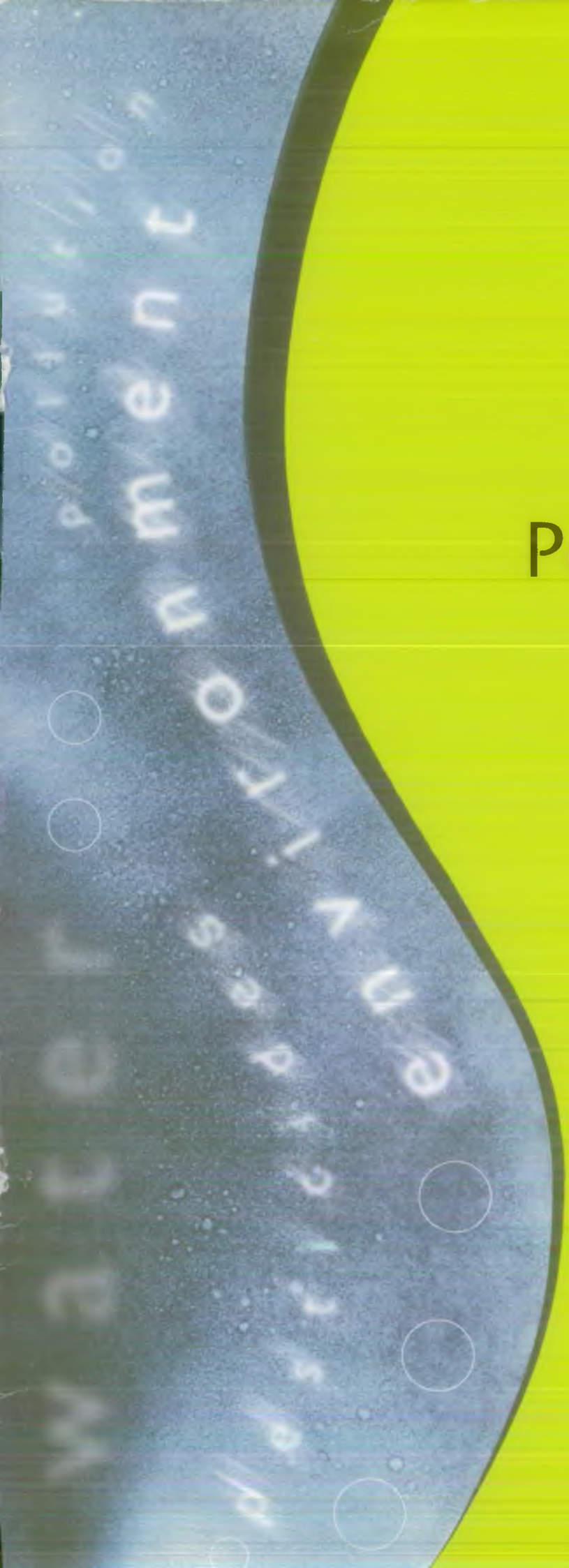


ENVIRONMENT AGENCY

Pesticides 1998

A summary of monitoring of the aquatic environment in England and Wales

National Centre for Ecotoxicology and Hazardous Substances

This is the sixth in a series of reports on monitoring pesticides in the aquatic environment produced by the Environment Agency at the National Centre for Ecotoxicology and Hazardous Substances (NCEHS).

The NCEHS is one of a number of specialist centres created by the Environment Agency. Its purpose is to provide scientific expertise and strategic direction in respect of chemicals in the environment. The centre is based at Wallingford in Oxfordshire, and it also has a laboratory at Waterlooville near Portsmouth (accredited by the UK Accreditation Service).

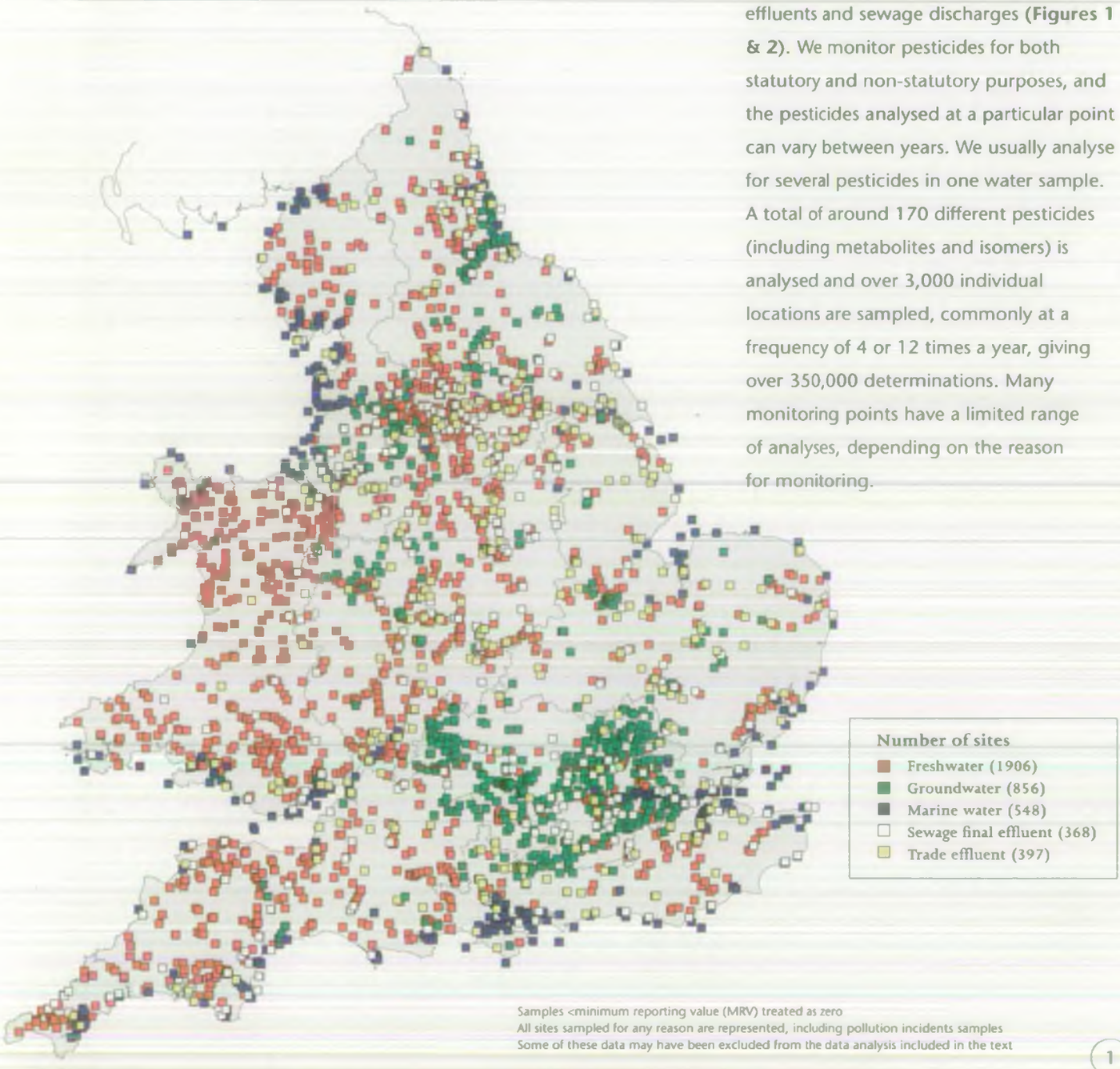
The Environment Agency's pesticide monitoring programme

Introduction

Pesticides (including herbicides, fungicides, insecticides, molluscicides, rodenticides, growth regulators, timber preservatives and sheep dips) in environmental waters come from a number of point and diffuse sources. In many catchments agriculture is the main source, while in others it may be a combination of industrial discharges, sewage treatment works and urban runoff. In coastal areas, especially ports and harbours, the main source of pesticides may be from the anti-fouling paints used on boats.

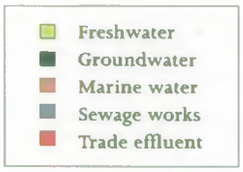
The Agency monitors pesticide levels in environmental waters, both routinely and on an *ad hoc* basis. We take samples from a range of sources: surface freshwaters, groundwaters, marine waters, trade effluents and sewage discharges (**Figures 1 & 2**). We monitor pesticides for both statutory and non-statutory purposes, and the pesticides analysed at a particular point can vary between years. We usually analyse for several pesticides in one water sample. A total of around 170 different pesticides (including metabolites and isomers) is analysed and over 3,000 individual locations are sampled, commonly at a frequency of 4 or 12 times a year, giving over 350,000 determinations. Many monitoring points have a limited range of analyses, depending on the reason for monitoring.

Figure 1.
Pesticide monitoring points in 1998

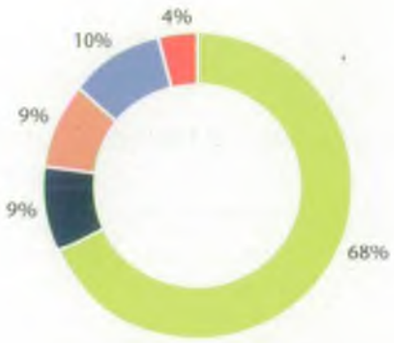


Samples <minimum reporting value (MRV) treated as zero
All sites sampled for any reason are represented, including pollution incidents samples
Some of these data may have been excluded from the data analysis included in the text

Figure 2. Number of analyses 1998

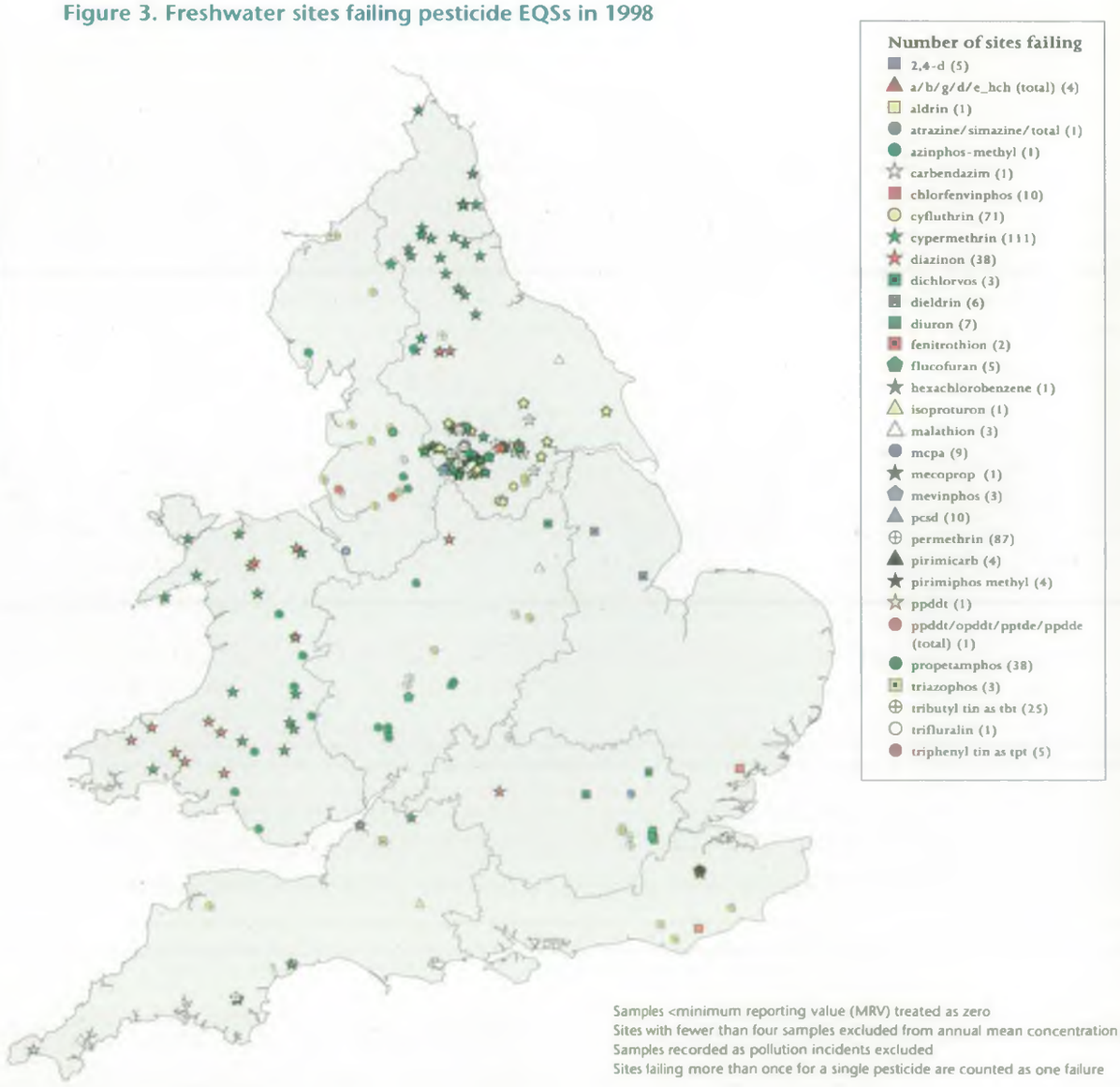


Total no analyses 369928



The data are compared with the Environmental Quality Standard (EQS) where available (the concentration of an individual substance which should not be exceeded in the aquatic environment – set on either a Maximum Allowable Concentration (MAC) or an Annual Average (AA) concentration figure), and the 0.1µg/l pesticide standard in the EC Drinking Water Directive. This report deals only with environmental waters and not drinking waters. Comparisons of data with the drinking water standard do, however, provide a good indication of those pesticides most likely to require action or treatment in order to comply with the Drinking Water Directive. This is also a useful way of looking at trends in levels of water contamination.

Figure 3. Freshwater sites failing pesticide EQSs in 1998



Samples <minimum reporting value (MRV) treated as zero
Sites with fewer than four samples excluded from annual mean concentration calculations
Samples recorded as pollution incidents excluded
Sites failing more than once for a single pesticide are counted as one failure

Pesticides in surface freshwaters

Figure 3 shows freshwater sites that failed any EQS for a particular pesticide. In 1998, 223 freshwater sites out of 1,461 monitored (15 per cent) and 32 pesticides failed their EQS at least once. This has increased slightly from 1997, where 202 sites out of 1,437 monitored (14 per cent) and 29 pesticides failed an EQS. Many failures are caused each year by sheep dip chemicals such as cypermethrin and diazinon, both from dipping activities and through discharges from wool processing industries. These chemicals are highly toxic to aquatic life. Mothproofers such as permethrin and cyfluthrin, used in the carpet industry, are another major source of EQS failures.

Various factors can affect the occurrence of pesticides found in different years. For pesticides largely used in agriculture, cropping changes, timing of applications and the weather in different years all have an effect, as well as the amounts used. Pesticides for home and garden and amenity use can occur at the times of the year associated with when they are used. Point source inputs such as sewage treatment works and industrial discharges may contribute throughout the year.

Figure 4. Trends in the pesticides occurring most frequently in freshwaters

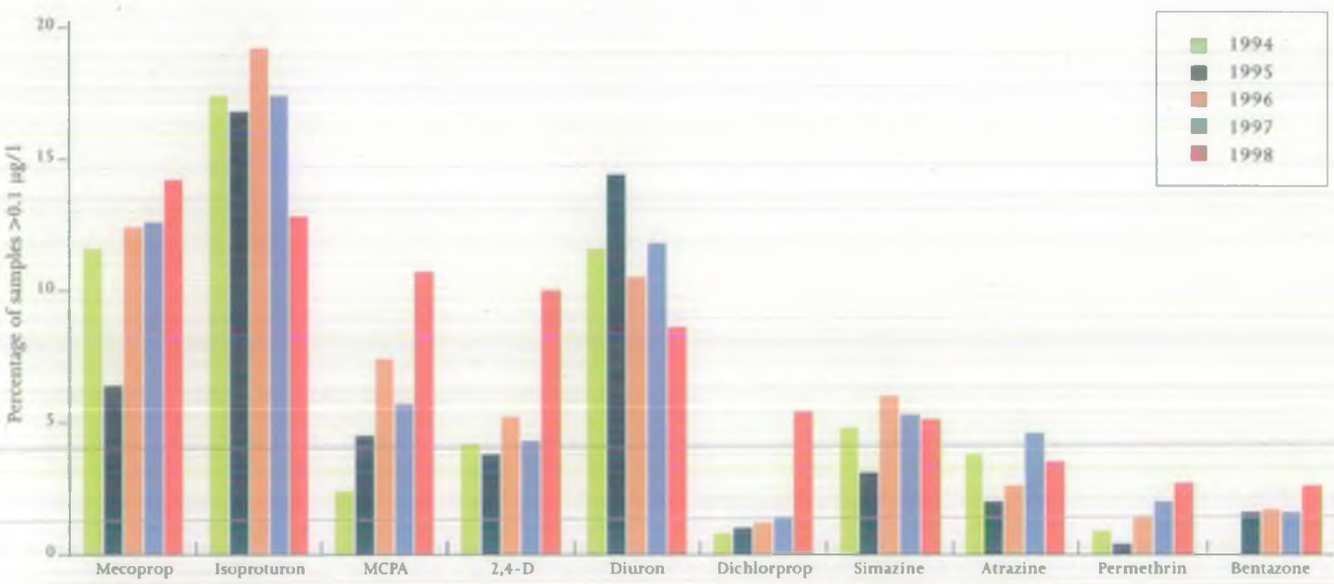


Figure 4 shows the most frequently occurring pesticides in surface waters. Many of these are solely or mainly used as agricultural pesticides, indicating that most freshwater pesticide pollution is from diffuse sources. In 1998 mecoprop occurred most frequently, with around 14 per cent of samples greater than 0.1 µg/l. Mecoprop is used as an agricultural and amenity herbicide and also has significant home and garden use. Other major contaminants are isoproturon, MCPA, 2,4-D, diuron and dichlorprop. These are all widely used, relatively mobile herbicides. There has been an increase in the frequency of occurrence for several of these herbicides compared with previous years. In contrast, levels of diuron have decreased, which may be a positive consequence of the Railtrack Agreement (see page 7).

Pesticides in marine waters and groundwater

The Agency's monitoring programme of marine waters and groundwaters for pesticides is much smaller than that of surface freshwaters. Pesticides usually occur to a lesser extent in these sources.

MARINE WATERS

Of the 467 marine and estuarine sites monitored in 1998, 157 (34 per cent) failed the EQS for at least one pesticide **(Figure 5)**. The most significant pesticide in marine water is tributyl tin (TBT), used as an anti-fouling treatment for boats. It caused widespread failures of the EQS in estuaries around England and Wales.

Since 1987 TBT has been banned from use on vessels less than 25 metres in length, because of its severe ecological impact in estuarine and marine areas. In many areas with high densities of small crafts there has been a significant biological improvement. For example, a recent survey of the Crouch estuary in Essex shows that the number and diversity of molluscs and crustaceans has increased markedly since the ban (CEFAS 1999). However, in other areas where larger boats and ships predominate, there has been no improvement (Minchin *et al* 1999). Consequently, the International Maritime Organisation (IMO) has proposed a global ban on TBT use as an antifoulant from 2003.

Figure 5. Estuarine and marine water sites failing pesticide EQSs in 1998

Samples <minimum reporting value (MRV) treated as zero
Sites with fewer than four samples excluded from annual mean concentration calculations
Samples recorded as pollution incidents excluded
Sites failing more than once for a single pesticide are counted as one failure

PESTICIDES IN THE ENVIRONMENT WORKING GROUP (PEWG)

This group was set up by the Agency to look at the overall balance of monitoring activities on pesticides in the environment and has recently produced a review of pesticide monitoring on the UK. Copies of "Monitoring of Pesticides in the Environment" are available from the National Centre for Ecotoxicology and Hazardous Substances.

RESEARCH & DEVELOPMENT

The Agency undertakes R&D to quantify and investigate pesticide pollution problems (around £100,000 for 2000/01). Much of this is collaborative with other funders. Current projects include work on reducing sheep dip impacts, development of pesticide waste disposal systems and guidelines on washdown and handling areas for agricultural pesticides.

REFERENCES

CEFAS (1999), Monitoring the Recovery of the Benthic Community in the River Crouch following TBT contamination. Final report for DETR.

Minchin, A., Davies, M., Pymm, H. and Grewar, G. N. (1999), North Sea Imposex Survey: CW0825, August 1998-July 1999, Final report, Fisheries Research Services, Report No 11/99.

Further information order form

Further information on pesticide monitoring is available free.

Tick the items that interest you and send or fax this form to the National Centre for Ecotoxicology and Hazardous Substances, Evenlode House, Howbery Park, Wallingford, Oxon, OX10 8BD.
Tel. 01491 828544 Fax. 01491 828532 E-mail ecotox@environment-agency.gov.uk

- ❑ Plant protection products
- ❑ Sheep dips and the textile industry

Regional trends in pesticides

- ❑ Anglian
- ❑ Midlands
- ❑ North East
- ❑ North West
- ❑ Southern
- ❑ South West
- ❑ Thames
- ❑ Wales

Title (Mr/Mrs/Miss/Ms/Other): **Initial:** **Surname:**

Address:

Postcode:

Pesticide monitoring data is available on the Environment Agency's website (under State of the Environment)
www.environment-agency.gov.uk

Environment Agency activities to reduce pesticide levels and impacts

The Agency aims to reduce the levels of pesticides reaching environmental waters. We are undertaking a number of activities to implement this, including the following:

PESTICIDE APPROVALS

We are involved with the approval and review of pesticides through the Advisory Committee on Pesticides (ACP). We can raise any issues of environmental concern and these will be taken into account during the approvals process.

THE GOVERNMENT'S PESTICIDE POLICY

We are a member of the Government's Pesticides Forum, set up to advise on and develop policy on minimising pesticides risks to the environment. We also advise the Government on specific pesticide policy issues such as the proposed pesticide tax and buffer zones.

RAILTRACK AGREEMENT

We have co-ordinated an agreement with Railtrack to restrict the use of the herbicide diuron on railway lines. With WaterUK, we have identified areas where diuron contamination could put drinking water abstraction sites at risk, and Railtrack has agreed not to use diuron in these areas.

STEWARDSHIP CAMPAIGNS

The Agency is involved in stewardship campaigns for isoproturon and diuron, whereby we work with manufacturers to ensure safe use of these products. For example, there has been a recent problem in Bridgewater, South West Region, with isoproturon contamination of a reservoir. We have been working with the Isoproturon Task Force to educate local farmers on the appropriate use of isoproturon.

LOCAL AUTHORITIES

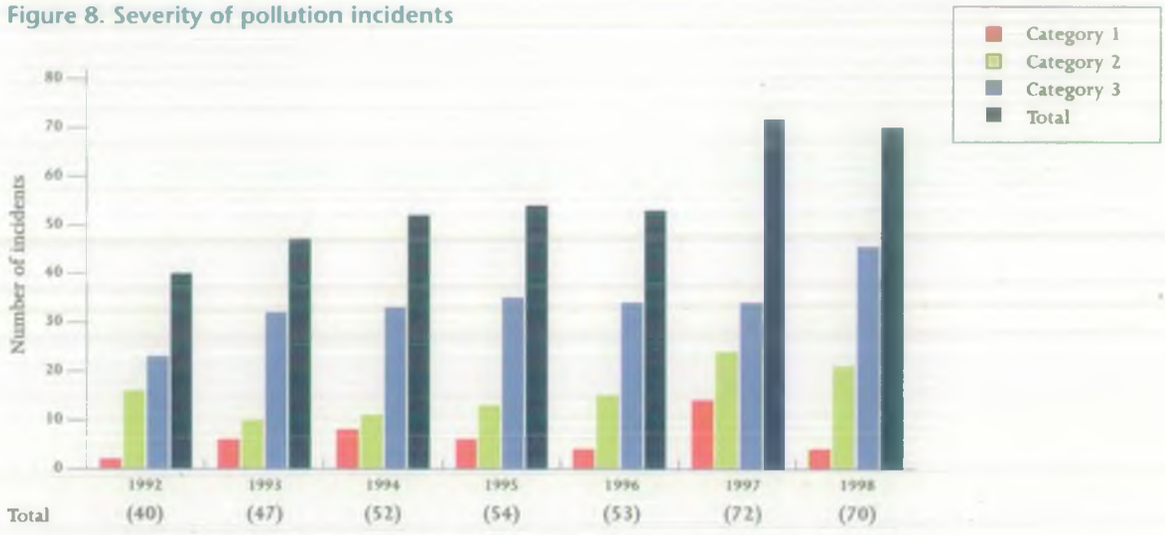
Local authorities are responsible for the use of amenity pesticides to control weeds and pests in parks, on roadsides, pavements, schools, etc. The Agency aims to educate and inform local authorities on good pesticide practice. To this end we are currently developing best practice guidelines on the safe use and disposal of amenity pesticides, to be used by local authorities and their contractors.

SHEEP DIPS

Sheep dip pollution arises from two main sources – usage and the textile industry. We have been tackling the problems with sheep dip usage by implementation of the Sheep Dip Strategy (March 1999). We are also assisting the DETR with the production of a sheep dipping code of practice under the Groundwater Regulations, 1998.

To combat pollution from wool washing plants and carpet manufacturers, the Agency has formed the Sheep Dip Chemicals and Textiles Industry Working Group. This group has developed a strategy (May 1999), which includes the need to review ways of reducing pesticide pollution from this source. Areas that need to be explored include sheep farming practice to reduce dip chemical residues in fleeces, pollution prevention measures for the processing plant, and effluent treatment technology.

Figure 8. Severity of pollution incidents

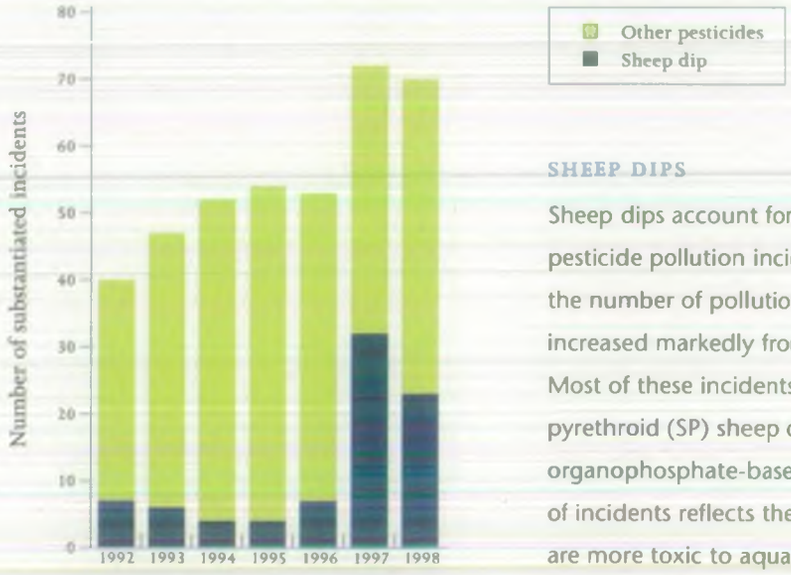


SOURCES OF INCIDENTS

Figure 9 shows the sources of pesticide-related pollution incidents. Agricultural usage accounted for the majority of incidents in 1998 (63 per cent). Agricultural use includes those pesticides used as sheep dips, on arable crops, vegetables, fruit, flowers, forestry and grassland. Other incidents occurred during transportation (11 per cent) and industrial use (4 per cent).

Figure 9. Numbers of pollution incidents in 1998 categorised by source

Figure 10. The number of sheep dip pollution incidents in relation to all incidents



SHEEP DIPS

Sheep dips account for the largest proportion of pesticide pollution incidents. **Figure 10** shows that the number of pollution incidents from this source increased markedly from 1996 to 1997 and 1998. Most of these incidents were caused by synthetic pyrethroid (SP) sheep dip chemicals rather than organophosphate-based dips. The increased number of incidents reflects the increased usage of SPs, which are more toxic to aquatic life than OPs.

Of the 96 pesticides analysed in marine waters, only 14 were above 0.1 µg/l in at least one analysis. Many of the same pesticides were found in marine waters as in freshwaters **(Figure 6)**. Diuron, isoproturon and mecoprop occurred most frequently. Diuron occurs widely in marine water and this may be due to its use as an anti-fouling treatment as well as its other land-based uses.

GROUNDWATER

Of the 130 pesticides monitored in groundwater in 1998, only 20 were found above 0.1 µg/l in at least one analysis. The most frequently found pesticide was atrazine **(Figure 7)**, thought to be mainly due to its historical use in non-agricultural situations. For some sites, atrazine's use on maize may also be a contributory factor.

Following the ban on atrazine for non-agricultural usage in the early 1990s, concentrations of the pesticide have not declined significantly across the Agency's groundwater quality monitoring network. Atrazine concentrations are however now decreasing at some public water supply boreholes. This is thought to be because these boreholes are pumping large volumes of atrazine-contaminated groundwater from aquifers, which is being replaced by water with lower atrazine concentrations. Clearly, even if the use of a pesticide is severely restricted, once an aquifer becomes contaminated with a pesticide, the groundwater is likely to take many years to recover.

Figure 6. Percentage of estuarine and marine samples >0.1µg/l

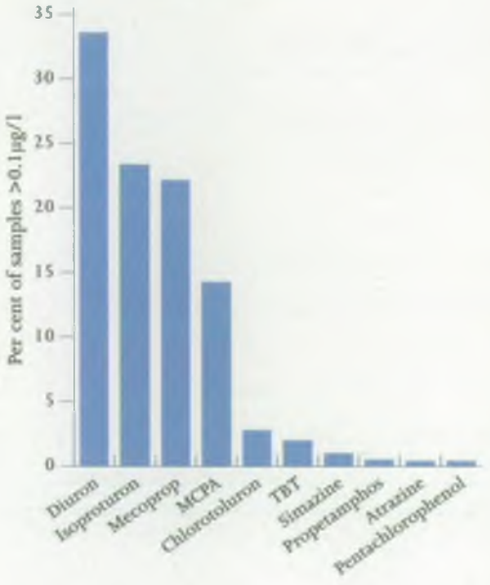
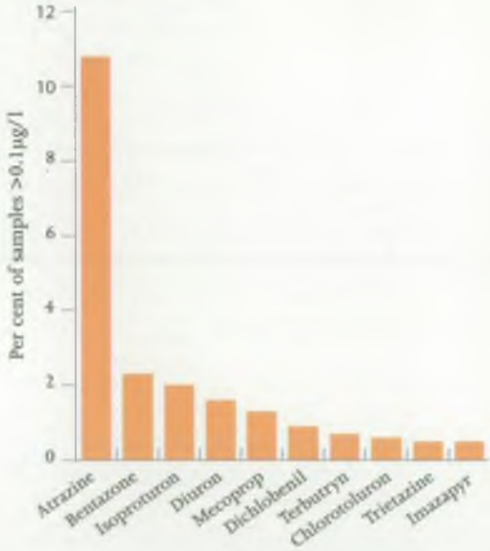


Figure 7. Percentage of groundwater samples >0.1µg/l



Pesticide pollution incidents

Many pesticides are toxic to aquatic life and can have devastating effects on rivers following spillages, accidents or other incidents.

In 1998 there were 70 pesticide-related pollution incidents **(Figure 8)**. Four (6 per cent) were Category 1 (major) incidents, 21 (30 per cent) were Category 2 (significant) and the remaining 45 (64 per cent) were Category 3 (minor incidents). The Agency has the power to prosecute acts of deliberate pollution and breaching of discharge consents, and we hope that this acts as a deterrent. Five incidents resulted in prosecution in 1998, two were Category 1 and three were Category 2.

The total number of incidents has increased by 35 per cent from 1994 to 1998, with a peak of 72 substantiated incidents reported in 1997. The increase is due mainly to increased numbers of Category 1 and 2 incidents being reported.

ENVIRONMENT AGENCY

Pesticides 1998

A summary of monitoring of the aquatic environment in England and Wales

Plant protection products

The Agency's pesticide monitoring programme is dominated by pesticides that are used or have been used in the past as plant protection products (PPPs). These include insecticides, fungicides, herbicides and plant growth regulators used on agricultural or horticultural crops, and also those with amenity and home and garden uses. Potential sources of contamination include spray drift on to watercourses during application, runoff from fields and hard surfaces, leaching into groundwater, poor disposal practice, spillages during mixing and handling, and losses from washdown areas.

The monitoring data are compared with the Environmental Quality Standard (EQS) where available (the concentration of an individual substance which should not be exceeded in the aquatic environment) and the 0.1µg/l pesticide standard in the EC Drinking Water Directive. This report deals only with environmental waters and not drinking waters. Comparisons of data with the drinking water standard do, however, provide a good indication of the pesticides most likely to require action or treatment in order to comply with the Drinking Water Directive. This is also a useful way of looking at trends in levels of water contamination.

Plant protection products are responsible for much of the pesticide contamination in surface freshwaters and groundwaters. Out of the 3,849 occasions that 0.1µg/l was exceeded in 1998, over 3,000 were due to PPPs. In addition, of the top 50 pesticides most frequently occurring above 0.1µg/l, 39 were plant protection products.

TRENDS IN PPP'S

Figures P1-P6 show the percentages of samples above 0.1µg/l in surface freshwater for six of the most frequently found pesticides in 1998.

Mecoprop has been found increasingly frequently in recent years **(Figure P1)**. Pesticide usage data for 1998 shows that the area treated with mecoprop increased by 14 per cent from 1996. However, in 1996 the mecoprop formulation was changed, with the result of halving the maximum application rate and so it would be expected that levels of environmental contamination should have decreased, not increased.

In 1998 isoproturon has been replaced by mecoprop as the most frequently occurring pesticide in surface freshwater **(Figure P2)**. The percentage of samples above 0.1 µg/l, while still high and of concern, has decreased over the past two years, possibly as a result of the stewardship campaign.

MCPA frequency of occurrence increased quite significantly in 1998 **(Figure P3)**, although its use decreased by 23 per cent from 1996. This pesticide needs more investigation to determine whether it is an increasing concern.

2,4-D, as with mecoprop, was found more often in 1998, although before this time its frequency of occurrence had been relatively constant **(Figure P4)**. Again, the increase in the number of exceedences of 0.1µg/l indicates a pesticide that may require further attention.

Figure P1. Mecoprop

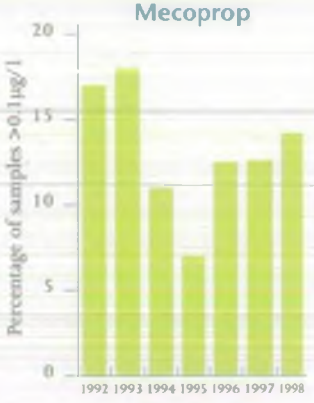


Figure P2. Isoproturon

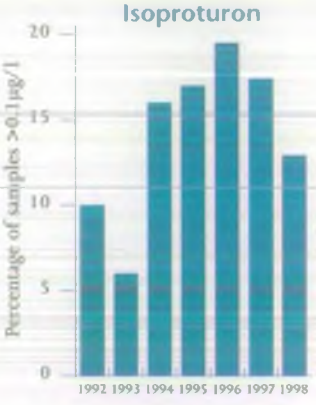


Figure P3. MCPA

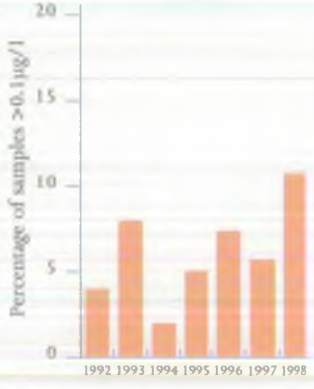
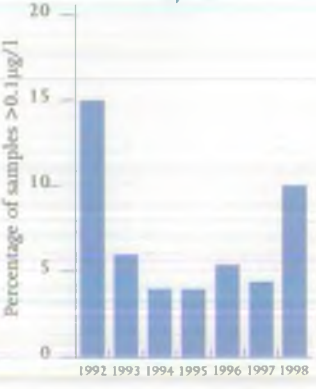


Figure P4. 2,4-D



Diuron contamination of surface freshwaters has been declining in recent years **(Figure P5)**. This may be a consequence of the Railtrack Agreement, which restricts the use of diuron on railway lines in sensitive areas. The diuron stewardship campaign may also be contributing to decreased levels.

The occurrence of atrazine in surface freshwaters has declined markedly since 1993 **(Figure P6)**, when a ban on non-agricultural uses came into effect. In more recent years, there has been a slight upward trend that may be associated with atrazine's use on maize and increased maize cropping.

Figure P5. Diuron

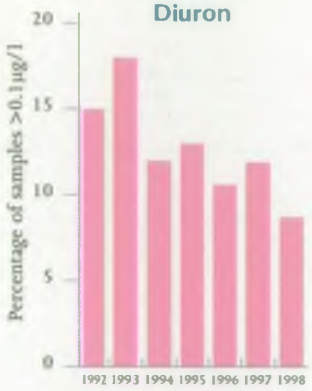
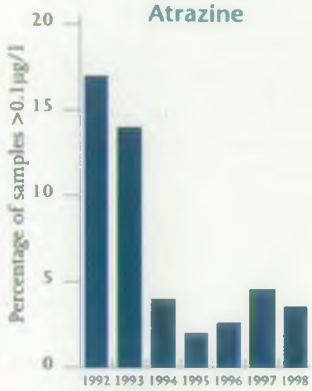


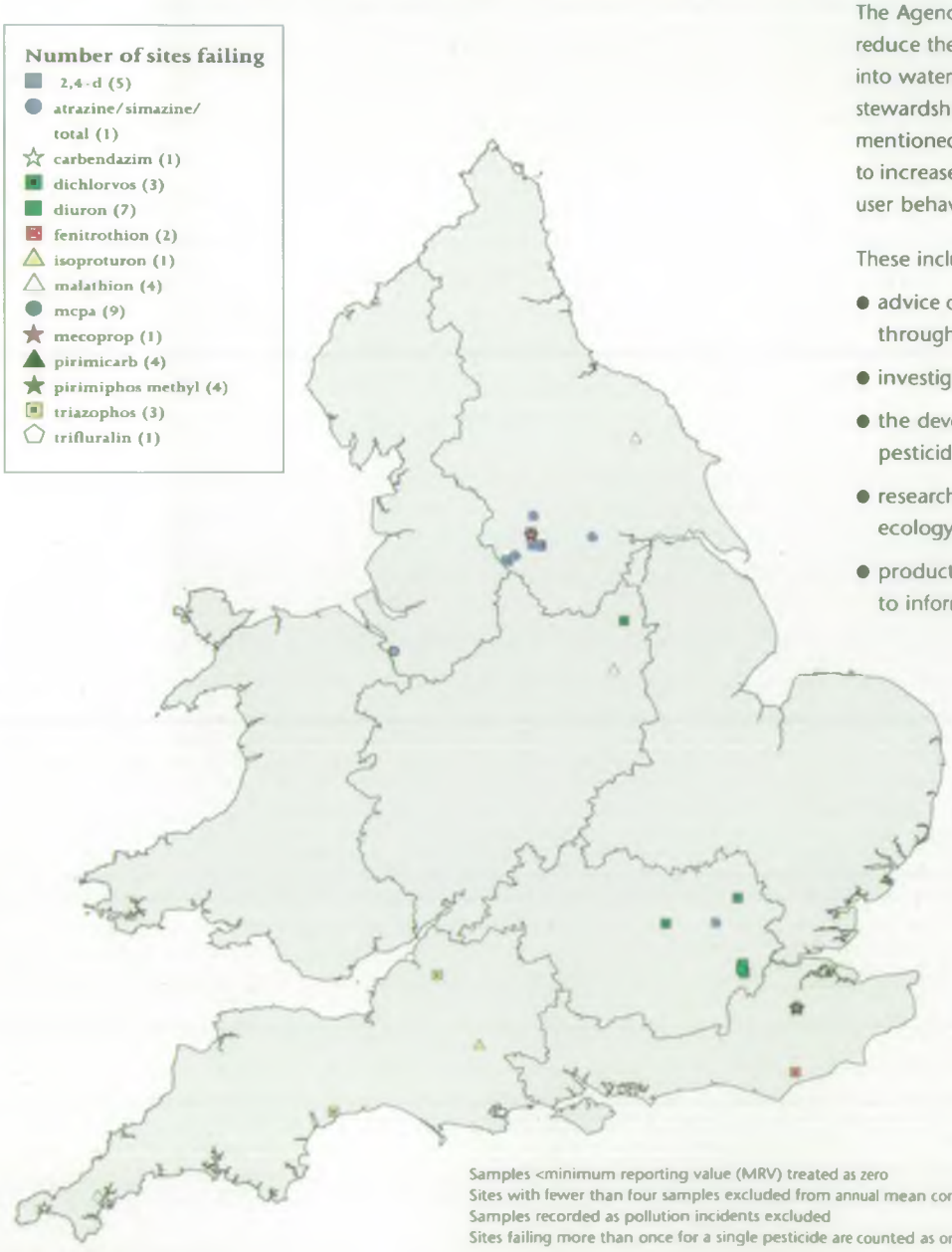
Figure P6. Atrazine



EQS FAILURES

Figure P7 shows the 1998 EQS failures for plant protection products. There are few failures in comparison with some of the other pesticide types. This information can be misleading, because relatively few samples are taken from small watercourses in rural areas where plant protection products may be failing EQSs. The detected plant protection product EQSs are mostly linked to pesticide manufacturing and formulation plants (Southern Region and North East Region) and other point sources, such as landfill and contaminated land. In Thames Region there has been a number of diuron failures in one catchment. This is currently the subject of a special investigation to determine the source. A major difference from the 1997 data is the absence of endosulphan failures. In previous years, these should not have been included as failures and their presence was due to the incorrect method of calculation of total endosulphan levels.

Figure P7. Sites failing EQSs for plant protection products in 1998



Samples <minimum reporting value (MRV) treated as zero
Sites with fewer than four samples excluded from annual mean concentration calculations
Samples recorded as pollution incidents excluded
Sites failing more than once for a single pesticide are counted as one failure

WHAT WE ARE DOING

The Agency is undertaking a number of activities to reduce the levels of plant protection products getting into watercourses and groundwater. As well as the stewardship campaigns and Railtrack Agreement mentioned earlier, a number of ongoing activities aim to increase our knowledge of pesticides and influence user behaviour.

These include:

- advice on Government pesticide policy particularly through our involvement in the Pesticides Forum;
- investigation of pesticide runoff from hard surfaces;
- the development of a design manual for agricultural pesticide handling and washdown areas;
- research on the impact of pesticides on river ecology;
- production of Pesticide Pollution Guidelines (PPG9) to inform users of best practice.

National Centre for Ecotoxicology and Hazardous Substances

CONTACTS:

THE ENVIRONMENT AGENCY HEAD OFFICE

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

www.environment-agency.gov.uk
www.environment-agency.wales.gov.uk

ENVIRONMENT AGENCY REGIONAL OFFICES

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

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

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

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

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

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

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

WALES
Rivers House/Plas-yr-Afon
St Mellons Business Park
St Mellons
Cardiff CF3 0EY
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

HO-10/00-2K-A-6FB Printed on CyclusPrint and Greencoat