

Programme Area Reviews of Research and Development

Report on a Review of the Water Quality Programme

Science Connections Ltd

R&D Note 359



NRA

National Rivers Authority

NATIONAL RIVERS AUTHORITY
PROGRAMME AREA REVIEWS
OF RESEARCH AND DEVELOPMENT

Report on a Review of
Water Quality Instrumentation and
Related Data Processing

Science Connections Ltd
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Wiltshire

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ENVIRONMENT AGENCY



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Statement of Use

This report is to be used by Water Quality function staff and the NRA's R&D Section to guide the management of the NRA's Water Quality R&D programme, in particular the Topic R&D programme in Instrumentation and Field Techniques.

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PROGRAMME AREA REVIEWS OF NRA RESEARCH AND DEVELOPMENT INTRODUCTION BY HEAD OF R&D

The NRA has a Statutory Duty under the Water Resources Act, 1991 to undertake research in support of its functions. Its R&D programme has now been in operation for about five years. During this time, the NRA has restructured the uncoordinated portfolio of projects which it inherited from the former Regional Water Authorities and the DoE Water Directorate into seven commissioned programmes of business-orientated R&D. Each of its core functions has its own "commission" and one further commission contains a programme of cross-functional R&D. The commissions are further subdivided into 25 Topic Areas, within which projects of a similar theme are managed.

In order to ensure that its R&D programme both delivers the intended benefits and does this efficiently and effectively, the NRA has decided to carry out annual Programme Area Reviews on appropriate areas of the programme. This is in line with Cabinet Office guidelines for assessment of public sector R&D. This report covers one of four areas of its R&D programme in which independent reviews were carried out during 1994 in order to evaluate the effectiveness of both the outputs from the programme and the way in which the programme is managed.

This programme area review of Water Quality Instrumentation and Related Data Processing R&D was undertaken by Science Connections Limited under the direction of Dr Keith Harrap with experienced professional advice from Robert Bogue. The review was commissioned by the NRA's R&D Section and carried out in close liaison with the NRA's Water Quality function which is the research customer. Paul Williams, R&D Topic Leader for the Water Quality Topic Area on Water Quality Instrumentation and Field Techniques, represented NRA Water Quality interests.

The report sets out the approach adopted by Science Connections in carrying out the review in Section 1. The outputs and other information which were examined during the review are described in Section 2 and Appendices 3 and 7. The analysis of these is discussed in Section 3 in terms of (a) quality of research; (b) its usefulness; (c) value for money; and (d) R&D contractors. Conclusions and recommendations are given in Section 4.

The overall conclusion of the review was that the R&D programme is delivering good results which are relevant to the NRA's business. Within this overall conclusion, various recommendations for improvement or targeting of the programme and its uptake were made.

These recommendations were discussed with the NRA at a Delivery Meeting held on 28 September 1994 and an approach to reporting and implementing these agreed.

Each recommendation indicates the person or body responsible for its implementation. Recommendations concerning specific technical issues relating to the programme and its uptake will be addressed by the research customer (Water Quality Function Managers). Those covering the management of research will be addressed by the Head of R&D in conjunction with the R&D committee. Some recommendations are broader and require the support of the NRA's Environmental Managers, its Directors or its Board.

Mervyn Bramley
Head of R&D

January 1995

Water Quality

EXECUTIVE SUMMARY

- The R&D undertaken in the Instrumentation and Related Data Processing (A4) Topic of the Water Quality Commission has been reviewed for NRA. The assessment process concentrated on the Evaluation of outputs, principally Projects Records and R&D Notes, from completed research projects, together with an examination of the Rationale and Objectives underpinning the Topic area. The approach specified for the Review was in accordance with the Cabinet Office ROAME principles. A commentary was also provided on the ongoing programme and some indication given of the desirable future direction of the Topic research.
- The assessment was carried out using a process of desk studies of available documentation including report outputs, and interviews of NRA staff and others involved directly or professionally with the content of the Topic programme. Evaluation of the outputs was undertaken primarily by a Technical Expert nominated by NRA. The overall management of the assessment, together with appraisal processes, management aspects, uptake, and overall delivery of the research in the Topic area, was provided by the Review Team from Science Connections.
- The Evaluation of the research was undertaken in a structured way in which each project was scored according to a number of parameters grouped in three broad criteria areas. Notes on the technical content of each project were also provided in support of the scoring process. This Evaluation of the individual projects then provided a programme overview to satisfy the need to assess the effectiveness, efficiency, and quality of the Topic area programme overall. A report was drafted outlining the Review task and its methodology, the information retrieved through interview and desk study, the analysis of the resulting findings, and development of recommendations. Components of the draft report were then presented to a Delivery Meeting of mainly NRA attendees, at which feedback was provided for incorporation into a final report.
- Overall, the Evaluation of the project outputs led to a favourable view of the programme and there were no fundamental causes for concern. Even allowing for the fact that several projects were inherited at vesting, most were a success and results were used. Projects matched NRA's policy and statutory requirements well and, in the main, objectives were well defined and attainable. Reports were usually well written and clear. The relatively few projects that did not score highly on these parameters did not significantly change the overview of the programme.
- Value for money was difficult to determine as financial data for comparative purposes were not always available. When they were, projects generally scored well though there were notable exceptions. More specific and detailed analysis of the impact of a selected number of R&D projects would be beneficial so that improved methodologies for determining value for money of NRA R&D in this Topic area (and others) could be defined.

- The impression of the present Topic programme was also very satisfactory. It was seen to comprise a well focussed selection of directly relevant projects covering many important and emerging technologies in instrumentation. A number of projects built on earlier research and addressed highly relevant issues. The Topic area could, with advantage however, embrace a small amount of more speculative R&D of a longer term nature and, as implied above, address through specific projects the issue of cost-effectiveness - a stated objective of the Topic area programme. Some further indications of R&D activity in the future programme were also provided.
- From a management standpoint the Commission, through its four defined business areas, addresses the appraisal and ownership of R&D projects effectively. It was found that at an operational level, however, some aspects of this appraisal process were not always sufficiently well rooted in practicality. The mechanistic procedures, especially for initiating projects, were also an area for some criticism.
- Take-up of R&D outputs is well specified at a managerial level through reliance on the business groups tasked with ownership of the R&D project at the appraisal stage. Criticisms were voiced however at the operational level. This was in spite of the fact that from a technical standpoint the usefulness parameters generally scored well. Whilst accepting that many organisations demonstrate a reluctance to accept change, the unease at the user level appeared to be due to uncertainty about communication channels and, as a result, the need for the user to act individually. This is surprising in view of the underpinning importance of instrumentation for the achievement of many of NRA's objectives.
- Some concerns were expressed about the state-of-the-art professional capability in NRA in relation to certain projects in the Topic. A perceived heavy dependence on research contractors caused some unease, even though overall the use of research contractors was undertaken well. Although the point was noted, and performance here should be closely monitored, the existence of an external advisor to the Topic area and the developing responsibilities of the new National Water Quality Centre for Instrumentation are both positive factors that should serve to allay any concerns.
- Although a number of recommendations are made in relation to this Topic area, the view overall is that Water Quality in NRA is getting what it wants from the Topic and the Commission has itself achieved a good level of awareness of what is required. With the possible exception of uptake issues therefore, the recommendations generally represent fine-tuning to further improve a successful Topic programme.

- The following recommendations are made as a result of this Review:
- (1) *Input must be sought much more actively from end users* in NRA both at the appraisal stage and implementation stages of instrumentation R&D in order to transfer technology effectively. To assist in this the strategy for use of Water Quality Monitoring Field Instrumentation must be published as soon as possible and *an appropriately constructed user group should be formed*, perhaps fostered by the new National Centre. Its membership must be drawn both Regionally and along a vertical axis in NRA in order to involve personnel ranging from policy-makers to field operators. (2.3.6, 3.2.15, 3.6.5, 3.6.7, 4.1.7, 4.2.3, 4.2.4, 4.2.7) (Action: Function; National Centre)
- (2) NRA must ensure that R&D outputs are made available to all directly interested internal parties in an appropriate form. Report distribution should be carefully targetted, greater awareness created of other forms of R&D output that are presently available, and other user-orientated procedures enhanced. (2.3.5, 2.4.4, 4.2.7) (Action: R&D; Function)
- (3) NRA must establish a strong awareness of, and familiarity with, sensor and instrumentation research, product development, and manufacturing industry priorities on a global basis. This will assist in defining new R&D programmes as well as ensuring that NRA is conversant with, and operating at, the technological leading edge. In this regard the future Topic programme should feature a small element - say 10 to 15% - of more speculative and longer term R&D as in a fast developing field such speculative work rapidly becomes tactical and applied. The National Centre or a Director such as the Chief Scientist could be an appropriate customer for such speculative research if a business function were not immediately interested. (3.4.7, 3.5.2, 3.5.4, 4.1.13) (Action: R&D; Function)
- (4) Potentially relevant technologies that have been investigated but not taken up should be reappraised on a regular basis taking into account subsequent research and commercial developments. (3.2.14, 4.1.14) (Action: R&D)
- (5) NRA should be aware of the many potential research contractors that exist in the UK and elsewhere that offer services relevant to this Topic. It should establish a database of these and their particular expertise. (3.2.20, 3.4.4, 3.4.7) (Action: R&D, National Centre)

WIDER R&D IMPLICATIONS

- (6) In commissioning and managing research projects effort should be maintained to:

- *define project objectives clearly and ensure that they are realistically attainable;*
- *ensure that any relevant earlier work, whether in the UK or overseas, is taken into account;*
- *monitor progress closely and terminate a project if its objectives cannot be met;*
- *when appropriate commission several shorter, lower cost projects rather than one large project;*
- *ensure that the research contractor is tasked to explain how the project's findings can be implemented.*

Many of these features represent sound management practices but they are especially relevant to R&D. Most are already identified in the R&D Project Management Manual. (3.2.8, 3.2.19, 3.3.5, 4.1.4, 4.1.5) (Action: R&D)

- (7) In certain instances the take-up of R&D project outputs requires *the undertaking of an adaptive research project the aim of which is to bring about operational use of a new methodology or product*. Much greater use should be made of such an approach in particular when field operators and researchers need to be brought together and additional short-term resources are needed to implement the results in a particular location or Region. (2.3.3, 3.6.5, 3.6.7, 4.2.4) (Action: Function; R&D)
- (8) The *management procedures* through which R&D has to be carried out are too mechanistic and *need reassessment* so that necessary elements are retained and appreciated and unnecessary procedures such as re-authorising work at Regional level are abandoned. It must be clear to everybody involved who takes decisions, where responsibility lies, and what the responsibility is. *The R&D Co-ordinators have a crucial on-the-job function in this respect so they should be fully involved in any reassessment*. (3.6.1, 4.2.2) (Action: R&D)
- (9) Selecting, appointing, rewarding, and training of Project Leaders and thereafter maintaining their enthusiasm and commitment needs more attention. The recognition of the importance of R&D projects to NRA and the rewards

associated with their management are key elements of any such underpinning and support to the Project Leader. Time availability is often a key constraint for Project Leaders so it is important that demarcations between operational and R&D responsibilities are neither so marked nor incompatibly paced. The commendable principle of a *matrix approach to delivering R&D project management needs to be actively supported by constantly reinforcing awareness of R&D and its intrinsic value to NRA function responsibilities from the most senior level of management* (3.6.2, 3.6.8, 4.2.3, 4.2.7) (Action: Function; R&D; Board)

- (10) Carefully specified studies should be undertaken on the operational, scientific/technological, and financial benefits of selected R&D projects so that model procedures can be derived for assessing impact and value for money. Studies of this type will help to underpin and endorse the importance of the R&D effort to the objectives of NRA overall. (3.6.5, 4.2.4) (Action: R&D)
- A practical programme for implementing these recommendations should be agreed with the Water Quality function and R&D Committee taking into account the opportunities and requirements for reorganisation of the R&D function with the development of the Environment Agency.

1. CONTEXT AND CONDUCT OF THE REVIEW

1.1 SCOPE AND EMPHASIS

1.1.1 NRA required a Review of its research and development (R&D) work in Water Quality Instrumentation and Related Data Processing which was based on Cabinet Office guidelines for the assessment of public sector R&D. Such guidelines encompass the ROAME principles of Rationale, Objectives, Appraisal, Monitoring, and Evaluation.

1.1.2 The prime requirement of the Review as stated in the terms of reference (see Appendix 1) was to cover Evaluation of R&D project outputs from work undertaken since "vesting" whilst also addressing the Rationale and Objectives of the R&D. NRA is said to have reasonably well established procedures to determine these two latter components that are designed to ensure that projects address the strategic or operational needs of the core functions of the business.

1.1.3 Because NRA R&D programmes are set largely by internal dialogue between core function business groups (as customers) and the R&D Topic Leaders (tasked with R&D supply), it is the intention that NRA R&D responds to a strong business remit of function activities. These are set out in the published core function strategy documents.

1.1.4 In view of the time and effort invested integrating R&D projects into the business needs of NRA, a particular emphasis required from the Review concerned the dissemination, take-up, usefulness, impact, and value for money (vfm) aspects of the research outputs. It is for this reason that the Evaluation (or ex-post) component of the ROAME principles was particularly stressed.

1.1.5 Evaluation work however is facilitated by clear Appraisal (or ex-ante) processes undertaken at the initiation of research projects. This appraisal is in turn dependant on having clear rationale and objectives for the research endeavour. This aspect represents the second emphasis given in the terms of reference for the Review.

1.1.6

The objectives of the Review were to assess:

- Effectiveness of achieving (i) Programme objectives and (ii) anticipated benefits
- Effectiveness of targeting the Programme in relation to (i) the NRA actual needs and (ii) the base of existing scientific knowledge
- Quality of the scientific innovation in the Programme
- Efficiency of the Programme in achieving of its objectives and whether Value for Money is being obtained

and to identify:

- Follow up action either to alleviate particular problems or to learn lessons for the planning and management of the future R&D Topic Programme.

1.1.7

To assist with the assessment of the quality of science and innovation in the Topic, a Technical Expert nominated by NRA was involved who was recognised in and conversant with water quality instrumentation matters. His prime responsibility was to evaluate the project outputs provided as reports designated either as R&D Notes or Project Records.

1.1.8

In early discussion with NRA it became apparent that there was interest in a commentary on the present R&D programme and its likely future direction. This was of interest in addition to the strict assessment of R&D effort that had already been undertaken and reported on in the project outputs provided.

1.1.9

The Topic Programme Review was required to retain a general overview of the sector and not lapse into a series of detailed reviews of individual projects. Furthermore it had to be set within the context of any related R&D being pursued outside NRA. The overall objective was to learn from successes and mistakes (or problems) and for this to be fed into future Programme direction. This should improve the overall shape and delivery of R&D in NRA and help to ensure that its anticipated benefits are effectively implemented.

1.2 METHODOLOGY

1.2.1 The Review was managed by Dr Keith Harrap of Science Connections Ltd assisted by Dr John Montague. In addition to the Review management role they assessed R&D project appraisal, project delivery, and take-up aspects. As indicated a technical/scientific evaluation of the outputs of the research in the Programme was undertaken by a Technical Expert - Mr Robert Bogue. This evaluation was done in a pre-determined and structured way.

1.2.2 By analysing project outputs usually in the form of Reports or R&D Notes, (amplified when appropriate by discussion/interview with Topic Leaders, Project Leaders, or research contractors) individual projects were scored on a + 2 to - 2 classification. The score markings can be interpreted as follows:

-	Excellent/High	+2
-	Good or Sound	+1
-	Fair/Some doubts or flaws	-1
-	Poor or seriously flawed	-2

The scorings were applied to a number of chosen parameters grouped under the broad criteria of quality of research, usefulness of research, and value for money. A pro forma of the assessment scheme used is provided in Appendix 2. Individual project scores were then assembled into an overall tabulation so that patterns of performance emerged for the programme overall.

1.2.3 To assess the rationale and objectives of the Programme and the way in which individual projects were appraised, the R&D project cycle initiation in NRA was carefully analysed in discussions with Topic Leaders. Particular attention was paid to needs identification, the way in which these needs were articulated to specify R&D projects and at the end of the cycle the way in which the results of the R&D project were fed into the NRA business areas so that the originating needs were satisfied.

1.2.4 In undertaking both the output evaluation and the appraisal aspects of the assessment work a number of internal documents were examined. These included the business area strategy, position papers, topic investment appraisals and project initiation documents. The documentation reviewed during the assessment is listed in Appendix 3. To facilitate the technical evaluation of the research outputs in particular, archived information from NRA Head Office or Regional Offices was obtained in order to inform the Technical Expert on the origination of the projects whose outputs were being evaluated.

- 1.2.5 In both appraisal and evaluation areas interviews were undertaken with the Topic and Project Leaders, with the Commissioner, and other staff involved, both face to face and by telephone. A list of people interviewed is provided in Appendix 4 and the interview structure used in Appendix 5.
- 1.2.6 A report was drafted addressing *inter alia* particular points at the Programme Area level identified by NRA in the terms of reference for the Review. Key findings set out in this draft report were presented at a Delivery Meeting in order to obtain feedback from those involved within NRA (and in certain instances outside it) so that this could be taken into account prior to the drafting of a final report incorporating recommendations.

2. INFORMATION RETRIEVED

2.1 NEEDS APPRAISAL

2.1.1 The principal aims of the NRA in relation to Water Quality, within its duties and powers, as set out in its Water Quality Strategy, are to:

- achieve a continuing overall improvement in the quality of rivers, estuaries, and coastal waters through the control of pollution;
- ensure that dischargers pay the costs of the consequences of their discharges.

In order to achieve these aims, NRA has to seek to:

- maintain waters that are already of high quality;
- improve waters of poorer quality;
- ensure all waters are of an appropriate quality for their agreed uses;
- prosecute polluters and recover the costs of restoration from them;
- devise charging regimes that allocate the costs of maintaining and improving water quality fairly and provide incentives to reduce pollution.

2.1.2 Effective regulation depends on statutory water quality objectives (SWQOs), regulation of continuous and intermittent point sources of pollution, identification and prevention of diffuse sources of pollution, and the control of developments.

2.1.3 Historically, the assessment of water quality is undertaken as a result of monitoring involving the collection and analysis of samples. In NRA terms, monitoring is regarded as an activity carried out to demonstrate compliance whilst surveillance is carried out to determine the general status of water quality. In addition to these two, sampling activities are also undertaken in order to assist investigations.

2.1.4 Such activities and responsibilities are described in the NRA Water Quality Strategy. They derive from, in particular, The Water Resources Act 1991 under which the NRA has statutory duties and responsibilities relating to the quality of the aquatic environment which are both general and specific. NRA has general environmental duties in relation to all its functions including the need to further and promote conservation. NRA is specifically responsible for water quality in all controlled waters. Controlled waters comprise:

- surface freshwaters;
- underground waters;
- coastal waters to the 3 mile limit in England and Wales.

The NRA is also given a role under other legislation as a consultee in relation to waste disposal, site licencing, planning permission and so forth.

2.1.5 There are many other bodies and organisations which have a role to play in improving the water environment. Effective liaison with them is a requirement for the success of the NRA Water Quality strategy. They include:

- Commission for the European Communities;
- Department of the Environment;
- Ministry of Agriculture, Fisheries and Food;
- Her Majesty's Inspectorate of Pollution;
- Office of Water Services;
- Drinking Water Inspectorate;
- water companies;
- the NRA Statutory Regional Committees;
- local authorities;
- English Nature and Countryside Council for Wales;
- industrial and trade associations;
- angling organisations and water recreation groups;
- the media;
- pressure groups;
- the public.

2.1.6 To support NRA in fulfilling its statutory duties and responsibilities, there is a need to develop scientific support services in order to provide an efficient service. Therefore, the NRA will *inter alia*:

- examine the potential to transfer routine measurements to field instruments freeing laboratory capacity for more complex work;

- ensure the provision of a basic routine capability for chemical, biological and microbiological analysis with areas of special expertise;

- apply new laboratory instrumentation and technology.

In this latter regard NRA has developed, and indeed has in place, automated instrumentation comprising continuous water quality monitoring stations placed at key locations and hand held monitors to take rapid accurate measurements in the field. This is an important component in resourcing the water quality strategy of NRA and the achievement of its aims, and is set out in the NRA Water Quality Strategy document.

2.1.7

For the R&D requirements in the instrumentation and field techniques Topic area (A4) the overriding aims are:

- to help to achieve a continuing overall improvement in the quality of rivers, estuaries and coastal waters through the control of pollution;
- to help to track down and prosecute, if required, the dischargers of unconsented or illegal effluents;
- to provide tools to the water quality enforcers to aid and improve their efficiency in the field;
- to evaluate existing instrumentation and field techniques and advise on best practicable means. If suitable equipment or techniques are not available, then to encourage and promote suitable R&D to fill the identified gap.

2.1.8

The rationale for the Topic aims rests on NRA responsibility for water quality in controlled waters and the statutory duties of compliance that derive from that. In general, the R&D to be undertaken in the Topic area supports "must do" water quality initiatives of:

- Statutory Water Quality Objectives;
- National water quality monitoring programme/implementation of Kinnersley Report.

NRA is also committed to the objective of providing value for money in the purpose and use of the best available instrumentation suitable for its needs. Overall, NRA has made a commitment to increase its use of instrumentation to assist in its aims to protect and improve the

aquatic environment. It has stated that it wishes to see a substantial reduction in pollution. With the proposed reduction in manpower, it is hoped that better pollution detection rates can be achieved by the use of instrumentation in the field.

2.1.9

Within this rationale, and the NRA strategic aims for water quality, the Topic has both overall and specific objectives. Overall, it is to develop new instrumentation and monitoring techniques to fulfil the NRA's business needs. Also, it has to ensure existing instrumentation is used to its optimum and such equipment is cost effective. Specifically, the objectives are:

- to develop new instrumentation where current technology is not able to fulfil the NRA's requirements;
- to develop best possible operational criteria to ensure instruments are as reliable and accurate as possible;
- to make the best use of the latest advances in instrumentation where it can be shown to have advantages over existing technologies and value for money;
- to develop instruments/operating methodologies to meet the requirements identified by the client function.

2.1.10

It should also be noted that much of the impetus for environmental legislation has come from the EC. The NRA will continue to use its technical expertise to influence the science underlying new and revised EC directives. This is a further component in the appraisal of the Topic and a strategic requirement for the type of science and technological capability that it embraces.

2.1.11

The benefits specifically stated in the R&D Topic Investment Appraisals are expected to arise from the ability to monitor for pollution incidents in real time, with the subsequent reduction in the effect on the receiving water and potential savings in the amount of remedial action required.

2.1.12

The initiation of R&D projects as components of the Topic programme has its origins in the discussion of business groups, of which there are four, in the Water Quality function. They concern:

- Statutory Water Quality Objectives;
- discharge consents and charging;
- water quality monitoring (to which Topic A4 reports);
- pollution prevention.

These business groups cover all water quality and pollution control in NRA and have Regional representation.

2.1.13 The origination of R&D in the Commission is interactive. The business groups represent top-down customer groups where the R&D requirement is largely policy driven. There is also a bottom-up approach in the form of proposals from Topic leaders, project leaders, managers and others in the function and elsewhere. All proposals have to be considered by the Water Quality Monitoring Group. This results, in the Autumn of each year, in key meetings, with R&D requirements as a principal agenda item, at which proposals are presented. Priorities matching business needs are derived from which the Topic leaders firm up a programme for prioritisation.

2.1.14 In the instrumentation topic, the Topic leader is assisted in this process by an external advisor (Mr Robert Bogue). The various business groups are quite robust in their tasking. They make the final decision so that a list of projects to be pursued has been generated that future users have already "bought into". At the end of the R&D work, the outputs achieved will therefore be submitted to the original tasking group.

2.1.15 After designation and approval of the projects as constituent components of the Topic programme, project leaders are selected. Sometimes this can be relatively tricky, though in the main people will take on the task without too much coercion. The perception is that the workload involved in such R&D projects is increasing. The Head of R&D, however, has commitment from Regional General Managers to support the Project Leader role at the Regional level. Increasingly, active and experienced Regional R&D Co-ordinators will assist the identified Project Leader in the administrative burden of getting the work started.

2.1.16 The Project Leader then writes the project initiation document (PID) (formerly the project investment appraisal (PIA)) from which the specification or terms of reference for the identified project are derived so that a contractor can be selected. Tendering is usually competitive and there has been a steady move away from reliance on one major contractor. Generally speaking, the degree of complexity

of the project is a determining feature in the selection of research contractors. They range from small instrumentation companies to universities.

- 2.1.17 Significant importance is attached at a senior level to the R&D in this Topic area and the way in which its outputs might deliver improvements in water quality and its monitoring. This has an influence on the appraisal process. On the ground, there are a range of perceptions. Some individuals cling tenaciously to the concept of sampling and laboratory analysis and this gives rise to Regional differences and emphases. Nevertheless, overall, instrumentation is regarded as being of the highest priority and to reflect this a field instrumentation use strategy has recently been drafted.

2.2 THE PROJECT OUTPUTS REVIEWED

- 2.2.1 The project outputs reviewed in the Topic area are listed in Appendix 6. They include 30 completed projects of which 25 were undertaken for operational reasons, 2 for policy reasons, and 3 for reasons of understanding. Four projects were listed as due to complete in the near future.

- 2.2.2 Work currently ongoing in this Topic area is set out in Appendix 7. The project or initiation of some of these projects was embraced in discussion with Topic and Project Leaders held during the course of the Review and some commentary is provided on it in Section 3.4.

- 2.2.3 Two projects related to instrumentation usage are being undertaken in different Topic areas of the Water Quality Commission and these are given in Appendix 8. One of these projects has not yet started. Their existence needed to be known, particularly in relation to the identification of any gaps in the programme.

2.3 TAKE-UP AND IMPACT

- 2.3.1 As stated above, within the Topic area the R&D projects commissioned are intended to have been identified by the staff representing the four business groups within the function. NRA staff, mainly drawn from the Regions, are appointed as R&D Project Leaders to supervise and manage the research. This is done to ensure that business objectives are achieved and that duplication is avoided.

Accordingly, it is pre-eminently in matters of dissemination, take-up and impact of the research that the amount of time invested integrating the research supply so closely into the business needs of the organisation should be seen to be paying dividends.

- 2.3.2 A take-up process is outlined, or at least recommended, in developing the project investment appraisal. In practice, the Topic leader reports back to the business area that specified the need for the R&D project in the first place. The Topic leader would generally give a view on what had been achieved, suggest an implementation path and ask for input. The take-up of research output is therefore intended to be through the business groups who signed up for the research supply initially.
- 2.3.3 It is at this stage that the R&D becomes operational and outwith R&D funding. However, the value of the technology generated has to be tested and this can involve work with the original R&D contractor, perhaps to produce a pre-production model. Experience in usage might also result in going back to the R&D contractor for further development work.
- 2.3.4 New instrumentation can also require a training programme if the uptake is to be successful. This has been done. However, at the end of the day the NRA Regions exercise some independent judgement and might decide against take-up of new instrumentation unless it is supported by mandatory NRA policy instructions.
- 2.3.5 At a field technical level, some staff with direct involvement as users, have never seen final reports on relevant R&D projects. This occurs even though they may be involved in implementation trials and on the basis of user experience, institute modifications to instrumentation to make it more user friendly.
- 2.3.6 There is a perception at this operational level that there is no overall implementation strategy in many instances and too much is left to individuals. In consequence, there is no mechanism to exchange experience. In the absence of any evolving national NRA overview all an individual involved in using a new piece of instrumentation can do is to provide feedback to the National Instrumentation Centre now established. There have been attempts in the past to have national users groups relating to instrumentation but these have been disbanded - in contrast to the situation in hydrometry. The new instrumentation strategy should address such issues.

2.3.7 Views were expressed that it would be helpful to ask the opinion of people using instrumentation in the field somewhat earlier. The development of field instrumentation equipment is never really finished. There is always room for improvement and problems often come to light in a user's hands which have not been, or are not being, addressed by R&D. In consequence, new instrumentation can disappoint as a result of detailed operational defects, for example relating to equipment housing, cable length, battery changing, and so forth. Some feel that such problems could be overcome if field testing was more properly taken account of. Such difficulties result in lack of take-up at a Regional level (the ammonia monitor was cited) especially when early models had failings.

2.3.8 Changes in working practice were more difficult to achieve than implementation of new pieces of instrumentation. Here there was greater dependence on the R&D report as representing the only tangible output for initiating change. One instance was cited by a Project Leader of circulating such a report to Water Quality managers at a Regional level with a proposal that if uptake were decided on, a seminar to discuss the R&D findings with users would be a valuable initial step. Over a five month period, no feedback has been forthcoming. Again advancing the uptake of the project has depended on individual one to one discussion. Some hope that the new National Centre for Water Quality Instrumentation can achieve a more effective and catalytic role in this area.

2.3.9 The roles of the business area groups within the function and the field technical users experiences outlined above should also be seen within the context of take-up procedures set out in Section 4B - Project Closure of the R&D Project Management Manual. Several post holders, sub-groups, and Boards are specified in the project closure process outlined in this document. The procedure is relatively recent and has not yet operated for a full year. One purpose of this Review has been to endeavour to determine whether or not the procedures in place for the take-up of research outputs are indeed working in practice. This matter is addressed in Section 3.2 of this report.

2.4 PAST, PRESENT AND FUTURE

2.4.1 An outline of the past, present and likely future scenarios in relation to Water Quality instrumentation and data processing is provided in later Sections of this report concerned with technical and scientific evaluation (3.2, 3.4, 3.5, 4.1). The aspects recorded here are more generic.

- 2.4.2 Early work in NRA at vesting was influenced by a report from the Water Research Centre (Project 050) on the need for future research in the instrumentation area. This report set the scene, for example, in creating a shift from science-driven to needs-driven R&D on instrumentation. It identified a number of other issues which, together with direction from the Water Quality function managers and input provided by the Topic Leader, steadily resulted in a more focussed Topic programme targetted on what was wanted by NRA to address its responsibilities.
- 2.4.3 At vesting almost all the water quality instrumentation R&D work was being carried out by the Water Research Centre as a result of the old agreement between the former Regional Water Authorities and Water Research Centre. This work formed part of the subscription programme which was agreed annually based on the perceived Water Authority needs. In many cases the objectives and routes for implementation were not very specific and some of the objectives became less clear as the Regional Water Authorities split to form privatised Water Companies and the NRA.
- 2.4.4 The Water Research Centre is now not a major contractor to this Topic area. Other independent advice has been commissioned and a more diversified range of research contractors are involved. Remaining project management and control difficulties are being alleviated to a degree through the existence of Regional R&D Co-ordinators who can support and advise Project Leaders.
- 2.4.5 Reports generated through scoping studies and reviews have been used to develop potential in particular areas and look at new technology and new collaborative linkages. This is in hand, for example, with UK Water Companies where common instrumentation requirements exist for STW effluent sampling and through improving awareness of activity in Europe. Furthermore, Regional initiatives have, where valuable, been brought into the mainstream of NRA endeavour as components of the R&D programme. This approach effectively builds on initiatives taken at a Regional level.
- 2.4.6 A more recent concept has been that of National Centres. The one for Water Quality Instrumentation and Marine Monitoring (though the latter component is now to be formed later than instrumentation) has been built largely around NRA staff who were previously involved in R&D being done speculatively in the former Wessex Region which was funded in various ways, only part being from the R&D

programme. The interface between the National Centre and the Topic is not yet fully operational, but is addressed in the NRA's Instrumentation Strategy document. But it is encouraging that the location of the Topic leader and the National Centre are the same, so that sensible interfacing of the overall R&D effort with the activities of the National Centre should be possible. Certainly the TIA makes clear that the National Centre will be responsible for co-ordinating future R&D into instrumentation and it will use a combination of in-house expertise and contracted resources to achieve this. It will also be capable of evaluating the latest technologies as they come onto the market and their applicability to the business needs of NRA. The continuing involvement of an external advisor for instrumentation requirements will also enhance this process.

3. ANALYSIS OF THE FINDINGS

3.1 RATIONALE, OBJECTIVES, AND APPRAISAL PROCESSES

3.1.1 The overall mission of NRA includes the aim "will protect and improve the water environment by the effective management of water resources and by substantial reductions in pollution".

3.1.2 Supported by this mission statement, the rationale for conducting research in instrumentation and related data processing is set out in the Topic Investment Appraisal (TIA) which states that "the NRA has made a commitment to increase its use of instrumentation to assist in its aims to protect and improve the aquatic environment. It has stated that it wishes to see a substantial reduction in pollution. With the proposed reduction in manpower, it is hoped that better pollution detection rates can be achieved by the use of instrumentation in the field". This then sets the context of the R&D in relation to the aims of NRA and the justification for spending public funds on it.

3.1.3 The strategic objectives for water quality are clearly stated and are measurable. The aims of the R&D undertaken through the Topic programme area however imply a continuum of activity rather than specific goals. For example, "to help to achieve", "to help to track down", "to evaluate". This makes it difficult to test or assess achievement of the aims.

3.1.4 In practice, the Topic area has a potential impact on all the business activities embraced by the Commission. There are four of these, each addressed by the business groups referred to in Paragraph 2.1.12. The rationale and required outputs from each and the basis of R&D, have been set out in the NRA R&D Strategy. It would be helpful if the TIA more clearly addressed the way in which the Topic impacts on the outputs required from each of these business areas.

3.1.5 The process of appraisal, in which project origination is identified in order to satisfy the rationale and objectives of the Topic programme, is, as has been described, structured at the user end. This is done to derive input primarily from business groups who consider suggestions, not only from the Topic Leader, but also from others. In practice, however, there is evidence that this user-orientated input is somewhat top-down. In consequence, some of the technical or field level application of project outputs appears to lack practicality.

3.1.6 In the appraisal stage of a research programme inputs from a variety of sources are taken into account. Though commendable, the strong management user orientation in NRA might put this process at risk. In particular, it could be possible that innovative scientific or technical aspects might not be well represented in a strongly user-orientated appraisal process. In this case, however, the use of an external advisor with state of the art knowledge, and the future interfacing of the Topic with a National Centre of expertise should address any theoretical deficiency of this sort quite effectively.

3.1.7 In general, the process of contractor tendering for projects and the diversity of research contractors considered, appears to be satisfactory. Particular research contractors of choice might be recognised as centres of expertise for which single tender action would be seen as attractive and good value for money. This is not always the case with the lowest bidders for R&D projects. Professional quality and state of the art knowledge are also key factors. Justification for single tender action, however, must be scientifically robust and logically argued. There is no indication that this has not been the case.

3.2 TECHNICAL QUALITY OF COMPLETED PROJECTS

3.2.1 The projects for evaluation are listed in Appendix 6. They were completed during the period September 1989 to February 1994. Scores were awarded on a range of parameters grouped under three broad criteria. They are tabulated project by project in Appendix 9 together with supporting notes. A programme overview tabulation is also provided. The information contained in this Section is derived from these individual and overview project evaluations.

3.2.2 The scope of the projects evaluated is broad and they address a diversity of issues. It is recognised that many of the projects completed during this period were inherited from the pre-NRA days at "vesting" and that, at that time, the programme was not as clearly defined or structured as it is today. Several of the projects are of somewhat uncertain relevance but appear to have been inherited by the Topic area (see Appendix 9).

3.2.3 Relatively few projects are concerned directly with specific instrumentation developments. Furthermore, little of the work can be classified as true "research". Most of it involves product or technique developments; appraisals and evaluations; defining needs and requirements; and, establishing working practices. The 31 reports examined mostly fall in the above categories, thus, the term "research" on the evaluation tables (Appendix 9) and below should be interpreted to reflect this. The overall impression portrayed by the R&D outputs examined is of a somewhat haphazard collection of projects, although it is noted that now projects are far more closely allied to the core activities of the "Instrumentation and Field Techniques" R&D Topic programme.

A. Quality of Research

(i) Relevance

3.2.4 This relates to whether the research has a direct link with, or is relevant to, policy or statutory requirements. Almost all projects score highly on these aspects (+2 or +1). There is no evidence of "research for its own sake" and very little of poorly focussed activities. Overall, very few criticisms can be levelled here.

3.2.5 It is encouraging to note that certain technologies of potential, but in some instances uncertain, relevance have been investigated. An example of this was the work on remote sensing by the NERC (1992) and Southampton University (1993), which led to the technology being introduced as an operational procedure.

(ii) Objectives

3.2.6 These scores evaluate how well a project's objectives were defined and the degree to which they were realistically attainable. These issues are important as, in addition to governing the project's likely outcome, they also illustrate how well the project was considered at the outset.

3.2.7 Overall, the scores were good (+2 or +1) with two notable exceptions: 043 (Integrating and sentinel samplers) and 047/061 (New biological methods for assessing the effects of pollution). Both of these were inherited projects. It should be noted, however, that project 047/061 did lead to the initiation of the ecotoxicology programme.

3.2.8 In a small number of instances, Project Leaders mentioned objectives or the emphasis of work being changed somewhat during a project. This can be interpreted favourably (eg flexibility allowing a project to be modified as dictated by preliminary results) or unfavourably (eg insufficient initial consideration). Generally, in pure research, a flexible approach is beneficial. There is no evidence of these changes having had a significantly detrimental effect on the programme.

(iii) Realisation of Objectives

3.2.9 This is a central issue and is defined here by six separate factors (see evaluation tables in Appendix 9).

3.2.10 The overall impression is favourable, but again there are a small number of noteworthy exceptions. The only project that failed on all counts was the aforementioned (inherited) project 047/061, and this has, in fact, been used as an in-depth evaluation example of a "poor" project (see 3.3). Two other projects scored -1s on two issues within this category (361 and 049) but these do little to detract from the high rating allocated to the overall programme.

3.2.11 Projects generally realised their objectives. Reports were mostly well written, clear and well orientated to the users. The facilities and teams employed by the research contractors were usually of an apparently high standard. Note, however, that it was not possible to allocate scores relating to project management and milestones in many cases.

B. Usefulness of Research

(i) Overall Impressions

3.2.12 Nine issues were considered here (see Appendix 9). Again, the overall impression is favourable and many projects were allocated +2

or +1 for all scored issues. The only projects with significant numbers of lower scores (3 or more) are: 063 (the part involving immunoassays for atrazine); 061 (Rapid kits for Salmonella); and 047/061 (see 3.2.10). Projects 061 and 063 both rated poorly with regards to use of results (see 3.2.14, 3.2.15), effectiveness of technology transfer (also see 3.2.15), other impacts/take-up and dissemination of findings. However, it is recognised that these were all older projects.

(ii) Use of Results

3.2.13 With only 3 exceptions (043, 063 and 061) all projects were allocated good or excellent scores (+1 or +2). This is clearly encouraging as the use of results defines, perhaps to a greater degree than any other single factor, the value and success of a project. In almost all instances, the NRA has used the results of projects and in some cases, other bodies have used them too, eg MAFF and NERC.

3.2.14 The case of the immunoassay (IA) part of 063 warrants adverse comment. Here, an emerging technology offering apparent potential was investigated and reported on in 1990 but not followed-up in the light of subsequent developments until now (a project will start shortly, involving the strategy for the use of IA). There is a need to continuously re-appraise such technologies on a regular basis (see 4.1.14).

(iii) Technology Transfer and Ease of Implementation

3.2.15 These two parameters are selected for comment as there are a number of instances where otherwise strong projects have scored somewhat poorly. Sometimes there was no technology transfer/implementation (eg 063 - the earlier project on immunoassays for atrazine, and 061 - kits for Salmonella) and in other instances, the means of implementation were not altogether clear, or the recommendations were difficult to implement. This is not seen as a major weakness but the issue of a contractor explaining more clearly how the project's findings might best be implemented warrants some consideration. Perhaps this aspect could be emphasised more strongly in future tender documents.

C. Value for Money

3.2.16 Project costs ranged from around £13k to several hundred-thousand pounds, reflecting, in the main, the scale and duration of the projects. However, as noted in the individual project evaluations, financial information on very early (pre-vesting) projects was, on occasion, not available, making comments on this aspect impossible at project level. The outputs examined represent a strong and significantly sized body of work but without a figure for the total cost, the programme's overall value for money, in purely financial terms, cannot be commented on. Similar comments apply to timescales, although in the main, it appears that these were usually met.

3.2.17 Where it has been possible to allocate an "overall" score against "Value for Money", there are only four instances of this being unsatisfactory (-1 or -2), namely various specific 061 project phases and 043 (Integrating samplers). However, in view of the number of "n/a"s allocated here, this should not be interpreted as a definitive statement to the effect that most projects are good value for money. Indeed, several interviewees expressed the view that WRc projects, in particular, were often not good value for money (see 3.2.19). Generally, one must also always question the value for money likely to be offered by the most costly projects - for example 002 (Pesticides in major aquifers) which cost £315k.

3.2.18 There is ample evidence of the use of prior or supporting information, although as a more general observation (derived from discussions with some Project Leaders), several of them have little knowledge of overseas activities in their fields, particularly regarding sensor R&D. For example, minimal reference is ever made to the US EPA. Establishing close links with this organisation is seen as important.

D. Research Contractors

3.2.19 The vast majority of the projects considered were undertaken by the Water Research Centre (WRc) with only six of the thirty-one reports examined being by authors from other establishments. Perhaps WRc was used so extensively for historical reasons, although it may be that it truly offered the strongest and most cost-effective R&D resource in the UK: this needs to be verified. WRc was mildly, and in some cases, heavily criticised by some NRA Project Leaders in terms of:

- poor project management;
- slippage of timescales;

- poor value for money;
- excessive administration;
- less than optimal consideration of the central scientific/technological issues;
- spending parts of the budget in inappropriate or minor areas (on certain projects);
- "generally wandering off course" and "losing focus".

However, it may be that any research contractor used as widely as WRc would attract similar criticism.

3.2.20

It is interesting to note the comments by the NRA Chief Scientist where it is stated that single tender contracts are sometimes issued to organisations that are "... uniquely qualified by virtue of their national or pre-eminent status". WRc is mentioned directly in this context. It should be noted, however, that NRA has ceased to use WRc as a centre of expertise in monitoring instrumentation. A greater use of other research contractors can also warrant consideration in appropriate areas as, in addition to the criticisms cited above, there is always the danger that a long-used contractor will continue to perpetuate concepts that warrant a fresh or novel interpretation. There are numerous establishments (such as universities, who are keen to exploit their capabilities) now offering expertise in water quality monitoring, sensor and instrumentation technologies and so forth. How well documented are these? Does the NRA maintain an up-to-date database of UK, and perhaps also, overseas consultants or centres of excellence in appropriate fields? It should.

3.3

TWO PROJECTS TECHNICALLY EVALUATED IN DEPTH

3.3.1

Two projects were selected for more detailed reviews. These were chosen on the basis of being examples of good and bad reports/projects, and were:

- A. New biological methods for assessing water quality (a "bad" example);
- B. A review of remote sensing techniques (a "good" example).

A. New biological methods for assessing water quality

3.3.2 It is recognised that this project was inherited from the pre-NRA days but it illustrates well the problems that can occur during a project's duration and the lessons that can be, and hopefully have been, learned. The summary project details are as follows:

Project No	:	047/061
Duration	:	April 1989 - March 1992
Contractor	:	WRc
Contract Type	:	Single Tender
Cost	:	£372k

This project achieved the scores against the set criteria used in the project evaluation table as follows:

+2	(excellent)	:	1
+1	(good)	:	7
-1	(fair)	:	11
-2	(poor)	:	4

3.3.3 The report (PRS 2399-M: "New biological methods for assessing the effects of pollution", Johnson et al, 1990) is complex, long (179 pages, 34 figures, 60 tables and 4 appendices), and difficult to read and assimilate. Several of the specific conclusions are often somewhat vague, eg "Some populations may be more tolerant to certain contaminants" (reviewer's underlining). Also, the conclusions are spread throughout the report rather than being gathered at the end. The majority of the recommendations relate to proposed further work, much of which fell within the remit of the original project, rather than deliverables for the end-user.

3.3.4 The project was very costly (over a quarter of a million pounds) and did not represent value for money, particularly as not all of the original objectives were even addressed in meaningful detail. The project was allocated a score of -2 for overall value for money.

3.3.5 Several lessons can be learned and conclusions drawn from this project:

- Within any individual project, keep the objectives simple and realistically attainable.

- Where the issues involved are complex and, perhaps, involve elucidating new science, shorter and more highly focussed projects are generally better.

- A more appropriate approach would have been to split this project into, say, four separate and lower cost projects, each with fewer and more attainable objectives.

Fortunately, NRA was able to use the project to develop an understanding of ecotoxicological methods. In particular as a result of NRA staff visiting the US EPA the whole NRA ecotoxicology programme was reorientated.

B. A review of remote sensing techniques

3.3.6 The summary project details are as follows:

Project No	:	0311
Duration	:	April 1991 - September 1991
Contractor	:	NERC
Contract Type	:	Competitive Tender
Cost	:	£30.4k

This project achieved the scores against the set criteria used in the project appraisal forms as follows:

+2	(excellent)	:	19
+1	(good)	:	4
-1	(fair)	:	1
+2	(poor)	:	0

Thus, 23 of the issues scored were seen as acceptable and only one was not. It should be added, however, that the single -1 score was against "Policy link or statutory requirement"; the score simply reflecting that this technology was not directly linked, at that stage, with either of these issues.

3.3.7 This project had four specific objectives, all of which were clear and realistically attainable. The timescale was short (five months) but was met by the contractor. Good features were:

- The project's outputs were clearly defined from the outset.

- The research contractor's team was strong and well qualified to undertake the task. Also, it drew on the expertise of other NERC personnel, where appropriate.
- The outputs (reports) were of high quality, making interpretation by the NRA and other bodies a relatively simple matter.
- Generally, awarding a contract by competitive tender may stimulate research contractors to perform better than in the case of single tender contracts.

3.4 TECHNICAL QUALITY OF THE CURRENT PROGRAMME

- 3.4.1 The Topic programme's objectives need to be borne in mind in any commentary on current R&D (see 2.1.9). There are presently 13 projects in the 1994-95 programme although several are approaching completion and others are yet to commence. Details are set out in Appendix 7. Assessment of these projects overall is less detailed than that covered in Section 3.2 as no project outputs are yet available.
- 3.4.2 The present portfolio of projects is viewed as being highly focussed, directly relevant to the NRA's instrumentation requirements and in compliance with the programme's stated objectives. None of the topics are of uncertain relevance and all appear to be central to the furtherance of the NRA's future monitoring requirements and strategies. However, there is neither any evidence of longer-term or more speculative R&D, nor of any issue relating to the cost-effectiveness of instrumentation.
- 3.4.3 The 1993-94 expenditure of approximately £327k appears to be realistic in view of the amount of work involved - nine projects. Equally, the figure of around £440k for 1994-95 seems good value for money and also involves nine projects. Some of these are continuing from 1993-94 and some are new starts in 1994.
- 3.4.4 It is noteworthy that there is a more diverse body of research contractors than in the historical programme evaluated in detail in this Review. An encouraging trend is that contracts are generally of shorter duration, are far better defined, have clear objectives, and are of an often lower value than many in the past.

3.4.5

It is also encouraging to note that several of the new measuring and sensing techniques and technologies are under investigation or on the verge of deployment. These include:

- immunological test kits (for algal toxins and pesticides);
- fibre-optic sensors (for ammonia);
- solid-state microelectrodes (for metals);
- remote sensing (for inland water quality);
- live-cell biosensors (for toxicity).

3.4.6

However, one might question whether the projects on metal sensors and broad-spectrum biosensors were placed with the most appropriate research contractors. In addition to Ecossensors, several UK companies and research groups are involved with metal sensors. Several overseas research groups are at a more advanced stage in the live-cell biosensor field than the Luton (biosensor) group. This LINK project has now been terminated.

3.4.7

This raises the issue of how well investigated these fields were prior to the letting of contracts. As discussed below, NRA should be fully conversant with academic and commercial R&D activities in all new fields of sensing and instrumentation technology, on a worldwide basis.

3.5

THE FUTURE PROGRAMME

3.5.1

In view of the fact that the future programme is yet to be defined (except where current projects run into and beyond 1995), no specific observations can be made. However, the following comments are of a general nature and as they are mainly stimulated by the absence of topics are intended to suggest functions that might be undertaken. It should be noted here that an advisor is retained who will be assisting in the definition of the future programme.

3.5.2

Instrumentation and monitoring technologies are in a highly dynamic state, with potentially relevant R&D activities underway at numerous academic and commercial establishments throughout the world. Many concern sensors and developments in this field are seen as central to the future monitoring procedures and strategies of NRA. It is vital for the NRA to stay abreast of research in these related areas, and of commercial product developments, on a worldwide basis.

3.5.3 Acquiring and interpreting these data should be a clearly-defined and formalised activity, undertaken on an on-going basis. As well as having value in its own right (awareness and pointers to possible future R&D projects), this function would allow better value judgements to be made when commissioning R&D projects in new and hitherto unfamiliar areas.

3.5.4 Because of the speed of development in the instrumentation field, strategic research can rapidly become applied. For this reason, it is felt that the NRA's future R&D programme could reasonably include perhaps 10-15% of longer-term or more speculative work that is not directly connected to defined technical or business requirements. This might include, for example:

- Investigating the capabilities of certain emerging technologies, (eg distributed fibre-optic chemical sensors, hand-portable analytical instruments) by commissioning exploratory studies at universities with appropriate expertise.

- Reviewing the literature in technological areas offering possible long-term prospects (which need first to be identified - see above).

3.5.6 The links with the Sensors for Water Interest Group (SWIG) are likely to be valuable in this context and are said to be already proving to be beneficial. Establishing liaisons and subsequent on-going dialogues with certain overseas counterparts of the NRA should be a routine function. The NRA might gain from the experiences, monitoring methodologies adopted and R&D activities underway by such organisations. Collaborative R&D projects are a possibility that warrants consideration.

3.5.7 It is recognised that the issue of standards is presently under preliminary consideration. The US EPA's practices in this area could act as a model and warrant close examination.

3.5.8 In the future it should be possible for some consideration to be directed towards the monitoring requirements of the proposed UK Environmental Agency. The instrumentation needs of this body will be far broader than those of the present NRA. Perhaps the future programme can take these into account and could include work on, for

instance, techniques for air monitoring, landfill site monitoring and waste analysis, and issues relating to the determination of Red List substances.

3.6 MANAGEMENT ISSUES

3.6.1 The R & D project cycle in NRA is somewhat mechanistic in style. The Topic under review suffers as much from that as some other Topics within the R&D endeavour. One purpose of the heavy procedural approach allegedly is to integrate the R&D projects within the business areas and so satisfy the business needs of the component parts of NRA - in this case instrumentation and data processing needs of water quality assessment. There are those who feel that the procedure delivers this aim effectively. There are others who feel that it inhibits research endeavour and the commitment of those involved. However, it also has to be recognised that elements of the mechanistic process laid down reflect procedures intrinsic to NRA administration overall and do not arise solely as a result of the R&D project cycle.

3.6.2 Within the Topic it is not surprising that it is people who are more effective in making things happen than administrative processes. Not surprisingly there have been both successes and failures though the former greatly outweighs the latter. A key factor is the selection of the Project Leader. A number of individuals are self-selecting as Project Leaders perhaps as a result of earlier involvements at a Regional level. They often have a very real interest in the R&D objectives of the project. It is important that considerable attention continues to be given to the selection of the Project Leader in order to achieve the right sort of R&D output and the correct monitoring and management of the project contractor. With a heavily specified process orientation there is always the danger that individuals may take on the task and fulfil the step by step management process requirements without having there "heart and soul" entirely in the achievement of the project objectives. It is particularly important that this does not occur with R&D projects and it was not really a problem in this Topic. The real problem was rather time availability for the Project Leader and conflict of interest with other responsibilities.

3.6.3 The project initiation document (PID) is an important component in the specification of the project and the efficiency with which it is delivered. Producing it is also an unwelcome task though it is becoming easier with the involvement of Regional R&D Co-ordinators.

- 3.6.4** In research not all projects succeed. Although this is widely recognised those involved with them naturally prefer to achieve successful outcomes. For a body such as NRA which does not fund science for its own sake the successful outcome of R&D projects in instrumentation underpinning statutory monitoring must mean creating a beneficial impact on the organisation as a result of a more effective way of doing things. It is at this stage that those involved will recognise the success of their effort.
- 3.6.5** Success criteria need to be monitored more carefully, possibly through some model project studies. Even without such studies there would be merit in taking initiatives to attempt to maximise the impact of the R&D. An example would be the use of adaptive research projects designed to bring new instrumentation into operational use. This concept has already been alluded to above (2.3.7, 3.2.15). The present position could be re-thought for example so that a proportion of the budget of every R&D project was devoted towards the eventual take-up of the successful outputs. Research contractors could also be tasked to address this. However, new project closure procedures have recently been devised to facilitate take-up. It remains to be seen whether a strong specification of the process will be instrumental in achieving what is required.
- 3.6.6** It is in this area where the Commissioner perhaps has a particular responsibility in the role of representing the customer requirement on the one hand, and channelling the research supply on the other. This is achieved in this Commission through robust business groups who commission R&D projects and so have ownership of the outputs. Tangible benefits of this can be identified but there are also failings.
- 3.6.7** There is evidence within the Topic of different attitudes, for example, to take-up in different Regions. This is not unusual within NRA or indeed other comparable bodies. To achieve better coherence in this regard, much depends on the effectiveness of take-up. There are those who feel that it lacks both strategic direction and realism. Communication is felt to be left to the individual. The new Instrumentation Strategy and the role of the National Centre for Water Quality Instrumentation are important components of tackling these issues.
- 3.6.8** The question of interfaces both between Regions, between R&D administrators both centrally and Regionally, between Topic leaders, Commissioner and Project Leaders, many of whom have dual responsibilities, remains a difficult one. But instrumentation issues have a commonality which should help to break down any vested

interests. The R&D endeavour is certainly diluted by the part-time nature of the responsibilities of many of its operatives. R&D is not normally seen as a part-time activity, but one that requires considerable personal commitment if new knowledge is to be acquired and difficult problems tackled and solved. It is not generally an activity that can be picked up and put down very easily if it is to be successful. Both within this Topic and more widely NRA will need to consider whether the current project management of its R&D maximises the achievement of the ends that it desires and what alternatives are available.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 SCIENCE AND TECHNOLOGY

A. The Projects Reviewed

4.1.1 The programme of previous work covers a diversity of topics and relatively few projects involved true research or specific instrumentation developments. Several projects were of uncertain relevance to this Topic area although it is recognised that a number were inherited from the pre-NRA era at vesting.

4.1.2 The large majority of projects were directly allied to the NRA's policy or statutory requirements. There is minimal evidence of research for its own sake. Most projects were ranked highly in terms of relevance.

4.1.3 The objectives of the projects were generally well defined and attainable. Some however score poorly, in particular inherited projects such as 043 (Integrating and sentinel samplers) and 047/061 (New biological methods for assessing pollution). The latter, especially, is viewed as a very poor project, as its objectives were hopelessly over-optimistic and few were fully met. Fortunately NRA subsequently was able to reorientate its ecotoxicology programme as a result of using the project to develop an understanding of ecotoxicological methods.

4.1.4 There is some evidence of projects' objectives being changed or modified during their course. Although this has done little to detract from the favourable overall impression, it suggests that more detailed planning in the project definition stages might warrant consideration.

4.1.5 In the main, projects met their objectives. Reports were usually well written and clear. Sub-contractors' teams were strong on the whole and appeared to be well qualified to undertake the work required of them. The aforementioned project 047/061 is a noteworthy exception. There is strong evidence of the use of prior/supporting information although knowledge of overseas work and of the US EPA (in particular) appeared to be weak.

4.1.6 The results from most projects were used by the NRA and in some instances, by other bodies also. The overall programme scores highly on usefulness although there are a small number of notable exceptions where the results were not used and/or not widely disseminated.

4.1.7 Most projects scored highly on technology transfer and ease of implementation of results. There were exceptions (eg the immunoassay part of 063 and 061 - kits for Salmonella), where there was no technology transfer/implementation. In some other cases the means of implementing the project's findings were a little unclear or the recommendations were difficult to implement.

4.1.8 Value for money was difficult to determine, both at project and programme level, as financial data were not always available. For projects where cost information was available, many scored well; the notable exceptions being parts of project 061 and 043. Certain research contractors were criticised by some NRA Project Leaders as offering poor value.

4.1.9 Historically, the programme used WRc extensively and this must be questioned (although it is noted that the current programme is far less reliant on it). Such a use of a single research contractor can lead to the perpetuation of concepts and views that may warrant a fresh or novel interpretation. There were some criticisms of this. However, any contractor used so widely might well attract such criticism.

4.1.10 The overall view of the programme is very favourable. Most projects were a success and the results were used. Taking into account the fact that several projects were inherited and the various, relatively minor, shortcomings highlighted above, there are no significant causes for concern.

B. The Present Programme

4.1.11 The present programme comprises a well-focussed selection of directly relevant projects which cover many important and emerging instrumentation technologies. Several projects build on earlier research and address issues of direct relevance to the programme's stated objectives. Project objectives are clear and potentially attainable.

4.1.12 The expenditure on these projects over the periods 93-94 and 94-95 suggests that the programme will represent good value for money. Many projects are of shorter duration and lower cost than several of their predecessors. The breadth of the contractor base is noted.

4.1.13 The only criticism of the programme as evaluated is that it fails to feature any more speculative work or R&D of a longer-term nature (see below), or any projects addressing the issue of cost-effectiveness - one of the programme's stated objectives.

C. The Future Programme

4.1.14 A number of functions and topics have been identified that might feature in the future programme. These include;

- maintaining some global awareness of research and developments concerning new sensor and instrumentation technologies;
- continuously reappraising technologies that have been investigated earlier but which have not yet been adopted;
- investigating instrument standardisation;
- a small amount of more speculative, longer-term R&D;
- issues relating to the cost-effectiveness of instrumentation;
- issues relating to the instrumentation requirements of the proposed Environment Agency for England and Wales;
- establishing a dialogue and perhaps collaborating with overseas environmental monitoring bodies.

4.2 MANAGEMENT

4.2.1 The Topic area benefits from what appears to be a well developed understanding of roles at a senior management level. For example, the Head of Environmental Quality is also the Water Quality Commissioner and R&D is seen as a support to achieving the business

needs. The ownership of the R&D project is therefore in the function, but its delivery is a R&D responsibility. The four business groups have a crucial role in identifying the research and deciding on the way in which its ultimate outputs are made operational. Within the Commission the Topic Leader himself has an operational job and interacts with customer groups.

4.2.2 The procedures involved in initiating R&D projects are a cause of frustration. The process is especially constrained by the inherent bureaucracy associated with NRA apparently as a result of its status as a non-departmental public body. Nevertheless, the length of time required to get projects operational is at times unacceptable and demotivates Project Leaders who might anyway be difficult to identify for other valid reasons such as workload. One instance was cited of project start-up taking more than a year because of administrative detail and cyclical responsibilities involving Head Office and Regional offices, although it is probable that availability of budget was a further factor. The management procedures related to R&D projects should be reassessed by those with particular hands-on experience of the process. The R&D Section, along with the R&D Co-ordinators who have been of significant benefit in easing the frustrations, should undertake a review of the mechanics and value of the procedures in place and suggest improvements.

4.2.3 Although appraisal of projects and their output implementation works commendably well at a managerial level, there is evidence "on the ground" that practical aspects of usage are not taken account of sufficiently well. Some work undertaken would not always be the users' choice, and in general users were not involved early enough to make a valuable input.

4.2.4 Most user criticisms, however, were levied at project output implementation and take-up. There was certainly a feeling that there was no overall strategy here and too much was left to the individual. In spite of the business group that should have established ownership of the output, there seemed to be a feeling that there was a lack of realism in design in some instrumentation for field use relating to battery changing, casing, cabling length and other pragmatic matters. It was pointed out that a survey involving new instrumentation takes a fair amount of time to set up. If the instrumentation fails it is exceptionally annoying and costly. It would make sense to fund some field testing (or adaptive research) as part of the R&D programme in order to avoid this, rather than have to use instruments in real field trials before they are fully proven. If this happens, and failures occur, take-up is impeded. For example, Regions may reject equipment that

they have had bad experience of. Certainly at the user end it was clear that "uptake is the problem that needs to be addressed". New procedures have now been specified for take-up and implementation of research outputs. Their impact should be closely monitored to see whether they deliver the necessary benefits in a realistic way.

4.2.5

Concerns were expressed about state-of-the-art professional awareness of NRA staff for some R&D project areas. Some managers felt there was a heavy dependence on research contractors and steps ought to be taken to enhance in-house R&D professional capability. Some users felt, ironically, that because in theory users have the opportunity to make an input, there may be failings because they were not able to decide on the validity of a project on a more academic basis - for example, if there were other scientific or technical options to be considered. This situation should not, however, prove to be too great a worry with the developing National Centre on Water Quality Instrumentation and the involvement of an independent external advisor.

4.2.6

Use of research contractors seems good. It was encouraging to see how it had moved away from dependence on one main research contractor, and that there was now a considerable diversity of contractor base. Indeed, research contractors may propose work as candidate areas for R&D projects. In this Topic, the type of research contractor could be categorised to some extent. There were dangers with universities being too academic and having their own agenda. In general also, they did not perform well in competitive tender situations. Certain technical institutions such as Cranfield Institute of Technology, though used, had limited applicability. The Water Research Centre was considered to have improved though was now used significantly less. Some private sector companies were highly regarded as were some consultancies, though there was a danger that these could lack the academic depth required in certain instances.

4.2.7

There were certainly those at the user end of the spectrum who felt that communication of R&D could be significantly improved. The absence of a "users group" for water quality instruments, which had been disbanded a few years ago, was regretted. There seemed to be a feeling that communication initiatives had to be taken at an individual level rather than through some forum or network, as is done in hydrometry. It is surprising that R&D into a generic technology such as instrumentation is not better networked particularly in an organisation in which the senior management attaches such importance to its development in order to fulfil its aims. The National Centre for Water Quality Instrumentation should take action to improve

communication channels on instrumentation matters both vertically and horizontally in NRA.

- 4.2.8 Despite such findings on managerial aspects, it is true (and the scientific and technological evaluations confirm it) that overall for this Topic the Water Quality function in NRA is getting what it wants and has achieved a good level of awareness of what is wanted.

4.3 RECOMMENDATIONS

- 4.3.1 The following RECOMMENDATIONS are made as a result of this Review. For convenience follow-up action areas are italicised.

- (1) *Input must be sought much more actively from end users in NRA both at the appraisal stage and implementation stages of instrumentation R&D in order to transfer technology effectively. To assist in this the strategy for use of Water Quality Monitoring Field Instrumentation must be published as soon as possible and an appropriately constructed user group should be formed, perhaps fostered by the new National Centre. Its membership must be drawn both Regionally and along a vertical axis in NRA in order to involve personnel ranging from policy-makers to field operators. (2.3.6, 3.2.15, 3.6.5, 3.6.7, 4.1.7, 4.2.3, 4.2.4, 4.2.7) (Action: Function; National Centre)*
- (2) *NRA must ensure that R&D outputs are made available to all directly interested internal parties in an appropriate form. Report distribution should be carefully targetted, greater awareness created of other forms of R&D output that are presently available, and other user-orientated procedures enhanced. (2.3.5, 2.4.4, 4.2.7) (Action: R&D; Function)*
- (3) *NRA must establish a strong awareness of, and familiarity with, sensor and instrumentation research, product development, and manufacturing industry priorities on a global basis. This will assist in defining new R&D programmes as well as ensuring that NRA is conversant with, and operating at, the technological leading edge. In this regard the future Topic programme should feature a small element - say 10 to 15% - of more speculative and longer term R&D as in a fast developing field such speculative work rapidly becomes tactical and applied. The National Centre or a Director such as the Chief Scientist could be an appropriate*

customer for such speculative research if a business function were not immediately interested. (3.4.7, 3.5.2, 3.5.4, 4.1.13) (Action: R&D; Function)

- (4) Potentially relevant technologies that have been investigated but not taken up should be reappraised on a regular basis taking into account subsequent research and commercial developments. (3.2.14, 4.1.14) (Action: R&D)
- (5) NRA should be aware of the many potential research contractors that exist in the UK and elsewhere that offer services relevant to this Topic. It should establish a database of these and their particular expertise. (3.2.20, 3.4.4, 3.4.7) (Action: R&D, National Centre)

WIDER IMPLICATIONS

- (6) In commissioning and managing research projects effort should be maintained to:
- *define project objectives clearly and ensure that they are realistically attainable;*
 - *ensure that any relevant earlier work, whether in the UK or overseas, is taken into account;*
 - *monitor progress closely and terminate a project if its objectives cannot be met;*
 - *when appropriate commission several shorter, lower cost projects rather than one large project;*
 - *ensure that the research contractor is tasked to explain how the project's findings can be implemented.*

Many of these features represent sound management practices but they are especially relevant to R&D. Most are already identified in the R&D Project Management Manual. (3.2.8, 3.2.19, 3.3.5, 4.1.4, 4.1.5) (Action: R&D)

- (7) In certain instances the take-up of R&D project outputs requires the *undertaking of an adaptive research project the aim of which is to bring about operational use of a new methodology or product.* Much

greater use should be made of such an approach in particular when field operators and researchers need to be brought together and additional short-term resources are needed to implement the results in a particular location or Region. (2.3.3, 3.6.5, 3.6.7, 4.2.4) (Action: Function; R&D)

- (8) The *management procedures* through which R&D has to be carried out are too mechanistic and *need reassessment* so that necessary elements are retained and appreciated and unnecessary procedures such as re-authorising work at Regional level are abandoned. It must be clear to everybody involved who takes decisions, where responsibility lies, and what the responsibility is. *The R&D Co-ordinators have a crucial on-the-job function in this respect so they should be fully involved in any reassessment.* (3.6.1, 4.2.2) (Action: R&D)

- (9) Selecting, appointing, rewarding, and training of Project Leaders and thereafter maintaining their enthusiasm and commitment needs more attention. The recognition of the importance of R&D projects to NRA and the rewards associated with their management are key elements of any such underpinning and support to the Project Leader. Time availability is often a key constraint for Project Leaders so it is important that demarcations between operational and R&D responsibilities are neither so marked nor incompatibly paced. The commendable principle of *a matrix approach to delivering R&D project management needs to be actively supported by constantly reinforcing awareness of R&D and its intrinsic value to NRA function responsibilities from the most senior level of management* (3.6.2, 3.6.8, 4.2.3, 4.2.7) (Action: Function; R&D; Board)

- (10) Carefully specified *studies should be undertaken on the operational, scientific/technological, and financial benefits* of selected R&D projects so that model procedures can be derived for assessing impact and value for money. Studies of this type will help to underpin and endorse the importance of the R&D effort to the objectives of NRA overall. (3.6.5, 4.2.4) (Action: R&D)

4.2.12

A practical programme for implementing these recommendations should be agreed with the Water Quality function and R&D Committee taking into account the opportunities and requirements for reorganisation of the R&D function with the development of the Environment Agency.

A P P E N D I C E S

APPENDIX 1

EXTRACT FROM TERMS OF REFERENCE - POINTS TO BE ADDRESSED IN REVIEW**Annex A - Points Arising at Project and Programme Level****(a) Project Level****1.0 Effectiveness**

- Were the R&D objectives achieved and the specified outputs produced?
- Have the anticipated benefits been achieved? If not are they still desirable?
- Is the output likely to bring these anticipated benefits?
- What was the quality of the R&D in terms of its contribution to scientific knowledge?
- What would have happened if the project had not been done?

2.0 Efficiency**2.1 R&D efficiency**

- Was the R&D well managed:
 - (a) by the NRA in processing and supervising the R&D?
 - (b) by the contractor undertaking the R&D?
- Did the R&D work build effectively on the available base of present knowledge?
- Were the R&D objectives achieved in the most cost-effective (including use of collaborative funding) and direct manner?

2. Uptake efficiency

- Has the uptake process been well managed?
- Has uptake been (or is it being) achieved in the most cost-effective and/or appropriate manner?

2.3 Overall cost-effectiveness

- Has the NRA achieved (or is it likely to achieve) value for money from the overall project?

3.0 Follow-up

- Identify/confirm any necessary actions to improve effectiveness.
- Identify/confirm requirements for uptake of R&D output to achieve overall project objectives and intended benefits.
- Identify lessons to be learnt and actions needed to disseminate these.

Not all of the above would need to be covered on any one project.

(b) Points Arising at Programme Area Level

1.0 Effectiveness

- Have the programme objectives been achieved (or are they being achieved), and the specified outputs produced?
- Have the anticipated benefits been achieved (or to what extent are they in process of being achieved)?
- How well is the programme targeted to the NRA's corporate objectives related to this area?
- What is the scientific quality of the programme (in terms of both utilising up-to-date scientific understanding and being well structured and managed)?

2.0 Efficiency

- How efficient has the programme been as a means of achieving the objectives (and how well have the rationale and objectives been defined)? Consider:
 - (a) appropriateness of selected projects;
 - (b) R&D management issues (including project planning);
 - (c) Research Contractor procurement and performance;
 - (d) Uptake activities
- Is the NRA achieving reasonable value for money from the overall programme?

3.0 Follow-up

- Identify any further actions to achieve effectiveness of existing programme. Consider:
 - (a) additional R&D stages to existing projects;
 - (b) new projects;
 - (c) additional uptake of existing/past project outputs;
 - (d) changes in management or procurement strategy.
- Identify any desirable major shift in the programme objectives to improve targeting towards NRA corporate objectives or other opportunities.
- Identify any generic lessons to be learnt from 1.0 or 2.0 above, and actions needed to disseminate these.

APPENDIX 2

PROFORMA FOR SCORING R&D PROJECT OUTPUTS

		RATING			
		+2	+1	-1	-2
Title:					
Quality of Research					
Policy link or statutory requ:					
Relevance to policy or requ:					
Objectives:	-	clear			
	-	attainable			
Objectives realised					
Execution of project	-	overall			
	-	management			
	-	monitoring/milestones			
	-	reports			
	-	facilities			
	-	quality of team			
Usefulness of Research					
Results used by:					
Aims fulfilled					
Innovative contribution					
Relevance to current concerns					
User orientation/quality of outputs					
Effectiveness of technology transfer					
Ease/affordability of implementation					
Other impacts/take-up					
Dissemination of findings					
Value for Money					
Overall:					
Other factors	-	maintaining timescale			
	-	use of prior/supporting information			
	-	adherence to budget			
	-	added value achieved			
	-	other features			
Notes					
+2	=	Excellent or high			
+1	=	Good or sound			
-1	=	Fair, some doubts or flaws			
-2	=	Poor or seriously flawed			

DOCUMENTATION REVIEWED

Annual Review of R&D (1990, 1991, 1992, 1993)

NRA Annual Report and Accounts (1990/91-1991/92)

NRA Corporate Plans (1991-92)

NRA Water Quality Strategy

Research and Development 2000 - a strategy for the Research and Development Support Service, Version 2

NRA R&D Strategy

NRA Review of Research and Development - Internal Audit

National R&D projects - six month reviews - October 1993 - March 1994

A strategy for the use of field instrumentation in water quality monitoring, May 1994 - Project Initiation Document, National Centre for Instrumentation, Business Case 30

Schedules of Ongoing Projects and New Starts (1992 - 94)

Environment Sensors - May 1994 (Institute of Physics Publishing)

R&D Project Lists

NRA R&D Management Manual - R&D Note 249

Guidance Note on the Production of R&D outputs for the NRA, R&D Note 180

Topic Investment Appraisals A10, A4

Project Investment Appraisals and Project Initiation Documents

New Biological Methods for Assessing Episodic Pollution (R&D PRS 2304)

Analysis, Storage and Archiving of Water Quality Data (R&D Project Record 361/4/NW)

Analysis, Storage and Archiving of Water Quality Data (R&D Note 183)

Review of Remote Sensing - Potential Role Within the NRA (R&D Note 28)

Coastal Sewerage Programme - Recommended Method for Estimating Storm Discharge Volumes and Frequencies (R&D Note 150)

Coastal Sewerage Programme - Estimating the Frequency of Operation of Storm Outfalls and Overflows - Method 1 (R&D Note 143)

Coastal Sewerage Programme - Estimating the Frequency of Operation of Storm Outfalls and Overflows - Method 2 (R&D Note 142)

Evaluation of Multiple Parameter Hand-held Meters - Technical Information (NRA Project Record 63/9/ST)

Evaluation of Multiple Parameter Hand-held Meters - Manufacturers Summaries (NRA Project Record 63/10/ST)

Detecting Changes in Groundwater Quality - Monitoring Requirements (R&D P-21)

Specification of NRA Field Test Facilities for Instrumentation Assessment (R&D Project Record 220/4/T)

Determination of the EC50 of Test Substances to the Microtox Reagent Photobacterium phosphoreum (R&D P-41)

Methods for Assessing the Toxicity of Sediment-Bound Contaminants (R&D Project Record 024/1/T)

Dissolved Oxygen and Ammonia in Tidal Waters Related to WQOS - Project Definition Study (R&D Project Record 323/3/HO)

Development of Integrating and Sentinel Samples (R&D Note 5)

NRA Instrumentation Assessment and Demonstration Facilities - Final Report (R&D Note 62)

A Review of Remote Sensing - Potential role within the NRA (R&D Project Record 311/2/HO)

Review of Sensing Techniques for in situ Monitoring - Water Chemistry (R&D Note 10)

Pesticides in Major Aquifers (R&D Note 72)

Evaluation of Rapid Detection Kits for the Isolation of Salmonellae (R&D P-60)

The Development of New Techniques for the Monitoring of Ammonia in Water (R&D Project Record 318/5/Y)

~~New Biological Methods for Assessing the Effects of Pollution (R&D P=25)~~

Interim Review of Data Handling and Information Needs of Regulatory Agencies (R&D PRS 2273-M)

Organisations Involved in Monitoring Instrumentation Standards and Evaluations (R&D Project Record 220/3/T)

Protocol for Investigation of Ion-Selective Ammonium Electrodes and their Applications in Field Measurement (R&D Project Record 220/7/T)

Electrochemical Immunoassay for Atrazine (R&D P-33)

Instrumentation for Monitoring by the NRA - Water Quality (R&D PRS 2272-M)

Safe System at Work - Fobney Mead Field Test Facility Safety Procedures (R&D Project Record 220/6/T)

Instrument Performance Assessment Standard Test Protocols - Revision A (R&D Project Record 220/9/T)

Airborne Remote Sensing of Coastal Waters (R&D Report 4)

PERSONS INTERVIEWED

Mervyn Bramley	R&D Head Office, Rivers House Waterside Drive, Aztec West Almondsbury, Bristol
John Dalton	R&D Head Office, Bristol
Gareth Llewellyn	R&D Head Office, Bristol
John Seager	Head of Water Quality, and Water Quality Commissioner, NRA Head Office, Bristol
Paul Williams	Topic Leader, Instrumentation NRA National Centre for Water Quality Instrumentation and Marine Surveillance, Rivers House Lower Bristol Road, Twerton Bath BA2 9ES
John Adams	Past Topic Leader, Instrumentation (A10, A4) NRA North West Region, Richard Fairclough House, Knutsford Road, Warrington
Geoff Brighty	Project Leader, NRA Anglia Region (on secondment to Severn-Trent) Sapphire East, 550 Streetsbrook Road Solihull
Simon Wills	Project Leader, NRA Severn-Trent Trentside Office, Scarrington Road West Bridgford, Nottingham
Dan Milner	NRA North Wessex Region Rivers House, Twerton, Bath
Terry Long	Project Leader, NRA Head Office Bristol

INTERVIEW STRUCTURE

Topic Leaders

Rationale and Appraisal

1. The appraisal process and pertinent questions re project identification
2. Rationale and objectives for the area
3. The questions addressed in Annex A of the TORs
4. Discuss the Topic Investment Appraisal
5. Rationale and objectives for each project

Information

6. Key persons to talk to
7. Recommended candidates for in-depth study
8. Any reviews undertaken of the area
9. Previous Topic Leader

The Future

10. Potential work for the future
11. Missed opportunities to be corrected

What is the programme like

12. Who are good contractors for quality and vfm
13. Discuss project examples that are past or present

14. Effectiveness
15. Quality of science and innovation - scope and emphasis
16. Problems

End Result and Uptake

17. How good is take-up and what are the success measures
18. What are the outputs for take-up
19. Benefits from take up
20. Targetting of needs and the knowledge base
21. Efficiency and value for money

Management

22. How is the overall commissioning process specified
23. What is the management structure - now and previously
24. Contact with project leaders, R&D staff, research contractors, and end users

Supplementary Questions (where necessary)

- Who is the customer and what is the customer's requirement
- What is this work to be funded
- What is the underlying rationale for the requirement. Is it valid
- What assumptions are made in formulating the requirements. Are they valid
- Are the proposals consistent with the customer's R&D strategy
- What other means of satisfying the requirement have been examined; for example international collaboration
- What are the objectives
- What are the outputs and on what timescale

- What related work has been done previously and what was its outcome
- What is the existing level of investment affected by this issue
- What is the customer's priority
- What are the likely benefits
- What are the risks of unrealised benefits or excessive costs
- What is the effect of doing nothing
- How will we measure success
- How good is the researcher and his track record
- How good is the parent organisation
- How will the Programme be monitored, reviewed and evaluated
- How will projects be selected

Project Leaders

The Project

1. Key features
2. Objectives from Commission/Committee of Regional Managers
3. Source of "Demand" for the work
4. Familiarisation with field - reviews, etc
5. Documentation (PIA, PID)
6. Role of Regional Support Team; Other Support
7. Preparing Tender/Selecting Contractors/Letting Contract
8. Approval Mechanisms - Getting the "Go-Ahead"
9. Financial Reporting
10. Operation of Project: Successes, Problems

Relations with "Customers"

11. Who are the Customers?, End Users
12. Targetting of Customer Needs; accommodating changing needs
13. Contact with End Users

Management: Chain of Command/Support

14. Reporting Structure: Topic Leader; Commissioner; M Bramley; Committee of Regional Managers
15. Relationships with national "Centres"
16. Regional Project Appraisal Board
17. Contact with Topic Leaders, R&D Staff, research contractors
18. Positive features of the structure/difficulties

End Result and Uptake

19. Features to ensure these in Project Spec
20. How good is/will be take-up
21. Difficulties
22. Likely benefits
23. What would happen if the Project did not exist

Project Leaders Job

24. How did you get job? Volunteer, asked, special expertise, etc
25. Do you get the help/support you need
26. Who do you report to: who "chases" you - asks "how are you getting on"
27. How is the PL role accommodated with main job
28. Would you do it again

Commissioner

1. The origination of R&D projects to meet identified needs in WQ.
2. The way in which WQ R&D findings are taken up within the NRA organisation (especially A4)
3. The degree of importance attached to instrumentation approaches to WQ needs.
4. The role of the National Centre for Instrumentation.
5. The interface between R&D and the Commission overall.

List of R&D Outputs and those nearing completion

PERIOD - SEPTEMBER 1989 TO FEBRUARY 1994

(a) Water Quality Instrumentation and Related Data

Topic objective

To develop and appraise accurate, reliable and robust instruments which measure parameters used as indices for the monitoring and control of water quality and provide data in a readily usable format.

Project No.	Output Ref.	Title	Uptake Route	Date
002	Note 72	Pesticides in major aquifers	Operational	1992
024	Project Record 024/1/T	Methods for assessing the toxicity of sediment-bound contaminants	Operational	1992
040	P-21	Detecting changes in groundwater quality - Monitoring requirements	Operational	1990
043	Note 5	Development of integrating and sentinel samplers	Operational	1991
044	PRS 2273-M	Interim review of data handling and information needs of regulatory agencies	Understanding	1989
047	PRS 2304	New biological methods for assessing episodic pollution	Operational	1989
049	P-41	Determination of the EC50 of test substances to the Microtox reagent <u>Photobacterium phosphoreum</u>	Operational	1990
050	PRS 2272-M	Instrumentation for monitoring by the NRA - Water quality	Operational	1989
061	P-25	New biological methods for assessing the effects of pollution	Operational	1990
	P-60	Evaluation of rapid detection kits for the isolation of Salmonellae	Operational	1990
	Report 2	Manual of standard methods for microbiological analysis	Operational	1992
	Note 100	Microbiological techniques - Storage and pre-treatment of samples		
063	P-33	Electrochemical immunoassay for atrazine	Operational	1990
	Note 10	Review of sensing techniques for in situ monitoring	Operational	1991
	Project Record 063/9/ST	Evaluation of multiple parameter hand-held meters - Technical information	Operational	1992
	Project Record 063/10/ST	Evaluation of multiple parameter hand-held meters - Manufacturers' summaries	Operational	1992
085	Note 84	NRA monitoring equipment database	Operational	1992
220	Note 62	NRA instrumentation assessment and demonstration facilities - Final report	Operational	1992

	Project Record 220/3/T	Organisations involved in monitoring instrumentation standards and evaluations	Understanding	1991
	Project Record 220/4/T	Specification of NRA field test facilities for instrumentation assessment	Operational	1991
	Project Record 220/6/T	Safe system of work - Fobney Mead field test facility safety procedures	Operational	1992
	Project Record 220/7/T	Protocol for investigation of ion-selective ammonium electrodes and their applications in field measurement	Understanding	1992
	Project Record 220/9/T	Instrument performance assessment standard test protocols - Revision A	Operational	1992
260		Coastal sewerage programme	Policy	
	Note 142	Estimating the frequency of operation of storm outfalls and overflows - Method 2		1990
	Note 143	Estimating the frequency of operation of storm outfalls and overflows - Method 1		1990
	Note 150	Recommended method for estimating storm discharge volumes and frequencies		1991
311	Note 28	Review of remote sensing - Potential role within the NRA	Operational	1992
	Project Record 311/2/HO	Review of remote sensing - Potential role within the NRA	Operational	1992
318	Project Record 318/5/Y	Development of new techniques for the monitoring of ammonia in water - Project definition study	Operational	1991
323	Project Record 323/3/HO	Dissolved oxygen and ammonia in tidal waters related to SWQOs - Project definition study	Policy	1992
328	Report 4	Airbourne remote sensing of coastal waters	Operational	1993
361	Note 183	Analysis, storage and archiving of water quality data	Operational	1993
	Project Record 361/4/NW	Analysis, storage and archiving of water quality data	Operational	1993

Projects due to complete in the near future

240	Bioaccumulation of red list organic compounds
349	Validation of field procedures for algal toxin test kit
471	Development of quality control procedures for monitoring
473	Review of field test kits

PROPOSAL /PROJECT NUMBER	PROJECT TITLE OBJECTIVES	START END	PROJECT COSTS £k								CONTRACTOR PROJECT LEADER	COMMENTS
			1993/94		1994/95		1995/96		1996/97			
			Ext	Int	Ext	Int	Ext	Int	Ext	Int		
	Business Area: Monitoring Topic Area A4 - Instrumentation and Field Techniques										Chairman: Topic Leader:	John Seager, HO Paul Williams, SW (Twerton) Linked to National Centre
A05(91)2 348	On-going projects A4 Field detection of algal toxins To develop a field test kit for the detection to a specified level of Microcystin - LR in water	9/91 5/94	23								Biocode M Pearson	Output - E. Link with Project 349 (Topic A4). A Biocode funding next phase.
A05(91)4 349	Validation of field procedures for algal toxin field test kits To validate for NRA the development and performance of the field test kit for Microcystin - LR, developed by Biocode and develop field procedures for its use by NRA staff	9/91 5/93	13								University of Dundee M Pearson	Output - f & O. Link with Project 348 (Topic A4). A
A10(90)4 240	Bioaccumulation of Red List organic compounds To develop code(s) of practice on the use of bioaccumulation techniques for monitoring Red List trace organic substances in freshwaters and estuaries that can be used through all the NRA Regions	9/90 5/93	5								Northern Environmental Consultants C Urquhart	Output - O & c. N/Y
A15(90)6 247	Broad spectrum sensors To develop and test in the laboratory and in the field a prototype instrument, incorporating biosensors, allowing a rapid assessment of toxicity of aqueous samples Phase 2 - further prototype development	12/90 11/93 94/95 95/96	53					*5		*30	WRc, Luton College P Waldron	Output - E. NRA contribution to DTI Link funded project. Total project cost £367k. A Phase 2 to follow NRA In-house evaluation.
A10(91)7 442	Development of new techniques for the monitoring of ammonia in water, Phase 2 To develop and test in the laboratory and the field new and improved techniques for monitoring ammonia in water	1/93 9/94	80		25						M Squared Technology M Briers	Output - E & O. Implementation plan to be submitted by August 1994 N/Y
A10(92)1 427	Assessment of field monitors for consent monitoring To assess accuracy, reliability, applicability and cost effectiveness of available equipment to enable the NRA to monitor alternative determinands to BOD and suspended solids Phase 2 - evaluation of the best monitors	9/92 2/94 94/95 95/96	52								WRc: T Long	Output - O, p & c. Part-funded by SNIFFER. Total project cost £165k. HO
								*20	2	*50	2	

PROPOSAL /PROJECT NUMBER	PROJECT TITLE OBJECTIVES	START END	PROJECT COSTS £k								CONTRACTOR PROJECT LEADER	COMMENTS	
			1993/94		1994/95		1995/96		1996/97				
			Ext	Int	Ext	Int	Ext	Int	Ext	Int			
A15(90)1 471	Development of quality control procedures for monitoring equipment To develop a standard method for Quality Control that can be applied to specifically to key determinands in portable water quality monitoring instrumentation to improve reliability of data	5/93 10/93	18								MetOcean Ltd S Wills	Output - O. Needs to link in with Laboratory Managers AQC sub-group. Supports Developmental Initiative - Programme of WQ Monitoring. Ref No WQ13.	
A10(92)2 473	Review of field test kits To review the use of field test kits in water quality monitoring to establish the feasibility and benefits of undertaking research to develop further test kits	5/93 9/93	19								R Bogue & Partners M Briers	Output - e & o. Liaison with Laboratory of Government Chemist and AEA. Liaison also with R&D Liaison Group for ENVAGE. Developed out of A(93)3 Monitoring Equipment project. Supports Developmental Initiative - Programme of WQ Monitoring. Ref No WQ13.	
A04(93)2 507	Evaluation of mini metal sensors To evaluate bench-top metals analyser and to develop methods to enable environmental concentration in seawater of major saline metals to be determined in situ on board a survey vessel Phase 2 - production of prototype	12/93 7/94 94/95 95/96	23					*20	5	*50	5	Ecossensors N Holden	Output - e & o. Developed out of A(93)3 - Monitoring equipment project, and in conjunction with Project 473. Supports Developmental Initiative - Programme of WQ Monitoring. Ref No WQ13. Prototype phase limited to minimum necessary commercial support. Phase 1 budget to be reviewed.
A04(93)1 523	Moored marine water quality monitor To develop a prototype self-contained monitoring buoy in order to fulfill our statutory obligations to monitor both out to the three mile limit and to investigate the effect of polluting discharges	3/94 7/95	60		44	27		1	8			In-House T Long	Output - E & m. Project manager - Paul Williams Wx. Developed out of A(93)3 - Monitoring equipment project. Supports Developmental Initiative - Programme of WQ Monitoring. Ref No WQ13.
A04(93)3 521	Feasibility study of track analysis particles To carry out a feasibility study to determine whether the GR-39 technique could be used in order to provide accurate, cost effective data for the NRA	2/94 3/94	5									Phoenix Research Laboratory J Dalton	Output - U. Customer - John Seager.
Total on-going projects, including contingent budgets, A4			351	0	114	34	131	15					

PROPOSAL /PROJECT NUMBER	PROJECT TITLE OBJECTIVES	START END	PROJECT COSTS £k								CONTRACTOR PROJECT LEADER	COMMENTS
			1993/94		1994/95		1995/96		1996/97			
			Ext	Int	Ext	Int	Ext	Int	Ext	Int		
A04(94)1	Proposed new starts A4 Biochemical oxygen demand predictor and hand held Instrument To develop a method of indicating the level of BOD in a discharge of receiving water to enable NRA staff to make on the spot decisions for further sampling or action Phase 1 - feasibility study	94/95 94/95			50	5					M Briers N/Y	Output - e, O & f. Supports Developmental Initiative - WQ Monitoring. Supports Continuing Activity - Consenting and Compliance. Handheld instrument R&D must be structured, utilising R&D Commercial Issues principles, to maximise procurement leverage and minimise NRA expenditure. Priority 1.
A04(94)2	Oil in water - a review of existing monitors To review current equipment used to monitor the presence and levels of oil in freshwaters to provide NRA staff with accurate assessment of their performance	94/95 94/95			30	2					J Frake S	Output - O & f. Supports Continuing Activity - Pollution Prevention. Priority 3.
A04(94)4	Inland use of airborne remote sensing To review the algorithms for interpreting data from airborne remote sensing to monitor the quality of inland waters	94/95 94/95			70	30					A Withers NW	Outputs - O & e. Supports Developmental Initiative - Water Quality Monitoring Programme. Link in with National Centre on Instrumentation and G01(91)3. Priority 3.
A04(94)5	Instrumentation for self-monitoring To specify and/or develop the equipment for self-monitoring and auditing of compliance to provide information for NRA staff through a business study	94/95 94/95			30						T Long HO	Output - O & e. Supports Developmental Initiative - Environmental Agency (ENVAGE). Liaison with NRA/HMIP/NAWRO Monitoring Group. Martin Griffiths identified as principal client. Priority 2.
Total proposed new starts, A4			180 37									

RELEVANT PROJECTS IN OTHER TOPIC AREAS

A3/A09(92)3
(not yet started)

Strategy for using immunoassays for screening of and
herbicides

A5/A12(92)2
Project 494
PL - Roger Sweeting (T)

Method of development of ecotoxicologically-based tests
for assessment of effluent and receiving water quality

NOTES ON PROJECT EVALUATION

The following points should be noted regarding the individual project appraisal and summary forms.

1. Allocation of n/a

Where n/a is inserted, this is due to any of the following circumstances:

- (a) where no information is available;
- (b) where the issue is not relevant;
- (c) where it has not been possible to resolve the issue, for whatever reason.

2. Value for Money

In many circumstances, no financial data were forthcoming. Therefore, many projects/reports could not be assessed in these terms. Boxes on project forms are allocated n/a in these instances.

3. Contact with NRA Project Leaders

NRA Project Leaders were contacted in a number of instances. This was primarily where it was necessary to gain a more detailed insight into larger or more complex projects, and/or to gain supplementary information.

4. Scores

The maximum score, +2, was not only allocated to indicate excellence but also where a particular feature was wholly satisfactory. For example, where a project's objectives were as clearly defined as necessary, etc.

NRA R & D PROJECT EVALUATION SUMMARY

Short title/project number:	Rapid kits for Salmonella /061	Manual of micro. methods /061	New bio. methods for poll'n/047/061	Analysis of water quality data/361	Interim review of data handling /044	Inst's for mon. by the NRA /050	Changes in groundwater quality /040
Type:	Applied	Applied	Pure	Strategic	Strategic	Applied	Applied
Duration (years):	n/a	n/a	n/a	2	n/a	n/a	1
Contractor:	WRC	WRC	WRC	C+W	WRC	WRC	WRC
External/Internal contract (E/I) :	E	E	E	E	E	E	E
Tender: Single/Competitive (S/C):	S(?)	S(?)	S(?)	C	S(?)	n/a	S(?)
Budget (£K):	n/a	n/a	372	54.8	n/a	n/a	n/a
QUALITY OF RESEARCH							
Policy link or statutory requirement:	+1	+2	+1	+1	+1	+2	+2
Relevance to policy or requirement:	+1	+2	+1	+2	+1	+2	+2
Objectives	-Clear:	+2	+2	-1	+2	+2	+2
	-Attainable:	+2	+2	-1	+2	+2	+2
Objectives Realised	-Overall:	+2	+2	-1	+2	+2	+1
	-Management:	+2	+1	-2	-1	n/a	n/a
	-Monitoring / milestones:	n/a	+1	-1	n/a	n/a	n/a
	-Reports:	+1	+2	-1	+1	+1	+1
	-Facilities:	+2	+2	-1	+2	+2	+2
	-Quality of team:	+1	+2	-1	+2	+2	+2
USEFULNESS OF RESEARCH							
Results used by:	-1	+2 (NRA etc.)	+1(NRA)	+1(NRA)	+2(NRA)	+2(NRA)	+2(NRA)
Aims fulfilled:	+2	+2	-1	+1	+2	+2	+2
9.2 Innovative contribution:	n/a	n/a	+1	+2	+1	n/a	n/a
Relevance to current concerns:	+1	+2	+1	+1	+2	+2	+2
User orientation / quality of outputs:	+1	+2	-1	+1	+2	+1	+1
Effectiveness of technology transfer:	-1	+1	+1	-1	+2	+1	+1
Ease / affordability of implementation:	+1	+1	n/a	-1	+1	+1	+1
Other impacts / take-up:	-1	+2	-1	n/a	+1	+1	+1
Dissemination of findings:	-1	+2	+2	+2	+1	+1	+1
VALUE FOR MONEY							
Overall:	-1	-1	-2	+1	n/a	n/a	n/a
Other factors	-Maintaining timescale:	n/a	+1	-2	+2	n/a	n/a
	-Use of prior / supporting information:	n/a	+2	+1	+2	+1	+2
	-Adherence to budget:	n/a	+1	-2	+2	n/a	n/a
	-Added value achieved:	-1	+2	-1	+1	n/a	n/a
	-Other features:	n/a	n/a	n/a	+2	n/a	n/a

Type:	Applied/ strategic	Applied
Duration (years):	n/a	2
Contractor:	WRC	WRC
External/Internal contract (E/I) :	E	E
Tender: Single/Competitive (S/C):	S(?)	S
Budget (£K):	n/a	65.2
QUALITY OF RESEARCH		
Policy link or statutory requirement:	+1	+1
Relevance to policy or requirement:	+1	+2
Objectives	-Clear:	-2
	-Attainable:	-1
Objectives Realised	-Overall:	+1
	-Management:	+1
	-Monitoring / milestones:	+1
	-Reports:	+1
	-Facilities:	+1
	-Quality of team:	+1
USEFULNESS OF RESEARCH		
Results used by:	+2(NRA)	-1
∞ Aims fulfilled:	+1	+1
∞ Innovative contribution:	n/a	+1
Relevance to current concerns:	+1	+1
User orientation / quality of outputs:	+1	+1
Effectiveness of technology transfer:	+2	-1
Ease / affordability of implementation:	+1	-1
Other impacts / take-up:	n/a	n/a
Dissemination of findings:	+1	+1
VALUE FOR MONEY		
Overall:	n/a	-1
Other factors	-Maintaining timescale:	+2
	-Use of prior / supporting information:	+1
	-Adherence to budget:	+2
	-Added value achieved:	-1
	-Other features:	n/a

Review of remote sensing /0311	Airborne remote sensing /0328	New techniques for ammonia in water /318	DO and ammonia in tidal waters /0323	Procedures for tox. of sediment /024
Applied/ strategic	Applied	Applied	Applied	Applied (?)
0.5	1.5	0.3	0.3	2
NERC	S'hampton Uni	Bogue	WRC	WRC
E	E	E	E	E
C	C	C(?)	S	S
30.4	98.7	13.0	15	97.6
-1	-1	+2	+2	+1
+2	+1	+2	+2	+2
+2	+2	+2	+1	+1
+1	+1	+2	+1	+1
+2	+1	+1	+1	+1
+2	+1	+1	-1	+1
+2	+1	+1	+1	n/a
+2	+2	+1	+1	+2
+2	+2	+1	+2	+2
+2	+2	+1	+2	+2
+2 (NRA, NERC)	+2(NRA, NERC)	+2(NRA)	+2(NRA)	+2(NRA and MAFF)
+2	+2	+2	+1	+1
+1	+2	+1	+1	+1
+1	+1	+2	+2	+2
+2	+2	+1	+1	+1
+2	+1	+2	+1	+2
+1	-1	+2	+1	+1
+2	+1	+1	+1	+2
+2	+2	+1	+1	+2
+2	+1	+2	+2	+1
+2	+1	+1	-1	+1
+2	+2	+2	+2	+2
+2	+1	+2	+2	+1
+2	+1	+1	n/a	+1
n/a	n/a	n/a	n/a	n/a

Short title/project number:

Pesticides in
major aquifers
/002

Coastal
sewerage
prog./260 (3
reports)

Type:

Applied/
strategic

Applied/
strategic

Duration (years):

2

1

Contractor:

WRC

WRC

External/Internal contract (E/I):

E

E

Tender: Single/Competitive (S/C):

S(inherited)

S(?)inherited)

Budget (£K):

315.2

15(last phase)

QUALITY OF RESEARCH

Policy link or statutory requirement:

+2

+2

Relevance to policy or requirement:

+2

+2

Objectives

-Clear:

+2

+2

-Attainable:

+1

+1

Objectives Realised

-Overall:

+1

+1

-Managment:

+1

+1

-Monitoring / milestones:

+1

+1

-Reports:

+2

+1

-Facilities:

+2

+1

-Quality of team:

+2

+1

USEFULNESS OF RESEARCH

Results used by:

+1

+2(NRA etc.)

Aims fulfilled:

+1

+2

Innovative contribution:

+1

+2

Relevance to current concerns:

+2

+2

User orientation / quality of outputs:

+2

+1

Effectiveness of technology transfer:

+1

+2

Ease / affordability of implementation:

+1

+1

Other impacts / take-up:

+1

+1

Dissemination of findings:

+1

-2

VALUE FOR MONEY

Overall:

+1

+1

Other factors

-Maintaining timescale:

+2

-1

-Use of prior /

+2

+2

supporting information:

-Adherence to budget:

+1

-1

-Added value achieved:

+1

+2

-Other features:

n/a

n/a

Spec. of test facilities for inst. assessment /220	Safe system at work - Fobney Mead /220	Organisations in instrument standards and evaluation /220	Sensing for in-situ monitoring /063	Evaluation of multiple parameter meters /063
Applied	Applied	Applied	Strategic	Applied
2 for all of project 220	-	-	2 (?) for all 3 parts of 063	-
WRC	WRC	WRC	WRC	WRC
E	E	E	E	E
S(?)	S(?)	S(?)	S(?)	S(?)
179 for all of project	220	-	063	-
+2	+1	+1	+1	+2
+2	+1	+1	+1	+2
+2	+2	+2	+2	+1
+2	+2	+2	+2	+2
+2	+2	+1	+2	+2
n/a	n/a	n/a	n/a	+1
n/a	n/a	n/a	n/a	n/a
+2	+1	+1	+2	+2
n/a	+1	+2	+2	+2
+2	+1	+2	+2	+2
+2(NRA)	+2(NRA)	+1(NRA)	+1(NRA)	+2(NRA)
+2	+2	+2	+2	+2
n/a	n/a	n/a	+1	+1
+2	+1	+2	+2	+2
+2	+1	+2	+2	+1
n/a	+1	n/a	+1	+1
n/a	+1	+1	n/a	+1
+2	+1	+2	+1	+1
+2	+1	+1	+1	+1
n/a	n/a	n/a	n/a	n/a
+2	n/a	n/a	n/a	n/a
+2	+1	+1	+2	+1
n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	+1	n/a
n/a	n/a	+1	n/a	n/a

Short title/project number:

Immunoassay
for atrazine
/063

Protocol for
ion-selective
ammonium
electrodes
/220

Type:

Applied

Applied

Duration (years):

-

2 for all of
project 220

Contractor:

WRC
(inherited)

WRC

External/Internal contract (E/I) :

E

E

Tender: Single/Competitive (S/C):

S

S(?)

Budget (£K):

-

179 for all for
project 220

QUALITY OF RESEARCH

Policy link or statutory requirement:

+2

+1

Relevance to policy or requirement:

+2

+1

Objectives

-Clear:

+1

+2

-Attainable:

+1

+2

Objectives Realised

-Overall:

+1

+1

-Management:

n/a

n/a

-Monitoring / milestones:

n/a

n/a

-Reports:

+1

+1

-Facilities:

+1

+2

-Quality of team:

+1

+2

USEFULNESS OF RESEARCH

Results used by:

-1

+2(NRA)

Aims fulfilled:

+1

+2

Innovative contribution:

n/a

n/a

Relevance to current concerns:

+2

+1

User orientation / quality of outputs:

+1

+1

Effectiveness of technology transfer:

-1

+1

Ease / affordability of implementation:

n/a

+1

Other impacts / take-up:

-1

+1

Dissemination of findings:

-1

+1

VALUE FOR MONEY

Overall:

n/a

n/a

Other factors

-Maintaining timescale:

+2

n/a

-Use of prior /

+1

+2

supporting information:

-Adherence to budget:

n/a

n/a

-Added value achieved:

-1

n/a

-Other features:

n/a

n/a

Inst.
assessment
and demo.
facility, final
report /220

Inst. standard
test protocols,
rev'n.A/220

Applied

Applied

WRC

WRC

E
S(?)

E
S(?)

+1

+1

+1

+1

+2

+1

+2

+1

+2

+1

+1

n/a

+1

n/a

+1

+2

+2

+2

+1

+2

+2(NRA)

+2(NRA)

+2

+1

+1

+1

+2

+2

+1

+1

-1

+1

-1

+1

+1

n/a

+1

+1

+2

n/a

-1

n/a

+1

+2

+1

n/a

+1

+1

n/a

n/a

PROJECT ASSESSMENT.

TITLE	Evaluation of Rapid Detection Kits for the Isolation of <i>Salmonellae</i>
PROJECT No.	061
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+1
Policy links or statutory requirements	+1
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+2
Management	+2
Monitoring/milestones	n/a
Reports	+1
Facilities	+2
Quality of team	+1
USEFULNESS OF RESEARCH	
Results used by	-1
Aims fulfilled	+2
Innovative contribution	n/a
Relevance to current concern	+1
User orientation	+1
Effectiveness of technology transfer	-1
Ease/affordability of implementation	+1
Other impacts/take-up	-1
Dissemination of findings	-1
VALUE FOR MONEY	
Overall	-1
Other Factors	
Maintaining timescale	n/a
Use of prior/supporting information	n/a
Adherence to budget	n/a
Added value achieved	-1
Other features	n/a

Notes:

Value for money - no financial information available. The report (R&D P-60) simply reports on an evaluation of certain test kits. The results were favourable but no kits were ever used and the report was not widely circulated, hence, -1 for overall value for money. Discussions with the NRA have failed to identify the reasons for this lack of uptake. (See also other project 061 forms)

PROJECT ASSESSMENT.

TITLE	Manual of Standard Methods for Microbiological Analysis
PROJECT No. .	061
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+2
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+2
Management	+1
Monitoring/milestones	+1
Reports	+2
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA etc.)
Aims fulfilled	+2
Innovative contribution	n/a
Relevance to current concern	+2
User orientation	+2
Effectiveness of technology transfer	+1
Ease/affordability of implementation	+1
Other impacts/take-up	+2
Dissemination of findings	+2 (report sold externally)
VALUE FOR MONEY	
Overall	
Other Factors	-1
Maintaining timescale	+1
Use of prior/supporting information	+2
Adherence to budget	+1
Added value achieved	+2
Other features	n/a

Notes:

This document is a manual describing various standard microbiological procedures and was derived from earlier NRA- and SNIFFER-funded studies at WRC. Some procedures are already in use by the NRA. The Project Leader felt that the cost was somewhat high (not stated) but overall, the project was a success. The manual is now widely used by the NRA, as well as being available as a standard reference to outside parties.

PROJECT ASSESSMENT.

TITLE	New Biological Methods for Assessing the Effects of Pollution
PROJECT No.	047/061
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+1
Policy links or statutory requirements	+1
Objectives	
Clear	-1
Attainable	-1
Objectives realised	
Overall	-1
Management	-2
Monitoring/milestones	-1
Reports	-1
Facilities	-1
Quality of team	-1
USEFULNESS OF RESEARCH	
Results used by	+1
Aims fulfilled	-1
Innovative contribution	+1
Relevance to current concern	+1
User orientation	-1
Effectiveness of technology transfer	+1
Ease/affordability of implementation	n/a
Other impacts/take-up	-1
Dissemination of findings	+2
VALUE FOR MONEY	
Overall	-2
Other Factors	
Maintaining timescale	-2
Use of prior/supporting information	+1
Adherence to budget	-2
Added value achieved	-1
Other features	n/a

Notes:

The two reports (R&D P-25 and R&D PRS 2304), which are identical except in title and number) cover only part of the work specified in the retrospective PIA. Of the four major areas of research identified in this document, only two are considered in detail in the report; the remainder are considered in summary form only. Other reports were issued during the course of this project which was inherited by the NRA from the DOE. Discussions with the NRA Project Leader revealed that it was fraught with all manner of problems (timescales, management, failure to address the key objectives, excessive spend on inappropriate areas etc.)

PROJECT ASSESSMENT.

TITLE	Analysis, Storage and Archiving of Water Quality Data
PROJECT No.	361
NRA CONTACT	
RESEARCHER/CONTRACTOR	Cremer and Warner
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+1
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	-1
Management	-1
Monitoring/milestones	n/a
Reports	+1
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+1
Aims fulfilled	+1
Innovative contribution	+2
Relevance to current concern	+1
User orientation	+1
Effectiveness of technology transfer	-1
Ease/affordability of implementation	-1
Other impacts/take-up	n/a
Dissemination of findings	+2
VALUE FOR MONEY	
Overall	+1
Other Factors	
Maintaining timescale	+2
Use of prior/supporting information	+2
Adherence to budget	+2
Added value achieved	+1
Other features	+2

Notes:

Two reports were examined (the R&D Note and the Project Record). This is a strong and thorough piece of work whose results are central to the NRA's use of water quality data. The use of information and experiences from other industries was strong. However the project's original objectives and emphasis changed somewhat during its course and some of the objectives were only addressed minimally. As a result of this, and discussions with NRA personnel, the project has been allocated several -1s.

PROJECT ASSESSMENT.

TITLE	Interim Review of Data Handling and Information Needs of Regulatory Agencies
PROJECT No.	044
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+1
Policy links or statutory requirements	+1
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+2
Management	n/a
Monitoring/milestones	n/a
Reports	+1
Facilities	+1
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA)
Aims fulfilled	+2
Innovative contribution	+1
Relevance to current concern	+2
User orientation	+2
Effectiveness of technology transfer	+2
Ease/affordability of implementation	+1
Other impacts/take-up	+1
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	n/a
Use of prior/supporting information	+1
Adherence to budget	n/a
Added value achieved	n/a
Other features	n/a

Notes:

The results of this report were acted on subsequently. No financial or timescale data were available

PROJECT ASSESSMENT.

TITLE	Instruments for Monitoring by the NRA
PROJECT No.	050
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+2
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+2
Management	n/a
Monitoring/milestones	n/a
Reports	+1
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA)
Aims fulfilled	+2
Innovative contribution	n/a
Relevance to current concern	+2
User orientation	+1
Effectiveness of technology transfer	+1
Ease/affordability of implementation	+1
Other impacts/take-up	+1
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	n/a
Use of prior/supporting information	+1
Adherence to budget	n/a
Added value achieved	YES
Other features	n/a

Notes:

No financial or timescale data available. The project was followed-up and led to the use of various instruments by the NRA. The report's recommendations were acted on.

PROJECT ASSESSMENT.

TITLE	Detecting Changes in Groundwater Quality - Monitoring Requirements
PROJECT No.	040
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+2
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+1
Management	n/a
Monitoring/milestones	n/a
Reports	+1
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA)
Aims fulfilled	+2
Innovative contribution	n/a
Relevance to current concern	+2
User orientation	+1
Effectiveness of technology transfer	+1
Ease/affordability of implementation	+1
Other impacts/take-up	+1
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	n/a
Use of prior/supporting information	+2
Adherence to budget	n/a
Added value achieved	n/a
Other features	n/a

Notes:

No financial or timescale data available. The project led to further actions and appropriately, drew heavily on earlier data. The statistical data interpretation is particularly strong and useful. The topic is central to the NRA's operations

PROJECT ASSESSMENT.

TITLE	Determination of the Ec50 of Test Substances to the Microtox Reagent <u>Photobacterium phosphoreum</u>
PROJECT No.	049
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+1
Policy links or statutory requirements	+1
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+1
Management	-1
Monitoring/milestones	-1
Reports	+1
Facilities	+1
Quality of team	+1
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA)
Aims fulfilled	+1
Innovative contribution	n/a
Relevance to current concern	+1
User orientation	+1
Effectiveness of technology transfer	+2
Ease/affordability of implementation	+1
Other impacts/take-up	n/a
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	-1
Use of prior/supporting information	+1
Adherence to budget	n/a (never defined)
Added value achieved	n/a
Other features	n/a

Notes:

This report is part of a project "Case studies of discharge control and monitoring by biological techniques" (R&D contract A18/049), for which there was no final report. It simply defines the methods to be used when conducting standard Microtox tests. No cost or timescale data are available. However, discussions with the NRA revealed that there were some fairly serious management and timescale problems during the project.

PROJECT ASSESSMENT.

TITLE	Development of Integrating and Sentinel Samplers
PROJECT No.	043
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+1
Objectives	
Clear	-2
Attainable	-1
Objectives realised	
Overall	+1
Management	+1
Monitoring/milestones	+1
Reports	+1
Facilities	+1
Quality of team	+1
USEFULNESS OF RESEARCH	
Results used by	-1
Aims fulfilled	+1
Innovative contribution	+1
Relevance to current concern	+1
User orientation	+1
Effectiveness of technology transfer	-1
Ease/affordability of implementation	-1
Other impacts/take-up	n/a
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	-1
Other Factors	
Maintaining timescale	+2
Use of prior/supporting information	+1
Adherence to budget	+2
Added value achieved	-1
Other features	n/a

Notes:

This project adhered to its timescales and broadly mets its objectives. However, the cost of £65.2K is such that the overall value for money is only rated as fair (-1). The project was inherited and the objectives were extremely poorly defined (one line of text!)

PROJECT ASSESSMENT.

TITLE	A Review of Remote Sensing - Potential Role Within the NRA
PROJECT No.	0311
NRA CONTACT	
RESEARCHER/CONTRACTOR	NERC
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	-1
Objectives	
Clear	+2
Attainable	+1
Objectives realised	
Overall	+2
Management	+2
Monitoring/milestones	+2
Reports	+2
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA, NERC)
Aims fulfilled	+2
Innovative contribution	+1
Relevance to current concern	+1
User orientation	+2
Effectiveness of technology transfer	+2
Ease/affordability of implementation	+1
Other impacts/take-up	+2 (Other projects spawned as a result)
Dissemination of findings	+2 (report available externally)
VALUE FOR MONEY	
Overall	+2
Other Factors	
Maintaining timescale	+2
Use of prior/supporting information	+2
Adherence to budget	+2
Added value achieved	+2
Other features	n/a

Notes:

As well as the NRA, who now employ RS on a routine basis, the NERC also uses this technology, so two UK organisations are able to compare results and methods.

PROJECT ASSESSMENT.

TITLE	Airborne Remote Sensing of Coastal Waters.
PROJECT No.	0328
NRA CONTACT	
RESEARCHER/CONTRACTOR	University of Southampton
QUALITY OF RESEARCH	
Relevance to policy	+1
Policy links or statutory requirements	-1
Objectives	
Clear	+2
Attainable	+1
Objectives realised	
Overall	+1
Management	+1
Monitoring/milestones	+1
Reports	+2
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA, NERC etc.)
Aims fulfilled	+2
Innovative contribution	+2
Relevance to current concern	+1
User orientation	+2
Effectiveness of technology transfer	+1
Ease/affordability of implementation	-1
Other impacts/take-up	+1
Dissemination of findings	+2 (report available externally)
VALUE FOR MONEY	
Overall	+1
Other Factors	
Maintaining timescale	+1
Use of prior/supporting information	+2
Adherence to budget	+1
Added value achieved	+1
Other features	n/a

Notes:

This project demonstrated the viability of remote sensing as a standard tool, as well as proving its utility within the R&D context. Other bodies such as the NERC are now using these methods and the NRA is also now investigating the detection of algal blooms by remote sensing. Despite the various unknowns associated with any novel and innovative technology, the project was extremely successful.

PROJECT ASSESSMENT.

TITLE	The Development of New Techniques for the Monitoring of Ammonia in Water
PROJECT No.	318
NRA CONTACT	
RESEARCHER/CONTRACTOR	
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+2
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+1
Management	+1
Monitoring/milestones	+1
Reports	+1
Facilities	+1
Quality of team	+1
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA)
Aims fulfilled	+2
Innovative contribution	+1
Relevance to current concern	+2
User orientation	+1
Effectiveness of technology transfer	+2
Ease/affordability of implementation	+2
Other impacts/take-up	+1
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	+2
Other Factors	
Maintaining timescale	+1
Use of prior/supporting information	+2
Adherence to budget	+2
Added value achieved	+1
Other features	n/a

Notes:

This review project led to the initiation of a specific ammonia sensor R&D programme which is now coming to fruition. There is a pressing need for such sensors by the NRA. At £13K, the project represented very good value for money

PROJECT ASSESSMENT.

TITLE	Dissolved Oxygen and Ammonia in Tidal Waters related to WQOs, Project Definition Study
PROJECT No.	0323
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	+2
Relevance to policy	+2
Policy links or statutory requirements	
Objectives	
Clear	+1
Attainable	+1
Objectives realised	
Overall	+1
Management	-1
Monitoring/milestones	+1
Reports	+1
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA)
Aims fulfilled	+1
Innovative contribution	+1
Relevance to current concern	+2
User orientation	+1
Effectiveness of technology transfer	+1
Ease/affordability of implementation	+1
Other impacts/take-up	+1
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	+2
Other Factors	
Maintaining timescale	-1
Use of prior/supporting information	+2
Adherence to budget	+2
Added value achieved	n/a
Other features	n/a

Notes:

This project met its objectives, is of central importance and represented excellent value for money. Its results have since been fed into a further project.

PROJECT ASSESSMENT.

TITLE	Methods for Assessing the Toxicity of Sediment-bound Contaminants
PROJECT No.	024
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+1
Objectives	
Clear	+1
Attainable	+1
Objectives realised	
Overall	+1
Management	+1
Monitoring/milestones	n/a
Reports	+2
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA and MAFF)
Aims fulfilled	+1
Innovative contribution	+1
Relevance to current concern	+2
User orientation	+1
Effectiveness of technology transfer	+2
Ease/affordability of implementation	+1
Other impacts/take-up	+2
Dissemination of findings	+2
VALUE FOR MONEY	
Overall	+1
Other Factors	
Maintaining timescale	+1
Use of prior/supporting information	+2
Adherence to budget	+1
Added value achieved	+1
Other features	n/a

Notes:

This report provides a detailed review of this research, which appropriately, drew heavily on earlier UK and overseas work. Findings were made available to MAFF who, it is understood, are now using these protocols. (The £97.6K budget includes inherited costs of £46.7K)

PROJECT ASSESSMENT.

TITLE	Pesticides in Major Aquifers
PROJECT No.	002
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+2
Objectives	
Clear	+2
Attainable	+1
Objectives realised	
Overall	+1
Management	+1
Monitoring/milestones	+1
Reports	+2
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+1
Aims fulfilled	+1
Innovative contribution	+1
Relevance to current concern	+2
User orientation	+2
Effectiveness of technology transfer	+1
Ease/affordability of implementation	+1
Other impacts/take-up	+1
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	+1
Other Factors	
Maintaining timescale	+2
Use of prior/supporting information	+2
Adherence to budget £315.2K	+1
Added value achieved	+1
Other features	n/a

Notes:

This was a long and complex project that met many of its original objectives. Some were not met, however, but overall, the project is seen as a success. (The budgetary figure above excludes earlier inherited costs between 1989 and 1990).

PROJECT ASSESSMENT.

TITLE	Coastal Sewerage Programme Estimating the frequency of operation of storm outfalls and overflows Method 1 and 2 - Recommended method for estimating storm discharge volumes and frequencies
PROJECT No.	260
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+2
Objectives	
Clear	+2
Attainable	+1
Objectives realised	
Overall	+1
Management	+1
Monitoring/milestones	+1
Reports	+1
Facilities	+1
Quality of team	+1
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA, water plcs)
Aims fulfilled	+2
Innovative contribution	+2
Relevance to current concern	+2
User orientation	+1
Effectiveness of technology transfer	+2
Ease/affordability of implementation	+1
Other impacts/take-up	+1
Dissemination of findings	-2
VALUE FOR MONEY	
Overall	+1
Other Factors	
Maintaining timescale	-1
Use of prior/supporting information	+2
Adherence to budget	-1
Added value achieved	+2
Other features	n/a

Notes:

This was an inherited project, funded originally by the water supply industry. Nine reports were produced during the course of the project and three were made available for comment, as above. Discussions with the NRA Project Leader revealed certain weaknesses but overall, the project was a success: its results are now widely used.

PROJECT ASSESSMENT.

TITLE	Specification of NRA Field Test Facilities for Instrument Assessment
PROJECT No.	220
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+2
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+2
Management	n/a
Monitoring/milestones	n/a
Reports	+2
Facilities	n/a
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA)
Aims fulfilled	+2
Innovative contribution	n/a
Relevance to current concern	+2
User orientation	+2
Effectiveness of technology transfer	n/a
Ease/affordability of implementation	n/a
Other impacts/take-up	+2
Dissemination of findings	+2
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	+2
Use of prior/supporting information	+2
Adherence to budget	n/a
Added value achieved	n/a
Other features	n/a

Notes:

The report examined (Project Record 220/4/T) simply describes in detail two of the NRA's instrument test facilities. This is fully achieved, hence the number of +2s. The report was one of several outputs from project 220 (see other assessment sheets) but the cost of this part of the project is not available, thus, the few scores in "Value for Money".

PROJECT ASSESSMENT.

TITLE	Organisations Involved in Monitoring Instrumentation Standards and Evaluations
PROJECT No.	0220
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+1
Policy links or statutory requirements	+1
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+1
Management	n/a
Monitoring/milestones	n/a
Reports	+1
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+1 (NRA)
Aims fulfilled	+2
Innovative contribution	n/a
Relevance to current concern	+2
User orientation	+2
Effectiveness of technology transfer	n/a
Ease/affordability of implementation	+1
Other impacts/take-up	+2 (being acted on)
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	n/a
Use of prior/supporting information	+1
Adherence to budget	n/a
Added value achieved	n/a
Other features	+1

Notes:

No cost or timescale data are available. This report addressed well an issue of great and growing importance and has elevated awareness of this within the NRA. Various activities have since followed and are in progress. (See also other project 0220 assessment forms).

PROJECT ASSESSMENT.

TITLE	Review of Sensing Techniques for <u>in situ</u> Monitoring
PROJECT No.	063
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+1
Policy links or statutory requirements	+1
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+2
Management	n/a
Monitoring/milestones	n/a
Reports	+2
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+1
Aims fulfilled	+2
Innovative contribution	+1
Relevance to current concern	+2
User orientation	+2
Effectiveness of technology transfer	+1
Ease/affordability of implementation	n/a
Other impacts/take-up	+1
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	n/a
Use of prior/supporting information	+2
Adherence to budget	n/a
Added value achieved	+1
Other features	n/a

Notes:

This report (R&D Note 10) has no named authors. It reviews available and emerging/new sensing techniques and is well researched and comprehensive. No project cost or timescale data are available for this specific part of project 063.

PROJECT ASSESSMENT.

TITLE	Organisations Involved in Monitoring Instrumentation Standards and Evaluations
PROJECT No.	0220
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+1
Policy links or statutory requirements	+1
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+1
Management	n/a
Monitoring/milestones	n/a
Reports	+1
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+1 (NRA)
Aims fulfilled	+2
Innovative contribution	n/a
Relevance to current concern	+2
User orientation	+2
Effectiveness of technology transfer	n/a
Ease/affordability of implementation	+1
Other impacts/take-up	+2 (being acted on)
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	n/a
Use of prior/supporting information	+1
Adherence to budget	n/a
Added value achieved	n/a
Other features	+1

Notes:

No cost or timescale data are available. This report addressed well an issue of great and growing importance and has elevated awareness of this within the NRA. Various activities have since followed and are in progress. (See also other project 0220 assessment forms).

PROJECT ASSESSMENT.

TITLE	Evaluation of Multiple Parameter Hand Held Meters - Technical Information and - Manufacturers Summaries
PROJECT No.	063
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+2
Objectives	
Clear	+1
Attainable	+2
Objectives realised	
Overall	+2
Management	+1
Monitoring/milestones	n/a
Reports	+2
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA)
Aims fulfilled	+2
Innovative contribution	+1
Relevance to current concern	+2
User orientation	+1
Effectiveness of technology transfer	+1
Ease/affordability of implementation	+1
Other impacts/take-up	+1
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	n/a
Use of prior/supporting information	+1
Adherence to budget	n/a
Added value achieved	n/a
Other features	n/a

Notes:

Two reports were examined, as above. The work is detailed, thorough and clearly central to the NRA's operations, and was acted on. However, no financial or timescale data were available for this part of project 063, hence the lack of scores under "Value for Money".

PROJECT ASSESSMENT.

TITLE	Electrochemical Immunoassay for Atrazine
PROJECT No.	063
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+2
Policy links or statutory requirements	+2
Objectives	
Clear	+1
Attainable	+1
Objectives realised	
Overall	+1
Management	n/a
Monitoring/milestones	n/a
Reports	+1
Facilities	+1
Quality of team	+1
USEFULNESS OF RESEARCH	
Results used by	-1
Aims fulfilled	+1
Innovative contribution	n/a
Relevance to current concern	+2
User orientation	+1
Effectiveness of technology transfer	-1
Ease/affordability of implementation	n/a
Other impacts/take-up	-1
Dissemination of findings	-1
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	+2
Use of prior/supporting information	+1
Adherence to budget	n/a
Added value achieved	-1
Other features	n/a

Notes:

Despite this work, immunoassay kits for pesticide determinations are still not being used by the NRA (although a current project is addressing this). The results of this study were not followed-up or reviewed in the light of subsequent commercial developments until very recently. The project was inherited and no financial information is available for this part of project 063.

PROJECT ASSESSMENT.

TITLE	Protocol for Investigation of Ion-selective Ammonium Electrodes and their Applications in Field Measurement
PROJECT No.	0220
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+1
Policy links or statutory requirements	+1
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+1
Management	n/a
Monitoring/milestones	n/a
Reports	+1
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA)
Aims fulfilled	+2
Innovative contribution	n/a
Relevance to current concern	+1
User orientation	+1
Effectiveness of technology transfer	+1
Ease/affordability of implementation	+1
Other impacts/take-up	+1
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	n/a
Use of prior/supporting information	+2
Adherence to budget	n/a
Added value achieved	n/a
Other features	n/a

Notes:

The protocols for testing ammonium ISEs were subsequently used. No timescale or cost data available. (See also other project 0220 assessment forms).

PROJECT ASSESSMENT.

TITLE	NRA Instrumentation Assessment and Demonstration Facilities: Final Report
PROJECT No.	0220
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+1
Policy links or statutory requirements	+1
Objectives	
Clear	+2
Attainable	+2
Objectives realised	
Overall	+2
Management	+1
Monitoring/milestones	+1
Reports	+1
Facilities	+2
Quality of team	+1
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA)
Aims fulfilled	+2
Innovative contribution	+1
Relevance to current concern	+2
User orientation	+1
Effectiveness of technology transfer	-1
Ease/affordability of implementation	-1
Other impacts/take-up	+1
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	+2
Other Factors	
Maintaining timescale	-1
Use of prior/supporting information	+1
Adherence to budget	+1
Added value achieved	+1
Other features	n/a

Notes:

The test facility has been built and is in use. Some of the technology transfer was difficult to implement and timescales slipped. Overall, however, the project was an unquestionable success. (See also other project 0220 assessment sheets).

PROJECT ASSESSMENT.

TITLE	Instrument Performance Assessment Standard Test Protocols, Revision
PROJECT No.	0220
NRA CONTACT	
RESEARCHER/CONTRACTOR	WRC
QUALITY OF RESEARCH	
Relevance to policy	+1
Policy links or statutory requirements	+1
Objectives	
Clear	+1
Attainable	+1
Objectives realised	
Overall	+1
Management	n/a
Monitoring/milestones	n/a
Reports	+2
Facilities	+2
Quality of team	+2
USEFULNESS OF RESEARCH	
Results used by	+2 (NRA)
Aims fulfilled	+1
Innovative contribution	+1
Relevance to current concern	+2
User orientation	+1
Effectiveness of technology transfer	+1
Ease/affordability of implementation	+1
Other impacts/take-up	n/a
Dissemination of findings	+1
VALUE FOR MONEY	
Overall	n/a
Other Factors	
Maintaining timescale	n/a
Use of prior/supporting information	+2
Adherence to budget	n/a
Added value achieved	+1
Other features	n/a

Notes:

No timescale or cost data available, hence several n/as, above. This assessment was derived wholly from the content of the report, which is clear, detailed and, apparently, meets an important objective. (See also other project 0220 assessment forms).