yearly intervals and the next audit will be of CEFAS in October 2005.”^{172,173}

¹⁷⁰ Lord Whitty, Forward Look 2003.

¹⁷¹ http://www.defra.gov.uk/science/funding/fund_index.htm

¹⁷² Defra paper for Review Steering Panel, SP9, June 2005.

¹⁷³ <http://www.defra.gov.uk/science/how/quality.htm>

51. Defra's approach to procurement¹⁷⁴ was updated and launched in April 2005 and its terms applied to the commissioning of research¹⁷⁵ are accessible through the department's website and apply to all commissioned scientific, economic and social research. "The Science Handbook and standard forms were introduced to provide clarity and consistency in approach and to ensure best practice in procuring research. Standard terms and conditions are operated to treat all research providers fairly and equally. For the main contractors, R&D Framework Agreements were introduced. Research competitions are advertised via the internet and an e-mail notification system advises those registered of the publication of every new competition. The Baker Review recommendations on assigning intellectual property to the most appropriate body, usually the contractor, were also introduced. Defra's Science Information System (SIS), the corporate database for information on research projects, helps the CSA and Management Board keep an overview of the scope, balance and budget allocation commitments of the Defra research programmes."¹⁷⁶

52. As indicated in the E&IS, there is inevitably a need to review and re-focus Defra's science spend from time to time. The Animal Health and Welfare area remains by far the largest area of spend, followed by Environmental Protection and Sustainable Food and Farming.¹⁷⁷ Defra also noted that research in some areas, such as animal health and fisheries, is expensive to conduct because of the facilities required, whilst in other areas funding is levered in from elsewhere, thus reducing costs.¹⁷⁸ Defra's spending is partly driven by historic or statutory requirements (e.g. in a mature policy area like EU fisheries, there is a substantial amount of monitoring required by the EU).

53. With regard to quality, about two thirds of Defra's science is said to be subject to peer review prior to commissioning.¹⁷⁹ A proportion of science programmes is also peer reviewed retrospectively to assess the quality of completed projects: Defra has established a unit to assist in assuring that Defra policy is informed by high quality science. The Science Quality and Priorities Team (SQP), which is distinct from existing science units within Defra and reports to the Chief Scientific Adviser, is charged with carrying out this work, co-ordinates a Final Report Peer Review by external experts (peer reviewers) and runs R&D programme reviews which are aimed at assessing the policy relevance of on-going and completed R&D projects as well as their scientific quality. "Programmes are selected on the following criteria:

- Public / political profile
- Value of programme
- Time since or to the last review carried out by independent experts
- Current level of independent challenge (e.g. peer review of proposals)"¹⁸⁰

54. Along with the FSA, BBSRC and NERC, Defra has implemented a Joint Code of Practice for Research¹⁸¹ that, since June 2004, all of its science providers have been expected to comply with. Defra also has highlighted the role of its science advisory bodies, in particular the SAC, as sources of independent, high-quality advice on various issues.¹⁸²

¹⁷⁴ <http://www.defra.gov.uk/corporate/finance/procurement/policy/award/index.htm>

¹⁷⁵ <http://www.defra.gov.uk/science/funding/contract.htm>

¹⁷⁶ Note from Defra procurement team, May 2006 and see: http://www2.defra.gov.uk/research/project_data/Default.asp

¹⁷⁷ See Appendix 1 which contains excerpts from: The Forward Look 2003: Government-funded science, engineering and technology, OST, July 2003, p.179, Table 1: Defra R&D and SET expenditure by subject area:

<http://www.dti.gov.uk/science/science-funding/set-stats/index.html>; and from Defra's Evidence and Innovation Strategy 2005-2008: <http://www.defra.gov.uk/science/how/documents/PDFs%20in%20Parts/Annex%201%20and%202.pdf>.

¹⁷⁸ Defra CSA's presentation to the Review Steering Panel, June 2005.

¹⁷⁹ Defra CSA's presentation to the Review Steering Panel, June 2005.

¹⁸⁰ http://www.defra.gov.uk/science/how/peer_review.htm

¹⁸¹ http://www.defra.gov.uk/science/documents/QACoP_V8.pdf

¹⁸² Defra CSA's presentation to the Review Steering Panel, June 2005.

Evidence sought

55. In view of the general rationale for looking at this area, and the evidence already available from Defra, the Review sought to establish: how Defra's science budget is determined, and the criteria used to review and allocate it; what types of science the department funds (e.g. commissioned research, capacity-building, monitoring, surveillance); and the department's experience of working with other agencies.

56. The Review also sought to consider how effectively Defra appraises (at the proposal stage), monitors (work in progress) and evaluates (after completion) the science it commissions for quality and relevance; feeds science findings back into its strategies; and reviews or evaluates its science providers.

Findings

Prioritisation and Allocation of Funding

57. The E&IS is playing an increasing role in becoming Defra's main overall mechanism for identifying future science needs, albeit to different degrees across the department.¹⁸³ At organisational levels below the Department as a whole, there are mechanisms to ensure that new programmes of work are exposed to review by other interested parts of Defra and OGDs. However, it is not clear how fully all parts of the Department are served by such mechanisms, especially where review needs to encompass different DGs. Within DGs, there are examples of Research Requirements Committees in Air and Environment Quality Division of DGE and in DG SFFF.¹⁸⁴

58. Until recently, funding of science in Defra's sectors was based largely on history, i.e. areas of expenditure tended to receive proportionally the same amount of funding from year to year. There is recognition that, as needs and priorities change over time, funding also needs to be re-allocated, for example on the basis of (estimated) economic and social risks to policy.¹⁸⁵ To this end, Defra has developed a risk-based model for analysing how resources should be aligned with priorities¹⁸⁶ though, as indicated below (in para.61), this approach is not yet fully implemented.

59. Various external sources have stressed the importance of:

- focussing research in support of major policy objectives,¹⁸⁷ whilst recognising the difficulty of matching research timescales to policy needs¹⁸⁸
- articulating the basic questions that Defra wants to address¹⁸⁹
- still greater consultation with stakeholders¹⁹⁰

¹⁸³ Annex 3, para.4.2-.35

¹⁸⁴ Annex 3, para.4.2-.35

¹⁸⁵ Annex 3, para.2.77, 3.92-.95. Note: this is a view expressed by several interviewees in Defra's central science team but not by sectoral colleagues

¹⁸⁶ See SAC(06)04 E&IS update Annex B "Defra R&D strategic Assessment Methodology" :

[http://www.defra.gov.uk/science/documents/papers/2006/SAC%20\(06\)%2004%20EIS%20update%20ANNEX%20B.pdf](http://www.defra.gov.uk/science/documents/papers/2006/SAC%20(06)%2004%20EIS%20update%20ANNEX%20B.pdf)

¹⁸⁷ BAA, devolved administrations, ESRC, EN, JNCC, NERC

¹⁸⁸ (h), (k), (j)

¹⁸⁹ NERC

¹⁹⁰ BAA, BGrassS, FARM, JNCC, SEPA

60. In the meantime, for both outsiders and some inside Defra, it is often not clear or understood how the balance of priorities between the major divisions of research is decided,¹⁹¹ although there is acknowledgment of the change in emphasis across Defra, towards science concerned with the wider environment.¹⁹²

61. All of Defra's science is aimed at meeting policy objectives, though not all science is directly for policy making. Some have suggested that the importance of (often long-term) monitoring or field activities or innovative research may have been neglected in favour of meeting more immediate policy or regulatory objectives.¹⁹³ While there is recognition of the advantages to the continuity of funding multi-year programmes,¹⁹⁴ the current resource allocation process makes it difficult to move resources to follow changes in policy priorities.¹⁹⁵

62. With the exception of economics, social science has historically been an area of weakness for Defra which it is recognising needs to be addressed and is taking steps to do so,¹⁹⁶ for example through the appointment of a Head of Social Research Unit in Rural & Resource Economics, its establishment of a new Rural Evidence Research Centre and its engagement in the Rural Economy and Land Use Programme and the commissioning of a team of social scientists to operate a Sustainable Development Research Network to ensure effective communication between policymakers and the research base in support of the Government's sustainable development strategy, which has been described as "a very welcome development".¹⁹⁷

Commissioning of New Science

63. A few responses have stressed the need to identify potential routes to exploitation at the outset of the research commissioning process.¹⁹⁸

64. Many of the responses have a positive view of the processes Defra uses to commission research,¹⁹⁹

"Mainly in the light of experience dealing with the Chemicals and GM Policy Divisions, but also from interaction with the Water Quality, Marine & Waterways, and Air Quality Divisions, ... e-mail notification of Announcements of Opportunity and the internet site detailing the status of all (potential) projects are good features of the commissioning process."²⁰⁰

"Defra's ... specifications are clear and well thought out, while allowing the would-be researcher to 'add value' in the tendering process. I like the practice of insisting that tenders are totally confined to 7 or 8 pages of A4."²⁰¹

although some suggest improvements are needed,²⁰² including feedback on (especially failed) bids²⁰³ and note that the commissioning processes are time-consuming and costly, both for Defra and bidders.²⁰⁴

¹⁹¹ EN, JNCC, RS, RSPCA, SEERAD, SA, (z), Annex 3, paras.4.10-.15

¹⁹² (b), (m)

¹⁹³ See Annex 1, para.4.3: BGS, JNCC, MBA, MO, RES, VLA

¹⁹⁴ BGrassS, BGS, CIRIA, CCW, IGER, LGC, MBA, MO, RES, RR, VLA, ZSL, (b), (f), (h), (i), (j), (k)

¹⁹⁵ Annex 3, para.4.2-.35

¹⁹⁶ ESRC, (u), (q), (s)

¹⁹⁷ ESRC

¹⁹⁸ CIRIA, HDC, IFR (for basic research as distinct from LINK), IGER

¹⁹⁹ ACoP, ARF, BES, BF, BGS, BSAS, CCRU, FC, IAH, LGC, MLC, NERC, RES, RGS, RSPCA, UKWIR, (a), (f)

²⁰⁰ NERC

²⁰¹ CCRU

²⁰² BES [:"to ensure that the best researchers apply"], FARM, GCT, JNCC, RR, RSPB, SGM and see Annex 2, para.4.8: (a), (b), (d), (f), (h), (q), (y)

“Defra staff encourage the submission of Concept Notes from stakeholders. Receipt of Concept Notes is not always acknowledged, and no time scale is given for their consideration. ... A clearer timetable for commissioning new research and better guidance on how and when stakeholders need to engage in the process would be helpful.”²⁰⁵

“Defra’s web page dedicated to research competitions (<http://www.defra.gov.uk/science/funding/competitions.htm>). ... is, in many ways admirable, but has a number of potential weaknesses. These include:

- i. we would suppose, from the number of the research projects detailed on the website in relation to the Defra research budget, and from our awareness of research commissioned by Defra, that the research projects listed on this website represent a small minority of the Defra total of projects in the process of being commissioned. This may be intentional, and there may be selection criteria in play for determining which projects are advertised in this way of which we are unaware;
- ii. the Defra website is geared primarily to assisting the tendering process, and relates to research proposals already developed, or being developed, by the Department rather than to developing any more strategic, or even two-way, relationship with the external research community;
- iii. while we do not know what proportion of the external research community consults the website regularly, the probability is that it is consulted by only a minority of the research community. We would suppose that this component of the research community could be comprised largely of those looking for contract work, and might not include those researchers having an in-depth knowledge of a particular research area whose time was already largely committed;
- iv. this website mechanism could not be expected to enable Defra to become alerted to the range of available scientific expertise in a comprehensive manner;
- v. so far as we know, many contracts are let after tendering where the tender list is put together (not through the website mechanism) but on the basis of existing internal Departmental knowledge and from previous experience of individual contractors.”²⁰⁶

“although Defra advertises potential projects through its Environmental Research Newsletter (a useful compendium of its research requirements) it seems to include in it both new projects for which Expressions of Interest or project proposals are required, and projects that have already been funded, and it is not always clear which are which. This can lead to time wasting.”²⁰⁷

To ensure continuity for longer-term work, calls for proposals need to be (some months) before the end of the current round of funding.²⁰⁸

²⁰³ GCT, RSPB, Annex 6 (Soils case study), para.65

²⁰⁴ BGS, IGER, MBA, MO, NHF, RR, RS, SEERAD, SGM, VLA, (a), (b), (f), (h)

²⁰⁵ RSPB

²⁰⁶ JNCC

²⁰⁷ NERC

²⁰⁸ IAH (suggests 12 months), MO, RR, SGM, VLA (suggests 3-6 months), (u)

65. There is criticism that Defra tends to commission too many small²⁰⁹ and short-term²¹⁰ projects, which are inefficient to commission and operate.²¹¹ Defra has pointed out that research to meet policy needs sometimes has to be conducted via short projects that report quickly. It is also noted that the commissioning process / documentation is designed with the natural sciences in mind and may not necessarily be appropriate for social science projects.²¹²

66. It has been suggested that the appraisal of bids could be streamlined, e.g. by adopting the Home Office's two-stage QUAD approach.²¹³

“The HO QUAD Chart or Concept Chart system: a one page concept sheet is used to identify the research area, provide a three-line description of the proposal and identify deliverables, benefits and approximate costs. These are then sifted by peer review and successful bidders asked to submit a full proposal that is only four pages long. By comparison, proposals for Defra have to be 30-35 pages long.”²¹⁴

“A two-stage approach (cf. the Home Office (HO) QUAD one, see below) would be more effective. It is gradually coming in to use in Defra, e.g. in waste research where CSL put in an expression of interest which has been accepted and a formally negotiated bid is now being worked up. “This is helpful but is the exception” at the moment. Defra has recently amended its procurement forms and manual (SID: Science in Defra). These are “no worse than they were but still pretty cumbersome.”²¹⁵

Competitive Tendering vs. Single Tender

67. Defra's approach has evolved and an increasing share of the R&D budget has been made open to competition.²¹⁶ There are mixed views about whether the correct balance between commissioned and competitively tendered work has been struck.²¹⁷ Some highlight the desirability of moving towards more longer-term contracts (3 years or more),²¹⁸ especially in areas of strategic importance such as sustainability,²¹⁹ where the issues are long-term²²⁰ and examples where such longer-term commitments have been made (e.g. horticulture, biodiversity, veterinary science) are welcomed.²²¹ Others suggest that research commissioned by Defra would benefit by drawing on a still wider sub-set of the research community²²² and should include more expertise from abroad.²²³

209 BBSRC, BGrassS, IGER, IoH, NERC, NFU, RES, SAC, (h), (i), (j)

210 (b), (e), (f), (g), (h), (i), (j), (w)

211 Annex 3, para.3.112-114

212 (q), (y), Annex 3, para.3.63

213 (b), (f) and see Annex 3, para.3.124

214 (f)

215 (b)

216 RI

217 ACoPack, BF, BGrassS, BBSRC, IAH, LGC [: welcomes the recent extension to VMD], NERC, RES, RI, SGM [: while use of Defra Agencies “ensures continuity, it also creates complacency and stifles innovation” e.g. slow take-up of genomics and difficulty of accessing sample archives.], ZIC

218 BGrassS, CIRIA, CCW, IGER, LGC, RR, VLA, ZSL

219 BGrassS, CCW, CIRIA, RR

220 BBSRC, BGrassS, CCW, HDC, NBN, RSPB, VLA, ZSL, (b), (f), (h)

221 See Annex 1, para.4.18: HDC, NBN, VLA

222 See Annex 1, para.4.20: ESRC, LGC [e.g. detection of prions by mass spectrometry], NERC, RES, RI [with regard to veterinary science], RR, SGM, UKWIR [w.r.t. water sector], ZIC, (b), (d), (e), (w)

223 NERC, RR

Collaborative Research

68. Defra's encouragement of collaborative research in recent years is welcomed by many²²⁴ but not in cases where partnerships are established solely as a means of winning a contract, rather than for the benefit of the science.²²⁵

69. Some responses would like to see still greater Defra involvement in (or encouragement of) collaborative research²²⁶ including in partnership with Agencies,²²⁷ OGDs and the RCs²²⁸ as well as internationally.²²⁹

Management / Monitoring

70. Of the evidence commenting on the effectiveness with which programmes are managed and monitored, most is complimentary about both staff and processes,²³⁰ although it is noted that conflicts of interest can arise among those asked to review work carried out by their competitors.²³¹

71. There is some criticism that the burden of reporting and monitoring can be considerable and focuses too much on process: meeting milestones etc., and is especially viewed as being over-bureaucratic for smaller projects.²³²

“the management tools remain similar whether the contract is for £400k or for £40k. For substantial contracts, the process is thorough and fairly effective, ... The ability to interact informally with Defra staff during the course of a contract is extremely useful and undoubtedly adds value. I am less convinced that, for contracts under £100k, the system is not over-bureaucratic. It can often take longer to negotiate a contract than to fulfil it.”²³³

Although recent versions of the Science Handbook²³⁴ seems to permit sufficient flexibility to allow for a lighter touch with smaller projects, it is not clear whether this is yet being applied.

72. Some external respondents commented that rapid Defra staff turnover, particularly at project or programme manager level, makes it inefficient and difficult to establish effective relationships between the department and contractors.²³⁵

224 BF, BGrassS, EN [: in its follow-up response, EN identifies the main factors for this success as being: having a strong policy driver (PSA target 3a); understanding of the link between science and policy development and an appreciation of the need to develop the evidence base before practical land management measures could be put into place; willingness of the department to make full use of the expertise/experience of its statutory advisor (EN) and develop productive working partnerships; and having the right people in the right jobs.], ESRC, FC, HGCA, IFR, NIAB, NFU, RI, (d), (e), (f), (g), (h), (x) and Annex 5 provides examples in the area of sustainable agriculture.

225 GCT, NIAB, (b), (d), (f)

226 BW, IFR, JNCC, SEPA, SEERAD, SNH, ZIC, (g), (h)

227 (g), (h)

228 IFR, SEERAD & SNH [: including the devolved administrations], (x)

229 JNCC, NIAB, RR, SEERAD

230 BSAS, CCRU, EN, FC, NERC, NHM, OFWAT, RGS, RS, SEERAD, (a), (c), (e), (f)

231 RES, VLA

232 IGER, IoH, NBN, RR, RES, SGM, (f) [: which also commends the HO and FSA approaches by comparison]

233 IGER

234 Defra Science Handbook version 4, August 2006

235 NIAB, RR, (b) and see Section 10.

Conclusions and Recommendation

73. As indicated in section 1 and Recommendation 4 on strategy, there is work to be done on prioritisation of Defra's science activities. With regard to commissioning and managing science, our findings indicate that Defra science project managers have a good reputation but there may be opportunities for the processes they apply to be streamlined or otherwise improved. Defra commissions a very large number of science projects each year and these can vary enormously in terms of cost, timescale and nature. It is entirely appropriate that major projects or programmes, some of which run for a number of years, should be thoroughly and independently: appraised (at the bidding stage), monitored (while the work is being done) and reviewed or evaluated (on completion or some time afterwards). We recognise that some projects that Defra commissions are of necessity small and urgent and may therefore have to be let by single tender. Our findings also indicate that there are areas where bringing together related projects would be beneficial to both Defra and its science providers, both in terms of the quality of the science and the administrative costs. In deciding on an appropriate level of management, the extent of administration should be proportionate to the cost of a project and its likely importance (also see paras.74 onwards with regard to quality control / peer review):

Recommendation 6

Defra should:

- a) **ensure the wider adoption of good practice and consider suggested specific improvements to its commissioning processes** (identified in paras.63-65 above); and
- b) **aim to reduce the administrative burden of its many small science projects by:**
 - **simplifying the commissioning and management processes for smaller science projects. This should not be at the expense of quality control.** The Home Office's QUAD approach (para.66) should be considered; **and**
 - **reducing the number of small projects commissioned**, for example by increasing the number of longer-term projects and programmes or by seeking to increase the proportion of larger, collaborative projects (albeit only where this will benefit the science, for example by improving the compatibility of data sets).

Quality and Relevance of Science

Findings

Quality

74. There is a good deal of external support for the procedures that Defra has in place to ensure science is of a high quality,²³⁶ in particular the new Code of Practice,²³⁷ although the cost implications of the Code are also recognised.²³⁸

Defra staff are complimented on their “proactive and helpful manner” and “continued drive in improving the relevance and integration of Defra strategic research with industry-funded S&T.”²³⁹

“Defra ... has formal and informal mechanisms for reviewing our research. Defra staff read our milestone reports and frequently follow up with questions, they also check that they are produced on time and are of good quality. In conjunction with MoD (who fund some of our related work) they set up a Science Review Group, an independent group of international scientists, who review aspects of our science programme every 6 to 12 months.”²⁴⁰

75. In speaking to Defra staff, a distinction was made between the scientific work commissioned, for example, to support policy development and the use of models to help with the analysis of data or to assimilate scientific findings, for example into projections. The point was made that, whereas Defra places emphasis on the quality of the science it commissions and invests in quality control processes, it does not invest so heavily in quality review of the modelling for which the science might be an input.²⁴¹ The radioactive substances (RAS) case study provides an example of good practice where underlying assumptions of the model are clearly presented, enabling external stakeholders to understand the design of the model.²⁴² Defra’s view is that “modelling exercises are quality assured along the same lines as other science projects. We have noted quality differences between modelling projects but would argue that this is in spite of our quality assurance efforts rather than because we do not do it.”

Peer Review

76. Defra’s increasing use of external peer review is acknowledged²⁴³ and strongly welcomed by many,²⁴⁴ as is the initiative to develop the Science Quality and Priorities Team.²⁴⁵ Ensuring that review panels comprise leading experts in the relevant fields²⁴⁶ and that better use is made of international experts is stressed.²⁴⁷ Both external responses and Defra have mentioned the difficulty of finding a suitable set of independent but expert peer reviewers to cover all the specialities needed.²⁴⁸

²³⁶ ARF, BF, BGS, BSAS, HDC, MO, NHM, RR, RGS, SEERAD, VLA

²³⁷ BES, DARDNI, FC, HDC, IAH, LGC, MLC, NHF, NERC, SEERAD, VLA, (a), (b), (d), (e), (j)

²³⁸ DARDNI, RR, SGM

²³⁹ HDC

²⁴⁰ MO

²⁴¹ Annex 3, para.3.149

²⁴² Annex 8 (RAS case study), para.60

²⁴³ IFR, MBA, MLC, MO, RR, RES, RGS, (b), (h)

²⁴⁴ BES, DEPC, DARDNI, ESRC, FC, MBA, MO, RES, RGS, RS

²⁴⁵ BES, MLC, NFU, RS

²⁴⁶ RES, RS, VLA

²⁴⁷ RR, RS

²⁴⁸ (b), (e), (h), (j), (k), (z), Annex 3, paras.3.150, 3.159, Annex 4, paras.4.64-68

77. There are examples where programme panels have been used to good effect to peer review whole areas of work, rather than specific elements. For example, the soils case study illustrates how work on indicators is reviewed by the UK Soil Indicators Consortium and for air quality, work is reviewed by the Air Quality Expert Group, which acts as an extended peer review.²⁴⁹ There are similar examples in the other case studies.²⁵⁰

78. Annex 9 of this report summarises the results of the peer review (and fitness for purpose) of a small sample of Defra science projects, covering a range of disciplines, project sizes, types of project and various science providers. Although far too small to be representative of Defra's science, the findings confirm that much of the department's science is peer reviewed, primarily as part of the publication process in learned journals as opposed to a separate exercise by Defra. There is almost uniform agreement that the quality of the science reviewed is good.

Relevance / Fitness for Purpose

79. Few responses cover this issue but most are positive.²⁵¹ It is recognised that Government policy needs to be based on science that is fit for purpose²⁵² and a few examples of good practice are cited.²⁵³ A few interviewees mentioned that there were some 'relic' issues, i.e. where science at or near completion was no longer as relevant or important to Defra as it had been at the time it was commissioned by MAFF or DETR.²⁵⁴ As with quality, the responses of our peer reviewers indicate that the science projects examined were indeed fit for purpose (see Annex 9), although there is rather more variation in the scores than for quality of the science.

80. The importance of evaluating research after completion has been mentioned²⁵⁵ and a possible example of good practice is summarised in Annex 2 at para.5.7:

CEFAS was told by Defra Ministers to develop a customer satisfaction index and this was done about 4-5 years' ago. Thus, CEFAS research is assessed (as summarised in its annual report) against 7 performance criteria:

- understanding of needs
- value for money
- timeliness of delivery
- meeting objectives
- administration
- communication
- responsiveness

These criteria are given equal weight and the values are averaged to provide an overall score. "However, the overall score is weighted by value of the contract, so that small contracts have less impact on the total average scores than large ones." CSL has a similar approach.²⁵⁶

²⁴⁹ Annex 6 (Soil), para.24 and Annex 7 (Air Quality), paras.18, 22, 68 and 77

²⁵⁰ E.g. MO, see Annex 1, para.5.7, Annex 3, para.3.154 and Annex 4 (Antimicrobial resistance), paras.4.69-.78

²⁵¹ CIRIA, FHRC, FC, IAH, NFU, NHM, OFWAT, RGS

²⁵² CIRIA, FHRC, FC, IAH, NFU, (a), (e), (h), (k), (z)

²⁵³ See Annex 1, page 37

²⁵⁴ See Annex 2, para.5.6: (h), (k), (z)

²⁵⁵ IGER, (j), (z)

²⁵⁶ (d)

81. However, Defra's review of science quality is better established than its reviewing or 'evaluation' of relevance. There is little evidence that Defra has yet achieved much in terms of evaluating whether, and how effectively, science has influenced policy etc. in the longer term, for example via the 'Strategic Analysis Tool' (as opposed to simply meeting immediate objectives).²⁵⁷ There may be lessons to be learned from DTI's use of evaluation for its various S&I support programmes.²⁵⁸

Conclusions and Recommendations

82. The joint quality assurance (QA) code developed and implemented by Defra, FSA, BBSRC and NERC is to be commended. Defra's increasing use of peer review (both prior to commissioning and after completion) is also supported.

Recommendation 7

OGDs should note and, where appropriate, adopt Defra's recent approaches to quality assurance²⁵⁹ and peer review²⁶⁰ of science.

83. Government science must not only be of good quality but needs to be fit for purpose as well. In this respect, Defra (along with OGDs) may need to do more to make it clear to academia and other potential science providers that its science is needed for various purposes (policy making, regulatory, surveillance and monitoring) and will not always need to be 'cutting edge', indeed some of it may be routine but no less important for that.

84. We support the trend towards increasing use of evaluation to assess the relevance of Defra's science.^{261, 262} In some cases this may be useful in judging whether certain areas of science need to be continued or the resources moved towards areas of greater priority. For areas that are being considered for closure, such evaluations need to include in their remit the probabilities, costs and timings of re-starting the science or re-building the expertise if needed again in future. The appropriate timing for an evaluation will vary according to the expected outcomes of a piece of work but may be several years after a project is completed. An evaluation will need to involve end-users of the science. It will usually require a multi-disciplinary approach and should consider science that may have been ignored as well as that which has been used.

Recommendation 8

Defra needs to increase its use of (post-completion) evaluation of science. Such evaluations should consider both fitness for purpose and added value. (There is expertise in OGDs such as DTI for Defra to draw on).

²⁵⁷ Annex 3, paras. 3.156, 3.163

²⁵⁸ OSI

²⁵⁹ http://www.defra.gov.uk/science/documents/QACoP_V8.pdf

²⁶⁰ http://www.defra.gov.uk/science/how/peer_review.htm

²⁶¹ Evaluation is defined as an independent, constructive analysis of the impact, efficiency and appropriateness of a policy or programme or activity.

²⁶² See Annex 3, paras.3.100-.101

6. Using science and scientific advice

Rationale

85. Departments need scientific advice to underpin their policy-making and regulatory activities. Such advice can be provided by external or internal experts, and / or informed by the output of research programmes commissioned by the department. There needs to be an effective communications bridge between the experts and the policy makers.

Defra Submissions

86. Defra stated that it:

“draws on a wide science base (including natural sciences, economics, statistics and social research) in support of policymaking from in excess of 800 contractors in the higher education, Research Council and private sectors.”²⁶³

“The Science Advisory Council (SAC) was established in February 2004 to provide Defra with expert, independent and published advice on science policy and strategy. The SAC communicates its advice to Professor Howard Dalton, the Defra Chief Scientific Adviser (CSA), and through the CSA to ministers.”²⁶⁴ It “offers advice to Defra’s CSA and helps guide Defra’s scientific priorities and work across all the Department’s activities. This includes long-range planning as well as dealing with short term risks and opportunities.”²⁶⁵

87. Defra’s CSA has overall responsibility for the balance, scope and quality of Defra’s science. This presents a number of challenges, including:

- ensuring that policies are based on sound science;
- attaining the respect of the wider scientific community; and
- achieving a high level of public trust in Defra’s science.²⁶⁶

²⁶³ Defra paper for Review Steering Panel, SP9, June 2005.

²⁶⁴ <http://www.defra.gov.uk/science/how/advisory.htm>

²⁶⁵ http://www.defra.gov.uk/science/how/how_index.htm

²⁶⁶ Defra CSA’s presentation to the Review Steering Panel, June 2005.

88. In 2004, Defra commissioned a review of the department's use of evidence in policy-making.²⁶⁷ This identified both examples of good practice and made recommendations for improvements. Among the main conclusions were that:

1. There are many different approaches around Defra to the incorporation of science advice into policy, and widely different levels of policy customer satisfaction with their current arrangements for obtaining scientific advice.
2. There is no single, simple model of "good practice" for securing such satisfaction, though various pointers towards good practice have been identified.
3. There are numerous examples of conscious efforts having been made, successfully, to improve the quality and effectiveness of science support to policy around Defra.

The review also recommended that:

1. Defra should promote a continuing culture change to align science more closely with the needs of policy customers and with Defra's strategic objectives. Particular emphasis should be placed on:
 - a) mechanisms and support for applying existing knowledge, as well as for advancing knowledge, and
 - b) support for strategic Defra objectives, particularly where these are (as must sometimes inevitably be the case) not neatly aligned with organisational boundaries.

89. In 2005 Defra organised the latest in a series of European "Science meets Policy" workshops. The aim of this workshop was to explore the challenges and opportunities in making better use of science in environmental policy making.²⁶⁸

Evidence sought

90. OSI sought to establish: what science was used by Defra to underpin its policies; how the department translates science results into policy and advice; the extent to which Defra takes advice on the science it uses in formulating policy; how the department acts on recent advances in knowledge which impact on the science and the scientific advice used; and how the department deals with situations where the science underpinning the advice is disputed or incomplete.

²⁶⁷ http://www.defra.gov.uk/science/documents/papers/2004/SAC%20_04_%2005_Tony_Taig.pdf

²⁶⁸ "Science Meets Policy – Zitouni Ould-Dada reflects on a European event" published in Science and Public Affairs, June 2006, page 24, also available on the BA website: www.the-ba.net/spa

Findings

91. There is widespread recognition that science is vital to Defra, in terms of spend, staff and use of science. Much of the work currently funded by Defra is to inform policy²⁶⁹ or regulation²⁷⁰ and the application of scientific evidence to policy-making (or other use) is supported by many of those responding.²⁷¹ The point is also made that the rationale for a good deal of Defra's science is the need for monitoring or surveillance, i.e. in support of policy rather than for policy-making purposes.²⁷² Many examples are provided of specific areas where Defra is said to make good use of research, data gathering and scientific advice.²⁷³

92. However, there are concerns, for example about instances of a lack of 'joined up thinking' between different parts of the department,²⁷⁴ the full integration of different strands of information into the evidence needs of policy makers²⁷⁵ and that Defra's scientific advisory functions could better operate in concert with the policy and delivery elements.²⁷⁶ Interviewees within Defra suggested that it is necessary to look across the department at the wider and longer-term implications of evidence and that Defra needs people who can spend more time doing so.²⁷⁷

93. Defra is said to increasingly recognise the need for policy to be informed by social and economic research as well as by research from the natural sciences²⁷⁸ (see para.62 for examples) but there is still some way to go,²⁷⁹ for example in terms of Defra's "capacity to commission high quality social science research and to interpret and transform social science research outcomes into integrated policy and practice."²⁸⁰

94. A few responses have suggested that Defra may sometimes give insufficient weight to scientific evidence in policy formulation²⁸¹ and several specific examples are mentioned.²⁸² Within Defra, there is recognition that a more pro-active approach is needed in determining when, and to what extent, decisions should take account of public or stakeholder perspectives, in addition to scientific evidence.²⁸³

²⁶⁹ ACoPack, ARF, BGS, BSAS, ESRC, EN, FHRC, FC, GCT, HDC, IAH, IFR, NERC, RES

²⁷⁰ CPA, RGS

²⁷¹ ARF, BES, BSAS, BW, CPA, ESRC, FHRC, FC, GCT, HDC, IFR, IGER, MBA, MLC, MO, NFU, NERC, OFWAT, RR, RES, RGS, RSPB, VLA, ZIC, (c), (d), (f), (h), (l)

²⁷² E.g. environmental quality or animal diseases. BGS, CCW, CPA, DEPC, EN, FHRC, GCT, HDC, IGER, MBA, MLC, MO, NERC, NHM, RES, RSPB, SEERAD, VLA, Annex 3, para.2.4

²⁷³ See Annex 1, para. 6.2, Annex 5, paras.48-49, Annex 8, paras.66-68 and evidence from: CPA, DEPC, EN, FHRC, GCT, HDC, IGER, MBA, MLC, MO, NERC, NHM, RES, RGS, RSPB, SEERAD, SNH, VLA

²⁷⁴ See Annex 1, para.6.6: BBSRC, BES, BGrassS [see detailed examples provided in follow-up response], BSAS, BW, FC, NBN, NERC, ZIC, ZSL

²⁷⁵ CCW, ESRC, OFWAT, RSPCA, SA, (f), (z), Annex 3, para.3.96

²⁷⁶ BES and similar from BW, NBN, ZIC, ZSL

²⁷⁷ Annex 3, para.4.7 and supported by comments from BF and BSAS in Annex 1, para.10.2

²⁷⁸ ESRC and similar from OFWAT

²⁷⁹ SA, (f), (i), (s), (u) and see Annex 2, paras.1.3 and 6.1

²⁸⁰ ESRC

²⁸¹ JNCC, NFU, RR, RS, RSPB

²⁸² See Annex 1, para.6.12 and evidence from: BAgA, BF, BGS, BW, ESRC, FARM, FHRC, HDC, IoH, NERC, NHF, NHM, OFWAT, RS, RSPB, SA, SEPA, VLA, ZIC

²⁸³ Annex 3, para.5.15 and Annex 8 (RAS case study), para.39

95. In most policy areas, it is a major part of the role of Defra scientists to advise policy colleagues on the implications of science.²⁸⁴ In a few areas, specifically where Defra has Agencies and operates a large number of projects, the role of Defra scientists is primarily seen as being to commission and project manage the science carried out by Agencies and other contractors and the advisory function being the role of Agency staff.²⁸⁵ The dispersal of science staff is viewed positively in terms of helping to formulate research questions and monitor the science.²⁸⁶

Conclusions and Recommendation

96. Within Defra there is full recognition that its science is commissioned to help formulate and meet policy objectives. Those outside the department have wider expectations. However, there is a need for fuller and more consistent understanding, both across Defra and between the department and external science communities, of the various purposes for which science is used and a wider recognition within Defra that these purposes are not restricted to the immediate demands of the policy agenda.²⁸⁷

97. Defra needs to consider when (e.g. at what stage of the policy making process) and how best to take account of external / public stakeholder perspectives in addition to scientific evidence. This is an issue across Government, not just for Defra. The Phillips report concluded that: “Our experience over this lengthy Inquiry has led us to the firm conclusion that a policy of openness is the correct approach. When responding to public or media demand for advice, the Government must resist the temptation of attempting to appear to have all the answers in a situation of uncertainty. We believe that food scares and vaccine scares thrive on a belief that the Government is withholding information. If doubts are openly expressed and publicly explored, the public are capable of responding rationally and are more likely to accept reassurance and advice if and when it comes.

- To establish credibility it is necessary to generate trust.
- Trust can only be generated by openness.
- Openness requires recognition of uncertainty, where it exists.
- The importance of precautionary measures should not be played down on the grounds that the risk is unproved.
- The public should be trusted to respond rationally to openness.
- Scientific investigation of risk should be open and transparent.
- The advice and the reasoning of advisory committees should be made public.”²⁸⁸

Recommendation 9

Defra should make its use of science more open to challenge so that both internal and external stakeholders can monitor the sensitivities of policy to changes in the underpinning science.

²⁸⁴ Annex 3, paras.3.81-.83

²⁸⁵ (a), (b), (c), (d), (e), (f)

²⁸⁶ (i), (f)

²⁸⁷ CPA, NERC, RGS, Annex 3, paras.2.2-.6

²⁸⁸ <http://www.bseinquiry.gov.uk/report/volume1/chapt142.htm#648931>

7. Publishing results and debating their findings and implications openly

Rationale

98. In the spirit of openness, and to ensure robust interpretation of scientific findings and their policy implications, departments should publish and openly debate scientific results.

Defra Submissions

99. Defra's Publication Scheme²⁸⁹ sets out its commitments to make information on all aspects of its work as widely available as possible within the terms of the Freedom of Information Act 2000 (FoI)²⁹⁰ and the Environmental Information Regulations 2004.²⁹¹

“Defra values openness and we strive to maintain it as one of our core values. We aim to work openly, honestly and with integrity, and to share information with each other and our stakeholders. We are committed to greater openness and to proactively disseminating information as part of our goal of encouraging an informed debate on the areas of public policy for which we are responsible. This is reflected in Defra's Accessibility Commitment.”²⁹²

100. Defra's submission to the review added that:

“We regularly publish research reports on our website.²⁹³ Policy issues and proposals, including relevant supporting research, are discussed openly through policy-led consultations and dialogue; for example, the GM dialogue.”²⁹⁴”²⁹⁵

Defra maintains a science communication programme which aims to promote published research to wider audiences including the media encouraging further discussion and understanding of the work.²⁹⁶

101. Defra also maintains an Information Asset Register²⁹⁷ which lists unpublished material with a one-line description of the material, its source within the department and its availability. Much of the material listed is described as 'available', some is 'classified' (and would presumably not be made public, even in response to a request under the terms of the FoI).

289 <http://www.defra.gov.uk/corporate/opengov/pubscheme/index.htm>

290 <http://www.dca.gov.uk/foi/foiact2000.htm>

291 <http://www.defra.gov.uk/corporate/opengov/eir/index.htm>

292 <http://www.defra.gov.uk/corporate/opengov/accessibility.htm> and see the extract below.

293 http://www2.defra.gov.uk/research/project_data/Default.asp

294 <http://www.defra.gov.uk/environment/gm/crops/debate/index.htm>

295 Defra paper for Review Steering Panel, SP9, June 2005.

296 <http://www.defra.gov.uk/science/how/communications.htm>

297 <http://www.defra.gov.uk/iar/default.htm>

102. Defra's **Accessibility Commitment**²⁹⁸ sets out eleven criteria whereby the department undertakes to :

- **actively publish and release information**, mainly through a comprehensive Publication Scheme in line with requirements of the Freedom of Information Act and the Environmental Information Regulations. We will review what we publish and take account of demand for information. We will publish information cost effectively in ways appropriate to the needs of the intended audience.
- **use language appropriate to the intended audience**. Where there are different audiences different approaches will be considered (e.g. full detail for specialists, summaries for the general reader). We will communicate in plain language and avoid the use of jargon. We will take account of, and ensure we are well informed about, the special communication needs of our intended audiences.
- **make it as easy as possible to find information**. In particular we will make material available on our website. We will continue to improve our website to make it as user friendly as possible to enable people to find the information they want quickly and easily, and we will, when necessary, draw attention to publication of information using other media as appropriate.
- **encourage better information management**. Through the creation and storage of records electronically and the implementation of the Code of Practice for Records Management.
- **consult openly and widely wherever appropriate and practical**. There may be times when action will need to be taken too quickly for wider public interest reasons to enable this to happen. In such cases, we will inform stakeholders as quickly as is practical about the reasons for our action, keep them fully informed of progress, seek feedback and consult and involve them in the longer term as practical.
- **encourage those who do scientific research for us to publish their research in peer-reviewed scientific journals** promptly and in line with contractual agreements.
- **publish our targets and our achievements** against them promptly and openly.
- **deal with individual requests for information in a timely manner**. We will treat all requests fairly and without prejudice taking into account the public interest in making information available wherever possible.
- **give a clear explanation of our decision** if information cannot be published or released. We will also tell people how to complain if they do not agree with any decision not to release information.
- **sometimes have to charge for publications** or for releasing information on request. Our charges will be set out in the Publication Scheme or agreed in advance for information released on request.
- **regularly monitor our performance**, actively seek and welcome feedback from all stakeholders including the general public and continue to look at how we can improve our accessibility to deliver a better service to customers.

Evidence sought

103. OSI sought to establish how effectively Defra has been able to achieve the commitments outlined above, with regard to both publication and accessibility.

²⁹⁸ <http://www.defra.gov.uk/corporate/opengov/accessibility.htm>

Findings

104. There is widespread recognition that, for the most part, results of Defra-funded science are published and debated openly,²⁹⁹

“It appears that enormous advances have been made in the openness, transparency and public debate of environmental research findings. It is pleasing to note the first signs of a return of public confidence in government-led environmental science.”³⁰⁰

“Defra produces a number of very good and informative publications. Most are very readable and written at an appropriate level (e.g. the recent short paper on nanotechnology was excellent). Defra also put considerable effort into public debate and open discussion ...”³⁰¹

though a few specific exceptions are mentioned.³⁰²

105. A few responses have noted that (early) publication of reports on Defra’s web-site can cause researchers problems unless an embargo is agreed pending publication in a peer-reviewed journal.³⁰³

106. Dissemination of findings via Defra’s web-site, seminars, newsletters and via libraries and archives is supported.³⁰⁴ Several specific examples of good practice are mentioned,³⁰⁵ along with a few suggested improvements,³⁰⁶ to:

- further encourage researchers it funds to publish in peer-reviewed journals³⁰⁷
- engage with the scientific community,³⁰⁸ e.g. by organising or sponsoring conferences³⁰⁹
- publish still more of its data and research results on its web-site³¹⁰
- make it easier to find and obtain overviews of commissioned research, including making it more easy to navigate its web-site³¹¹
- improve its communication and engagement with the public on science-related issues, including explaining how results are obtained (and not simply reporting the results)³¹²
- achieve effective communication of risk³¹³

²⁹⁹ ACoPack, ACoP, BF, BSAS, CCRU, CPA, DEPC, FC, GCT, HGCA, IAH, IFR, IGER, IoH, JNCC, LGC, MBA, MLC, MO, NHF, NERC, OFWAT, RR, RES, RGS, RS, RSPB, RSPCA, SEPA, SEERAD, SNH, VLA, ZSL, (e), (j), (h), (m), (y), (z), Annex 5, para.50, Annex 7, paras.89-97 and Annex 8, paras.70-71

³⁰⁰ SEPA

³⁰¹ SEERAD

³⁰² See Annex 1, para.7.2 and evidence from: RES, RSPCA, SA, (m), (j)

³⁰³ IAH, NIAB, VLA, (b), (f)

³⁰⁴ BGS, CCRU, CPA, FC, MBA, NERC, NFU, RS, SNH, VLA, (c), (f), (i), (j), (k), (l)

³⁰⁵ See Annex 1, para.7.6 and evidence from: BES, BF, BGS, IFR, IoH, JNCC, MO, NBN, NERC, NFU, NHF, RR, (h)

³⁰⁶ See Annex 1, para.7.7 and evidence from: BES, BF, BGS, BSAS, HGCA, NHM, RES, RS, RSPB, VLA, ZIC, (j)

³⁰⁷ BES, RES, RSPB

³⁰⁸ BES, NHM, RES

³⁰⁹ BES

³¹⁰ BES

³¹¹ HGCA, ZIC and Annex 3, para.3.166

³¹² BGS, BSAS, RSPB and RS: “it is ...important that there is scientific involvement in the production of press releases [and this has not always been the case]”, Annex 3, para.3.166 and Annex 7, para.95. There are examples of good practice in terms of communicating with stakeholders (Air Quality Stakeholder Forum: see Annex 7, para.89) and the wider public (CoRWM: see Annex 8, para.39)

³¹³ VLA

107. There is general encouragement from Defra for science providers to publish their work,³¹⁴ although the approach to publication seems to vary somewhat from one area and Agency to another³¹⁵ and a lot of work is done by Agency staff on a voluntary basis because the costs of producing a paper and publication in a peer-reviewed journal are not covered by Defra.³¹⁶

Conclusions and Recommendation

108. There is widespread recognition that almost all of Defra's science is made publicly available and for the most part shared effectively. The main significant criticisms relate to the handling of the large volume of underlying data that Defra science generates, which is not normally published in its own right, and how this could be made more readily available or better integrated with data from other sources. This is a common issue across Government departments and has been made the subject of (one of three) 'Grand Challenges' for Government to address (see: http://www.dft.gov.uk/stellent/groups/dft_science/documents/page/dft_science_611659.hcsp)

109. We commend the criteria set out in Defra's Accessibility Commitment (see para.102 above) and understand that Defra has various activities in-hand to improve its internal knowledge management.³¹⁷ We support such activities as precursors to the implementation of department-wide systems.

Recommendation 10

Defra should:

- a) **together with some of its main stakeholders, examine options for improving the awareness, integration and (especially external) availability of its data.** (The EA web-site has been suggested as an example of good practice for availability of data).
- b) **develop and maintain its science / knowledge information system(s) as a means of enabling better cross-sectoral and multi-disciplinary awareness of existing knowledge and to avoid corporate memory loss and duplication of effort.**

³¹⁴ "For all research it is Defra policy to publish project results and at the least this will involve publication on Defra's own website. As such in making a bid contractors are required to include costs for doing the work and costs for writing up the results into a report which Defra can publish. Where Defra wishes to more widely disseminate information via leaflets or any other route, this would be covered in the Defra project specification and included in the project costs. We aim to treat all our contractors fairly and equally regardless of size and/or status and therefore do not make distinctions between universities, public bodies or commercial firms. It is also our policy to encourage contractors to publish project results in appropriate peer review and/or science journals.": Note from Defra, 09.06.06.

³¹⁵ (a), (b), (c), (d), (e)

³¹⁶ (b), (f)

³¹⁷ Knowledge audits and knowledge networks are being piloted: see Annex 7, para.98 and Annex 3, paras.3.170-175

8. Sharing and transferring knowledge

Rationale

110. Knowledge transfer should be treated by departments as a strategic goal and enjoy high level focus.

Defra Submissions

111. Defra's submission to the review stated that:

*"We share knowledge with our stakeholders and actively work together with industry and others on knowledge transfer activities, e.g. through the establishment of the non-food crops centre etc."*³¹⁸

Evidence sought

112. The Review sought to establish: how Defra promotes the transfer of knowledge from research it funds; how cross-cutting science issues are handled by the department; how Defra promotes the effective exploitation of the research it funds; and how much importance is attached to these activities by the department.

Findings

Sharing Knowledge

113. Whilst commending its knowledge transfer,³¹⁹

Defra is commended for "the openness and frankness of the dialogue and the readiness of the Science Directorate to engage expertise from elsewhere to remedy weaknesses"³²⁰

"Defra facilitates the sharing, transfer and management of knowledge through its open publication policy. At a cross departmental level, we note that Defra has taken the lead on cross-departmental initiatives such as the new nanotechnology Research Co-ordination group."³²¹

In the pesticides safety area, Defra staff are said to "contribute actively to international debate on approaches to risk assessment and risk management for pesticides"³²²

a few responses suggest that Defra is perhaps less good at internally managing the enormous amount of information which its sponsored research generates:³²³

318 Defra paper for Review Steering Panel, SP9, June 2005.

319 ACoP, FC, RS, (g), (l), OST and see Annex 2, para.8.1 for examples of good practice

320 FC

321 RS

322 ACoP

323 NERC and similar from ARF, BF, BW, EN, ESRC, NFU, RSPCA, SAC, UKWIR

ESRC “would like Defra (in common with OGDs) to ensure that the potential for high quality social science research offered by administrative and other data that it collects or holds is realised. This concerns both provision of better access to such data and communication of the availability of such data, as well as identification of innovative research agendas which might stimulate utilisation of these resources and support in building research capacity in the analysis of such data. The creation of a Rural Evidence Research Centre is an important step here and we have begun discussions with Defra about how it might support further developments to encourage greater utilisation of data resources.”³²⁴

“Because the information is dispersed and nobody has an overview of its totality, the value of this base-load is frequently underestimated. Individual components of information are vulnerable to cuts because although individuals can see the cost of collection no one can easily see the enhanced value of the components through their contribution to the whole. To act as champion, and take on a broad stewardship and coordination role for this information, would be a logical and very valuable role for Defra to perform. In our view this would not require extra resources. We are not advocating Defra paying for more work, or being a central custodian for all data, but to take on the role of champion and point out to others the importance and value of their contribution, and perhaps acting as a coordinator for a system of dispersed storage.”³²⁵

“The accessibility of Defra’s scientific data collections is a concern:

- General access to Defra’s data sets.
- Communication of the availability of, and methods of access to, such data.
- Overlap and inconsistency of approach in data sets collected by Defra, government agencies and the Devolved Administrations (for example, environmental data sets that are limited by political rather than geographical boundaries).

Better access to data is likely to stimulate the identification of more innovative research agendas and support research capacity building in the analysis of such data. The creation of a Rural Evidence Research Centre is an important step here and discussions have begun with Defra about how they might support further developments to encourage greater utilisation of data resources.”³²⁶

114. The Catalyst programme was an acknowledgement by Defra that it needed to do better in this respect but the pilot project was not followed up.³²⁷

115. It has also been suggested that Defra staff tend to be over-reliant on a narrow group of individual contacts, rather than there being an embedded / institutional approach to knowledge sharing.³²⁸

Knowledge Transfer

116. The need to transfer knowledge, as opposed to simply publishing results is stressed³²⁹ and several responses and interviewees stated that Defra and its Agencies achieve this effectively,³³⁰ though others express concerns about how effectively Defra transfers knowledge in some areas.³³¹

³²⁴ ESRC

³²⁵ EN and similar from NFU

³²⁶ SAC

³²⁷ Annex 3, paras.3.88, 3.170, 4.89

³²⁸ IGER, JNCC, RSPCA, (g), (y), Annex 3, paras.3.170-.172, 4.90

³²⁹ CIRIA, FHRC, HGCA, RSPCA, SEPA, (f)

³³⁰ BGrassS, FHRC, LGC, MLC, MO, NHF, NERC, RR, SEERAD, (a), (b), (c), (d), (e), (g), Annex 4, para.93-96 and Annex 5, paras.53-55

³³¹ ARF, BF, BSAS, BW, FHRC, HDC, HGCA, IGER, JNCC, RSPCA, VLA, (f), (h), (k), Annex 3, paras.4.89-90

117. The need for stronger and more effective links between Defra, OGDs and research councils is stressed,³³² including via integration of databases.³³³ A few possible improvements are suggested:³³⁴

One suggested remedy is for Defra “to make available top up funding, up to 10% of project costs, to any research relevant to Defra’s objectives carried out by a public body and where the public body agreed that the research carried out would be made available in electronic form to Defra to place on the web. This would make available large pieces of research and development work currently funded and retained by public bodies for their own benefit.”³³⁵

Another suggests “consideration being given to including in the research project web pages – as well as a final report which is currently given where available – links to published papers and to any information that may be available about practical implementations of the results. Researchers should be required, as part of the contract, to notify Defra of any successful application of the intellectual property generated by the research. The possibility of a periodic publication of a summary of practical applications and benefits achieved as a result of Defra-funded research could also be considered.”³³⁶

Another response suggests a need for better targeting of the recipients for particular information.³³⁷

SEPA mentions the “electronic, targeted-audience, drill-down, dissemination of outputs by the Scotland & Northern Ireland Forum for Environmental Research (SNIFFER) and also the Foundation for Water Research (FWR). These electronic services seem popular with users.”³³⁸

Exploitation

118. Exploitation and Intellectual Property Rights have been a bone of contention in the past³³⁹ though some of the issues may now have been resolved.³⁴⁰ Comments indicate the need for exploitation routes to be identified at the outset³⁴¹ and Defra is encouraging its researchers to do so.³⁴² As indicated in the Baker Report,³⁴³ “All Government purchasers of Public Sector Research Establishment (PSRE) research should have as part of their research mission the explicit objective of transferring PSRE research outputs to the wider economy; this should be explicitly reflected in all contracts between sponsors (and other Government purchasers of research) and PSREs.”

119. It is a point for debate whether the public should be charged for access to the results of publicly-funded science.³⁴⁴

For conclusions and recommendations see section 7.

³³² BF, ESRC, LGC, MO, NERC, NHF, SAC

³³³ (f), (z)

³³⁴ See Annex 1, page 50 and evidence from BW, HDC, RSPCA, SEPA and Annex 2, para.8.4: (f), (z)

³³⁵ BW

³³⁶ RSPCA

³³⁷ HDC

³³⁸ SEPA

³³⁹ IGER, RGS

³⁴⁰ IAH, ZSL, (h)

³⁴¹ CIRIA, NFU, HDC, IGER, IoH

³⁴² IAH, IGER, ZSL and Annex 3, paras.3.177-.178

³⁴³ http://www.hm-treasury.gov.uk/documents/enterprise_and_productivity/research_and_enterprise/ent_sme_baker.cfm

³⁴⁴ E.g. see Annex 6 (Soils case study), para.84

9. Implementing Guidelines and the Code of Practice for Scientific Advisory Committees

Rationale

120. Guidelines 2005³⁴⁵ is a high-level document aimed at the way Government departments obtain and use scientific advice in policy-making. Its key messages are that departments should: think ahead and identify early the issues on which they need scientific advice; get a wide range of advice from the best sources, particularly where there is scientific uncertainty; and publish the scientific advice and all relevant papers. The Guidelines have been drawn upon in formulating the ten key criteria for the OSI Reviews.

121. The purpose of the Code of Practice³⁴⁶ is to provide more detailed guidance specifically focused on the operation of scientific advisory committees and their relationship with Government and to help them translate the principles in the Guidelines into day-to-day practice.

Defra Submissions

122. In response to Guidelines 2000, the department stated that:

“Guidelines 2000 is implemented through our work in support of the better policy making agenda. All advisory committees are aware and we have, with FSA, carried out a check of how advisory committees shared across Government departments implement Guidelines 2000.”³⁴⁷

123. Defra sets up scientific advisory bodies according to need.³⁴⁸ Many are temporary but fifteen well-established committees are listed as following the Code of Practice for Scientific Advisory Committees.³⁴⁹

Evidence sought

124. OSI sought to determine how effectively the department used its many advisory bodies to better inform its activities.

³⁴⁵ Revised in October 2005: <http://www.dti.gov.uk/files/file9767.pdf>

³⁴⁶ Office of Science and Technology. Code of Practice for Scientific Advisory Committees, December 2001 (<http://www.dti.gov.uk/files/file9769.pdf>).

³⁴⁷ Defra paper for Review Steering Panel, SP9, June 2005.

³⁴⁸ <http://www.defra.gov.uk/corporate/delivery/landscape/bodies/index.htm>

³⁴⁹ <http://www.dti.gov.uk/files/file9769.pdf>

Findings

125. As indicated in Defra's evidence, 15 of its advisory committees are signed up to the Code of Practice. In contrast, whilst the principles in Guidelines are applied ('taken as read' / 'almost invisible'), in interviews with Defra staff, no mention was made of Guidelines 2005.³⁵⁰ Most of the external comments received view positively Defra's use of advisory bodies,³⁵¹ including the establishment of a Science Advisory Council,³⁵² and accept that Defra follows both Guidelines³⁵³ and Code.³⁵⁴

126. There is concern that a consequence of the separation between the central science team and policy sectors is that the central team (and CSA) can be by-passed in the provision of advice to Ministers. Particular examples mentioned are: Defra's Committee on Radioactive Waste Management (CoRWM) and the Independent Steering Group with regard to badger culling / bovine TB.³⁵⁵

127. In a few instances it has been suggested that Defra could also make even more use of advice from a wider range of sources,³⁵⁶ for example the learned societies³⁵⁷ and research councils.³⁵⁸

128. There is a call for clarification of the role of Defra laboratories.³⁵⁹ For their part, it is a source of frustration for Agencies that their advice and expertise is not or may not always be called upon directly by Defra,³⁶⁰ although Agency staff are called on to advise indirectly, e.g. by attending advisory committee meetings as observers.³⁶¹ As a result, Defra Agencies contribute more to international advisory committees than they do in the UK (and some consider themselves to be more valued abroad).³⁶²

Conclusions and Recommendations

129. Defra makes extensive use of external advisory bodies, many of these are formally signed up to the Code of Practice for Scientific Advisory Committees and the indications are that the others (generally bodies with a shorter-term remit) also adhere to the same principles. We share the concerns expressed that the CSA has, in a few (high-profile) cases, been by-passed in the provision of scientific advice to Ministers.

Recommendation 11

To ensure a coherent picture, all scientific advisory bodies set up to advise Defra Ministers should report via the CSA. This is a recommendation that OGDs should also follow.

³⁵⁰ Annex 3, paras.5.101-.108 [The points regarding Guidelines are messages for OSI rather than Defra]

³⁵¹ ACoPack, ACoP, BBSRC, DEPC, IGER / ACRE, (h), (j), (v), (z)

³⁵² BBSRC, IFR, NFU, RS, (k), (m)

³⁵³ BGS, FC, MLC, RR, (h)

³⁵⁴ BGS, IFR, IGER, MLC, NERC, RR

³⁵⁵ See Annex 1, para.9.2 and evidence from RS and (g), (w), (z)

³⁵⁶ See Annex 1, para.9.3 and evidence from BES, BGS, RR, RS

³⁵⁷ BES, RS

³⁵⁸ IFR, RR

³⁵⁹ (g)

³⁶⁰ (b), (e), (f), (g)

³⁶¹ (e), (h)

³⁶² (a), (b), (c), (f)

130. Defra’s SAC fulfils an important role in:
- providing a challenge function
 - supporting and advising the CSA
 - using sub-groups to look at specific issues in-depth
 - engaging with the wider community
 - interacting between the natural and social science communities.³⁶³

We agree with the Royal Society’s view that, “To be effective SAC must be involved in all major policy issues involving scientific evidence and include a sufficient number of internationally recognised scientists (covering an appropriate range of disciplines) in addition to other stakeholders.”

Recommendation 12

OGDs which use a significant amount of science should consider adopting Defra’s and MoD’s approaches to having an over-all Science Advisory Council.

131. With regard to the use of the best available scientific advice, see para.14 and Recommendation 3(b) above.

132. Defra is applying the principles in Guidelines but OSI should consider whether Guidelines are serving a useful purpose among Government departments generally.

³⁶³ See Annex 2, table below para.9.1

10. Maintenance and development of scientific expertise

Rationale

133. Whether a department has its own dedicated research unit, or commissions work from outside organisations, it needs to ensure it has long-term access to experienced scientists who are able to understand and interpret issues at the science-policy interface, taking into account the full range of scientific opinion as appropriate.

Defra Submissions

134. Defra has said that:

“Since joining us as Chief Scientific Adviser, Professor Howard Dalton has led initiatives to raise the quality and profile of Defra’s science, including improving communication with the public and other stakeholders. Over the next few years, the Chief Scientific Adviser will develop his Head of Profession role and work on improving mechanisms for co-ordination of the science community, including a proper career structure for scientists in Defra to attract and retain talent.”³⁶⁴

“We have established a Head of Science Profession project to look at how Defra maintains and develops its scientific expertise.³⁶⁵ A strategy document³⁶⁶ was produced at the end of March 2005 which presents Defra scientists’ views of the HoSP role and activities, outlines the key ‘criteria’ that the role will need to fulfil and will be used to guide our implementation activities.”³⁶⁷ An implementation plan, which was developed and agreed with the stakeholder community, was produced in April 2006 as the means of turning the high level role outlined in the strategy into an active Head of Science Profession role for Defra’s Chief Scientific Adviser and describes 10 areas of work (work packages) that will start to meet the recommendations on the HoSP role as set out in the strategy.³⁶⁸

“We hope to foster and support science of the highest quality. In order to do so we recognise that our scientists must be supported to develop their skills and encouraged to communicate their science.”³⁶⁹

135. Defra is a major employer of science expertise, with about 2,500 scientific staff in total. A tenth of these work in the core department, the majority are accounted for by the three executive agencies (CSL, CEFAS and VLA) and Veterinary Medicines and Pesticides Safety Directorates. The scientists in the core department are mostly responsible for the procurement and management of science and the provision of scientific advice, with a central team headed by the CSA. This central team now has overall responsibility for science (including social research), economics and statistics.³⁷⁰

³⁶⁴ Lord Whitty, Forward Look 2003.

³⁶⁵ <http://www.defra.gov.uk/science/how/head.htm>

³⁶⁶ Developing the Chief Scientific Adviser’s role as Head of Science Profession in Defra [Unpublished document on the Defra intranet under Change Management/HeadOfProfession/documents/HoSP(05)48 pdf]

³⁶⁷ Defra paper for Review Steering Panel, SP9, June 2005.

³⁶⁸ Developing the Chief Scientific Adviser’s role as Head of Science Profession in Defra [Unpublished document on the Defra intranet under Change Management/HeadOfProfession/documents/HoSP(06)64 pdf]

³⁶⁹ http://www.defra.gov.uk/science/info_4_scientists/default.htm

³⁷⁰ Summary of presentation by Defra CSA to the Review Steering Panel, June 2005.

Evidence sought

136. OSI sought to examine: the deployment of scientific expertise accessed by the department; how Defra ensures that scientific issues and advice are understood by its policy makers; how the professional development of the department and its Executive Agencies' scientific staff is ensured; and how Defra supports the scientists it employs to maintain and develop their expertise.

Findings

Defra Staff

137. Defra is said to have expert and highly professional staff³⁷¹ and there are examples of Defra scientists contributing to international committees³⁷² but there is concern among external stakeholders that Defra is failing to maintain internal scientific expertise³⁷³ and in some areas rapid staff turnover can lead to problems.³⁷⁴ According to Defra interviewees, the problem is not so much being able to recruit scientists to replace those that leave but that there is loss of expertise / insufficient succession planning when experienced staff move on.³⁷⁵ This is almost certainly an issue across Government and not confined to Defra, although it may be more evident in departments such as Defra, where scientists are a significant proportion of the overall staff.

138. The dispersal of scientific staff has some benefits (see paras.4 and 9 and sections 4 and 6) but is also viewed with scepticism by some,³⁷⁶ though see Annex 2, para.10.3 for a suggested example of effective practice:

In EA, a separation between science and policy has reportedly not always worked well but an area where scientists have been merged with their policy colleagues has not worked either. The best teams are said to have arisen where policy and scientific staff are co-located but managed separately, with a clear division of responsibilities and 'active management'.³⁷⁷

³⁷¹ FC and similar from NHM, RR, SEERAD

³⁷² ACoP, (l) and Annex 3, para.3.48

³⁷³ See Annex 1, para.10.2 and follow-up evidence from BF: "The former Postgraduate Training Scheme turned out 50+ postgraduates per year. These scientists were able to think across disciplinary boundaries and integrate knowledge and practical expertise in the service of land-based rural industries. Many of the postgraduates went on to occupy high managerial and policy formulation posts which contributed to sensible and well considered strategies for the conservation and use of our countryside. The absence of these postgraduates has resulted in a widening rift between those who wish to operate businesses in rural areas and those who view these areas as being purely devoted to conservancy. There are no new scientists and technologists available capable of working at this interface and solving its problems. As a result we now have divergent and potentially irreconcilable approaches to environmental protection and sustainability, including rural land use.", BSAS, and Annex 2, para.10.1: (a), (g), (p), (y)

³⁷⁴ ARF, HDC, NHM

³⁷⁵ Annex 3, paras.3.41, 3.121, 4.39 and 4.51-.58

³⁷⁶ (b), (g), (h), (n), (q)

³⁷⁷ (g)

139. Defra needs to encourage and make provision for the continuing professional development (CPD) of its scientific staff,³⁷⁸ for example to narrow the gap between experienced staff and new recruits.³⁷⁹ The efforts of the CSA and Permanent Secretary with regard to CPD are noted.³⁸⁰ However, the point was made that a tension might arise between the role of a CSA as advisor and their other roles as Head of the Science DG and Head of Profession for a department's scientists. This might arise, for example, where the scientific advice to a department might be to invest in new areas of scientific work whilst the DG role might require the reduction of overall staff resources to deal with budgetary constraints.³⁸¹ As indicated in paras.7, 62 and 93, Defra's increasing need for social science means there will be an increased need for well-trained social scientists within Defra.³⁸²

140. Some suggest that Defra could make more of opportunities for interaction (e.g. through collaborative studentships and fellowships, secondments, placements, exchanges, internships).³⁸³

Using External Sources of Expertise

141. Many responses have highlighted the importance of networking between Defra staff and others.³⁸⁴ Maintenance of a research base and facilities that are able to respond rapidly to meet national emergencies has been highlighted³⁸⁵ and several responses have commented on the importance of Defra's Agencies and NDPBs as sources of scientific capacity.³⁸⁶ As noted above (section 9, para.128), Defra Agency scientists sit on many international committees but, at least in some cases, they may not be permitted to contribute fully to the work of Defra advisory bodies because they are not considered to be 'independent' of Defra. There are a few examples of Defra making use of international experts for advice³⁸⁷ but rather more believe Defra needs to do so more often.³⁸⁸

142. The use of secondments is thought to be a useful means of improving the understanding of science by policy-makers and policy issues by scientists.³⁸⁹ At present, the flow is almost all into Defra³⁹⁰ and it is suggested that even very short secondments of staff out of the department (to Defra Agencies or other science providers) could be worthwhile.³⁹¹

³⁷⁸ BES and similar from P, RR [; suggestion of short secondments of Defra staff to research providers] and BF: "The Institute of Biology has established a successful Continuing Professional Development (CPD) scheme and has given advice to Defra's Chief Scientific Advisor on establishing such a scheme within Defra. It is essential that the scheme provides training to develop staff skills, techniques and extend their awareness and understanding of scientific advances. Simply attending conferences and reading journals will not suffice."

³⁷⁹ Annex 3, paras.4.58-59

³⁸⁰ (m), (s) and Annex 3, para.4.57

³⁸¹ Annex 3, paras.5.13-20

³⁸² ESRC and similar from SAC

³⁸³ ESRC and similar from NERC, RR, RS

³⁸⁴ ACoP, ARF, BF, BAA, BSAS, CCW, DEPC, ESRC, FC

³⁸⁵ DEPC, DARDNI, IFR, RS, VLA, (d), (e), (h), (x) and Annex 3, paras.4.72-.74

³⁸⁶ BES, FC, HDC, NHM, SEERAD, VLA, (e) and Annex 3, paras.4.72-.74, 4.84-.86

³⁸⁷ MO, (l) & Annex 3, paras.2.35, 4.48, Annex 4, paras.65, 68 and 74

³⁸⁸ BGS, JNCC, LGC, NIAB, RR, RS, SAC, SEERAD, VLA

³⁸⁹ (a), (b), (f), (g), (h), (y)

³⁹⁰ (a), (b), (f), (g)

³⁹¹ (a), (b), (f)

143. Several organisations have expressed concern about dwindling supplies of UK scientific expertise in some subject areas.³⁹² The withdrawal of MAFF studentships is strongly criticised³⁹³ and Defra is advised to reinstate PhD funding³⁹⁴ or consider ways of encouraging young researchers.³⁹⁵

Maintenance of Research Capacity / Infrastructure

144. Increased use of short-term funding³⁹⁶ and competitive funding³⁹⁷ are said to have had an adverse effect on research capacity and capability in some areas and the need for long-term funding to track change and identify trends is stressed.³⁹⁸

145. Defra's responsibility to help maintain the UK science base is stressed in several responses. There are mixed views as to how effectively it fulfils this role.³⁹⁹ There are commonalities between the science expertise used by Defra, the RCs, OGDs and the devolved administrations,⁴⁰⁰ and Defra could be more effective in collaborating with other funders to maintain and build capacity.⁴⁰¹ The external perception of Defra is that the department is ambivalent towards its responsibility for maintaining the science base. For example, Defra has signed up to the recommendations of the Research Institute & Public sector research establishment Sustainability Study (RIPSS, see Appendix 2 below) but in some areas has not implemented it or is being slow to do so.⁴⁰² Defra's response to this is "Defra imagines that this unfounded perception of ambivalence comes from those most affected by Defra's well-publicised rebalancing of its science programmes to bring them better into line with the department's strategic priorities. This rebalancing is inevitably leading to lower levels of spending in some areas of science where Defra has invested heavily in the past. Defra is not ambivalent to its responsibility for maintaining the science base, but equally, Defra has limited resources available for investment and has to make the best use of them. Defra has been in discussions with the BBSRC for some time on the strategic agreements envisaged by RIPSS. Differences of view with the BBSRC persist on how to take forward the implementation of RIPSS, but Defra hopes to conclude these discussions soon."⁴⁰³

146. It is beyond the review's remit to comment but it is noted that Defra is currently reviewing areas in which it needs to maintain an 'in-house' (i.e. Executive Agency) capability for science.⁴⁰⁴

³⁹² See Annex 1, paras.10.10-10.11 and pages 56-57 and evidence from: ACoPack, ARF, BBSRC, BES, BF, GCT, HGCA, IoH, MLC, NFU, RES, RR, SAC

³⁹³ ARF, GCT, HGCA, HDC, IoH, NHF, RR, RES, (k)

³⁹⁴ GCT and similar from ARF, HGCA, NHF

³⁹⁵ HGCA and similar from NERC, RES, RS

³⁹⁶ BF, BGrassS, HDC, IGER, LGC, NERC, VLA

³⁹⁷ RI

³⁹⁸ MBA, MO, VLA

³⁹⁹ IGER, MO, NFU, RI, RR, RS and see Annex 4, para.106 for an example of support for the science base.

⁴⁰⁰ BBSRC, IFR, NERC, RR, RES, SEERAD

⁴⁰¹ BBSRC, IFR, NERC, Annex 5, paras.62-65

⁴⁰² BBSRC, IFR, IGER, (x), Annex 3, paras.4.79-.83, Annex 5, para.64 and Annex 7, para.70. Defra's collaboration with Research Councils such as NERC at the ERFF is in marked contrast to the relationship with BBSRC and its RIs: see Annex 3, paras.3.69, 4.20 and 5.70

⁴⁰³ Note from Defra: 19.06.06 and see Annex 3, paras.4.71-.83

⁴⁰⁴ (b), (c), (e), (f), Annex 3, para.4.62

Conclusions and Recommendations

Internal Science Expertise

147. We agree that, from time to time, Defra has to re-balance the ‘skills set’ of its scientists to meet the department’s changing needs and there are benefits to the introduction of new staff with new ideas. However, a rapid turnover of Defra staff with scientific expertise impacts adversely on the effective working of the department in several ways, for example: corporate memory loss / repetition of previously commissioned science; less effective communication with external stakeholders including contractors; and poorer use of science and scientific advice for policy or other purposes.

Recommendation 13

Defra should ensure it achieves and maintains the right balance of internal scientific expertise. This could be assisted in a variety of ways, for example by:

- a) making better provision for succession planning;**
- b) reducing the rate of staff turnover** (e.g. financial incentives for key experienced staff to stay in post longer)⁴⁰⁵;
- c) greater use of secondments into and out of the core department** (i.e. including exchanges between Defra and the Environment Agency or Defra Laboratory Agencies);
- d) implementing a consistent approach to tracking staff deployment and expertise** (e.g. as part of the department’s development of its knowledge management systems: see Recommendation 10(b)).

(Also see: Recommendation 2 with regard to social science expertise in overarching themes).

148. We agree that tensions might occasionally arise between the roles of a CSA (as an independent source of scientific advice) and a departmental Science DG (i.e. a civil servant and budget holder). This could also apply to OGDs where such roles are filled by the same individual. However, there could also be disadvantages to having the roles separated, for example in terms of diminished influence of the CSA on a departmental Management Board. This is an issue for the GCSA, Defra and OGDs to consider further and we recognise that the best approach may vary from one department to another.

⁴⁰⁵ There are certainly precedents for this, at least in DTI if not OGDs.

External Science Expertise

149. Perhaps the most frequent criticism of Defra that we have heard is that the department is being slow or reluctant to ensure the existence of scientific expertise in areas for which it is a main customer / recipient. This is a particular concern in areas where there is a need to be able to respond to emergencies. While the need for Defra to re-prioritise its work from time to time is fully acknowledged, including the need to ‘sun-set’ some areas altogether, and we recognise that some of its critics are ‘interested parties’, the department needs to recognise that in some areas it is a major customer for scientific advice and that, in areas where it is required, science expertise needs to be built up and maintained. Defra needs to ensure that its requirements for expertise and facilities can be met now and in the future. To this end, its strategic planning needs to be joined up with that of other funders of Public Sector Research Establishments and other strategic facilities, as required under RIPSS in 2004.⁴⁰⁶

Recommendation 14

As a matter of urgency, Defra should conclude agreements with other funders and partner organisations, making the resource commitments needed to sustain the science expertise and infrastructure that will enable the department to meet its policy and delivery needs.

[Also see Recommendation 4 above]

⁴⁰⁶ <http://www.dti.gov.uk/science/science-funding/ripss/page22675.html> or see the extracts from the RIPSS review in Appendix 2 below.

Appendix 1

Defra Science Spend

Excerpt from “The Forward Look 2003 Government funded science, engineering and technology”, OSI, July 2003⁴⁰⁷:

Table 1 Department for Environment, Food and Rural Affairs R&D and SET expenditure by subject area

£ million	Outturn 2001-02	Estimated Outturn 2002-03	Plan 2003-04	Provisional Plan 2004-05
Subject area				
Plant health control	0.1	0.0	0.0	0
Arable crops science	14.9	14.6	15.7	16
Horticulture science	13.7	11.7	11.5	12
Animal health & welfare	38.0	39.6	42.7	44
Livestock science	9.0	8.3	8.7	9
Rural environment	14.0	14.0	15.5	16
Flood defence & coastal protection	2.9	2.5	2.6	3
Flood technology	3.6	3.3	3.5	4
Conservation & exploitation of fisheries	6.8	6.5	6.6	7
Aquatic environment	3.8	3.9	3.8	4
Royal Botanic Gardens, Kew	11.8	13.2	16.7	17
Central administration & economic studies	3.6	4.3	4.4	4
Energy efficiency	3.0	3.6	3.6	4
Environmental technology	-	-	-	-
Waste policy	0.2	0.1	0.2	0
Air and environmental quality	9.9	8.4	9.4	10
Noise	0.7	2.5	8.5	9
Chemicals and biotechnology	2.9	3.8	4.2	4
Darwin Initiative	0.9	0.9	1.1	1
Global atmosphere	12.9	14.0	16.6	16
Radioactive substances	0.6	0.6	0.6	1
Water and land	3.6	3.3	3.3	3
Wildlife and Countryside Directorate	2.2	1.6	1.6	2
Countryside Agency	2.1	2.1	2.2	2
English Nature	3.4	3.3	3.3	3
Environment Agency	6.5	6.6	6.6	7
Environmental Protection Statistics	0.9	0.9	0.9	1
EU and International Science	0.2	0.2	0.2	0
TOTAL R&D	172.3	173.7	194.2	197

⁴⁰⁷ <http://www.dti.gov.uk/files/file34199.pdf>

Excerpt from Defra's Evidence and Innovation Strategy 2005-2008,⁴⁰⁸ Annex 1⁴⁰⁹:

Table A1: Resource allocations by Strategic Outcome and other related policy areas

Strategic Outcome and other related policy areas	R&D SPEND	R&D SPEND	NON-R&D
	2005/06 (£'000s)	2005/06 (£'000s)	SPEND 2006/07 (£'000s)
Sustainable development			
Local environment quality	8,372	8,372	-
Climate change and energy			
Climate change	15,227	17,327	46,600
Homes heated	1,200	1,200	-
Flooding and coastal erosion risk management	2,425	2,425	1,100
Improved air quality	9,699	10,599	-
Sustainable consumption and production			
Sustainable consumption and production (decoupling)	2,730	3,630	-
Waste and resources management	3,770	5,104	13,400
Chemicals and nanotechnology*	3,867	3,867	-
Protecting the countryside and natural resource protection			
Protect and enhance the natural environment	6,821	7,180	1,079
Access to the natural environment	100**	100**	-
Water quality and the environment	2,119	3,019	4,710
Sustainable marine environment	10,666	10,725	18,167
Radioactive substances	319	319	1,848
Sustainable rural communities			
Rural enterprise and social exclusion	821	2,243	-
Sustainable farming and food, including animal health and welfare			
Sustainable farming and food	38,464	34,019	5,476
Animal health and welfare (including fish health)	38,889	39,231	88,836***
Pesticides	5,459	5,459	2,830

* Funding for genetically modified organisms (which falls under sustainable farming and food) is included within this amount.

** Research in this area is mainly funded by the Countryside Agency

*** 69.7% of non-R&D spend consists of statutory requirements. The total figure for non-R&D spend does not include State Veterinary Service (SVS) spend.

⁴⁰⁸ <http://www.defra.gov.uk/science/how/strategy.htm>

⁴⁰⁹ <http://www.defra.gov.uk/science/how/documents/PDFs%20in%20Parts/Annex%201%20and%202.pdf>

Strategic management of the Science and Engineering Base

4.13 We recommend that

- R1. It should be Government policy that the fitness-for-purpose and sustainability of the wider Science and Engineering Base is a matter of joint responsibility of the principal public funding stakeholders (the Research Councils, Government departments and their agencies).
- R2. RC Chief Executives and Permanent Secretaries of Government departments, working through Chief Scientific Advisers, should be jointly accountable for developing joint scientific and investment strategies for their cross-boundary research interests. As a minimum, such an interest exists if the Government department procures 15% or more of a RC institute's turnover. Once agreed, these joint strategic plans should be deemed to place a commitment on a Government department's science budget holder to honour the joint agreement. RCUK and CSAC should jointly review such strategies every five years.

Responsibilities of UK public sector funders and sponsors

4.16 Any UK department or public sector body which is funding or sponsoring research done in a Public Sector Research Establishment has a responsibility to ensure that, as well as achieving its own research objectives, it respects and contributes to the need to maintain the sustainability of this part of the research infrastructure. (R1, R2)

4.17 The central principle here is that those who use the research infrastructure should leave it as healthy as they found it, and they should not (for example) seek to gain a short-term financial advantage in a way which damages the future sustainability or effectiveness of UK science. Such funders and sponsors therefore have to balance their legitimate desire for efficiency and value for money (and the best deal they can get) with the longer-term needs of the research infrastructure.

4.18 In practice this comes down to three main requirements:

- i. (for major funders) being willing to discuss their longer term strategic needs with the PSRE and / or its parent and to collaborate in defining future needs and investment strategies (strategic partnerships) so that changes in their needs do not unduly distort the programme or lead to unplanned or discontinuous requirements for new investment or restructuring (R1, R2);
- ii. being willing to pay the appropriate full economic cost of the work they commission (R9);
- iii. being willing to act collaboratively with other funders and sponsors to encourage healthy competition that recognises cost-for-quality criteria and does not act to impair the sustainability of the Science and Engineering Base (R4).

* see footnote 406



Steering Panel Members

Sir David King, Government Chief Scientific Adviser – Chair

Professor John Beddington, Imperial College and Chair of Defra’s Science Advisory Council

Dr Bernie Bulkin, UK Sustainable Development Commission

Professor Sally Davies, Department of Health

Sue Duncan, Government Chief Social Researcher

Professor Roy Haines-Young, University of Nottingham

Professor Brian Hoskins, University of Reading

Professor Brian Legg, former Director of the National Institute of Agricultural Botany

Professor Georgina Mace, Institute of Zoology

Professor Quintin McKellar, Royal Veterinary College

Professor Susan Owens, University of Cambridge

Professor Jane Plant, Imperial College

Professor Donald Ritchie, University of Liverpool and Deputy Chair, Environment Agency

See Annex 11 for detailed information on the Steering Panel.

Defra representatives attending and participating in the Panel meetings:

Professor Howard Dalton, Defra Chief Scientific Advisor

Dr Miles Parker

Dr Sarah Ball

Dr Emily Thompson

OSI Review Leader and Steering Panel Secretary:

Dr Andrew Kruszewski

Lead Consultants from Arthur D Little:

Dr David Brown

Richard Granger

David Lyon

Dr John Murlis

Bryony Webb



List of organisations providing written evidence

Introduction

1. In January 2005, a consultation document was sent to over 350 Defra stakeholder organisations and published on the OSI web-site.
2. In total, we received written evidence from 63 organisations, as listed in the table below. None of those contributing has objected to their responses being made public and, on completion of the review, submissions of evidence are being posted on OSI’s web-site at: <http://www.dti.gov.uk/science/science-in-govt/works/science-reviews/review/defra/page24808.html>
3. A summary of the written responses is provided at Annex 1 of this report.

Organisation Name	Acronym
Advisory Committee on Packaging	ACoPack
Advisory Committee on Pesticides	ACoP
Applied Research Forum for Farming and Food	ARF
Biosciences Federation [: incl. Institute of Biology]	BF
Biotechnology & Biological Sciences Research Council	BBSRC
British Aggregates Association	BAAgA
British Airports Authority	BAA
British Ecological Society	BES
British Geological Survey	BGS
British Grassland Society	BGrassS
British Society of Animal Science	BSAS
British Waterways	BW
Campaign for Science and Engineering in the UK [not a formal response to the review]	CaSE
Construction Industry Research and Information Association	CIRIA
Countryside Council for Wales	CCW
Countryside and Community Research Unit, University of Gloucestershire	CCRU
Crop Protection Association	CPA
Department for Environment, Planning and Countryside, Wales [on behalf of National Assembly for Wales]	DEPC
Department of Agricultural and Rural Development, Northern Ireland	DARDNI
Economic and Social Research Council	ESRC
English Nature	EN
FARM	FARM
Flood Hazard Research Centre, Middlesex University	FHRC
Forestry Commission	FC

Organisation Name	Acronym
Game Conservancy Trust	GCT
Home-Grown Cereals Authority	HGCA
Horticultural Development Council	HDC
Institute for Animal Health	IAH
Institute of Directors	IoD
Institute of Food Research	IFR
Institute of Grassland and Environmental Research	IGER
Institute of Horticulture	IoH
Joint Nature Conservation Committee	JNCC
Laboratory of the Government Chemist	LGC
Marine Biological Association of the UK	MBA
Meat and Livestock Commission	MLC
Meteorological Office	MO
National Biodiversity Network Trust	NBN
National Farmers' Union	NFU
National Horticultural Forum	NHF
National Institute for Agricultural Botany	NIAB
Natural Environment Research Council	NERC
Natural History Museum	NHM
Office of Water Services	OFWAT
Prospect	P
Roslin Institute	RI
Rothamsted Research	RR
Royal Entomological Society	RES
Royal Geographical Society	RGS
Royal Society	RS
Royal Society for the Prevention of Cruelty to Animals	RSPCA
Royal Society for the Protection of Birds	RSPB
[Defra] Science Advisory Council	SAC
Scottish Environment Protection Agency	SEPA
Scottish Executive Environment and Rural Affairs Department	SEERAD
Scottish Natural Heritage	SNH
Society for General Microbiology	SGM
Soil Association	SA
Sustainable Development Commission	SDC
UK Water Industry Research	UKWIR
Veterinary Laboratories Agency	VLA
Zinc Information Centre	ZIC
Zoological Society, London	ZSL



Case Study Summaries

1. Five case studies were carried out to look at detailed examples of how Defra uses science, against all ten review criteria. Case study topics were chosen in consultation with the Steering Panel and Defra and the fieldwork was carried out by ADL. The topics chosen:

- Antimicrobial Resistance
- Wheat Genetic Improvement
- Soils Monitoring
- Air Quality: Particulate Matter
- Radioactive Substances and Contaminated Land

were selected primarily with the aim of covering a broad range of Defra's areas of interest:

2. The enclosed notes summarise the main findings from the case studies. Further information on the conduct of the case studies is provided in the Introduction to Annexes 4 to 8 and the findings are described in the individual Annexes 4 to 8. These are all available on the OSI web-site at: <http://www.dti.gov.uk/science/science-in-govt/works/science-reviews/review/defra/page24808.html>

3. The findings from the case studies have been used in the main report in support of the review's findings, conclusions and recommendations.

Antimicrobial Resistance

(See Annex 4 for details)

Antimicrobial resistance (AMR) is the ability of micro-organisms to resist agents intended to kill them, such as antibiotics. Increasing use of antimicrobials to treat farm animals and to promote their growth has been linked to increasing resistance in both animals and humans. Research done principally in other Member States informed EU policy and led to an EU-wide ban on the use of the antimicrobials as growth promoters. Defra then launched its AMR research programme a part of which was aimed at further developing the evidence base for public health policy.

The programme content has been largely driven by the reports arising from the House of Lords Select Committee on Science and Technology “Resistance to antibiotics and other antimicrobial agents”, the Advisory Committee on Microbiological Safety of Food “Microbial Antibiotic Resistance in Relation to Food Safety” and what researchers and policy customers believed were the priority recommendations within those reports, rather than by developing a separate overall science strategy for this area. There has been no formal horizon scanning research project in the programme though some of the work is itself horizon scanning in nature.

The programme is a good example of effective mechanisms for coordination across Government and other bodies. The chief mechanism is the Defra Antimicrobial Resistance Co-ordination (DARC) group, whose membership includes a wide range of Government bodies with interests in AMR. The group provides oversight, direction and validation of the research programme, as well as a link between the animal and human health communities. It also identifies possible knock-on effects of policies for different parts of the UK and helps to avoid duplication of research effort.

The programme is directed and funded on behalf of the Veterinary Medicines Directorate and Animal Health & Welfare Directorate. Both halves of the programme are managed by a single AMR Programme Manager, which helps to avoid duplication. The commissioning process follows the Defra Science Handbook. Researchers submit concept notes, enabling the scientific community to have input into the identification of research requirements. Tenders are peer reviewed, with the final choice resting with the relevant policy customer.

Defra uses appropriate processes to ensure quality and relevance, including close project supervision, independent peer review, and periodic programme reviews. The specialised and multidisciplinary nature of AMR research can mean that there may be few potential peer reviewers with the necessary independence and breadth of expertise; hence Defra may use multiple reviewers to cover a single project.

Defra is now looking at improving the evaluation of projects for fitness for purpose. It recognises that this could be done more effectively.

The programme has not yet led to major policy developments; rather, the results to date provide no evidence to suggest there needs to be a change of the original policy on the responsible use of antimicrobials in agriculture including the EU ban on certain uses of antimicrobials. Defra will continue to review its AMR policy in the light of the research outcomes.

Defra is to be commended for its encouragement of open publication of results, for example through the DARC group website. However, it is not so active in promoting public debate on the implications of the results.

Wheat Genetic Improvement

(See Annex 5 for details)

Crop genetic improvement is being used to produce crops which have improved characteristics such as disease and pest resistance and nutrient-use efficiency, leading to reduced environmental impacts and furthering the sustainable development of agriculture. The case study focuses on one of the satellite projects of the Wheat Genetic Improvement Network (WGIN), and on an associated LINK project. WGIN, one of five Crop Genetic Improvement Networks, promotes a close working relationship between researchers and industry.

The rationale underpinning this investment is one of market failure. This rationale has been clearly set out, perhaps in part because it contrasts with a more tightly policy-focused approach elsewhere in the Department. Defra has recognised the adverse effects of former policy on withdrawal from near-market research, which left a large gap between research and application and resulted in poor industry-research base links and poor knowledge transfer. Defra's involvement in plant breeding research is able to help rectify this situation, provided it is accompanied by measures to address the demand side by providing "market pull" in the form of clear economic signals and market incentives to encourage commercial uptake of more sustainable varieties. The research provides the "science push" to produce these varieties, leading to material that industry can use in its breeding programmes.

The case study illustrates aspects of good practice in collaboration with Research Councils, linkages with industry and levy bodies, the use of scoping studies, and use of complementary overseas science. The rationale for forming GINs has been well thought out by Defra and its advisors: they are an excellent example of how Defra has put in place a mechanism to bring industry to the table and get it to pay attention, and they are valuable for enhancing co-operation and engagement between industry and the research base. However, there is concern among some external stakeholders that this could be threatened by organisational changes in Defra, changes in funding priorities, or insufficient attention to long term research strategy.

The work on wheat is likely to benefit both policymakers and business. Its primary aim is to influence industry as distinct from supporting policy formulation. Changes in industry attitudes towards plant-breeding for sustainability, and better co-operation between industry, government and researchers, have been the greatest impacts of the project and the associated dissemination mechanisms.

The WGIN facilitates the inception of LINK and other projects in two ways. First, it provides a forum for discussion and dissemination of information to researchers and for industry it has greatly improved co-operation, industry involvement and articulation of industry needs, though further progress is still required. Secondly, it provides research to address the ideas coming from these discussions. The WGIN employs several mechanisms to communicate findings to a wider audience, while the LINK programme has furthered co-operation between industry members and the dissemination of science to industry.

Both the WGIN and LINK programmes have been effective in developing scientific expertise by encouraging dialogue and cooperation. The WGIN facilitates LINK projects by initiating research and alerting industry to new ideas, while the LINK programmes achieve greater dissemination to industry.

Soils Monitoring

(See Annex 6 for details)

The quality of air and water has long been a concern in the UK but the quality of soils has until recently been relatively neglected as an environmental issue. In particular, there has been a lack of good up-to-date information about the current status of soils and trends in soil status. However, in 2004, Defra published a Soils Action Plan containing a commitment to the development of indicators to be built into a national soil monitoring scheme. This case study considers the scientific work done to underpin the development of indicators for Soil Organic Carbon or Soil Organic Matter.

Defra's aims for soils monitoring are clearly set out in the Evidence and Innovation Strategy. These include developing indicators that will enable Defra to understand changes in soils as an input to the development of policies for halting the decline of soil quality. The work on indicators commissioned by the Soils Unit therefore tends to be focussed on policy development needs. Some external interviewees felt that Defra should take on a wider remit and contribute through its research funding to a broader understanding of soils in the UK.

There are clearly challenges for Defra in assimilating current knowledge, given the volume and diversity of the relevant scientific outputs. This challenge has been addressed in the work on soils indicators through the formation of the UK Soils Indicators Consortium (UK SIC), a group of stakeholders with interests in soil policy, which oversees the development of indicators, and through the commissioning of regular reviews. When new work is needed, Defra's research commissioning processes follow the Departmental Guidelines closely. The interviewees considered the projects to be well managed; specifications are fixed once agreed, there is good progress monitoring and the publication of completed work is encouraged.

Defra is seen to have been successful in ensuring the quality of its work and the peer review system now in place is recognised as effective. The Soils Unit takes a highly collaborative approach to the commissioning process, with wide stakeholder involvement through UK SIC. Some external interviewees still feel that the focus on shorter-term policy needs can make it unclear how a new piece of work fits into the existing portfolio of projects.

The opinion was also expressed that more could be made of research results, particularly where they may have relevance to a wider group of stakeholders, such as the farming community. Nevertheless, there are examples of highly effective use of research, for example the Loveland report "Identification and development of a set of national indicators for soil quality".

The number of experts in soils monitoring has diminished in recent years and Defra plays an important role in developing a network of soils scientists. However, some commentators feel that crucial expertise is being lost and that Defra should increase its role in maintaining the soils science community.

Air Quality: Particulate Matter

(See Annex 7 for details)

This case study examines the development of the evidence base used for reviewing and revising the air quality objectives for particulate matter (PM) which is the most serious cause of air quality-related health impacts. PM is managed within the UK Air Quality Strategy, the framework for the management of major pollutants in the UK. As part of the strategy review, Defra's Air and Environment Quality Division (AEQD) reviewed the objectives for each pollutant. This was supported by the research programme to assess air pollution emissions, environmental processes and effects, and routine networks for monitoring air pollution. Defra has formed a number of advisory bodies to provide support, including the Air Quality Expert Group (AQEG) which advises Defra on air quality issues generally, including current sources and trends of air pollutants, the fitness for purpose of models used for predicting future levels and research requirements for the development of PM policy.

The strategy for PM work in AEQD is clear and the scope was managed to ensure that resources are targeted towards problems of immediate concern. This is done at the expense of a more comprehensive approach to PM evidence. As the issue of PM is so complex, Defra has had to find ways of integrating the information from different sources into the policy process. Expert groups play a major part in this. Crucially, the management of PM pollution depends on close co-operation between Government Departments.

Defra officials feel the need to widen the boundary around their research to include human factors, particularly in assigning priorities within AQ Strategies and in assessing potential for behavioural change and the factors that drive it. Defra relies on inputs from other parts of Defra to supply economic analysis and social intelligence. The input of the Defra economists is considered very important in developing policies and well matched to other work on PM, but it has been suggested that economists in some Other Government Departments (OGDs) are more concerned with cost burdens on industry and tend to discount the environmental benefits.

AEQD policy customers are involved in developing specifications for new science. A Research Requirements Committee, convened by AEQD with membership drawn from OGDs and delivery agencies, meets annually to consider the AEQD research programme and the potential for synergy with OGDs. Much of the work commissioned is subject to peer review through publication processes; AQEG experts provide a further level of review. The guarantee that research will be fit for purpose is the close relationship between the commissioning officials and the policy customers.

As a result of the complexity of the scientific evidence and the potential for contentious results, Defra has relied heavily on external expert advice to draw conclusions from research data. For example a new approach to PM management, based on reducing the population's exposure to PM rather than limit values, came from a National Society for Clean Air initiative. This illustrates Defra's willingness to respond to new evidence and suggestions.

Publication requirements arise from Defra's policy needs. All data produced is publicly available and where possible there are commentaries on the results. The main route for public debate on the information provided to AEQD is the Air Quality Forum. This is a stakeholder group and while it is generally accepted that Defra has a good record in publishing its PM work, there is a more mixed view of the influence of Defra's public information in forming public opinion on air pollution.

AEQD has ensured that the results of its work are widely accessible, but there is no formal knowledge management system. Knowledge is shared well within the scientific communities but there appears to be weaknesses in the way results are shared with OGDs.

At present, the strength of the scientific communities involved in AQ research is considered to be good. Internally the pace of development of the AQ policy agenda and turnover of key staff has left officials stretched. The level of funding available to Defra for true research (as opposed to monitoring) is now much reduced. This has a bearing on succession planning.

Radioactive Substances and Contaminated Land

(See Annex 8 for details)

The Radioactively Contaminated Land (RCL) case study examines the evidence base for developing systems for identifying and remediating historical radioactive contamination. It illustrates how an evidence gathering strategy (based around scientific research and advice) is used in Defra's Radioactive Substances (RAS) Division to inform the transposition of international requirements into UK law and ensure that they are interpreted in a manner that is clear and legally enforceable. The case study demonstrates some of the mechanisms by which Defra assimilates a wide range of existing knowledge and produces models that fit well with existing approaches to dealing with contaminated land. The focus of the study is on the development of the Radioactively Contaminated Land Exposure Assessment (RCLEA) model, and the work of the Steering Group. The work of this group informed Defra's formal letter to the National Radiological Protection Board (NRPB). The response from the NRPB was publicly disclosed and informed the proposed regime.

The RAS strategy ensures that initiatives are consistent with existing management regimes for contaminated land and with established principles of radiological protection. This is reflected in the RCL programme and ensured that different approaches for managing contaminated land fit closely together. A further aspect of the wider science strategy is the use of risk-based approaches to inform the development of new regimes: The Steering Panel for the RCL programme screened approaches on which a robust strategy could be formed. Members discussed the level of certainty in the data and perceptions of acceptable levels of risk. There is less evidence of social research to understand and meet stakeholder concerns; this has been developed in other RAS initiatives such as the Committee on Radioactive Waste Management.

The RCL programme contained work to review existing science and identify gaps. This included papers and work packages prepared for the Steering Group, both of which demonstrate understanding of the extensive research conducted by leading international bodies. Access to these data was enhanced by the active involvement of experts having relevant international experience in the Steering Group. Gaps in research were identified at the first Steering Group meeting when the members suggested several work streams based on critical issues related to RCL. Work stream reports were produced and presented back to the Steering Group for endorsement or revision. Similarly the development of the RCLEA model also involved the review of background materials on related models and radioactive waste management.

Consultants, selected through a competitive process and retained under a research management contract, were commissioned to support the Steering Group and to provide scientific advice and support throughout the RCL programme.

To develop the scope of work for the development of RCLEA, Defra obtained experienced, independent support which provided detailed guidance on the specification and ensured submissions were closely aligned with the needs of the programme. The work was let by competitive tender and a Defra project manager provided a strong link between Defra and the contractors; the contractors also benefited from having a knowledgeable client.

The methodology for developing the RCLEA model is clearly articulated. The methodology report discusses each of the key assumptions and the approach for developing the calculation. Periodic progress updates were provided by the contractor. The audit trail in the development of the model enables external stakeholders to assess the quality of the science, based on the data and assumptions. The methodology behind the RCLEA model was also subject to extensive review. This included peer review from the Steering Group and regular reviews by the Defra technical lead.



Acronyms

ADL	Arthur D Little
AHW	Animal Health & Welfare
BBSRC	Biotechnology & Biological Sciences Research Council
BSE	Bovine Spongiform Encephalopathy
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEO	Chief Executive Officer
CoRWM	Committee on Radioactive Waste Management
CPD	Continuous Professional Development
CSA	Chief Scientific Adviser
CSAC	Chief Scientific Adviser's Committee
CSL	Defra Central Science Laboratory
Defra	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DG	Director(ate) General
DoH	Department of Health
DTI	Department of Trade and Industry
DTLR	Department of Transport, Local Government and the Regions
EA	Environment Agency
EBP	Evidence Based Policy
EBPM	Evidence Based Policy Making
E&IS	Evidence and innovation strategy
ERFF	Environment Research Funders' Forum
ESRC	Economic and Social Research Council
EU	European Union
FEC	Full economic cost
FMD	Foot and Mouth Disease
FP	EU Framework Programme

GECC	Global Environmental Change Committee
GCSA	Government Chief Scientific Adviser (i.e. Sir David King)
GM	Genetic modification / Genetically modified
HEI	Higher Education Institutions
HS	Horizon scanning
IPR	Intellectual Property Rights
MAFF	Ministry of Agriculture, Fisheries and Food
NDPB	Non-Departmental Public Body
NERC	Natural Environment Research Council
NGO	Non-Governmental Organisation
OGD	Other Government Department
OSI	Office of Science and Innovation (formerly OST)
OST	Office of Science and Technology (now OSI)
PSRE	Public sector research establishment
QA	Quality Assurance
QC	Quality Control
QQR	Quinquennial Review
RC	Research Council
R&D	Research & Development
RELU	Rural economy and land-use programme
RI	[Research Council] Research Institute
RIA	Regulatory impact assessment
RIPSS	Research Institute & Public sector research establishment Sustainability Study
ROAME	Rationale, Objectives, Appraisal, Monitoring and Evaluation
ROAMEF	As for ROAME but with the addition of Feedback [into policy]
RPG	Research Priorities Group
SAC	[Defra] Science Advisory Council
SFF	Sustainable Farming and Food
SRT	OSI Science Review Team
TSEs	Transmissible Spongiform Encephalopathies
VLA	Veterinary Laboratories Agency



Glossary

Term	Definition
Aims	High-level, strategic objectives.
Appraisal	A review of proposals for a piece of work, prior to its being started, when deciding whether or not to proceed.
Capacity/capability maintenance	Maintaining sufficient capacity / capability in a department to ensure that the department's science needs can be adequately addressed.
Chief Scientific Adviser (CSA)	The person accountable to the Secretary of State and Ministers for science procurement and advice within a department.
Evaluation	An independent, constructive analysis of the impact, efficiency and appropriateness of a policy, programme or other activity: in most cases ex-post, i.e. after completion.
Horizon scanning	The systematic examination of potential threats, opportunities and likely future developments, which are at the margins of current thinking and planning. Horizon scanning may explore novel and unexpected issues, as well as persistent problems or trends. Overall, horizon scanning is intended to improve the robustness of policies and the evidence base.
Knowledge transfer	The processes by which knowledge and ideas move from the source of knowledge / science to other [potential] users of that knowledge.
Monitoring	Assessment/management of a piece of work while it is being done.
Outcome	What happens as a result of a piece of work, e.g. economic or social benefits to the UK.
Output	The product(s) of a piece of work, e.g. reports.
Peer review	Assessment of research proposals and outputs by peers.
Policy	The translation of government's political priorities and principles into programmes and courses of action to deliver desired change (including regulation).
Policy-maker	A person or organisation charged with assisting a decision-taker in reaching a decision by providing policy analysis, generating policy options, or by conducting a risk assessment.
Project	A single, self-contained piece of work with fixed timescale and dedicated budget.
Programme	A set of organised but often varied activities (projects, measures or processes), directed towards the achievement of specific operational objectives.
Rationale	The reasons for supporting an activity, e.g. expected social or economic benefits.

Term	Definition
Research	Systematic study directed towards fuller scientific knowledge or understanding of the subject studied.
Science	For the purposes of this Review, 'science' encompasses all branches of science including social and natural sciences, research, data collection, and monitoring. Natural Science: deals with the physical world, e.g. physics, chemistry, geology, biology. Social Science: deals with the study of society in general, the factors motivating the behaviour of humans within that society, and the results of such behaviour, e.g. economics, psychology and sociology.
Stakeholder	A person or organisation representing the interests and opinions of a group with an interest in the outcome of the review or policy decision.
Sustainable development	[Economic and social] development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Targets	Activities (usually measurable) whose achievement will indicate that objectives are being met.

