

National Groundwater & Contaminated Land Centre

Annual Report
2001/2002

...tools of
the trade...

...informing
& educating...



ENVIRONMENT
AGENCY

GA NGWCLC
(Box 5)

FOREWORD

2001/02 saw continued sustained growth within the National Groundwater and Contaminated Land Centre. Four new staff joined the National Centre to fill the additional posts, arising from extra funding, and additional new partnerships were developed with academic and consultancy groups. Two staff took up short-term assignments in other parts of the Agency, which gave the opportunity for Area-based staff to gain some experience with us.

An already tight programme of work was expanded with planned additional 'new duties' in support of groundwater monitoring, IPPC permitting and the Landfill Directive. However, essential response work to both the Foot and Mouth Disease outbreak and the increasing demands of the forthcoming Water Framework Directive were additional demands that changed the planned programme.

The quality and knowledge of our staff continues to be well reflected in the demands for our time by Head Office Functions and DEFRA to provide requisite scientific underpinning. Centre staff have given high level technical advice at both European Commission and Government levels in respect of a wide range of issues including:

- Contaminated Land Exposure Assessment (CLEA model)
- Groundwater aspects of the Water Framework Directive
- Groundwater protection aspects of Foot and Mouth Disease carcass disposal
- Catchment Abstraction Management Strategy (CAMS)
- Redefinition of groundwater NVZs for the Nitrate Directive.

An increase in Capital Fund work and slower than expected Regional use of the scheme led to the submission of a business case and subsequent approval to appoint a dedicated project manager to facilitate some of the more difficult projects. The success of this has been reflected in an increase in grant-in-aid for the coming year.

The technical lead provided by Centre staff has been greatly aided by many Regional and Area colleagues. We have also actively sought and built relationships with key external technical groups in research institutes and industry to increase our understanding and knowledge. In particular our role in the FIRST Faraday partnership, and our second Fellowship in a key technical area are worthy of being singled out.

Despite the successes of the year the future shape and nature of the National Centre is now uncertain as the re-organisation of the wider Agency under the various 'BRITE' initiatives begins. This report is likely to be the last from the Centre in its present guise. We will seek to ensure that the solid foundation that the Centre has delivered over the past five years in developing the underpinning science and the better understanding of the sub-surface environment, particularly with regard to its protection and remediation, will not be lost.

BOB HARRIS

HEAD OF NATIONAL GROUNDWATER & CONTAMINATED LAND CENTRE

ENVIRONMENT AGENCY



1 18442

FOREWORD**1. INTRODUCTION****2. SUMMARY OF THE YEAR****3**

2.1	Groundwater resource issues	3
2.2	Groundwater quality issues	5
2.3	Land quantity issues	7
2.4	Waste management issues	10
2.5	Integrated pollution prevention and control	10
2.6	Education and dissemination	11
2.7	Furthering the science base	14
2.8	Outcomes	14

3. CENTRE MANAGEMENT**15**

3.1	Business systems	15
3.2	ISO 9001 and ISO 14001 audit	15
3.3	Finance	15
3.4	Staffing	15
3.5	Effort	15
3.6	Budget for 2002/03	16

4. UNSOLICITED COMMENTS**16****APPENDICES**

A	- Published and conference papers by National Centre staff	17
B	- National Centre staff in 2001/2002	18
C	- Key outputs for the year	20

1. INTRODUCTION

Our continuing mission is to:

'Develop the scientific and technical understanding of the subsurface environment ensuring its translation into clear policy, helpful operational guidance and sound technical support that will contribute to open, effective and consistent regulation.'

In progress of this mission our staff resources grew from 22 FTEs to 27 FTEs by the end of December 2001. This was through the:

- addition of further 'new duties' work related to the Landfill, Water Framework and IPPC Directives;
- addition of an Exposure Assessment Manager post to develop and deliver the CLEA model;
- addition of a project manager post for the Capital Projects team.

The lateness of the formal notification of some of these items created some problems in programming and the buoyant external jobs market in hydrogeology and land contamination also presented major difficulties in filling the new posts. However, we have been fortunate to find some talented individuals to join us. The pages that follow illustrate some highlights from our work programme, carried out by Centre staff, often hand in hand with Regional and Area staff.

2. SUMMARY OF THE YEAR

This section provides brief highlights of some of the key work items undertaken this year. Most of our work is cross-cutting and does not lie within a single traditional Agency Function or Directorate. However, to help the Agency readers relate to the current Functional structure, items have been broadly grouped within groundwater resource, groundwater quality, land, waste and IPPC issues.



GROUNDWATER RESOURCE ISSUES


The Groundwater Resources team have continued to provide underpinning science and the translation of this into operational tools as the Agency prepares for the implementation of Catchment Abstraction Management Strategies (CAMS) and the Water Framework Directive. Key areas of work continued to focus on:

- Resource Assessment and Management (RAM) Framework.
- Regional modelling strategies and the development of methods;
- Integrating groundwater abstractions and river flows (IGARF);
- Developing closer links with universities and research institutes; the Groundwater Resources R&D Topic, within the Water Resources Programme, is led from the Centre.
- And of course developing and leading training for Operational staff on all these issues.

RESOURCE ASSESSMENT AND MANAGEMENT (RAM) FRAMEWORK

This is a nationally consistent, transparent and auditable approach to assessing water resources for the Agency. It also acts as a filter ensuring the Agency resources are focused on key contentious catchments. The methodology underpins CAMS (see page 6) and is likely to have a key role in defining our response to implementing the Water Framework Directive. It integrates hydrology, hydrogeology and ecology into a single framework, which therefore improves our consistency in ultimate service delivery and minimises the potential for conflicts and duplications. It also provides an intellectual lead in this area making us less vulnerable to challenge from customers and regulated industry.

Both National Centre projects and R & D projects carried out by our staff rely heavily on the participation of Regional and Area colleagues, either as part of the project boards and teams, or in critically reviewing projects. The Centre continues to play a leading part in the Groundwater Resources Group which has developed its own



business plan. This in turn feeds into the Centre business plan and the Groundwater Resources Topic of the R & D programme.

GROUNDWATER NITRATE VULNERABLE ZONES

Though originally assumed to be complete in 1999/2000, this project has again been driven to continue due to DEFRA needs for support and advice. The new designation methodology for groundwater built by Centre staff continues to be refined and new data from Regional sources incorporated. The continuing threat of potential infringement proceedings from the European Commission (and the implication of up to £0.5M per day fines) balanced with significant concerns from the farming community, have ensured a high profile.

CATCHMENT ABSTRACTION MANAGEMENT STRATEGIES (CAMS)

Centre staff have advised Head Office on the Catchment Abstraction Management Strategies (CAMS) project through being part of the CAMS development group, and we are also part of the Resource Assessment & Management (RAM) group that is developing a method for use in CAMS. In November this involvement increased significantly, as two staff joined the CAMS Technical Group, which was tasked with producing a new ground and surface water licensing and resource assessment methodology for implementation by May 2001.

Additionally, the external R & D contract for this work was written, let and managed by the Centre, involving one staff member being taken 'offline' and one other being substantially offline. This has placed considerable stress on the Centre programme and on the remaining staff.

GROUNDWATER MODELLING

Work on modelling continues with two main aims to:

- develop new modelling tools and systems including leading the development of conceptual modelling
- provide the technical expert lead of groundwater resource modelling in the Agency.

The 'Strategic Review of Groundwater Modelling,' led from the Centre, in turn fed into to a National Modelling Framework. The subsequent Regional Strategies help both planning and various modelling projects which in turn support, for example, CAMS, Habitats Directive preparations and Water Framework Directive work. In some Regions, where staff shortages mean that the timetable for these strategies cannot be met, it is becoming clear that the Agency will struggle to deliver all these needs on time.

Our work in developing MODFLOW to incorporate chalk flow processes into this industry standard modelling software is now being used in five Agency modelling projects. Without these modifications, the Agency would be unable to do the low-flow studies and resource studies as single projects. This would mean having ten models rather than the five and a potential additional cost of £800k. The modifications mean that the Agency has the best available technology for simulating groundwater flow in these often stressed catchments. These models will underpin the Agency's responsibilities under CAMS, Habitats Directive etc for these stressed catchments.

We have also built links to a new contaminant transport modelling expert centre at the University of Sheffield. A small amount of consulting time and a post graduate studentship have been established and this has already paid off; we have been working with them to assist an Operational problem of bromate pollution at a high profile site.

IMPACT OF GROUNDWATER ABSTRACTIONS ON RIVER FLOWS (IGARF)

This project has delivered a tool that is now used across all Regions by over 80 Agency officers. The methodology and supporting software have been designed as a practical operational tool to assist primarily with groundwater abstraction license determinations. The roll-out of IGARF to all Regions has greatly improved:

- the quality of our decision making

- the consistency with which those decisions are made
- the ability to record and audit decisions for the future.

Development of IGARF by the Centre staff also fits well with the "one, few, many" approach since we have avoided duplication of approaches in eight Regions. Perhaps key to the success of IGARF is that it provides a rational filter allowing senior officers to decide whether a more detailed groundwater flow model is needed or whether existing data and concepts are sufficient. Since new groundwater models cost from £150k to £300k this is a substantial benefit to the Agency.

A vital part of the implementation of IGARF has been the subsequent training programme for Operational staff. A training event in workshop format was developed and in part delivered by our staff. The workshop provides a hands on introduction to the IGARF methodology and then presents the new IGARF toolkit capabilities. Whilst primarily designed for new users of the IGARF methodology, it also offers practical guidance on how to apply the extended functionality of the latest version. The workshop was very well received by Operational and Head Office staff.

RECHARGE

For some years, the Agency has needed a national recharge methodology but this has been delayed by lack of datasets and funding. The Centre started an internal project as part of our support to Regional colleagues. The development has been undertaken by both Centre and Midlands Regional staff and has already produced a new, workable method aimed at Agency needs, which is currently being used in other Regional projects. This will be further developed over the coming year as part of an R & D project.

WETLANDS

Whilst not leading in the field of wetlands, we saw the need to develop predictive methods and tools, which could be used to assess the effects of groundwater abstraction

on wetlands in a programme analogous to IGARF. As a preliminary stage, the Centre has developed a specification for a contract to determine our current knowledge and future requirements as regards the investigation of wetlands. We are delighted to be working with Agency ecological colleagues on this important scoping project.

ADVICE TO THE CZECH REPUBLIC

The Agency is managing the contract to give pre-accession advice to the Czech Republic with the aim of equipping them to join the EU by implementing relevant EU Directives. The National Centre have been asked to look through the current Czech Regulations and assess the degree to which they will enable the EU Water Framework Directive to be implemented. This has involved working with the Czech Ministry and presenting at a seminar attended by 30 high ranking scientists and ministry personnel. Preparation for this seminar has also advanced our own understanding of the detail of the Directive.

2.2 GROUNDWATER QUALITY ISSUES

Centre staff have again been active providing technical input at all levels of the business:

- supporting policy development at Head Office, DEFRA and European levels for the Water Framework Directive;
- providing technical expert input to operational problems (e.g. contentious applications and public enquiries);
- providing links to external research and technical experts; the Groundwater Quality R&D Topic, within the Water Quality Programme, is led from the Centre.

We have continued to take a lead in training staff on groundwater quality issues, with further events on natural attenuation and remedial target methodology given to operational staff. We have also contributed to key externally run courses, which has allowed Agency operational staff to take up some free places.

FOOT AND MOUTH DISEASE

As we noted in last year's report, the outbreak of Foot and Mouth Disease in early 2001 led to a large amount of additional work for Centre staff. This was recognised in an Agency submission to DEFRA for recovery of costs. Over the course of the year well over 1 FTE has been spent on providing high level technical support on risk assessment and monitoring issues.

Work included input to national policy and expert advice to Head Office, DEFRA, the Spongiform Encephalopathy Advisory Committee (SEAC) and Operational staff. Our staff helped develop the guidance on 'Disposal of culled stock by burial: Guidance and reference data for the protection of controlled waters'.

Even though the outbreak is now past, our work continues. Centre staff are leading a number of research projects to improve understanding of the impacts of carcass disposals on our environment, not least the implications for the protection of groundwater. For example, a number of site investigations are underway into the remains from the 1967 outbreak to help this understanding.

Many of the products from past Centre work, for example the Groundwater Vulnerability maps and Source Protection Zone maps, provided key resources for the assessment of disposal sites.

WATER FRAMEWORK DIRECTIVE (WFD) AND DAUGHTER DIRECTIVE ON GROUNDWATER

The demands of the Water Framework Directive on our workload and the implications for the future of the Agency's business have grown significantly over the year. The Directive was ratified in December 2000 and must be translated into UK law within three years. Centre staff have provided an integrated policy and technical advisory service to Head Office, the Agency's WFD Project Team and to DEFRA. In particular, the requests for support from DEFRA have meant increasing involvement in technical discussions at a European level. Support to Head Office has included technical expert comment on the

(technical) Annexes II and V. The Daughter Directive on Groundwater has a very tight timescale for delivery and Centre staff are active on all five of the drafting groups that are preparing parts of the Directive. These groups are listed below and it is vital that the Agency influences the technical basis of the Daughter Directive in order that relevant robust and achievable regulations are drawn up:

- Group 1 - Unpolluted groundwater : do we need a high chemical status class ?
- Group 2 - Diffuse sources;
- Group 3 - Point sources;
- Group 4 - Surface/groundwater interactions;
- Group 5 - Testing of trend analysis tools.

Final drafts are due to be presented to the European Parliament in November 2002 and our work will continue apace.

In parallel with this technical advice to DEFRA and the EU, our staff have been leading a number of Agency projects to prepare for implementation. Key projects are:

- definition and characterisation of groundwater bodies
- development of groundwater quality standards
- groundwater and surface water interactions.

GROUNDWATER SOURCE PROTECTION ZONES

A national set of Groundwater Source Protection Zone maps was first compiled in 1999. At the time it was recognised that there would be a need to carry out regular updating and review of this national set to ensure consistency and quality. We have therefore begun an update cycle for the maps with a collection of all changes from each Region and the creation of a database to record the changes. The maps have proved extremely popular both within and outside the Agency and we hope to update the internet dataset early in 2002/03.

GROUNDWATER QUALITY MONITORING

Work on the future groundwater quality monitoring needs of the Agency has continued this year and has been recognised

as a key item in the Agency's Vision. The Water Framework Directive has provided an added driver and therefore much of the work on monitoring has gone hand in hand with preparations for WFD. Our staff have provided the technical input and direction for a nationally consistent strategic approach including how we relate to third parties who own facilities, which could contribute to Agency monitoring efforts.

The strategic technical work is supported by detailed projects on:

- characterisation of groundwater bodies
- development of sampling strategies
- development of sampling protocols
- development of standard reporting methods
- new data analysis procedures
- new quality procedures.

This is a key business area for the Agency with multi-million pound expenditure on monitoring currently and this is planned to grow. It is vital that the plans are based on sound science to optimise expenditure and effort.

BASELINE QUALITY OF AQUIFERS

Work continued on this large collaborative effort with British Geological Survey (BGS) in the UK and many international organisations on an allied EU Framework IV project. An initial batch of aquifer reports from the project was delivered in the late summer. However, progress was badly affected by the Foot and Mouth Disease (FMD) outbreak. Staff (both in the Centre and Operations) were simply unable to commit the time and effort to the project that was originally planned because of their work in response to FMD. Although contractors and BGS staff took on some more of the Baseline work wherever possible, this in turn stretched cash budgets beyond their limits. In early 2002, this was recognised by the provision of an additional £44k from the monies reclaimed by the Agency for work done related to FMD.

As work on the Water Framework Directive progressed in parallel, it also became clear that each aquifer report would need to

contain significantly more detail than originally intended. After discussions with our partners, it was decided to reduce the number of aquifer reports to allow each to contain more detail.

The project continues and promises to develop into a key new tool to aid the protection of quality groundwater and future sustainable development.

NATURAL ATTENUATION

The first large 'umbrella' R&D project 'Fate, transport and natural attenuation of pollutants in the subsurface' is managed from the Centre. With 23 sub-projects in 4 main 'clusters':

- infrastructure
- fuel ethers
- microbiology
- biogeochemical properties.

Many of the projects are, or have been, collaborative with: industry (e.g. Shell, Institute of Petroleum), research translators (e.g. CL:AIRE), research institutes (e.g. BGS) and universities (e.g. Sheffield, Queen's University, Belfast). Natural attenuation is a continuing area of interest since it is, by inaction, the solution that has been implicitly adopted at many waste and contaminated land sites. It is also the only option for many polluted sites at the present time, because robust clean up technologies do not exist. Nevertheless, there are many factors which mitigate against use of Monitored Natural Attenuation (MNA) as a remediation method, not least because it is knowledge based and acceptance of MNA requires self-confidence on the part of the regulator. It is also technically challenging requiring generic and site-specific understanding of geology, hydrogeology, chemistry, microbiology and risk analysis.

2.3 LAND QUALITY ISSUES

CAPITAL FUND PROJECTS

Management and technical review of the DEFRA Programme on Supplementary Credit Approval sites continued as before. We also provide technical advice and support to a limited degree for new and

existing Agency Capital Fund projects carried out by operational staff.

Early in the year it became clear that the Agency's uptake of the Capital Fund was slowing and both the numbers and progress of these sites was also slowing. Indeed, we had noted the effect in our previous Annual Report. One way to address this problem was to develop an in-house resource capable of assisting operational staff by providing detailed technical project management. A business case was developed in consultation with Regional and Area colleagues and this was submitted to the Director of Operations and the Director of Finance for consideration. Both Directors gave their support for up to two new posts to be created to service this Capital Fund need. This is a cost neutral development for the Agency since the costs can be recovered through the Capital Fund itself. In November 2001 our first Senior Project Manager Contaminated Land (Jonathan Greaves ex-Anglian Region), was appointed.

CONTAMINATED LAND EXPOSURE ASSESSMENT (CLEA)

Work on this key regulatory tool accelerated this year with the appointment of a dedicated Exposure Assessment Manager (Land Quality). Funded by the Land Quality R&D programme, Ian Martin (formerly Manager - Contaminated Land & GW Remediation in the Centre), was appointed to lead the CLEA work.

A major overhaul of the model itself was undertaken in order to prepare for publication. In addition, a host of supporting documents in the Contaminated Land Report (CLR) series were written. All of this was undertaken in close collaboration with internal Agency experts at the National Centre for Risk Assessment and Options Appraisal and Head Office Policy group, together with external experts at Nottingham University and in the Department of Health.

As a result of this activity, CLEA was publicly launched to critical acclaim at a major event attended by Sir John Harman and senior DEFRA officials at the Barbican

Centre in London on 14 March. Coming as a culmination of almost ten years of effort, the launch marks a milestone in the regulation of land contamination. However, this is not the end, much work lies ahead to increase the range of contaminants covered and to improve the computer model itself. The National Centre set up and is running a 'help desk' in the initial stages of the model's release to the public.

OPERATIONAL SUPPORT

Centre staff have again supported operational work in Regions and Areas for some high profile and sensitive sites. Much of this has involved the review of external risk assessment methods used at these sensitive sites. For example, in relation to the Weston Quarries site in the North-West Region, where local residents have had to leave their homes because of vapours from past waste disposal activity. Involvement with the Byker incinerator ash site in the North-East continued and, of course, there has been considerable assistance given with Capital Projects funded sites.

CONTAMINATED SEDIMENTS

Two National Centres (Ecotoxicology and Hazardous Substances and the Groundwater and Contaminated Land Centre) collaborated on a scoping investigation into contaminated sediments; their effects on the wider environment and impacts on Agency business. The report 'Scoping Study: Sediments in England and Wales: The Nature and Extent of Issues' was used to prepare a briefing note to EP Management Team. In addition, an internal Agency workshop was held in July 2001 to review the document at draft stage and solicit input before it was finalised. As a result EPMT:

- recognised that addressing sediment issues is a significant priority for the Agency.
- agreed that taking co-ordinated action is important because:
 - the Agency needs to make changes to meet its Statutory Responsibilities

- sediments issues are often cross-functional and sometimes cross-directorate, making cohesive management a challenge.
- approved development of a 'Sediment Management Framework for England and Wales' (to be initiated in April 2002).
- approved a new post for 2002/2003 to develop this Sediment Management Framework.

TECHNICAL TRAINING FOR LAND CONTAMINATION: 1 RISK ASSESSMENT

We have led the development of a range of technical training packs for use by the Agency. These are intended to address the needs of officers in deciding whether to use Agency powers. For example, the Agency is often required to evaluate chronic risks posed to human health either by the land itself or by the activities carried out on that land. Such decisions commonly include an examination of the risks posed by 'contaminated soils' and involve an evaluation of information supplied by third parties for the purpose of:

- determining whether there is a significant possibility of significant harm to human health at a potential Special Site under Part IIA of EPA 1990;
- setting and reviewing the provisional standard of remediation under Part IIA of EPA 1990.

This project aimed to better equip Operational staff to make these decisions and specifically to:

- evaluate information supplied by customers or third parties
- recognise when human health risk assessment is needed
- recognise the common mistakes of misapplications of commercially available tools.

TECHNICAL TRAINING FOR LAND CONTAMINATION: 2 PART IIA STANDARDS

The procedural training for the Process Handbook and Procedures is in progress to Agency staff who are already in post. This programme has successfully provided a best practice and cost effective delivery using a

combination of workshops and workbooks structured around competencies based on the Procedures. The next step is to provide a training programme for specific technical areas covered by the Internal Standards. At this stage, two Internal Standards namely, Inspection of Potential Special Sites and Remediation, have been selected as the subject of this training package.

The project provides a training package for the Inspection of Potential Special Sites and Remediation. This includes interactive training workshops and supporting distance learning packages.

EXTERNAL INFLUENCING AND LIAISON

We are closely involved with an increasing number of collaborative research initiatives. The National Centre has played a significant part in developing or supporting many of these which give access to externally funded R&D and the ability to influence at both national and European levels.

- **FIRST Faraday Partnership** on remediation of land and water. Alwyn Hart was actively involved in the successful bidding process for this prestigious award (one of only 17 Faraday Centres) and Bob Harris now chairs the management steering group for this £4M+ research initiative funded by DTI and Research Councils
- **DTI LINK Programme on Bioremediation.** The Agency has agreed to sponsor this new programme (value £12M); Centre staff represent the Agency on the management groups
- **Queens University, Belfast – QUESTOR Centre.** The Centre joined the QUESTOR Centre at the end of the year on behalf of the Agency and now has an opportunity to steer significant research in partnership with leading blue chip companies and fellow regulators interested in contaminated water and polluted groundwater problems
- **ExSite, CL:AIRE,** Centre staff sit on technical steering groups for these contaminated site research programmes
- **Biowise,** we have agreed to co-operate

with this DTI initiative to assist with technical review and advice on their publications related to contaminated land

- **CLARINET**, Bob Harris is one of two national expert representatives to this European regulator forum and has played an active role in its Working Group on water resources
- **SAGTA and NICOLE**, The Soil and Groundwater Technology Association (SAGTA) is the UK network of industrial contaminated land problem holders and the Network for Industrially Contaminated Land in Europe (NICOLE) is its European equivalent. NGWCLC staff have regularly been asked to present papers and chair workshops at both their meetings.

2.4 WASTE MANAGEMENT ISSUES

LEACHATE QUALITY

Staff provide technical expert advice in relation to groundwater and waste management, for example, on Regulation 15 queries and in addition manage two key R&D projects.

One project is examining the impact of the Landfill Directive on leachate quality from future UK landfills. Phase 1, which is now complete, involved gathering data from European sites that are used for the disposal of hazardous wastes and mechanical & biological pre-treated (MBP) municipal waste; the latter often with untreated municipal waste. Phase 2 is now focusing on leachate quality from MBP waste landfill sites, including trace organics, and on laboratory-scale leach tests on municipal waste incinerator residues. The report will draw conclusions on the nature of leachate following implementation of the Directive, implications for landfill design and time to stabilisation, and provide tentative predictions on the impact of waste treatment to the latter. The report will also summarise the leachate data to assist with groundwater risk assessments where site-specific leachate data is not available.

SCRAPYARDS

Work is also underway to better understand the impacts of scrapyard emissions on human health both for site workers and neighbours by:

- identifying and measuring the emissions (dust, vapours, noise and oils, etc.) at four different types of scrapyards
- establishing the characteristics of the potential exposed populations and the pathways by which each emission may pose a hazard.

Results will be collated and used to conduct a human health risk assessment. We should then be able to quantify the relationship between concentrations of selected emissions to any exposure effects, particularly those related to human health, and apply the methodology developed under previous (e.g. composting, WTS, incineration) contracts for assessing the potential exposure to the emissions measured. The project will eventually publish specialist technical and general readership booklets.

2.5 INTEGRATED POLLUTION PREVENTION AND CONTROL

This is a new area of work for us. However, the provisions under the new IPPC regime for licence surrender, and the need to ensure that the land under the facility has not been degraded by pollution, call for many of the same skills and knowledge areas as our land and groundwater contamination work. The 'new duties' money provided for this was used to recruit a new member of staff, who has been active throughout the year both giving site-specific advice to operations and drafting portions of guidance on site surrender.

An important role has been provision of a technical audit to ensure a consistent approach is being taken across the Agency, when reviewing Site Reports submitted in support of PPC Permit applications. This work has identified a number of common issues across all Regions and also identified areas where the existing guidance could be improved (e.g. an accurate site plan must be

provided; internal technical guidance and training is needed). The work has also highlighted the importance of the Site Report in protecting land and groundwater quality.

The other main work item has been to produce guidance to operators on preparing a Site Report at closure of the site so that the PPC permit can be surrendered. This work has implications not only during the lifetime of the site operation but also for reinstatement at surrender. Since the IPPC regime aims to prevent contamination, the need for any restoration measures may be significantly stricter than would be derived from the "suitable for use" test and the risk-based approach used in the Part IIA regime (Environment Protection Act 1990).

2.6 EDUCATION AND DISSEMINATION

The Centre continued to promote groundwater issues and land contamination issues both internally, through training provision and externally, through leading or collaborating on seminars and workshops and contributing to conferences etc. A particular highlight this year was the organisation of a major international conference on Groundwater Protection.

PRINT MEDIUM

The Centre has produced two new A5 sized booklets during the year to inform staff and customers on key issues:

- Piling into contaminated sites
- Assessing the groundwater pollution potential of cemetery developments.

The Centre continued to produce the bi-monthly, circular 'Underground' and a wide range of Agency and external authors have contributed to make the circular a groundwater and contaminated land community document. With each issue we receive more requests to be added to the circulation list.

INTERNET

The introduction of the content management system for the Agency website and loss of any access to modify the site for several months, led to great disruption to

dissemination of work and the fragmentation of much of our earlier content. At the end of 2000/01, we could happily report that groundwater and contaminated land issues had risen to be the third most popular area of the site with over 6,000 page hits in March 2001 alone. Statistics are unavailable for most of the year 2001/02 however we do know that in December '01, combined hits for the fragmented groundwater and contaminated land pages had fallen to around 35% of the March '01 levels. This would seem to be in line with the Agency homepage hits.

However, there is some good news, almost 5,800 individuals have now registered for Source Protection Zone data over the web, with 3,300 of these downloading areas of their interest (the dataset is "cookie cut" by the Local Authority area). A handful of individuals have downloaded every SPZ area although most registrants have downloaded just a few, presumably around their specific location. In total then there have been over 9,000 areas downloaded.

Other notable items delivered over the web have been the risk management softwares CONSIM, LANDSIM and the Remedial Targets Spreadsheet. The first two provide demonstration versions of software whilst the latter is a working tool relating to published Agency guidance (P20).

The delivery of our data to customers via the web provides a significant potential for saving time and cost of Operational staff. The SPZ data is a good example and is described in more detail on page 8. Moreover, the web makes the data more readily available to customers, there is therefore:

- a concomitant external cost saving to customers in removing the need for customers to attend Agency offices in person to get this data
- the opportunity to influence people (planners, developers, etc), who previously may not have considered the protection of groundwater sources because the data was harder to obtain.

This latter point in particular, supports the Vision and the ideas of Making It Happen well.

VIDEO – 'KEEPING OUT OF DEEP WATER – GROUNDWATER PROTECTION FOR INDUSTRY'

A new video was produced highlighting the responsibilities of industry to protect groundwater not least in relation to the Groundwater Regulations. 'Keeping out of deep water – Groundwater Protection for industry' is intended to help Operational staff explain groundwater protection to small and medium sized industry customers. Copies have been provided to all Areas for free external distribution and a limited number of copies are available for customers directly from a mailing service. A digital version is also available for laptops and download from the web.

INTERNATIONAL CONFERENCE – 'PROTECTING GROUNDWATER'

The Centre held a highly successful major international conference 'Protecting Groundwater - applying policies and decision making tools to land-use planning' organised on behalf of the Royal Town Planning Institute, the Scottish Environmental Protection Agency and the Northern Ireland Environment and Heritage Service. Believed to be the first such commercial conference held by the Agency, it attracted over 200 delegates from 14 countries. The programme was designed to achieve three objectives:

- a public launch of the end of the long programme to deliver the groundwater vulnerability maps and source protection zones as an effective toolkit for groundwater protection
- to boost the process of engaging with the land-use planning community in the use of the toolkit and
- to raise awareness of the need for integrated water protection planning between all environmental media, in the face of the future needs of the Water Framework Directive and River Basin Management Plans.

Opened by Colin Beardwood, the Midlands Region Agency Board member, the

conference included a variety of internal and external speakers. Giles Philips (Head of Water Resources) and Dave Foster (Water Framework Directive Project Manager) dealt with the CAMS process and the Water Framework Directive respectively, whilst Roger Vallance (Head of Local and Regional Relations) dealt with the Agency's approach to strategic planning. Several international speakers gave examples of innovative practice, for example from Denmark and Germany where there is widespread use of local taxes to pay for groundwater protection measures. NGWCLC speakers were also prominent in discussing the WFD, monitoring and groundwater protection issues in the FMD crisis. The papers were made available on the web-site and will soon be published in an edited report.

PRICED PUBLICATIONS

In line with Agency practice, some of our outputs are sold by other organisations. Major items are sold through TSO and this includes items such as the Groundwater Vulnerability maps and important R&D reports such as Guidance for the Safe Development of Housing on Land Affected by Contamination (P66).

No new printed publications were produced via TSO during 2001/02. However, a new digital set of vulnerability maps was released which provides:

- updated digital formats
- improved user interface
- view before you buy function
- electronic copies of relevant printed reports e.g. 'Policy and Practice for Protection of Groundwater'.

In all, Centre related TSO products amounted to 2,859 items valued at £81,500 in 2001 (data is for the calendar year 2001). This is out of total Agency/TSO sales of 4,029 items and £126,984 (i.e. GWCL items amount to 71% numbers and 64% of face values sales respectively). Looking back over the past five years, Centre led outputs provide three of the four top selling reports in terms of numbers and three of the top nine sellers in terms of face value sales. In view of the limited number

of Centre outputs released in this way, these percentages demonstrate in part the external interest in subsurface issues relative to other parts of the Agency's business. Our products are far from mass-market but they are essential to a wide range of industry and regulatory customers.

Groundwater vulnerability data continues to be supplied to a number of value-added-resellers (e.g. Landmark Information Group). This is managed by the Scientific and Technical Information Service (SATIS) and income and benefit to the Agency are managed through SATIS.

The site risk software tools ConSim and LandSim continue to be in demand. This is particularly the case for LandSim, since the revised edition LandSim II was released in late 2000. During the past year, a further ten copies of ConSim and 71 copies of LandSim II have been sold resulting in sales receipts of almost £30,000 shared between the Agency and our partners Golders Associates. The income has been used in further software development and training for Agency staff. ConSim II is currently under development.

As always a lot of our work is distributed through the Agency R&D system which publishes printed materials through WRC. As with TSO, groundwater and land contamination titles show strong demand although again fewer titles have been released this year. Partly this has been beyond our control with projects such as CLEA being given precedence with R&D and WRC staff meaning that other titles have been delayed. As a result only two of WRC's "top ten" bestsellers were from projects managed through the Centre, including P20 'Methodology for the derivation of remedial targets for soil and groundwater to protect water resources'.

SUPPORT TO UNIVERSITY COURSES

Centre staff have continued to support relevant MSc courses by giving guest lectures at Nottingham, Reading, Sheffield, Bristol, Greenwich, Imperial College London and Queen's University Belfast. We have also participated in several short

courses which have provided benefit to the Agency either as income to the Centre (see financial reporting on page 17), or more commonly through the allocation of free places or reduced fees to Agency staff by the course organisers (e.g. Sheffield University – Natural Attenuation; Risk Assessment and Solvents in Groundwater courses, Birmingham University – Groundwater Modelling, Informatics courses, ESI Contaminated Land Risk Assessment, Landfill Risk Assessment courses). Conservative estimates of the benefit of these is c.£10K per annum.

JOURNAL AND CONFERENCE PAPERS

Centre staff authored several papers published in recognised journals and international conference proceedings over the year. More than 30 oral conference papers were presented. A list of the most important papers is included in the Appendix. Many of these were by invitation and staff are increasingly finding a name in the international community. For example:

- Bob Harris asked to present at:
 - the Swedish contaminated land network "Renare Mark" on the UK approach to risk assessment/management
 - NICOLE meeting in Rotterdam on natural attenuation and the Water Framework Directive
 - UNESCO meeting on groundwater protection in Budapest
- Alwyn Hart asked to present at:
 - German (DECHEMA) natural attenuation conference in Frankfurt
- Stuart Kirk asked to run a workshop at:
 - International Association of Hydrogeology (IAH) Cape Town.

Staff are also regularly asked to review proposed research projects and journal articles. Rob Ward is a member of the editorial board for the Geological Society's publication Engineering Geology and Bob Harris is on the editorial board for the Journal of Hazardous Materials.

2.7 FURTHERING THE SCIENCE BASE

We have continued to maximise our links with external organisations, enabling collaborative projects and influencing externally funded work. This has included serving on steering committees for national and international bodies such as:

- FIRST Faraday Centre on remediation of contaminated land and water, a DTI and research council funded initiative (£2.5M)
- Bioremediation LINK Programme steering committee
- UK technical expert in CLARINET
- NERC Lowland Catchment Research (LOCAR) Steering Committee
- EUGRIS – a Framework 5 project led by Umwelt Bundes Ampt
- CORONA – a Framework 5 project led by University of Sheffield.

Participating in these is only possible because of the technical competence and external credibility of staff and, by ensuring that we make space to provide the resources to undertake the work.

2.8 OUTCOMES

Much of our work is often part of a chain of actions or activities that ultimately provide new Agency working methods. Almost by definition, the provision of underpinning science and the creation of a sound science base does not produce many end 'products'. This can mean that it is difficult to identify outcomes that can be ascribed to our work alone. Only in those areas where there is a low policy resource in Head Office, does our work become more visible within the Agency.

VALUE FOR MONEY

Many of the issues that we deal with come under the heading of 'must-do' for the Agency but with limited immediate impact beyond. Hence it is often difficult to compare ourselves with external groups. However, we have used several staff from consultancies under the National Engineering and Environmental Agreement (NEECA) on our projects over the course of

the year. This allows us to consider the relative costs of our services against market rates. For example, most of the consultant staff that we engage would be grade 4 or 5 with some Grade 6; comparing the NEECA rates even with standard Agency pollution incident response rates (themselves substantially higher than actual National Centre costs) shows what good value can be provided by internal resources.

Staff grade	Agency pollution incident response rates £/h	Typical NEECA rate experienced £/h
4	31.83	32 to 42
5	40.26	41 to 62
6	52.32	62 to 69

COST SAVINGS

Occasionally, it is possible to estimate Agency cost savings that may be realised from one of our projects. A good example is the release of SPZ data over the internet. In all, over the past 20 months from over 9,000 areas, data has been downloaded by external customers. Previously, this information would have required the customer to visit an Agency office, discuss and negotiate with local officers and for the Agency to provide a copy of a paper map. A very conservative estimate of the time cost would be 30 Agency minutes per item. Moreover, the paper nature of the material would discourage sharing and transfer within external organisations (e.g. consultants or Local Authorities) which in turn would lead to multiple requests for the same information. The provision of digital data over the internet means that such organisations can place the data on their own GIS servers greatly facilitating sharing.

The half hour saving claimed above therefore seems extremely conservative, it also takes no account of the savings made by customers themselves. Nonetheless, the 9,000 half-hours saved in Operations amounts to approximately 2.75 Full Time Equivalent (FTE) or over £140,000 saved using the Grade 4 hourly rate listed.

3. CENTRE MANAGEMENT

The Centre is managed by the Head of Centre and the Senior Management Team. The Midlands Regional Director and the Regional Environmental Protection Manager have provided a quarterly management review. The NGWCLC Client Board met in May but the December meeting was cancelled in view of the organisational change anticipated for 2002/2003.

3.1 BUSINESS SYSTEMS

We have continued to work in a flexible, project based way with the use of computer based timesheets and project databases. The Centre continues to use various computer systems to promote efficient delivery of work including our Project Database (developed in-house) which holds details of all Centre projects. Our use of 'Timesheet Professional' as a desktop timesheet recording system for all staff allowed reliable recording of time spent on the Foot and Mouth outbreak. This data was then used in compiling the Agency recharge to DEFRA for the work. The Centre has recorded over 1FTE spent on F&M work this year with £18k additional income to the Centre in respect of this work.

The Centre has reported against its Operational Performance Measures to the Midlands Regional Director, on a quarterly basis.

3.2 ISO 9001 AND ISO 14001 AUDIT

The Centre took part in the audits carried out by Lloyds Register of Quality Assessors in support of the Agency's application for accreditation to these two important standards. Auditors spent a day at the Centre assessing management systems and working practice, discussing with several staff their roles and work. Land Quality issues and the Capital Projects work were a particular focus. At the end of the day the lead auditor had no observances or non-compliance points to make, highly unusual in his experience, and summed up his assessment of both the Midlands Regional Land Quality team and the Centre as

'shining stuff – upstairs and down'.

3.3 FINANCE

The Centre budget and end of financial year out-turn is presented below. As for previous years our performance target was to end the year within plus or minus 2.5 % of budget. The final out-turn for the year (see table below) shows an overspend of £33,000 which is indeed within our target range.

Item	Cost (£k)	
	Budget	Actual
Staff costs	1,015	1,047
Project direct costs	772	773
TOTAL	1,787	1,820
Overspend		33

3.4 STAFFING

The Centre grew once again this year from 22 full time equivalent (FTE) posts at the end of the previous year to 27 this year. A further potential post in support of Capital Projects was not progressed to allow us to first assess the impact of the sister post (Senior Project Manager Contaminated Land). Nevertheless, this growth brings the Centre to almost double its initial complement at formation (14 FTE) and most eloquently describes the demands for our work from internal customers over the years.

Over the year, we have also used contractor support through Centre call-off and the NEECA framework arrangements.

As previously, our new staff have been recruited from a variety of internal and external backgrounds; Agency Regional and Area staff, local authority staff and environmental consultants.

3.5 EFFORT

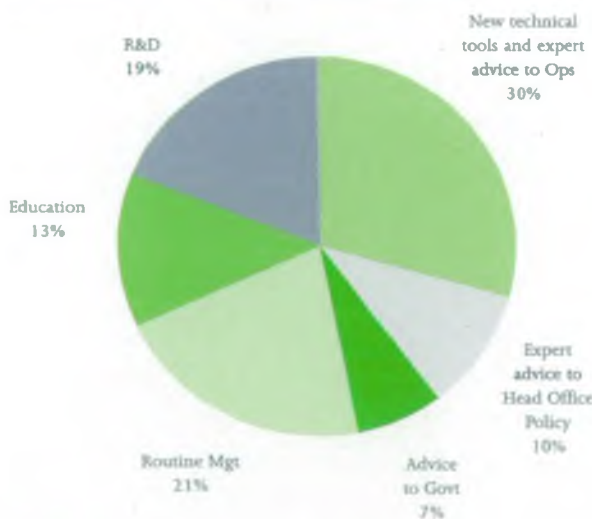
Delivery of the Centre work programme is focussed through a system of projects and a computer-based time recording system. This allows us to both review the effort expended on each project and then to use this information in future planning. A breakdown of the workload by Agency Directorate or Function is shown in the

attached chart. However, it is important to recognise that this is only a partial reflection of the beneficiaries of Centre projects since much of our work is cross-Directorate and cross-Functional.

Effort (staff time) expended by Function (or Directorate) is shown in the figure below:



Or an alternative view of our work: based on what we do rather than who pays...



3.6 BUDGET FOR 2002/ 03

The indicative budget for the financial year 2002/03 is below. For most Functions this is a small increase over 2001/02 and does mean that economies and cost savings will need to be found. However, the Water Resources budget remains completely static once again and it is apparent that the amount of work that we can carry out in that area is now constrained by available funds.

Further additions for new Agency duties are anticipated during the year in respect of Groundwater Monitoring, the Water Framework Directive and the Landfill Directive and Agricultural Waste Directive, but details were not available at the time of writing.

SUPPORTING DIRECTORATE OR FUNCTION (£K)	
Water Resources	422
Land Quality	517
Water Quality	793
Waste Management	78
IPPC	43
Radioactive Substances	39
TOTAL (£K)	1892

4. UNSOLICITED COMMENTS

"Regulators don't always receive good press but you've been a source of great help and common sense, and it reflects well on the Agency as a whole that you've been so proactive in your approach. Thanks once again."

Martin Hopkins, Technical Marketing Manager, British Cement Association.

"The Water Resources Managers asked me (and I am delighted) to drop you a line thanking you very much for the work in developing the (RAM) framework but then for your special effort in presenting it nationally and then round all the Regions. Well done and thank-you for your input and commitment to this major project."

Giles Phillips, Head of Water Resources.

"I heard lots of complimentary comments and I think your team and Jenny's did a fantastic job and the result well justified all the work that was put in."

Andrew Skinner, Acting Director of Water Management; Head of Environmental Quality

"I have written to Steve and Stuart to thank them for the enormous contribution which they have made in helping to develop the RAM Framework. The project is something which they and the Agency should be proud of."

Ian Barker, CAMS Project Executive.

"I'm grateful for the Centre's help in delivering operations plans and in responding to challenges such as safe carcass disposal for Foot and Mouth disease."

Archie Robertson, Director of Operations.

"shining stuff – upstairs and down"

Chris Watkins, LQRA Auditor

"Holding this conference has done much to enhance the status of the EA both within the UK groundwater community & internationally – well done"

Rick Brassington, Consultant
Hydrogeologist

A note to thank you all again for joining us in Brussels this week. Joly, David and I greatly appreciated your expertise and first class support.

Ian Macdonald, DEFRA

"The National Centre has raised the standard of groundwater modelling in the Agency"

Professor Paul Younger, University of Newcastle.

APPENDIX A

PUBLISHED AND CONFERENCE PAPERS BY NATIONAL CENTRE STAFF

PUBLISHED PAPERS

Atkinson, T.C., Ward, R. S., Barker, J. A. and Low, R. G. (2001). 'Radon - an indicator of solute transport in double-porosity aquifers'. In: New Approaches to Characterising Groundwater Flow, XXXI IAH Congress, Sept 2001. Ed: KP- Seiler and S Wohnlich. ISBN 902651 848X.

Darmendrail, D. and Harris, R.C (2001) 'Water resource protection issues in relation to contaminated land'; Land Contamination & Reclamation; 9, p.89-94.

Darmendrail, D., Harris, R.C. and Ziegler, U. (2001) 'Comparison of current water protection strategies and outlook on future developments' in: Proceedings of final CLARINET Conference, Vienna, 2001.

Ellis, P.A., Rivett, M.O., Henstock, J., Dowle, J., Mackay, R., Ward, R. S. and Harris, R.C. (2001). 'Impacts of contaminated groundwater on urban river quality - Birmingham, UK'. Groundwater Quality 2001 Conference, June 18-21, 2001, Sheffield.

Evers, S., Fletcher, S. W., Ward, R. S. and Harris, R. C. (2001). 'A strategy for the protection of groundwater from nitrate leaching using spatial and geo-statistical analyses'. In: New Approaches to Characterising Groundwater Flow, XXXI IAH Congress, Sept 2001. Ed: KP- Seiler and S Wohnlich. ISBN 902651 848X.

Fretwell, B.A, Heathcote, J.A. and Hart A.J. (2001). 'Planning non-mains sewerage discharges to ground'. Presented at Protecting Groundwater, Birmingham UK October 2001.

From Do-Nothing to Protocol and Practice Presented at ad-hoc international working group on contaminated land. Geneva, Switzerland September 2001.

Grosso, A. and Crane, M. (2002). 'Time to event analysis of ecotoxicity data'. In Risk Assessment with Time to Event Models. Lewis Publishers, Boca Raton, FL. Pages 7-22.

Harris, R.C. (2001) 'Developing an approach to Monitored Natural Attenuation (MNA) in the UK':

Harris, R.C., Tinsley, D. and Power, B. (2001) 'Navigating a course through dirty mud in England and Wales' in: Proceedings of International Conference on the Remediation of Contaminated Sediments; Venice, 2001.

Hart, A.J. (2001). 'MTBE in groundwater of England and Wales'. J Assoc Petroleum and Explosives Admin, 39 (1) 27-29.

Hart, A.J. (2001). 'Monitoring and assessing natural attenuation: the approach in England and Wales'. Presented at Symposium Natural Attenuation 3, Dechema e.V. Frankfurt Germany, December 2001.

Hart, A.J. and Harris, R.C. (2002). 'MTBE occurrence in England and Wales'. In 'Handbook for managing releases of gasoline containing MTBE' AEHS, Amherst MA. In press.

Riley, M. S., Ward, R. S. and Greswell, R. B. (2001). 'Converging flow tracer tests in fissured limestone'. Quarterly Journal of Engineering Geology and Hydrogeology, 34, 283-297.

Smith, J.W.N. (2001). 'Groundwater Protection and landfill risk assessment'. All Party Parliamentary Group on Earth Sciences, Houses of Parliament, London. October, 2001.

Smith, J.W.N. (2001). 'The regulatory framework for remediation of contaminated land and groundwater in the UK, and development of risk-assessment and risk-management tools'. International Workshop of Contaminated Land Investigation, Assessment and Remediation. Bucharest, Romania, October 2001.

Swannel, R. Macnaughton, S. Lethbridge, G. Neaville, C. and Hart A.J. (2001). 'SIReN: Site for innovative research into monitored natural attenuation'. Presented at GQ2001, Sheffield, England, July 2001.

Ward, R. S. (2001). 'Groundwater protection tools to support land-use planning'. Protecting groundwater: Applying policies and decision making tools to land-use planning. Environment Agency Conference, Oct 2001.

Ward, R. S., Williams, A. T., Barker, J. A. and Lawrence, A. (2001). 'Transport of microbiological contaminants in the unsaturated zone of the Chalk aquifer', In: New Approaches to Characterising Groundwater Flow, XXXI IAH Congress, Sept 2001. Ed: KP- Seiler and S Wohnlich. ISBN 902651 848X.

MAJOR INTERNATIONAL CONFERENCES

- CLARINET Final Conference, Vienna, 2001 (contaminated land and Water Framework Directive)
- Protecting Groundwater, Birmingham, 2001 (groundwater protection)
- Contaminated Land Ad-Hoc Group, Geneva, 2001 (natural attenuation)
- NICOLE meeting, Rotterdam 2001 (natural attenuation)
- UNESCO Helsinki Convention Budapest 2001. (groundwater protection, chair and keynote presentation).

APPENDIX B

NATIONAL CENTRE STAFF IN 2001/2002

Bob Harris	Head of Centre
Mary Goldsworthy	Business Support Officer
Sue Irons	Business Support Assistant
Steve Fletcher	Manager - Groundwater Resource Management
Paul Hulme	Senior Groundwater Modeller
David Johnson	Senior Groundwater Modeller
Stuart Kirk	Senior Hydrogeologist
Sarah Evers	Hydrogeologist (on assignment to Midlands)
Felicity Miller	Hydrogeologist (on assignment from Southern)
Alwyn Hart	Manager - Programme Management & Information
Stephen Hall	Data and Information Scientist (on assignment to North-East)
Trevor Howard	Data and Information Scientist (on assignment from Midlands)
Lamorna Zambellas	Senior Management Support Officer
Bill Baker	Manager - National Capital Projects
Shaun Robinson	Programme Officer Capital Projects
Brian Bone	Senior Site Investigation Engineer
Jonathan Greaves	Senior Project Manager-Contaminated Land

Theresa Kearney	Manager - Contaminated Land & GW Remediation
Vacant	Senior Remediation Scientist
Bob Barnes	Senior Site Assessment Scientist
Bridget Butler	Senior Risk Scientist
Albania Grosso	Senior Risk Assessment Scientist
Tony Marsland	Manager - Groundwater Quality & Protection
Jonathan Smith	Senior Contaminant Hydrogeologist
Rob Ward	Senior Hydrogeologist
Phil Humble	Senior Hydrogeologist
Hugh Potter	Senior Contaminant Hydrogeologist
Kamrul Hasan	Groundwater Quality Officer
Ian Martin	Exposure Assessment Manager - CLEA

APPENDIX C - KEY OUTPUTS FOR THE YEAR

Land and groundwater remediation	<ul style="list-style-type: none"> ● Remedial treatment action datasheets further subjects published ● "Piling in land affected by contamination" Guidance and A5 booklet
Risk assessment	<ul style="list-style-type: none"> ● Contaminated Land Exposure Assessment model and supporting documents launched ● Expert site specific advice on nationally recognised sites where PCB, chlorinated solvent and bromate contamination is present
Contaminated sediments	<ul style="list-style-type: none"> ● National workshop and Technical Report on sediments ● Paper to EPG resulting in new Agency post for 2002/03
Groundwater protection	<ul style="list-style-type: none"> ● Guidance on methodologies for defining Nitrate Vulnerable Zones ● Draft Code of Practice for use of chlorinated solvents ● LandSim v2
Foot and Mouth Disease	<ul style="list-style-type: none"> ● Guidance on 'Disposal of culled stock by burial: Guidance and reference data for the protection of controlled waters'
Groundwater monitoring	<ul style="list-style-type: none"> ● Review of groundwater monitoring in England and Wales ● Guidance on determinand suites and sampling frequency ● AQUACHEM training
Groundwater modelling	<ul style="list-style-type: none"> ● Strategy document for long term Agency modelling needs ● Guide to good practice in development of conceptual models ● Guidance on assessment of third party contaminant transport models ● Guidance on assessment of model probability functions ● Representation of V_kD
Waste Issues	<ul style="list-style-type: none"> ● Review of policy and practice for Regulation 15 ● "Assessing the groundwater pollution potential of cemetery developments A5 booklet" ● Guidance and computer application of Cation Exchange Capacity(CEC) in landfill liners
Water Resources	<ul style="list-style-type: none"> ● IGARF versions and associated training ● RAM Framework ● Input to CAMS
International Conference	<ul style="list-style-type: none"> ● "Protecting groundwater" held in Birmingham with 200+ delegates from UK and abroad.
Education	<ul style="list-style-type: none"> ● Video on Groundwater Regulations for industry "Keeping out of deep water" ● Groundwater Festival at 3 sites (2 Midlands, 1 Thames) ● Sponsor at International Clean-Up exhibition

MANAGEMENT AND CONTACTS:

The Environment Agency delivers a service to its customers, with the emphasis on authority and accountability at the most local level possible. It aims to be cost-effective and efficient and to offer the best service and value for money.

Head Office is responsible for overall policy and relationships with national bodies including Government.

Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol BS32 4UD
Tel: 01454 624 400 Fax: 01454 624 409

Internet World Wide Web www.environment-agency.gov.uk
www.environment-agency.wales.gov.uk

NATIONAL GROUNDWATER & CONTAMINATED LAND CENTRE

Olton Court, 10 Warwick Road, Olton, Solihull B92 7HX
Tel: 0121 711 5885 Fax: 0121 711 5925 E-mail: ngwclc@environment-agency.gov.uk
E-mail address (if required)

Internet World Wide Web: <http://www.environment-agency.gov.uk>

ENVIRONMENT AGENCY REGIONAL OFFICES

ANGLIAN

Kingfisher House
Goldhay Way
Orton Goldhay
Peterborough PE2 5ZR
Tel: 01733 371 811
Fax: 01733 231 840

SOUTHERN

Guildbourne House
Chatsworth Road
Worthing
West Sussex BN11 1LD
Tel: 01903 832 000
Fax: 01903 821 832

MIDLANDS

Sapphire East
550 Streetsbrook Road
Solihull B91 1QT
Tel: 0121 711 2324
Fax: 0121 711 5824

SOUTH WEST

Manley House
Kestrel Way
Exeter EX2 7LQ
Tel: 01392 444 000
Fax: 01392 444 238

NORTH EAST

Rivers House
21 Park Square South
Leeds LS1 2QG
Tel: 0113 244 0191
Fax: 0113 246 1889

THAMES

Kings Meadow House
Kings Meadow Road
Reading RG1 8DQ
Tel: 0118 953 5000
Fax: 0118 950 0388

NORTH WEST

Richard Fairclough House
Knutsford Road
Warrington WA4 1HG
Tel: 01925 653 999
Fax: 01925 415 961

WALES

Rivers House/Plas-yr-Afon
St Mellons Business Park
St Mellons
Cardiff CF3 0LT
Tel: 029 2077 0088
Fax: 029 2079 8555



ENVIRONMENT AGENCY
GENERAL ENQUIRY LINE

0845 933 3111

ENVIRONMENT AGENCY
FLOODLINE

0845 988 1188

ENVIRONMENT AGENCY
EMERGENCY HOTLINE

0800 80 70 60



ENVIRONMENT
AGENCY

Guidance on the Assessment and Integration of Subsurface Analytical Contaminant Data and Transport Models

National Groundwater & Contaminated Land Centre report NC/99/361

Guide to Good Practice for the Development of Conceptual Models and the Selection and Application of Mathematical Models of Contaminant Transport Processes in the Subsurface

National Groundwater & Contaminated Land Centre report NC/99/362

Guidance on Assigning Values to Uncertain Parameters in Subsurface Contaminant Fate and Transport Modelling

National Groundwater & Contaminated Land Centre report NC/99/363



PROTECTING Groundwater

Underground

From the National Groundwater and Contaminated Land Centre
Environment Agency

Barbara Young learns about groundwater and contaminated land

Barbara Young is a member of the National Groundwater and Contaminated Land Centre's Advisory Group. She is a former member of the Environment Agency's Groundwater Protection Group. She is currently a member of the Environment Agency's Groundwater Protection Group. She is currently a member of the Environment Agency's Groundwater Protection Group.



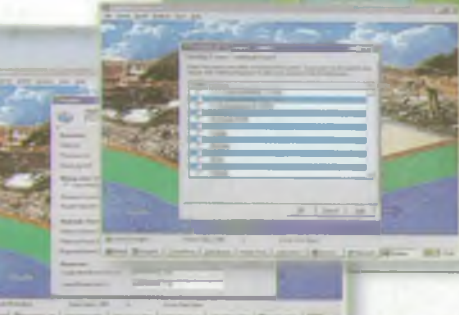
National Groundwater and Contaminated Land Centre
Assessing the Groundwater Pollution Potential of Cemetery Developments



Resource Assessment Stages - CAMS Maps



Resource Assessment Stages - CAMS Maps



Remedial Treatment Action Data Sheet on Monitored Natural Attenuation (MNA)

