PESTICIDES IN THE AQUATIC ENVIRONMENT 1997

ENVIRONMENT AGENCY

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1. EXECUTIVE SUMMARY

This is the fifth in a series of reports on the monitoring of pesticides in the aquatic environment produced by the Environment Agency (and one of its predecessor bodies, the National Rivers Authority, refs. 1, 2, 3 and 4). It presents the 1997 data for pesticide monitoring of environmental waters. For the purposes of this report "pesticides" include agricultural and non-agricultural pesticides, sheep dip, moth-proofing agents, anti-foulants and wood preservatives.

During 1997 the Agency monitored 165 pesticides (including some breakdown products, Appendix II). Samples were taken from over 3000 sites for both statutory and non-statutory purposes and almost 370,000 separate analyses of pesticides were recorded. The water sources sampled include, freshwaters, groundwaters, marine waters, trade effluents and sewage treatment final effluents.

The data are compared with the Environmental Quality Standard (EQS) where available, 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 against 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.

There are currently 65 pesticide EQSs available (Appendix III). The data show that of the 1,437 freshwater sites monitored, 202 failed one or more pesticide EQSs (14 per cent). This represents an increase on 1996 during which nine per cent of sites failed at least one EQS. The rise is mainly due to significant increases in the numbers of failures for permethrin and cyfluthrin and the sheep dip chemicals cypermethrin, diazinon and propetamphos.

For permethrin and cyfluthrin, increased failures may be due to elevated emissions from carpet manufacturers in the Midlands and North East regions, where they are used as moth-proofers, and possible home/garden inputs in Thames Region. Increased sheep dip failures are probably largely due to increased monitoring activity for these chemicals. Many sheep dip failures are associated with effluents from the textiles industries. The effect of textile effluents is of concern to the Agency and a working group has been set up to tackle the problem. The sheep dip chemical and textiles working group comprises representatives of the regulatory authorities, water industry, and the textiles, sheep dipping and pharmaceutical industries. This group produced a strategy document in May 1999 (ref. 5). Other sheep dip EQS failures are due to pollution from sheep dipping activities rather than industrial discharges. In the last year the Agency has produced a sheep dip strategy (ref. 6).

Of the 435 marine and estuarine waters monitored, 128 (29 per cent) failed at least one EQS. In 1996 15 percent of sites failed a pesticide EQS. The increase in 1997 is due mainly to a large increase in failures of tributyl tin (121 sites) which is used in anti-fouling paints on ships. EQSs for organo-tin became statutory in 1997 and the subsequent increase in monitoring activities has highlighted this chemical as a major issue in the marine environment.

As with previous years, the cereal herbicide isoproturon exceeded 0.1µg/l most frequently in surface freshwaters (17 per cent). Mecoprop (13 percent) and diuron (12 per cent) were also found frequently to exceed 0.1µg/l. The pesticides found above 0.1µg/l, most often in

groundwater, were atrazine (seven per cent) , diuron (two per cent) and isoproturon (1.5 percent).

In addition to the general monitoring data, for the first time this report includes pesticide aquatic pollution incidents (section 4.0). There were a total of 72 pollution incidents involving pesticides in 1997, of which 14 were category-1 (major), 24 category-2 (significant) and 34 category-3 (minor). These incidents resulted in a total of 10 prosecutions by the Agency. Many more pollution incidents associated with sheep dips were recorded in 1997 than in previous years probably through the use of synthetic pyrethroid dips that are highly toxic to aquatic life, but also due to more intensive monitoring and investigation in some areas.

2. INTRODUCTION

2.1 Definition of pesticide

A pesticide is defined under the Food and Environment Protection Act (1985) as "any substance, preparation or organism prepared or used for destroying any pest". Pesticides include herbicides, fungicides, insecticides, molluscicides, rodenticides, growth regulators and masonry and timber preservatives. They are not confined to agriculture, but are also used on roads and rail tracks, in homes and gardens, - as anti-fouling paints, timber treatments and surface biocides, and for the protection of public health. Although classified as veterinary medicines and authorised under different legislation, in many cases sheep dips contain the same active ingredients as those used in certain crop protection pesticides.

2.2 Pesticides and the aquatic environment

Pesticides enter the aquatic environment from point and diffuse sources. Point sources are potentially the most likely to cause acute incidents. Some of these sources are controlled by discharge consents, such as those from manufacturing plants, while others are less easily controlled and include spillages, inappropriate disposal of sheep dips and dilute pesticides and accidents. Inputs from diffuse sources include spray drift into watercourses, leaching from the soils and atmospheric deposition.

Pesticides vary widely in their chemical and physical characteristics. Their mobility, rate of degradation and solubility govern their potential to contaminate controlled waters from diffuse routes. Many pesticides break down quickly in the soil or by the action of sunlight but are more likely to persist if they reach subsoil or groundwater because of reduced microbial activity, absence of light and lower temperatures.

2.3 Environment Agency monitoring programmes

The Agency's pesticide monitoring programme is largely dependent on statutory requirements to monitor concentrations in water, sediment and biota. The Agency also undertakes non-statutory monitoring, tailored to known or predicted local pesticide problems. It is estimated that the cost of the Agency's pesticide analytical programme is in excess of £4 million annually. The data are held on the public register and are available to anyone wishing to see them. The 1992-97 database is also available on CD-ROM from the National Centre for Environmental Data and Surveillance at Twerton[1].

Surface water monitoring

The Agency is required to monitor downstream of all known discharges of List I and List II substances under the Dangerous Substances Directive (76/464/EEC) (Appendix IV) and report the results annually to the Department of the Environment, Transport and the Regions (DETR). Additionally, List I substances are monitored at background environmental monitoring sites, known as "national network" sites. Abstraction points identified under the Surface Water Abstraction Directive (75/440/EEC) must also be monitored for relevant pesticides. Exceedences of any EQSs have to be reported annually to the DETR.

The Agency undertakes monitoring as part of the Harmonised Monitoring Programme. This was set up by the DETR in 1974 to provide a network of sites at which river quality at the lower end of the surface water catchments can be assessed. It also enables estimation of the

[1] National Centre for Environmental Data and Surveillance, Lower Bristol Road, Bath BA2 9ES Tel 01225 444066

load of materials carried into estuaries. The list of monitored substances includes the pesticides aldrin, dieldrin, gamma HCH, heptachlor, pp DDE and pp DDT.

The Agency also monitors and reports on substances entering the North Sea. Annex 1A of the Final Declaration of the 3rd North Sea Conference lists 36 substances with target reductions, 18 of which are pesticides (Appendix V). Discharges are monitored to show whether these targets are being met. In addition to Annex 1A substances, further actions were agreed to reduce inputs of other groups of substances listed in Annex 1B, including 18 pesticides (Appendix VI).

Monitoring effluent discharges

Discharge consents are issued under the Water Resources Act (1991) and are used to control point source inputs of effluents. Consent conditions are set to meet EQS requirements in the receiving water. Industries manufacturing or formulating pesticides, washing wool and manufacturing textiles are regulated by authorisations under Integrated Pollution Control (IPC).

Effluent discharges containing one or few specific pesticides are controlled by consent limits for the individual substances. Complex discharges containing a mixture of pesticides (for example from manufacturing sites) may be more appropriately controlled by means of toxicity-based consents.

Monitoring of discharges and receiving waters is carried out to ensure compliance with permit conditions and, where appropriate, the EQS. The sampling frequency depends on the volume and location of the discharge, but is typically 12 times a year.

Permissive (non-statutory) monitoring

The Agency carries out additional, non-statutory monitoring for the pesticides it considers may be present in the aquatic environment at significant levels. With approximately 500 agricultural, horticultural and amenity active ingredients and nearly 150 non-agricultural active ingredients on the UK market, it is not practical or possible to monitor them all. Apart from its usage pattern, the physico-chemical properties of a substance, such as mobility, persistence and solubility, and other factors such as time of application, dose rate, soil type and climate, should be considered when assessing whether a pesticide is likely to reach water. Each Agency region carries out monitoring tailored to known and potential problems associated with the local use of pesticides. Many pesticides are used in agriculture and monitoring should aim to cover those most widely used in intensively cropped farming areas. By contrast, upland areas have little cropped land but more sheep farming, and monitoring should target sheep dips. In urban areas, the amenity pesticides likely to be used on roads and railways should be monitored. With new pesticides entering the UK market, the monitoring programmes must be continually reviewed and new analytical methods developed.

Groundwater monitoring

Groundwater is used extensively for drinking water, particularly in the Midlands and southern England. The most important aquifers in the UK are chalk, the Permo-Triassic sandstone, Jurassic limestone and Lower Greensand. Water supplies derived from groundwater are regularly monitored by water companies, who are required to notify the Agency of any exceedence of the drinking water standard. They make all the data from groundwater supplies available to the Agency. There are large regional variations in the amount of groundwater monitoring that the Agency carries out. Taking England and Wales as a whole, groundwater monitoring is limited in its extent and is often targeted to specific

known problems or intermittent special surveys.

Pesticide pollution incidents

The Agency is responsible for investigating pollution incidents including those caused by pesticides. Serious incidents of pesticide pollution are rare, comprising fewer than one per cent of all substantiated pollution events. However, when these do occur they can cause severe environmental damage. Data on specific incidents and their effects are contained in the pesticide pollution incidents section of this report (Section 4.0) and the Agency's main Water Pollution Incident Report (ref. 9).

2.4 Analysis of pesticides

The Agency uses its own National Laboratory Service (NLS) for the analysis of pesticides. Analytical methods are carefully selected (based on methods by the Standing Committee of Analysts) and subjected to detailed statistical evaluation to ensure they meet defined performance targets. The quality of results has a high priority and the NLS has adopted rigorous quality control procedures. The NLS has installed Quality Assurance Management Systems and the laboratories are accredited to the internationally recognised National Accreditation of Measurement and Sampling (NAMAS) administered by the United Kingdom Accreditation Service (UKAS).

2.5 Analytical constraints on monitoring

The analysis of trace levels of pesticide can be difficult because:

i) Required detection levels introduce problems of accuracy, reproducibility and reliability. The lower the concentrations then the higher the cost, analytical skill and degree of uncertainty.

ii) Many pesticides are very soluble in water making extraction and concentration difficult.

iii) A wide range of other organic compounds present at higher concentrations in environmental samples can mask pesticides present.

Analytical methods need to be developed for these more difficult pesticides.

2.6 Environmental Quality Standards

An EQS is the concentration of a substance which should not be exceeded in the aquatic environment. It is specific to an individual substance and is derived from an assessment based on the available toxicity data

The Dangerous Substances Directive (76/464/EEC) requires the EC to set EQSs for List 1 compounds and member states the EQSs for List 2 compounds. In the UK both the DETR and the Agency have commissioned work to derive EQSs. In the UK EQSs are currently available for more than 100 substances, of which 65 are pesticides (Appendix III).

The majority of EQSs are for the protection of aquatic life and are derived for both the marine and freshwater environments. EQSs are generally expressed as annual averages (AA) to protect long-term exposure, or maximum allowable concentrations (MACs) to protect short-term exposure. In addition, some EQSs for example permethrin and cyfluthrin, are

expressed as 95 percentiles (concentration that should not be exceeded for 95 per cent of the time).

The EC has set statutory standards for 18 List 1 compounds that are regulated under the Surface Water (Dangerous Substances) (Classification) Regulations of 1989 and 1995. Monitoring is undertaken by the Agency to ensure compliance with these standards and the results are reported annually to the DETR. In addition, a further 30 of the EQSs proposed by the Agency and the DETR have recently become statutory via the Surface Water (Dangerous Substances) (Classification) Regulations 1997 and 1998. A number of these are for pesticides (see Appendix III).

The Government Circular 7/89 (16/89 for Welsh Office) details proposed EQSs for a number of compounds. As these are not yet included in legislation they are not formally statutory standards. The pesticides included in the proposed list are detailed in Appendix III.

Although many EQSs are not contained in legislation or government circulars and are therefore not statutory, they are used by the Agency to assist in the control of substances in the aquatic environment. They are termed operational standards.

3. MONITORING DATA FOR 1997 – THE NATIONAL PICTURE

In 1997 the Agency monitored 165 pesticide determinands (including breakdown products, Appendix II). Samples were taken from approximately 3,000 sites and approximately 370,000 separate determinations made. Most of the Agency's monitoring effort is expended on surface waters (70 per cent of analyses) with 30 per cent on sewage effluent, marine water, groundwater and trade effluent. Figures 1 to 3 give a summary of the scale and geographical distribution of pesticide monitoring in 1997.

The 1997 pesticide monitoring data have been compared with the EQS, where one is available, and the EC Drinking Water Standard (0.1µg/l). The data on EQS failures are, in general, a better indication of point source pollution as they are generally associated with discharges to the water environment (recorded pollution incidents are excluded). Comparison with the 0.1µg/l standard gives a better indication of diffuse pollution.

Due to the wide variety of pesticide types and the range of different applications and usage times, the data are reported by calendar year to make comparisons between pesticides and earlier years easier. For the purpose of this report, all results below the minimum reporting value (MRV)[2] are treated as zero and EQS failures are calculated on this basis. A regional perspective on the data is provided in Appendix I.

3.1 EQS exceedences

The data from each site have been compared with all available EQSs (Figure 4). If standards for both an annual average (AA) and a maximum allowable concentration (MAC) are available, both are used for assessment. When investigating sites with EQS failures all samples, excluding those listed as known pollution incidents, are included (Table 1). However, only one failure is counted where one site failed both EQSs. No EQSs are available for groundwaters. Of the 65 pesticides with EQS values that were monitored in 1997, 30 exceeded their EQS value at at least one site.

EQS failures in surface freshwaters

The location of each surface freshwater EQS failure in England and Wales is shown in Figure 5. Of the 1,437[3] freshwater sites monitored, 202 sites (14 per cent) failed at least one EQS. This is an increase from 1996, where only nine per cent of freshwater sites failed an EQS, and is mainly due to significant rises in the number of failures for permethrin and cyfluthrin and the sheep dip chemicals cypermethrin, diazinon and propetamphos. For permethrin and cyfluthrin, increased failures may be due to elevated emissions from carpet manufacturers in the Midlands and North East regions, where they are used as moth-proofers, and possible home/garden inputs in Thames Region. Increased sheep dip failures are probably largely due to increased monitoring activity for these chemicals.

The number of sites failing EQSs for individual pesticides in surface freshwaters are shown in Table 2. The most frequent EQS failure in surface freshwaters was permethrin (81 sites) followed by cypermethrin (72 sites), diazinon (65 sites), cyfluthrin (53 sites) and propetamphos (42 sites).

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[2] MRV is the value for an individual determinand at which Agency analysts are confident in the measured level based on performance testing.

[3] Excludes known pollution incidents and sites where no pesticides with an EQS were monitored.

Table 1. Number of sites failing any EQS in 1997

	Total number of sites monitored	Number of monitored sites suitable for EQS comparison	Number of sites with EQS failure(s)	Percentage of sites failing any EQS
Freshwaters	1570	1437	202	14%
Marine waters	446	435	128	29%

Figure 1. Pesticide monitoring points for 1997

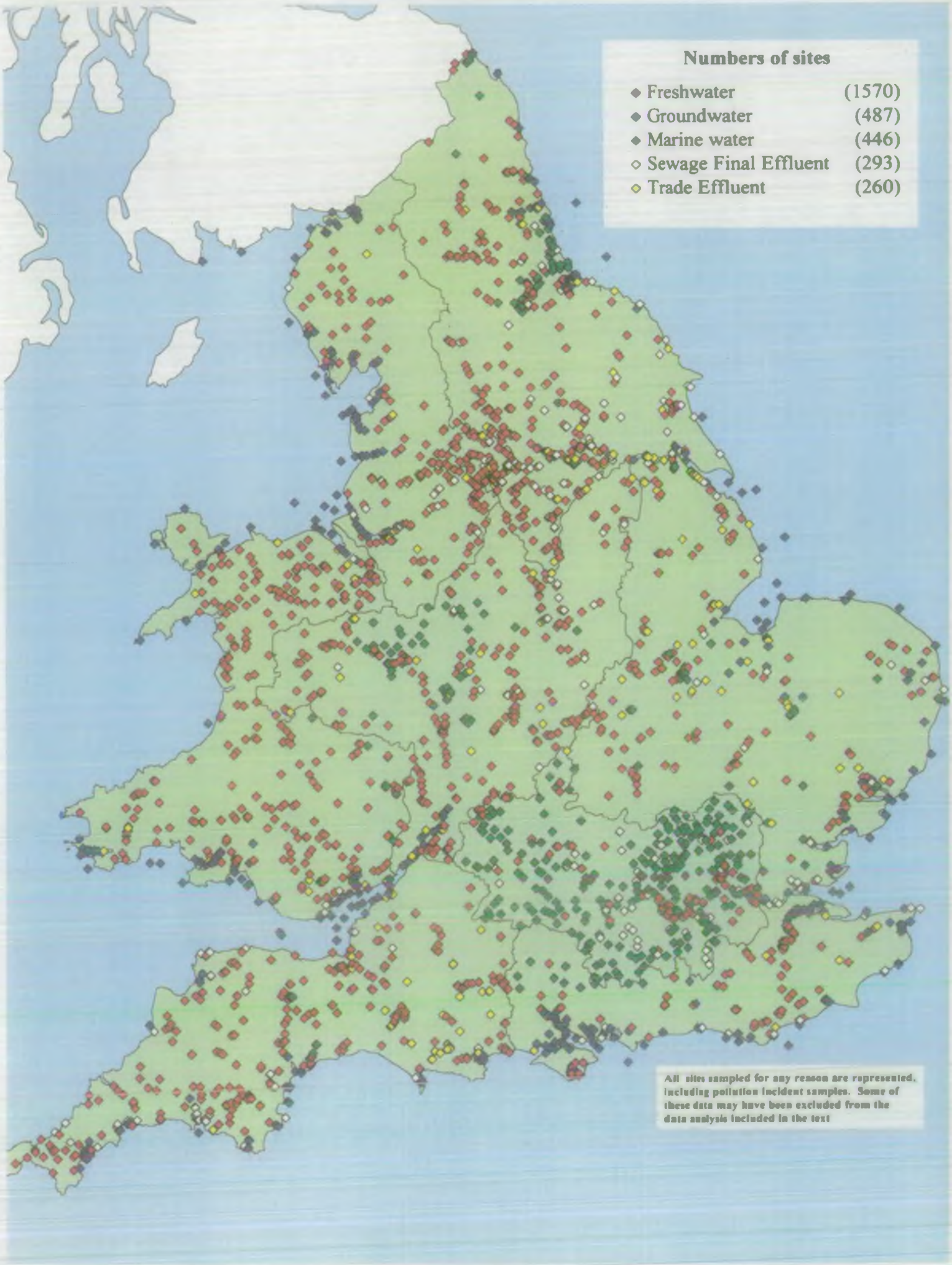


Figure 2. Number of pesticide analyses 1997

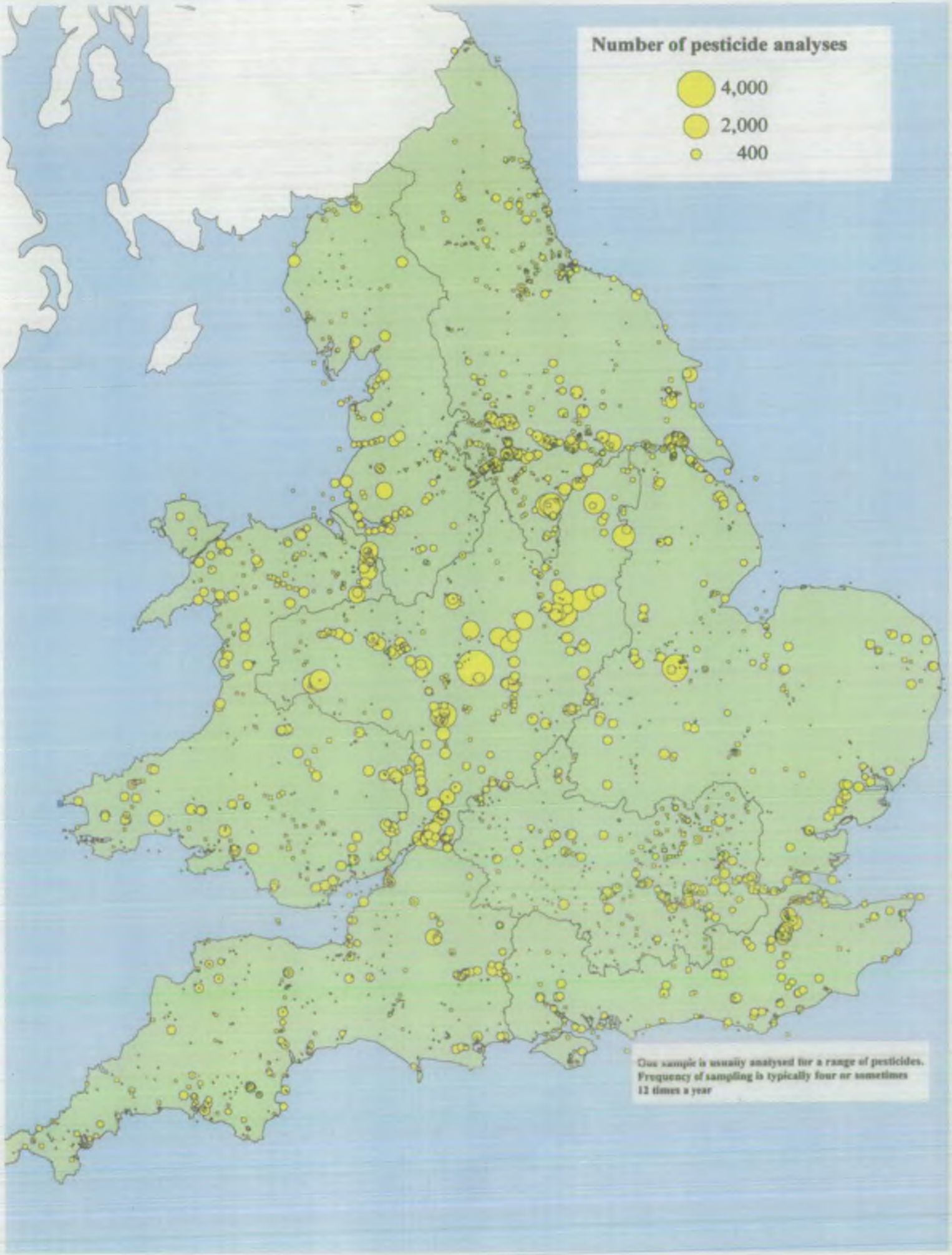
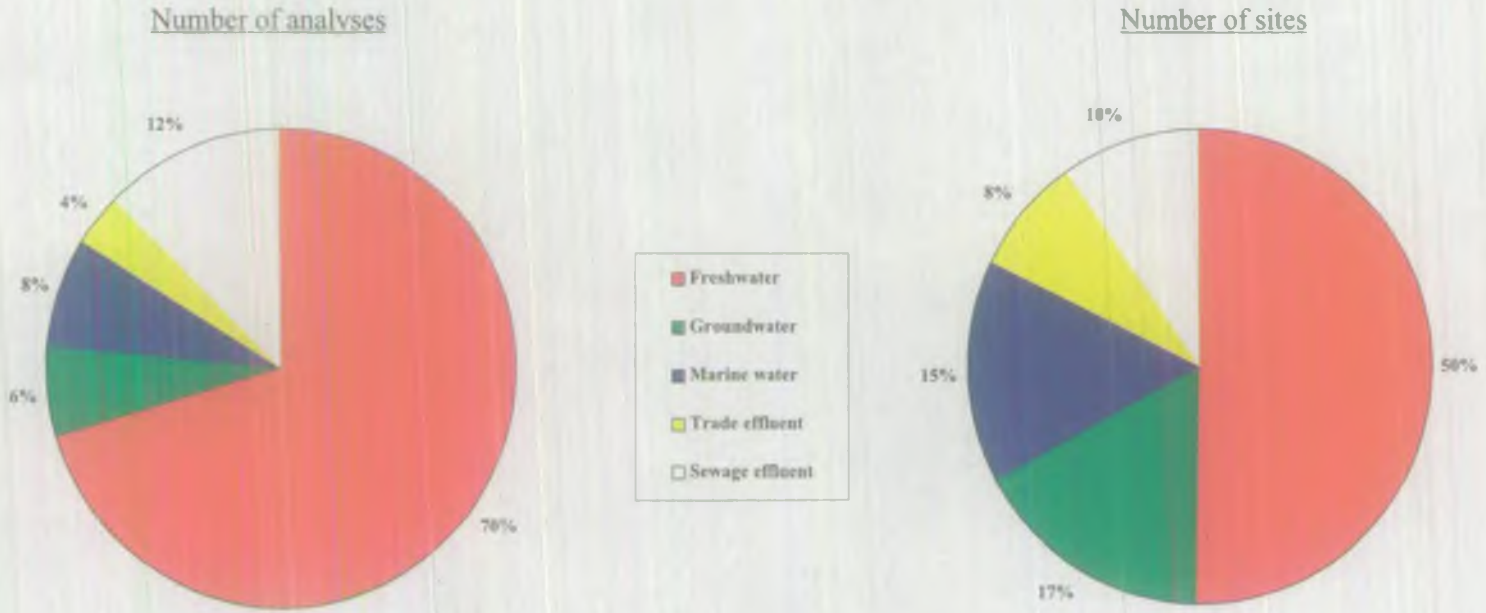


Figure 3. National pesticide monitoring summary 1997



Number of analyses: 360645
Number of sites: 2854
Pollution incidents excluded

Table 2. Surface freshwater sites failing any EQS in 1997

Pesticide	Number of sites failing any EQS	Number of sites monitored	% of monitored sites failing any EQS
Permethrin	81	190	42.6
Cypermethrin	72	160	45.0
Diazinon	65	497	13.1
Cyfluthrin	53	125	42.4
Propetamphos	42	453	9.3
Tributyl tin	19	184	10.3
PCSD	15	96	15.6
Chlorfenvinphos	13	328	3.9
Total endosulfan	9	306	2.9
Dieldrin	8	957	0.8
Total HCH	5	1030	0.5
Dichlorvos	5	419	1.1
Pirimicarb	5	92	5.4
Azinphos-methyl	4	339	1.2
2,4-D	4	334	1.2
Fenitrothion	4	423	0.9
MCPA	4	294	1.4
Carbendazim	2	135	1.5
Diuron	2	423	0.5
ppDDT	2	549	0.4
Pirimphos-methyl	2	64	3.1
Triphenyl tin	1	97	1.0
Aldrin	1	561	0.2
Hexachlorobenzene	1	473	0.2
Isoproturon	1	392	0.3
Linuron	1	359	0.3
Mecoprop	1	427	0.2
Total DDT	1	549	0.2
Triazophos	1	192	0.5

Note: The percentages of these sites are calculated from the number of sites monitored for each pesticide. Data exclude samples from known polluted sites and recorded pollution incidents.

EQS failures in marine waters

Of the 435 marine water sites monitored, 128 sites (29 per cent) failed at least one EQS (Figure 6). The most frequent EQS failure in marine water was tributyl tin (124 sites) (Table 3).

Compared with 1996, the number of sites failing any EQS has increased from 64 sites (15 per cent) to 128 sites (29 per cent). The region with the largest rise is Southern (an additional 34 sites on 1996). The number of sites monitored in Southern Region was similar in 1996 and 1997, but the number of samples taken rose significantly (approximately 186 (1996) to 287 (1997). This increased monitoring frequency could be responsible for some of the rise in the number of sites failing. Another possible explanation is the re-suspension of sediment

containing TBT during dredging processes.

Table 3. Marine water sites failing any EQS in 1997

Pesticide	**Number of sites failing any EQS**	**Number of sites monitored**	**% of monitored sites failing any EQS**
Tributyl tin	121	206	58.7
Total HCH	6	296	2.0
Triphenyl tin	6	159	3.8
Dieldrin	2	268	0.7
Diazinon	1	19	5.3
Endosulfan	1	117	0.9
Endrin	1	244	0.4
ppDDT	1	227	0.4
Total DDT	1	241	0.4

Note: The percentages of these sites are calculated from the number of sites monitored for each pesticide. Samples from known polluted sites are excluded.

Figure 4. All sites failing a pesticide EQS in 1997

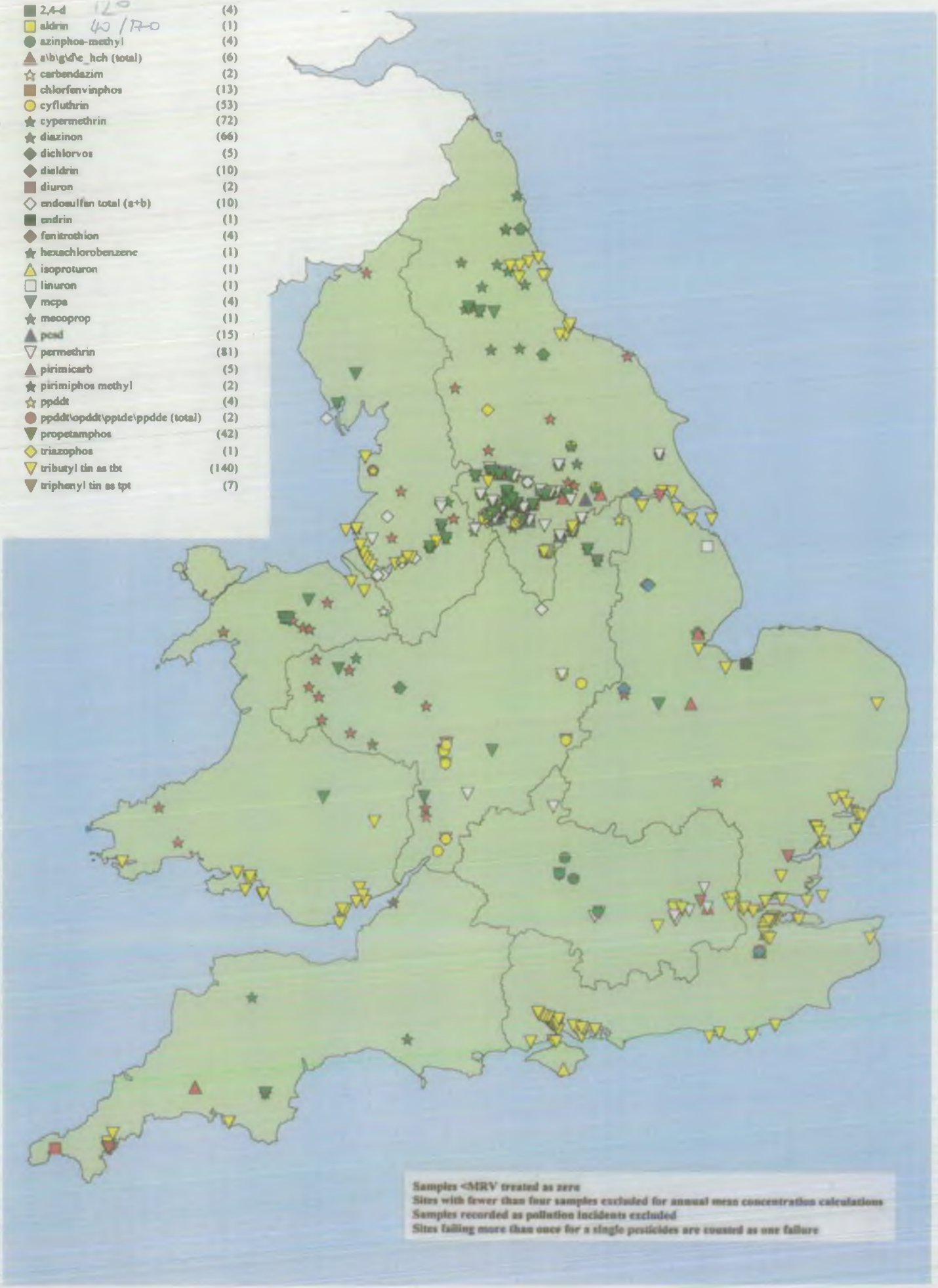


Figure 5. Freshwater sites failing pesticide EQSs in 1997

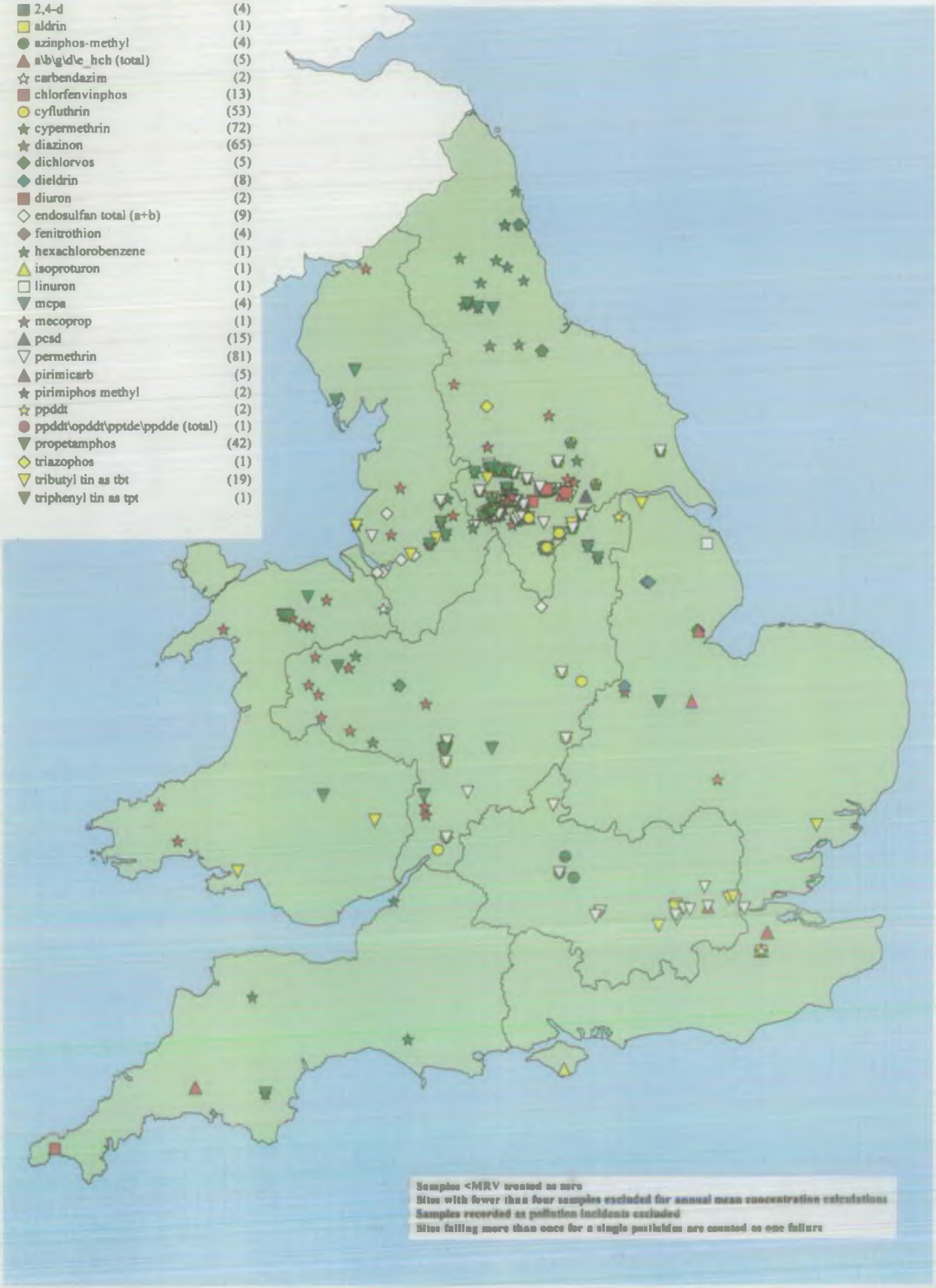
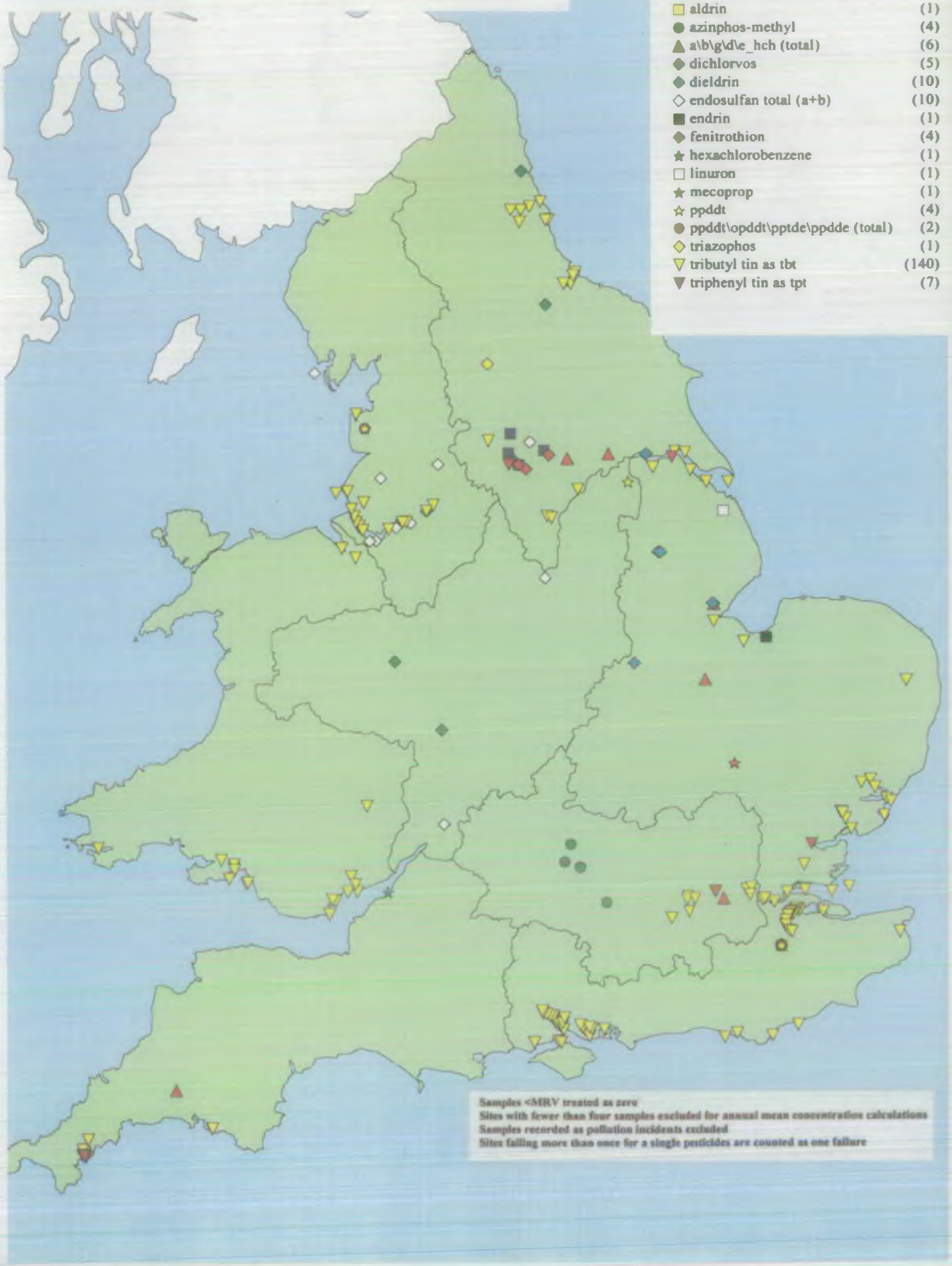


Figure 6. Estuarine and marine water sites failing pesticide EQSs in 1997

Figure 7. Sites failing statutory pesticide EQSs in 1997



In the following sections, discussion of EQS failures has been separated into statutory EQS failures and four different categories of pesticides (grouped by pesticide usage). Grouping of the EQS values in this way allows easier investigation and targeting of control measures, and advice to government for specific areas of pesticide use. Some pesticides may appear in both the statutory EQS section and the pesticide use areas.

Statutory pesticide EQSs

Figure 7 shows sites failing statutory pesticide EQSs in surface waters in England and Wales. The EC has set statutory standards for 18 List 1 compounds, of which 10 are pesticides.

Five Dangerous Substances Directive List 1 pesticides failed their EQS in 1997 on at least one occasion and at least one site. These were ppDDT, total DDT, dieldrin, total HCH and hexachlorobenzene. Although DDT, hexachlorobenzene and the "drins" have been banned for many years, there are still a number of sites which fail the EQS. These pesticides are extremely persistent and are only gradually released into water from contaminated sites.

The occurrences of EQS failures for HCH are thought to be largely due to its use in non-agricultural areas, for example timber treatment rather than plant protection. However, the EQS failure for HCH in North East Region (River Calder in Yorkshire) may have arisen from a wool scouring company where imported Russian wool containing HCH was processed in 1994. EQS failures for HCH are still occurring in this area three years after the event due to this pesticide's persistence in the environment.

The Dangerous Substances Directive List II organo-tin pesticides, tributyl tin and triphenyl tin, exceeded their EQSs frequently. These compounds are discussed in a specific section below.

Sheep dip

The sheep dip chemicals cypermethrin (72 sites), diazinon (65 sites), propetamphos (42 sites) and chlorfenvinphos (13 sites) (Figure 8) account for some of the highest number of sites failing EQSs. Cypermethrin is particularly noteworthy since 45 per cent of sites monitored failed the EQS.

Sheep dips are generally extremely toxic to aquatic life and hence have relatively low EQSs. Exceedences can be seen in clusters around the textile industry bases of Leeds and Bradford, and probably reflect discharges to watercourses from trade effluents via the public sewage treatment works.

There are other more randomly spread exceedences, particularly in the upper reaches of the River Severn in the Midlands Region, Wales and Northumberland, and are probably associated with sheep dipping activities.

After permethrin, cypermethrin exceeded its EQS most frequently in 1997. In 1997, 72 sites (45 percent) exceeded the EQS, compared with 60 sites in 1996, 26 sites in 1995 and one site in 1994. This increase is in part a reflection of improved analytical techniques and greater monitoring effort. There may also have been an increase in the use of cypermethrin as a sheep dip over this period and, while it is less toxic to humans than the organophosphate sheep dips, it is considerably more toxic to aquatic life. There has also been an increase in the number of category 1 pollution incidents caused by cypermethrin in 1997 compared with 1996 (see section 4.0).

Chlorfenvinphos is no longer authorised as a sheep dip in the UK. EQS failures are likely to be associated with the processing of imported wool containing residues of the pesticide, although some may be due to the use of old stocks of sheep dip. Chlorfenvinphos and cypermethrin also have plant protection uses and it is possible that some of the failures have arisen from this use.

Organo-tin pesticides

The organo-tin pesticides comprise tributyl tin and triphenyl tin. EQS failures for both pesticides in England and Wales are shown in Figure 9. The organo-tin pesticide EQSs became statutory in 1997.

The data for 1997 show a similar geographical distribution of failures to those in 1996. Most of the failures are estuarine and marine waters and are most likely due to the use of organo-tin compounds in anti-fouling paints on boats. Historically, tributyl tin has been widely used for this purpose but, because of its effect on shellfish, restrictions limiting its use to vessels over 25m in length were imposed in 1987. The increased number of failures in 1997 compared with 1996 is difficult to interpret since we are not aware of any change in use. Extra monitoring effort in Southern Region may account for the rise in failures in that region but cannot account entirely for the national increase.

There are some tributyl tin EQS failures in freshwaters which may be due to leaching from suspended sediments as a result of its historic use on small boats and its use as a wood preservative. Another cause may be the illegal use of anti-foulant paints containing tributyl tin on small craft. Work is on-going to identify sources of EQS failures in freshwaters.

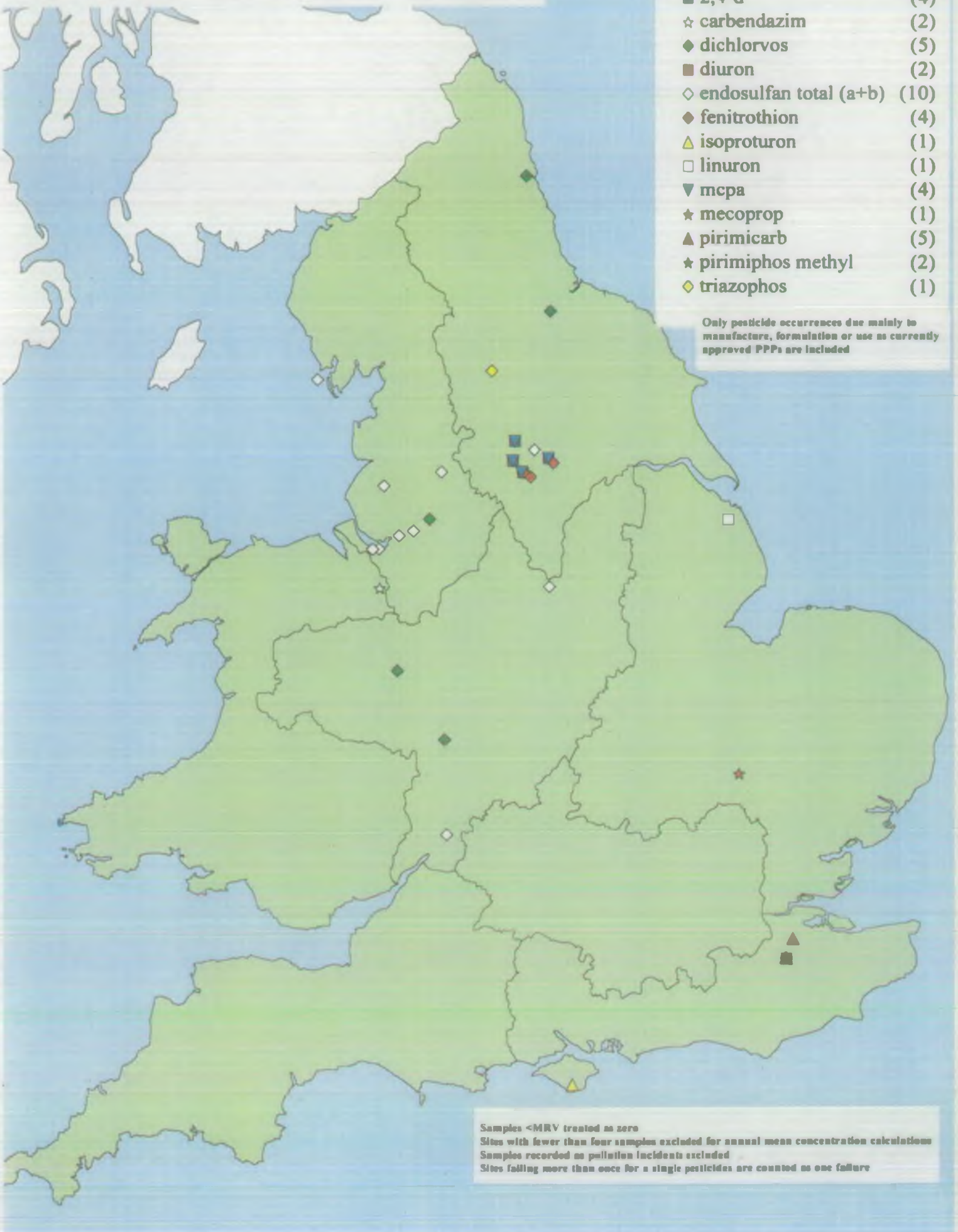
Triphenyl tin is no longer used in anti-foulants, but is still detected in marine and estuarine waters in the vicinity of dockyards. It is approved for use in some plant protection products, in the form of fentin acetate and fentin hydroxide, which are applied to potatoes to protect against potato blight. The EQS failures for triphenyl tin detected in 1997 are thought to be due to its past use in anti-foulants, and not its use in plant protection products.

Figure 8. Sites failing sheep dip pesticide EQSs in 1997

Figure 9. Sites failing organo-tin EQSs in 1997

Figure 10. Sites failing moth proofing agent EQSs 1997

Figure 11. Sites failing EQSs for plant protection products in 1997



Moth-proofing pesticides

High numbers of EQS exceedences for the moth-proofing pesticides permethrin, cyfluthrin and PCSD/eulan are detected each year, mostly in the North East and Midland regions (Figure 10). These pesticides are mainly associated with the textiles and carpet manufacturing industries.

Permethrin exceeded its EQS most frequently in 1997. In 1997, nearly 45 per cent of sites failed the EQS compared with 25 per cent in 1996. Although permethrin has other uses, including agriculture and timber treatment, it is most likely that the EQS failures are due to its use as a moth-proofing agent although the possibility of inputs from home/garden use is also being investigated.

Plant protection products (PPPs)

Figure 11 shows sites failing any pesticide EQS where the most likely source is a result of its manufacture or use as a plant protection product. The map shows that sites failing plant protection product EQSs make up a relatively small proportion of the total EQS failures for all types of pesticides. However, when compared with the drinking water standard (0.1 µg/l), plant protection products represent a much greater proportion of exceedences (section 3.2). Herbicides such as isoproturon, mecoprop, diuron and 2,4-D are generally not very toxic to aquatic life and therefore have relatively high EQS values. Only a small proportion of sites show concentrations above their EQS each year and these are likely to arise from point sources.

A significant proportion of the EQS failures for the plant protection products indicated on the map are associated with their manufacture, rather than their agricultural use. For example, many of the EQS failures in the North East and Southern regions are due to discharges from pesticide manufacturing processes. However, it is worth noting that most of the Agency's sampling programme covers larger rivers, often at the base of catchments, and is therefore less likely to pick up EQS failures resulting from the agricultural use of plant protection products.

3.2 Drinking Water Directive standards

In addition to the EQSs, the 1997 data were compared with the Drinking Water Directive standard. The Drinking Water Directive sets a maximum allowable concentration of 0.1µg/l for any pesticide in drinking water, irrespective of its toxicity. The Agency is not directly responsible for the quality of drinking water but it must take appropriate action to safeguard resources when it is notified by water companies of any breach of the pesticide limit. An exceedence of the standard in environmental waters provides a good indication of those pesticides most likely to require action or treatment in order to comply with the Drinking Water Directive. If breaches of the 0.1µg/l standard are found in drinking water then the Drinking Water Inspectorate will consider enforcement action to secure improvements in water treatment.

Only those samples taken from the monitoring of environmental waters have been included in the analysis of exceedences of 0.1µg/l, with the data from discharges, pollution incidents and, as far as possible, known grossly polluted sites being excluded. The results should for the most part reflect concentration from diffuse inputs. Many pesticides are monitored at a large number of sites across England and Wales, with several samples at each site, so we have reasonable confidence in apparent trends in contamination levels across the years.

In 1997, 100 of the 169 pesticides monitored were detected above 0.1µg/l, 41 were detected at least once but did not exceed 0.1µg/l, and the other 28 pesticides were not detected. These figures are similar to those for 1996.

Overall, the numbers of pesticides detected above 0.1µg/l have risen from 52 in 1992 to 98 in 1997. This increase is probably more a reflection of improved analytical techniques and a wider range of determinands monitored (from 120 pesticides in 1992 to 165 in 1997) rather than an increase in pesticide concentrations in water.

Exceedences of 0.1µg/l in surface freshwaters

Of the 163 pesticides analysed in surface freshwaters, 95 pesticides (58 per cent) were detected above 0.1µg/l on at least one occasion, 35 pesticides (22 per cent) were detected but did not exceed the 0.1µg/l limit, and 33 pesticides (20 per cent) were not detected above the limit of detection.

The herbicides isoproturon, mecoprop, diuron and MCPA exceeded the 0.1µg/l standard most frequently in 1997 (Table 4). The moth-proofing pesticide PCSD/eulan, as well as the sheep dips cypermethrin and diazinon, were also found to exceed the 0.1µg/l standard.

Figure 12. Pesticides most frequently exceeding 0.1 µg/l in surface freshwaters in England and Wales (1992-97)

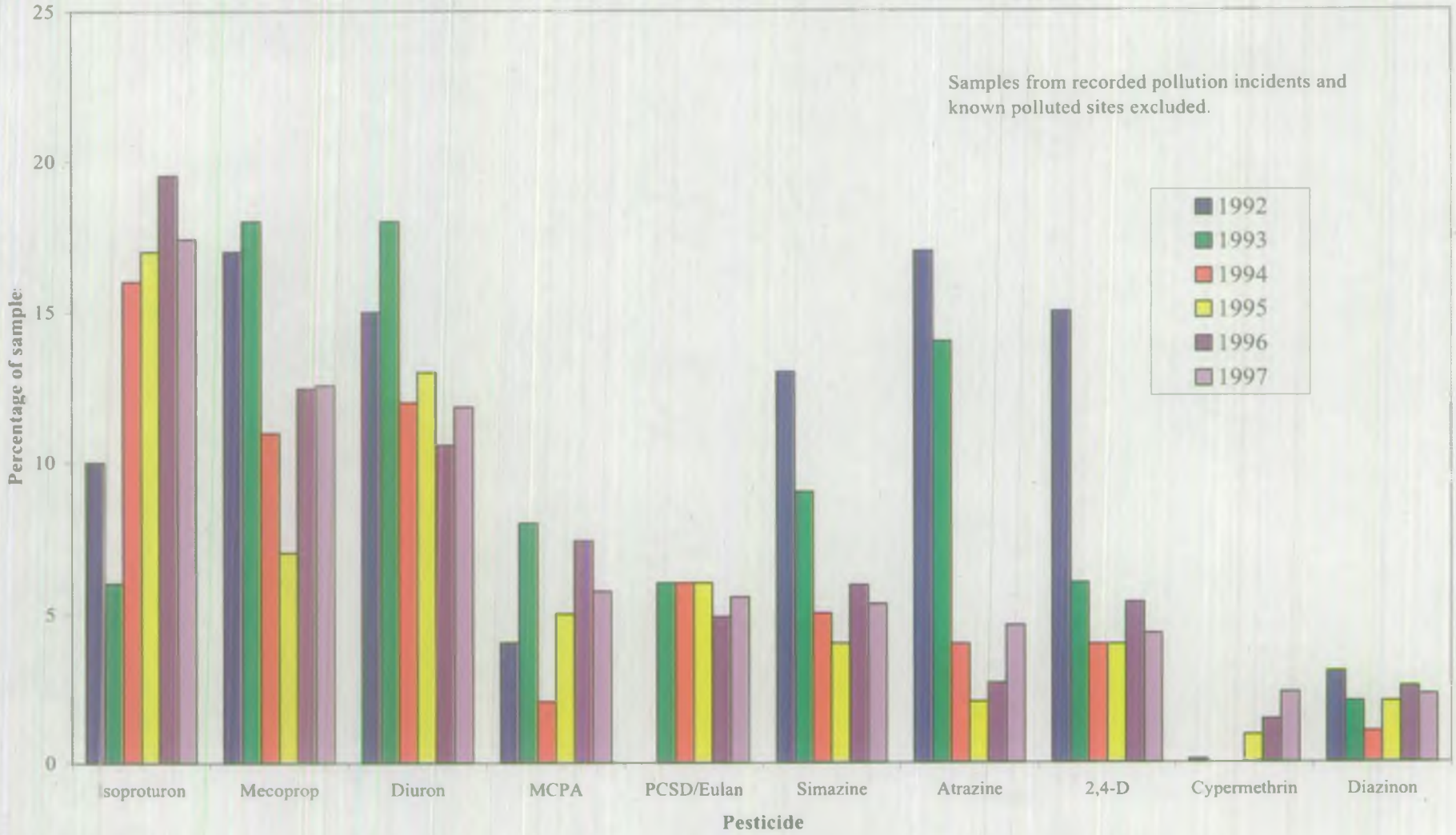


Table 4. 25 pesticides most frequently exceeding 0.1µg/l in surface freshwaters in England and Wales, 1997

Pesticide	Total number of samples	Number of samples > 0.1µg/l	% of samples > 0.1µg/l
Isoproturon	3571	622	17.4
Mecoprop	3526	443	12.6
Diuron	3759	446	11.9
MCPA	2120	121	5.7
PCSD or Eulan	904	50	5.5
Simazine	6284	333	5.3
Atrazine	6409	297	4.6
2,4-D	2586	113	4.4
Oxamyl	784	32	4.1
Cypermethrin	1007	23	2.3
Diazinon	4317	96	2.2
Permethrin	1079	22	2.0
Carbofuran	1040	21	2.0
Carbaryl	1075	20	1.9
HCH Delta	2345	38	1.6
Aldicarb	947	15	1.6
Bentazone	1638	25	1.5
Dichlorprop	1393	20	1.4
Propetamphos	3896	55	1.4
Chlorotoluron	3619	51	1.4
Pentachlorophenol	3870	44	1.1
Dichlobenil	1300	12	0.9
Cyfluthrin	978	9	0.9
Alpha HCH	6424	58	0.9
TBT	1861	11	0.6

* Pesticides with sample numbers <500 have been excluded from the analysis. Pollution incidents and known polluted sites excluded.

Figure 12 illustrates the trends in exceedences of 0.1µg/l in surface freshwaters in England and Wales (1992-97).

The cereal herbicide isoproturon (IPU) exceeded 0.1µg/l the most frequently in surface freshwaters in England and Wales in 1997. During 1997 there was a slight decline in IPU exceedence compared with 1996. Overall, however, there has been little change in the occurrence of IPU in the period 1994-97. The manufacturer-led IPU stewardship programme (which has been seeking to improve the way IPU is used) would appear to have had little affect on the high numbers of 0.1 µg/l exceedences in environmental waters, although it may have averted even higher levels of water contamination.

Mecoprop shows little change in levels of occurrence in 1997 compared with 1996. Commercial mecoprop products containing mixtures of active and in-active isomers are gradually being phased out by the manufacturers following a two-year "use-up" period which

began in December 1996. A more active form, Mecoprop-P, was introduced in 1995. Mecoprop-P can be applied at lower rates than mecoprop and should lead to reduced usage. It is difficult to distinguish between the two isomers of mecoprop in environmental water samples so changes in the proportions of each cannot be easily assessed. However, the move towards the use of Mecoprop-P has, so far, made no significant difference in mecoprop levels in waters.

Simazine and atrazine appear to be maintaining a level of around five per cent of samples above 0.1µg/l. This has been the case since 1994 following a ban on the use of these on non-cropped land in August 1993. Simazine is recommended for a number of agricultural and horticultural crops, whereas atrazine is only recommended for grass weed control in maize (and sweetcorn). The data for 1997 show an increase in atrazine from 2.5 per cent in 1996 to nearly five per cent. Of equal concern is the potential for atrazine to contaminate groundwater where maize is grown over vulnerable aquifers.

Diuron is a contact/residual herbicide used largely in non-agricultural situations. Its usage has increased since the simazine/atrazine ban. Diuron exceedences of 0.1µg/l in surface waters appear to have risen slightly in 1997 to nearly 12 per cent from 10.6 per cent in 1996. Overall there is little change in the occurrence of diuron in the period 1994-97. The companies that manufacture and distribute diuron have been involved with a product stewardship campaign since 1991. The campaign promotes best practice for the product among its users.

Exceedences of 0.1µg/l in estuaries and coastal waters

Although saline waters are not used for drinking water supplies, for consistency the data have been compared with the 0.1µg/l standard.

Of the 88 pesticides analysed in marine waters, 21 pesticides (24 per cent) were above 0.1µg/l on at least one occasion, 29 (43 per cent) were detected but did not exceed the 0.1µg/l limit, and 38 (33 per cent) were not found above the limit of detection.

Many of the same pesticides were found in saline waters as in freshwaters, with diuron, isoproturon, MCPA and mecoprop being detected most frequently above 0.1µg/l (Table 5). As well as its use as a non-agricultural herbicide, diuron is used as an anti-foulant. This may be an alternative source for its presence in marine waters.

Table 5. Pesticides exceeding 0.1µg/l in estuaries and coastal waters in England and Wales, 1997

Pesticide	Total number of samples	Number of samples > 0.1µg/l	% of samples > 0.1µg/l
Diuron	104	39	37.5
Isoproturon (IPU)	95	26	27.4
MCPA	108	27	25.0
Mecoprop	108	26	24.1
2,4-D	118	3	2.5
Simazine	590	14	2.4
Chlorpyriphos	58	1	1.7
Permethrin	63	1	1.6
Prochloraz	84	1	1.2
Atrazine	595	7	1.2
Chlorotoluron	103	1	1.0
Diazinon	129	1	0.8
Alpha HCH	1356	9	0.7
Total Organotin	158	1	0.6
Tributyltin	767	4	0.5
Pentachlorophenol	1093	5	0.5
OPDDT	984	1	0.1
PPDDT	1012	1	0.1
Dieldrin	1293	1	0.1
Gamma-HCH	1472	1	0.1

*Pollution incidents and known polluted sites excluded.

Exceedences of 0.1µg/l in groundwaters

Water companies regularly monitor drinking water from groundwater sources. Agency monitoring of these sources is limited.

A total of 84 pesticides were monitored in groundwater in 1997. Table 6 shows only 12 (14 per cent) of the 85 pesticides exceeded 0.1µg/l, 15 (18 per cent) were detected but did not exceed the 0.1µg/l limit, and 57 pesticides (67 per cent) were not detected above the limit of detection. The pesticide most frequently exceeding 0.1µg/l was atrazine, thought to be due mainly to its historical use in non-agricultural situations, although there is some evidence of contamination through its use on maize crops.

Table 6. Pesticides exceeding 0.1µg/l in groundwaters in England and Wales, 1997

Pesticide	Total number of samples	Number of samples > 0.1µg/l	% of samples > 0.1µg/l
Atrazine	664	49	7.4
Diuron	505	10	2.0
Isoproturon (IPU)	518	8	1.5
Bentazone	419	4	1.0
Mecoprop	447	4	0.9
2,4-D	425	2	0.5
MCPA	425	2	0.5
Simazine	667	3	0.4
Gamma-HCH	494	2	0.4
Chlorotoluron	518	2	0.4
Dichlorobenil	265	1	0.4
Linuron	516	1	0.2

*Pollution incidents and known polluted sites excluded. All regions except North West sampled groundwater for pesticides in 1997.

3.3 Discussion

The sheep dips cypermethrin, diazinon and propetamphos exceed their EQSs frequently. A sheep dip strategy (ref. 6) recently produced by the Agency highlights a series of recommendations for their control.

The sheep dip chemicals and textiles working group has been set up to tackle the concerns about the environmental impact of sheep dips in effluents arising from the textiles industry (wool washing and fell mongering). The working group has members from the Agency, Scottish Environment Protection Agency, Veterinary Medicines Directorate, National Office of Animal Health, water industry, the textile and wool processing industry and sheep farmers. A strategy has recently been produced by this group (ref. 5) which has five key recommendations. The group's considerations include minimisation of the use of sheep dips, effluent treatment technology, and the need for further research and development.

Around 60 per cent of marine water sites monitored exceeded the EQS concentration for tributyl tin. Organo-tin occurrences in marine waters are of concern because of the possible adverse effects of these compounds on shellfish. Organo-tin compounds were banned as anti-fouling additives in paint for use on ships under 25m in length in 1987. However, owing to TBT's high affinity for organic matter, high concentrations may be found in sediments where it may persist for many years, posing a long-term threat to the environment. In response to these on-going concerns, a working group of the International Maritime Organisation has recommended a global ban on the use of TBT anti-foulants on ships from 2003. On a national scale, the Agency is working closely with the DETR and the Health and Safety Executive (HSE) to quantify potential problems from other anti-foulants and seek solutions, and two R&D reports have been produced (refs. 7 and 8).

High numbers of EQS exceedences for the moth-proofing pesticides permethrin, cyfluthrin and PCSD/eulan are detected each year, mostly in the North East and Midland regions.These pesticides are mainly associated with the textiles and carpet manufacturing industries. There were considerably more EQS failures for permethrin in 1997 than 1996. The Agency is working closely with industries who discharge these chemicals into the environment.

In general, it is much more difficult to control diffuse source inputs than point sources. Resolving these problems relies more heavily on improving practice among users and, in some cases, changing the use or application of a pesticide.

The most frequently occurring pesticides in freshwaters are widely used agricultural herbicides such as isoproturon and mecoprop. Diuron, which is mainly used as an amenity herbicide, also occurs widely.

Both isoproturon (IPU) and diuron have stewardship campaigns. These were initiated by their manufacturers to promote best practice and to try to reduce water contamination nationally. The Agency is working with the co-ordinators of both campaigns.

The Agency co-ordinates a voluntary agreement between Railtrack and water companies within England and Wales where the application of diuron has been restricted on designated lengths of railway track to protect drinking water abstraction sites. The restricted lengths of track account for approximately five per cent of the total railway track in England and Wales. The Agency is also part-funding a collaborative study on the movement of pesticides such as diuron from their use on hard surfaces and looking at ways to minimise the contamination of

water.

The effect of the 1992 ban on the use of atrazine and simazine on non-cropped land has dramatically reduced the percentage of samples exceeding 0.1µg/l to around five per cent, for both pesticides for the period 1994 to 1997. Simazine has a greater crop range and is used more extensively than atrazine in agriculture. Atrazine remains a problem locally where maize is extensively grown and occasionally occurs in groundwaters as a result, such as in South West Region. An increase in the occurrence of atrazine in water in 1997 is being kept under close scrutiny to check that the historic problems with the use of this herbicide on hard surfaces are not repeated through its use on the increasingly widespread maize crop. Use of atrazine in the home/garden may also be a source of contamination.

The Agency's monitoring effort needs to be targeted to ensure that pesticides are covered in the most cost-effective manner. The Agency is currently reviewing its monitoring of pesticides in water (ref. 10). A significant proportion of the Agency's monitoring effort is spent on pesticides listed in various EC directives. Many of these are old, persistent pesticides that are no longer approved for use. The amount of effort spent monitoring them is disproportionate when compared to the number of detections. It is apparent that much of the resource spent on monitoring these pesticides would be better spent on currently used pesticides.

The main tool used to better target the Agency's non-statutory monitoring programme is the POPPIE (Prediction of Pesticide Pollution In the Environment) system. This system predicts the likely occurrence of pesticides from diffuse pollution from agricultural and horticultural sources. It can be used to highlight areas in England and Wales where particular pesticides have a high usage or where they are predicted to occur in water above a certain concentration. Graphs and reports can be produced for pesticide usage and predicted concentrations. The monitoring database is contained within POPPIE and can be interrogated by sampling point to show the sampled concentrations at that point for a particular year. By using information on pesticide usage, predicted concentrations in water and monitoring data, POPPIE can be used to better define suites of pesticides to be monitored in different parts of the country.

4. PESTICIDE POLLUTION INCIDENTS IN ENGLAND AND WALES - 1997

4.1 Introduction

This section summarises pollution incidents involving pesticides that were investigated by the Agency in 1997. The definition of "pollution incident" in this context is an incident reported to the Agency and investigated by pollution control officers. The Agency is often able to prevent these incidents from becoming serious and in some cases, prevent pollution of watercourses due to prompt reporting and immediate action.

Reporting incidents helps the Agency identify the main sources and causes of pesticide pollution and assist in the development of pesticide policy including, for example, the targeting of pollution prevention activities. This section provides additional detail on pesticide incident data to that included in the main annual pollution incident report (ref. 9).

The incidents have been categorised according to the criteria of severity, source and cause.

Severity
Ranges from category 1, which is a major incident, to category 3, which is a minor incident. Unsubstantiated incidents are reported incidents not substantiated on investigation (see Appendix VII for definitions).

Source
Classified into the following source categories: agricultural, industrial, transport and other. Agriculture is further subdivided into sheep, arable and horticulture.

Cause
Defined as accidental, malpractice, deliberate, vandalism, fire, dumping and unknown (see Appendix VII for definitions).

Please note that fire and dumping categorised as "source" in previous pesticide pollution incident reports (ref. 9) have been removed to fall in line with the national incident reporting scheme, making cross-comparison possible. Fire and dumping have been placed in the "cause" category. Type has been removed from this year's incident report as it is thought to provide limited additional information.

4.2 Incidents reported to the Agency in 1997

In 1997 there were a total of 72 substantiated pollution incidents involving pesticides. Details of the pesticide, environmental effects, incident category and any legal proceedings are given in Appendix VIII

The severity of incidents
Pollution incidents have been grouped into varying degrees of severity as defined by categories 1-3 (see Appendix VII for definitions). In 1997 there were 14 category 1 incidents, 24 category 2 incidents and 34 category 3 incidents.

Of the 14 category 1 incidents, half were caused by malpractice with sheep dips and all had an impact on the biology of the watercourse. The other seven category 1 incidents were from

a variety of sources including industry, arable agriculture, horticulture and other sources (see Appendix VIII).

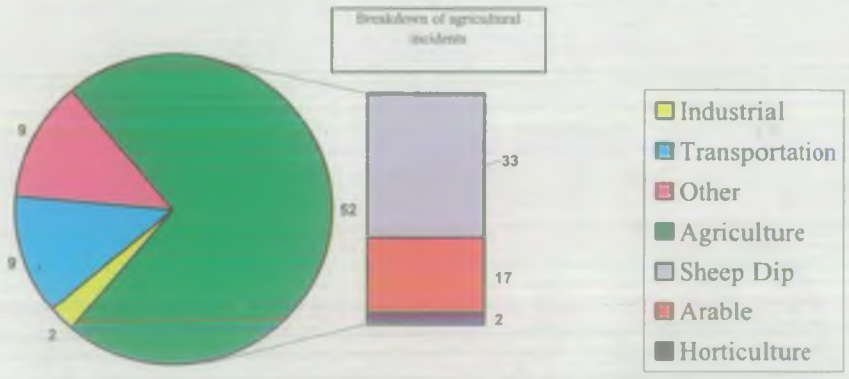
The source of incidents

The sources of pollution incidents are illustrated in Figure 13. Source is defined by broad categories, that is, agricultural, industrial, transportation and other. The latter category includes non-agricultural and amenity use of pesticides.

Agricultural usage accounted for nearly three-quarters (71 per cent) of the total number of incidents in 1997. Agricultural use is defined in the report as pesticides used for sheep dips, arable crops, vegetables, fruit, flowers, forestry and grassland. Transportation and other uses accounted equally for the next highest source category (13 per cent each). Industrial use caused the least number of incidents (three per cent).

Figure 13 shows that sheep dips made the largest contribution to total pollution incidents in 1997. Sheep dips accounted for 33 of the 72 pollution incidents (46 per cent). Figure 14 shows how sheep dips relate to the total numbers of incidents for the years 1992-7. It is clear that sheep dips show a marked increase out of all incidents in 1997.

Figure 13. Numbers of pollution incidents in 1997 categorised by source



The cause of incidents

Causes of pollution incidents were assessed and defined as accidental, malpractice, deliberate, vandalism or unknown. Dumping and fire were also added as causes to the pollution data for 1997 (Figure 15).

Malpractice was the most common cause, accounting for well over half of all pesticide incidents (63 per cent). Accidental spillage was the next highest cause, representing nearly a quarter of incidents (24 per cent). Appendix VIII gives further details on the main reasons for each pollution incident. Some of the most common causes were sheep dip disposal, spillages from agricultural machinery and leaks from stores and containers.

Figure 14. The number of sheep dip pollution incidents in relation to all incidents (1992-97)

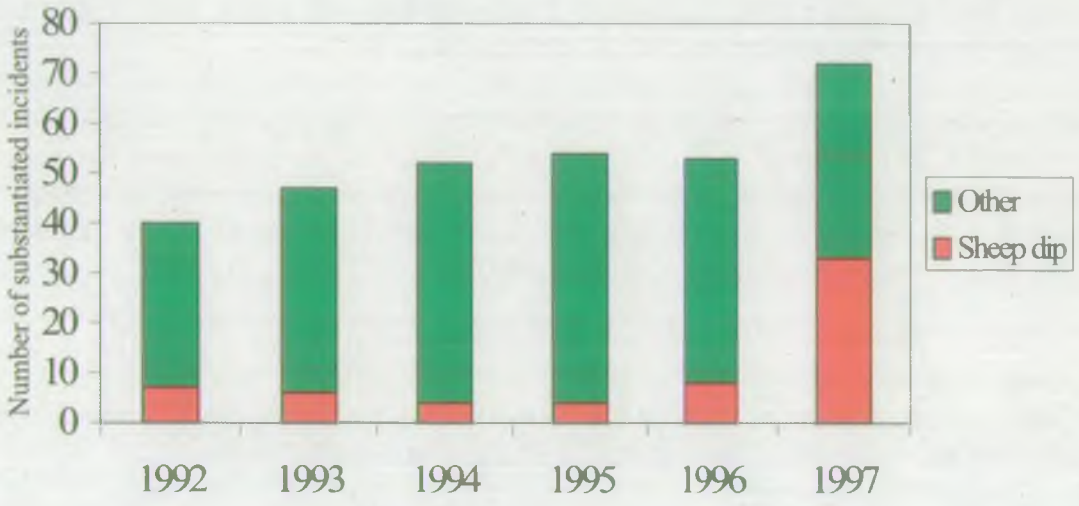
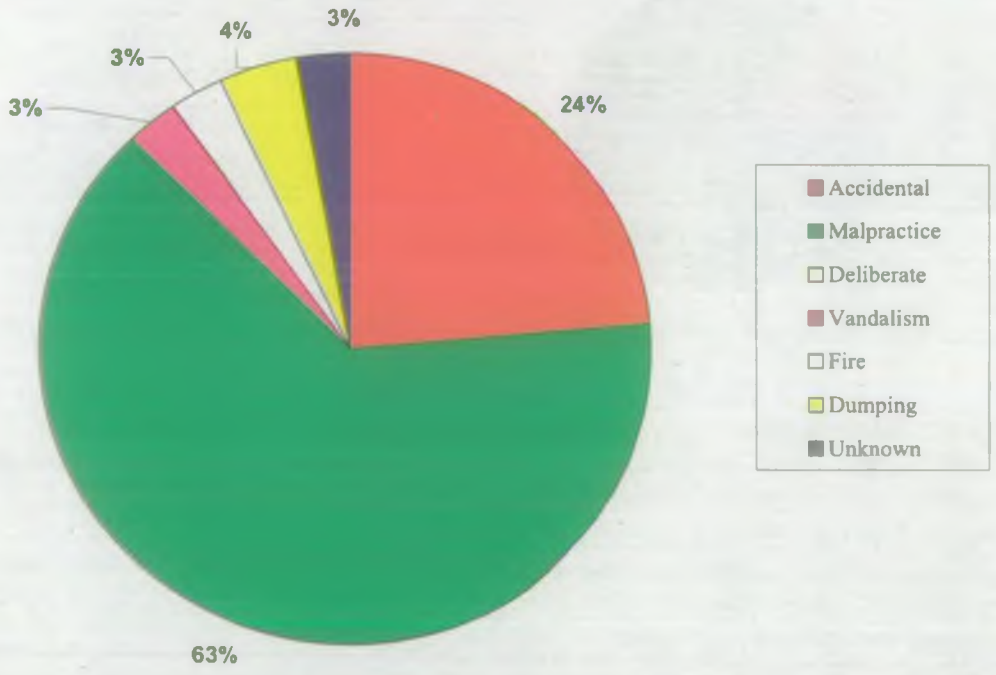


Figure 15. The percentage of pollution incidents in each cause category –1997



Legal action

Of the 14 category 1 incidents, four resulted in prosecution. Of these, three were as a result of sheep dipping malpractice and the other was due to the accidental release of trade effluent, which contained unknown pesticide from a spillage. Six of the category 2 incidents reported resulted in prosecution. All of these were again due to sheep dipping malpractice. There were

no category 3 incidents leading to prosecution in 1997.

4.3 Discussion

The greatest single cause of incidents in 1997 was as a result of sheep dip use, particularly synthetic pyrethroids. Synthetic pyrethroids were first marketed as sheep dips in 1986 and since then the use of organophosphates has been in decline, most recently because of concerns about the possible risk to human health from exposure to them. Synthetic pyrethroids have a lower mammalian toxicity but a significantly higher toxicity to aquatic life, and their use has been to the detriment of the aquatic environment.

Agricultural use remains the main source of pollution incidents and should therefore still be a focus for pollution prevention measures and promotion of best practice. The 1997 data clearly indicate that malpractice is the most common cause of pesticide incidents. The continued promotion of best practice is thus essential in order to address this problem.

The Agency has produced pollution prevention guidelines on both pesticides and sheep dips, along with other pollution prevention leaflets. We are determined to ensure that pollution prevention measures work and are effectively implemented.

5. GLOSSARY

ACP – Advisory Committee on Pesticides
Active ingredient – the active component of a pesticide
ADAS – private agricultural consultancy (formerly part of MAFF)
Annex 1A – the list of 36 priority dangerous substances, agreed at the North Sea Conference for load reductions
Annex 1B – further groups of dangerous substances, agreed at the North Sea Conference for load reductions
Bioaccumulation – the build-up of substances within the tissues of organisms
Biocide – a substance which is intended to destroy, deter, render harmless, prevent the action of or otherwise exert a controlling effect on a harmful organism
Contact herbicide – a herbicide which kills weeds when it comes into contact with the foliage, rather than acting through the soil
Controlled waters – waters subject to the Water Resources Act 1991, including all rivers, lakes, groundwater, estuaries and coastal waters
COPR – Control of Pesticide Regulations
DETR – Department of the Environment, Transport and the Regions
Diffuse source – a non-specific release of a substance to the aquatic environment
Environmental Quality Standard (EQS) – the concentration of a substance which must not be exceeded within the aquatic environment in order to protect it for its recognised uses
FEPA – Food and Environment Protection Act
Fungicide – a pesticide used for controlling fungal diseases
Growth regulator – a pesticide used to control the growth rate of plants
Herbicide – a pesticide used for controlling weeds
HSE – Health and Safety Executive
Insecticide – a pesticide used for controlling insects
IPC – Integrated Pollution Control
Pesticide – any substance, preparation or organism prepared or used for destroying any pest
Plant protection product – an active ingredient or mixture of active ingredients used in plant protection, including herbicides, growth regulators, product preservatives, some insecticides and fungicides (check the Plant Protection Products Regulations 1995 (as amended) and the Plant Protection Products (Basic Conditions) Regulations 1997 for actual definition)
MAFF – Ministry of Agriculture, Fisheries and Food
MRV – Minimum Reporting Value
Point source – a specific identifiable release of a substance to the aquatic environment
POPPIE – a system for the Prediction of Pesticide Pollution in the Environment
PSD – Pesticides Safety Directorate
Red List – the UK's initial priority list which preceded Annex 1A
Residual herbicide – a herbicide which acts through the soil and is therefore persistent in the soil
Toxicity – the relative poisoning effect of a chemical
VMD – Veterinary Medicines Directorate

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7. APPENDICES

APPENDIX I - Monitoring data for 1997 – the regional picture

Figures 16 and 17 show the numbers of analyses carried out and the number of sites monitored for each region in 1997.

Anglian

Regular EQS failures are associated with the historic use of pesticides. Dieldrin is regularly detected at a number of sites that are historically associated with the timber treatment industry and from contaminated land around an old pesticide factory from which dieldrin seeps to the surface water. In addition to historical problems, EQS exceedences also occur for total-HCH which may be a result of run-off from agricultural land or from timber treatment plants. The EQS failures for tributyl and triphenyl-tin all occurred in marine waters and are most likely associated with their use in anti-foulant paints.

Isoproturon, mecoprop and bentazone exceeded 0.1µg/l most frequently in surface freshwaters (Figure 18) in 1997. These are major agricultural pesticides and reflect the intensive arable farming in the region.

Six pesticides exceeded the 0.1µg/l in marine waters, including the organo-tins.

Groundwater is monitored for special investigations work. In the Lincolnshire limestone aquifer to the North of Peterborough, high and variable concentrations of mecoprop have been detected. In the area around Helpston, concentrations ranged from less than 1µg/l to over 1000µg/l mecoprop. The source of the contamination was a series of old landfill sites that have been subject to investigation. This work is on-going and an Interim Management Plan has been devised and implemented.

Midlands

EQS failures occurred mainly for diazinon, cyfluthrin, cypermethrin, permethrin, propetamphos and endosulfan (Figure 19). The majority of EQS failures for diazinon, cypermethrin and propetamphos are most likely due to sheep dipping activities. Some exceedences for these compounds may be associated with discharges from textile and carpet manufacturers in the region. The EQS failures for the moth-proofing pesticides cyfluthrin and permethrin also arise from their use in textiles and carpet manufacture. Endosulfan is approved for use as an insecticide on agricultural and horticultural crops and it is thought that the EQS failures have resulted from its application in these areas.

Isoproturon, mecoprop, diuron, simazine and atrazine most frequently exceeded the 0.1µg/l in surface freshwaters. Isoproturon exceeded the standard most often in 1997, with nearly one-third of samples failing (32 per cent). The percentage of mecoprop samples exceeding 0.1µg/l is similar to that of the previous year with more than a quarter of all samples exceeding the standard. The herbicides isoproturon, diuron and atrazine have been detected above 0.1µg/l more frequently than in previous years. This is despite stewardship campaigns to improve the use of isoproturon and diuron.

Owing to the small amount of marine waters in the region, no marine sampling for pesticides was carried out in 1997.

There were no exceedences of the 0.1µg/l standard for pesticides in groundwaters.

North East

There were a large number of EQS failures for the sheep dip chemicals diazinon, cypermethrin and propetamphos. These are primarily due to point source discharges from industries associated with various stages of wool processing. The textile industries continue to liaise with the DETR, the VMD and the Agency to try to deal with this on-going problem. Sheep dipping activities in Northumberland are also thought to account for some of the EQS failures for these compounds. Also associated with the textile industry are the EQS failures for the moth-proofing pesticides cyfluthrin, permethrin and PCSD/eulan.

Several sites failed EQSs for tributyl tin in freshwater and marine sites in 1997. These are most likely due to TBT manufacture or its use as an anti-fouling agent.

The main exceedences of 0.1µg/l in the region are for the herbicides diuron and isoproturon (Figure 20). These may result from pesticide manufacturers' consented discharges and some use in lowland river catchments. As well as isoproturon, the herbicides mecoprop, MCPA and 2,4-D show a fall in the percentage of freshwater samples failing 0.1µg/l for 1997 compared to 1996.

The other exceedences of 0.1µg/l reflect the industrial nature of the region. These include propetamphos, pentachlorophenol, diazinon, PCSD/eulan and permethrin.

North West

EQS failures in North West Region include diazinon, propetamphos, permethrin, endosulfan and tributyl tin. EQS exceedences for diazinon and propetamphos in the north of the region are probably associated with sheep dipping. The cluster of failures in the south of the region are most likely related to discharges of textile washing waste. The EQS failures for permethrin may result from discharges from the textiles finishing factories and sewage treatment works in the area. There are six EQS failures for endosulfan, of which four are from the Manchester Ship Canal. The source of these is believed to be from trade effluents discharging from sewage treatment works in the catchment. Five freshwater tributyl tin failures were recorded and investigation work continues to try to trace the source.

The majority of marine EQS failures for tributyl tin occur around the Mersey as a result of its use on large ships. Also, contaminated sediments in the Mersey estuary have hot-spots of tributyl tin and occasional surges in concentrations may occur due to re-suspension of sediments in the water. Other failures may be as a result of its use in shipyards authorised for TBT use and some may result from manufacturing discharges in the area.

Atrazine most frequently exceeded 0.1µg/l in surface freshwaters (Figure 21) and this shows a rising trend in exceedences from 1993. Diazinon, simazine, pentachlorophenol and propetamphos also exceeded the threshold on several occasions.

Pesticides are not monitored in groundwaters in the region. The water companies notify the Agency of any exceedences of 0.1µg/l. None was reported in 1997.

Figure 16. Regional pesticide sampling – 1997 – number of sites monitored

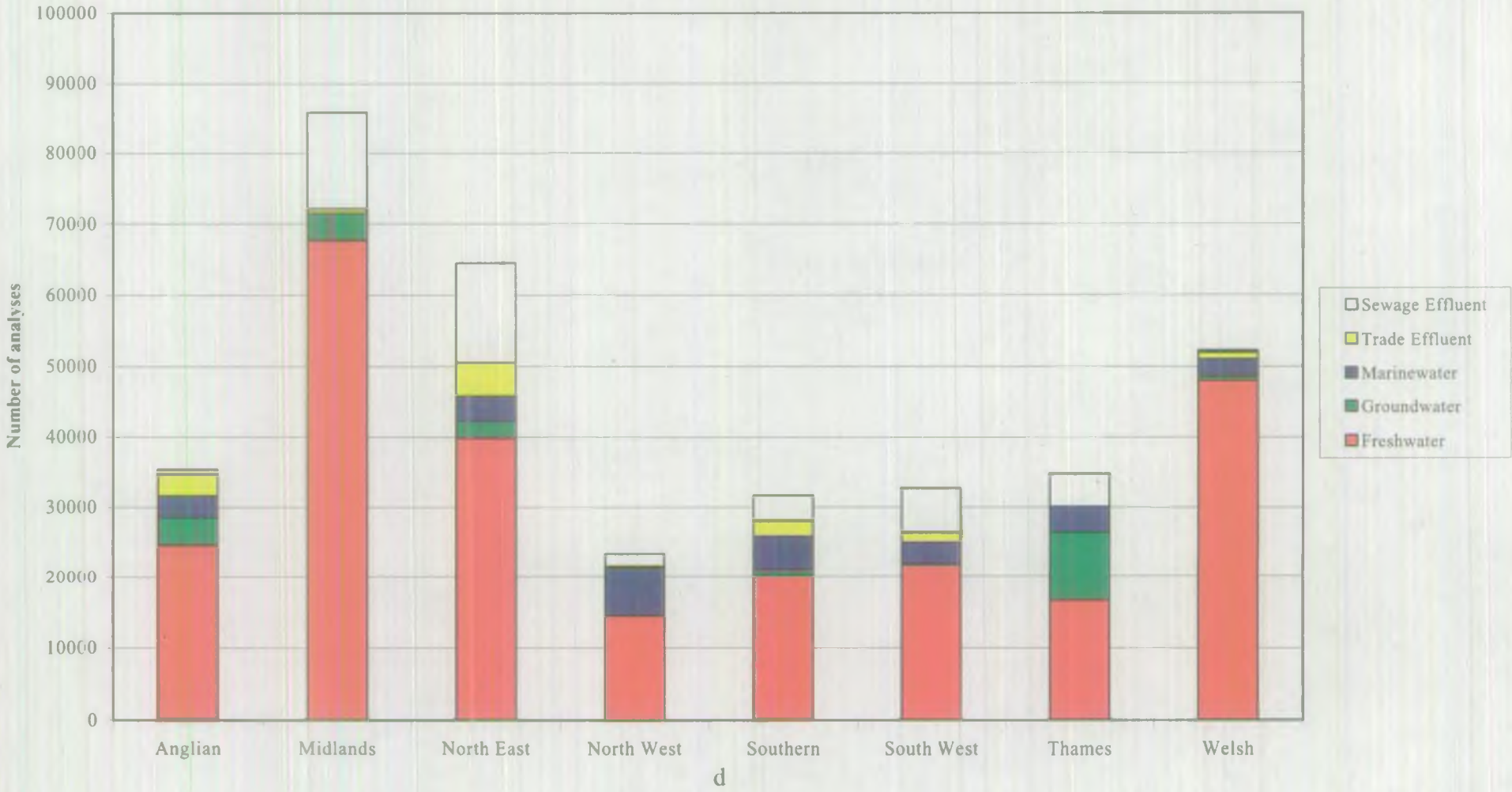
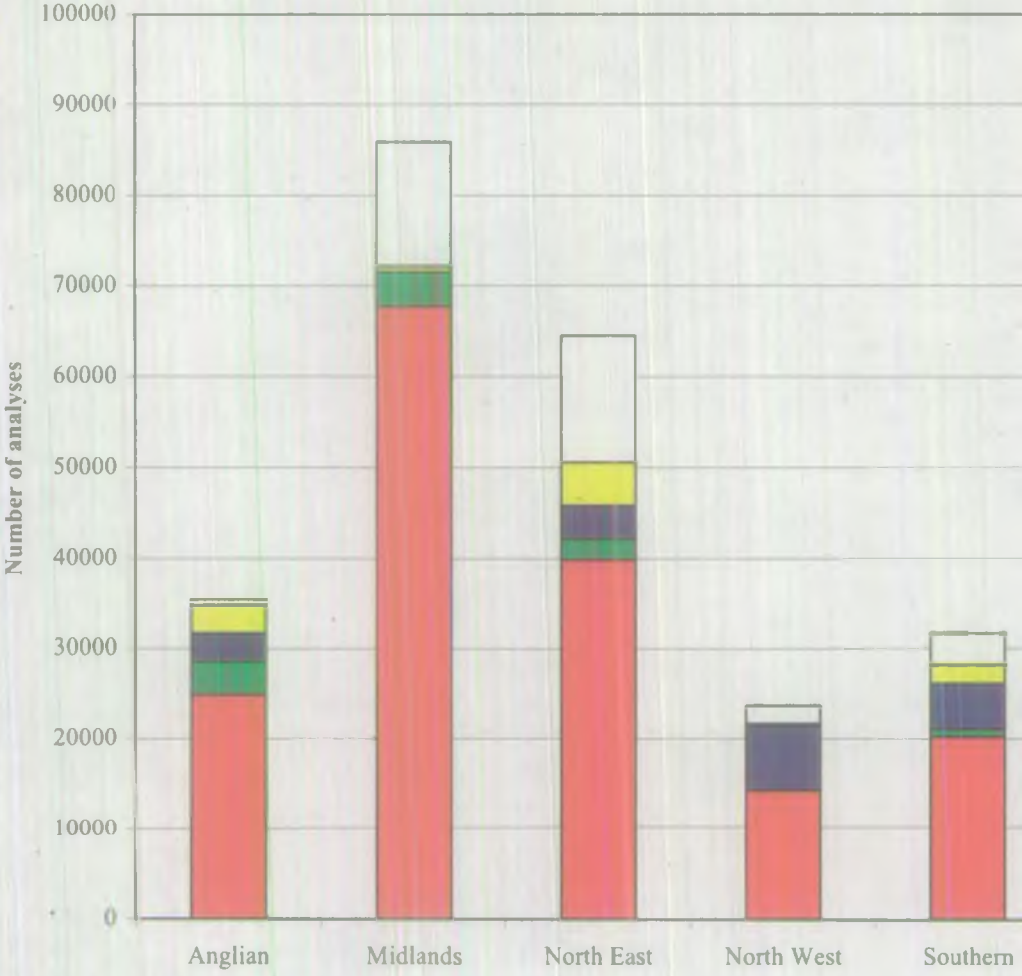


Figure 17. Regional pesticide sampling – 1997 – number of analyses



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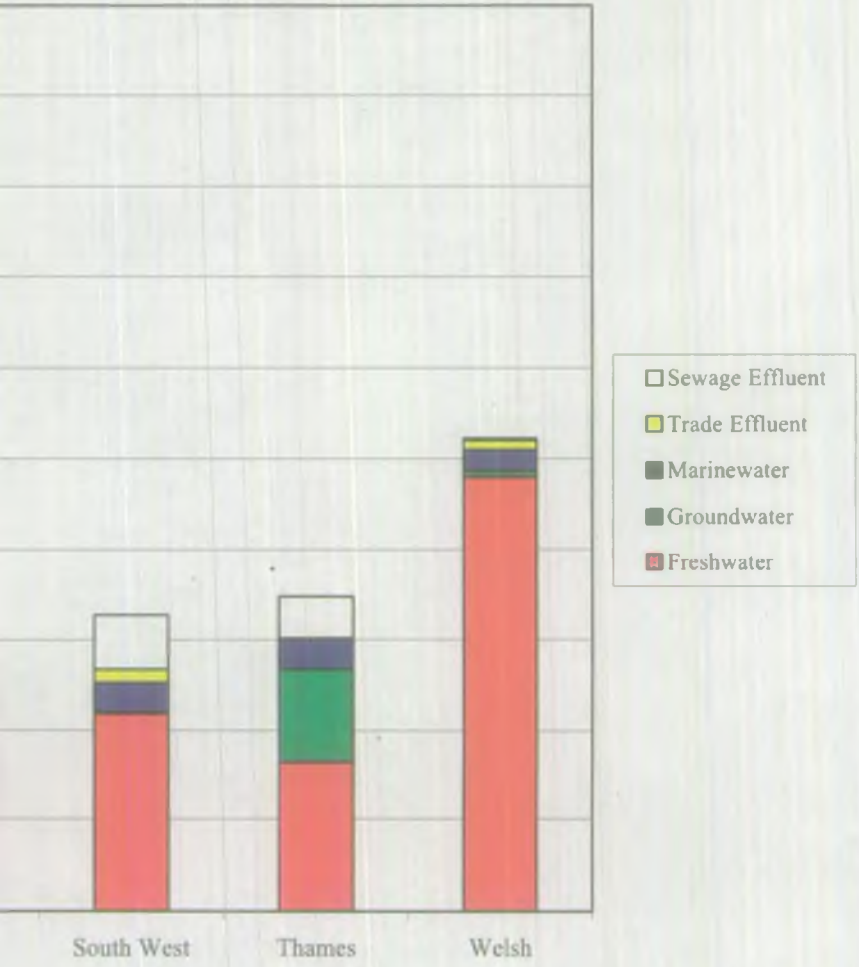

Sewage Effluent
Trade Effluent
Marinewater
Groundwater
Freshwater
South West
Thames
Welsh

Southern

The River Medway catchment experienced the greatest number of EQS failures in 1997. A number of pesticides failing EQSs are believed to be associated with historical contamination from a large pesticide manufacturer located in the catchment. The apparently large number of EQS failures on the Medway is a result of more frequent monitoring as part of a special survey owing to the history of contamination around the manufacturing site. There were a large number of EQS failures for tributyl tin in the region in 1997, most likely due to contamination from marine vessels. Isoproturon also failed an EQS as a result of its use on winter cereals.

The pesticide that most often exceeded 0.1µg/l was the agricultural herbicide simazine (Figure 22). Diuron also exceeded 0.1µg/l quite often, although it may be in decline from previous years.

Only atrazine exceeded the 0.1µg/l drinking water limit in groundwater, and on one occasion only.

South West

The majority of EQS failures involved organo-tins in both marine and freshwaters (27 failures). Many of these were one-off failures where only one sample in a whole series may have failed from sites not historically associated with organo-tin contamination.

There are some sites which have a long association with organo-tin EQS failures. The River Yealm estuary is one such area from which samples are taken near to the International Paints plant. Since 1997, however, this site has been considered as effluent, rather than a marine water site, as the point at which the sample is taken is not fully mixed and is estimated to be 90 per cent effluent. The other sampling sites downstream of the International Paints surface boil in the estuary are also regular failures as a result of this. The Fal estuary similarly fails EQSs for organo-tins owing to the Falmouth dockyard discharge from shipping and ship painting activities. The problems with Falmouth and International Paints have been well documented and there are ongoing investigations at both sites. Discussions have taken place with the dischargers to agree a way forward.

There were 10 EQS failures in freshwaters, associated with agricultural activity and industrial discharges.

Only a small percentage of freshwater samples exceed 0.1µg/l in the region each year (Figure 23). The main exceedences for 1997 were for atrazine, mecoprop and isoproturon resulting from their agricultural use.

Three pesticides were found to exceed 0.1µg/l in groundwater in 1997, compared to none in 1996. Atrazine and atrazine desethyl exceeded the threshold once each and gamma-HCH in two samples.

Thames

The number of EQS failures rose in 1997 compared with previous years. Failures in

freshwaters occurred mainly for permethrin and azinphos-methyl, and the specific cause of these is under investigation. There were a large number of EQS failures for tributyl tin, all concentrated in the lower reaches of the Thames and its tributaries. These TBT failures are most likely due to shipping activity in the estuary.

Pesticides regularly exceeding 0.1µg/l in surface freshwaters included atrazine, simazine, mecoprop and the "uron" herbicides: diuron, chlorotoluron and isoproturon (Figure 24).

Thames Region abstracts more groundwater for drinking water supplies than any other region. For this reason it has established a groundwater quality monitoring network for most of its major aquifers, which indicates atrazine was most frequently found above 0.1µg/l. Diuron, isoproturon, mecoprop, bentazone and simazine were also detected above 0.1µg/l.

Environment Agency – Wales

A targeted monitoring program for sheep dips was carried out in 1997. Sites were selected using local knowledge of intensity of sheep farming and fortnightly samples were taken for analysis of the following sheep dip compounds: diazinon, propetamphos, chlorfenvinphos, cypermethrin and flumethrin. This accounts for the high number of EQS failures for 1997. Only two sites failed an EQS outside this special survey. Both of these sites failed an EQS for diazinon, each being within sheep dipping areas.

The majority of TBT failures were in marine waters in major shipping channels and close to commercial docks in the Bristol Channel/Severn estuary, Milford Haven and the Dee estuary. Two TBT EQS failures were recorded in freshwaters. Neither site is historically associated with organo-tin failures and the reasons for the failures remain unknown.

There were a greater number of samples exceeding 0.1µg/l in 1997 compared to 1996 (Figure 25). Mecoprop, isoproturon, atrazine and diazinon all exceeded the limit more frequently. There appears to be little decline in the percentage of exceedences for any pesticide in 1997, although the rate of exceedence is low relative to national figures.

Groundwater source monitoring is restricted mostly to those discharging as springs, and is reported in the surface water part of the monitoring programme. Only one pesticide, bentazone, was detected above the 0.1µg/l limit in one sample for groundwater.

Key to regional charts (Figures 18 to 25):

The following figures (18 to 25) show the percent of samples above 0.1 µg/l for the top 10 pesticides in each region (eight in the case of North West region). The data are ranked on the year 1997. Pollution incidents and known polluted sites are excluded from the analysis. Pesticides with fewer than 200 samples (130 in the case of North East Region) are also not included. It should be noted that the y-axis scale differs from figure to figure. The key to the colours is as follows:

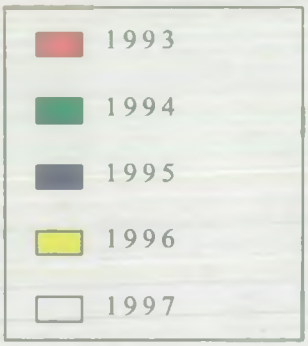


Figure 18. Percentage of samples greater than 0.1 µg/l in Anglian Region (1993-97)

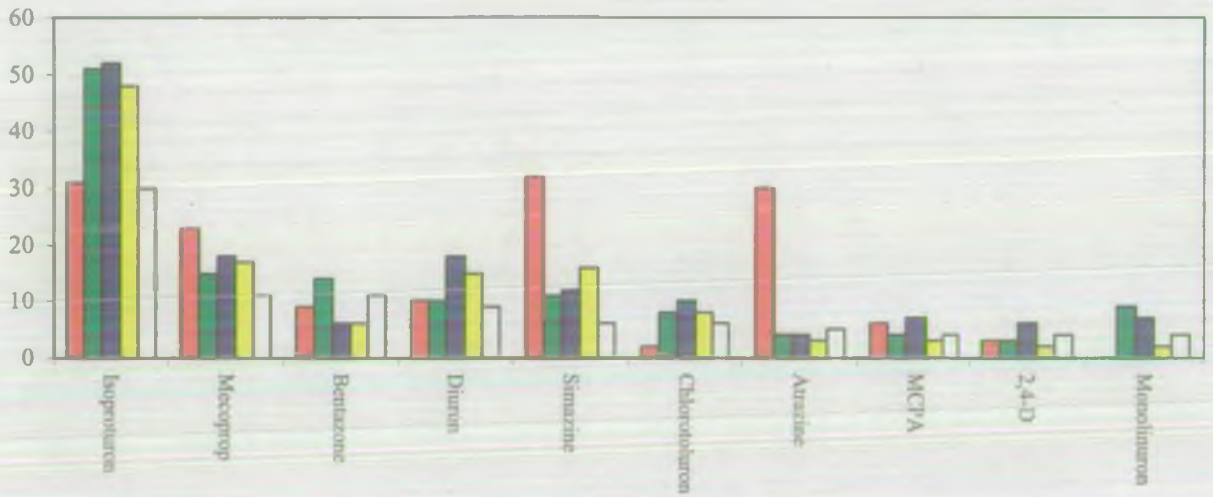


Figure 19. Percentage of samples greater than 0.1 µg/l in Midlands Region (1993-97)

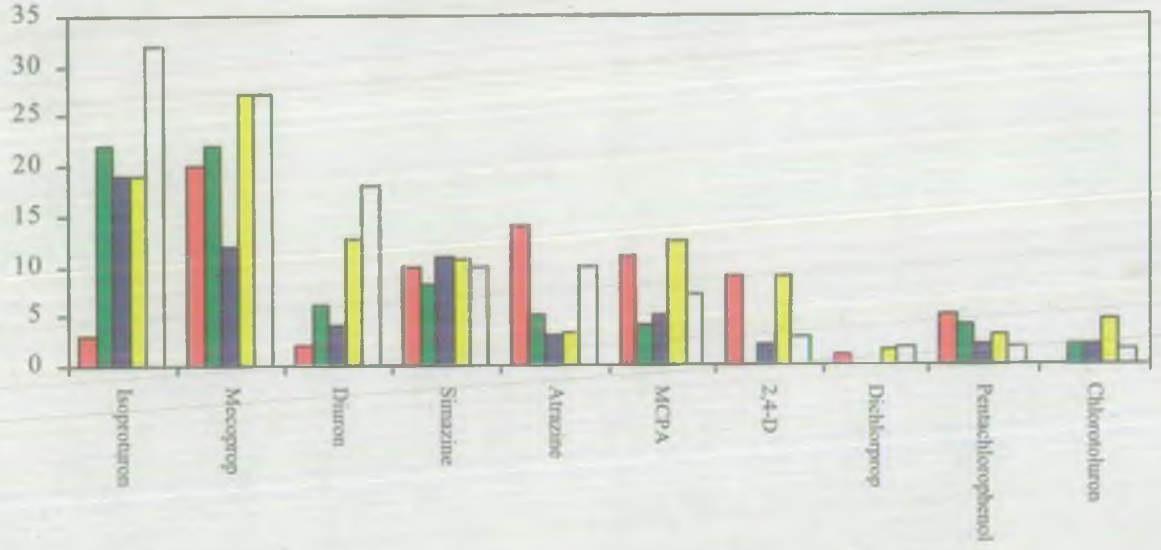


Figure 20. Percentage of samples greater than 0.1 µg/l in North East Region (1993-97)

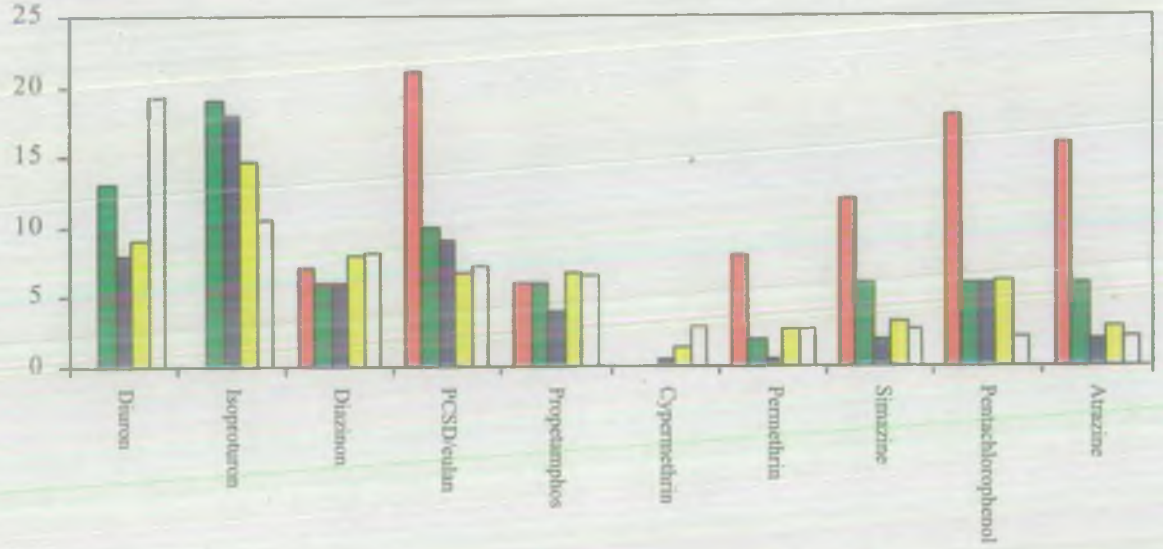


Figure 21. Percentage of samples greater than 0.1 µg/l in North West Region (1993-97)

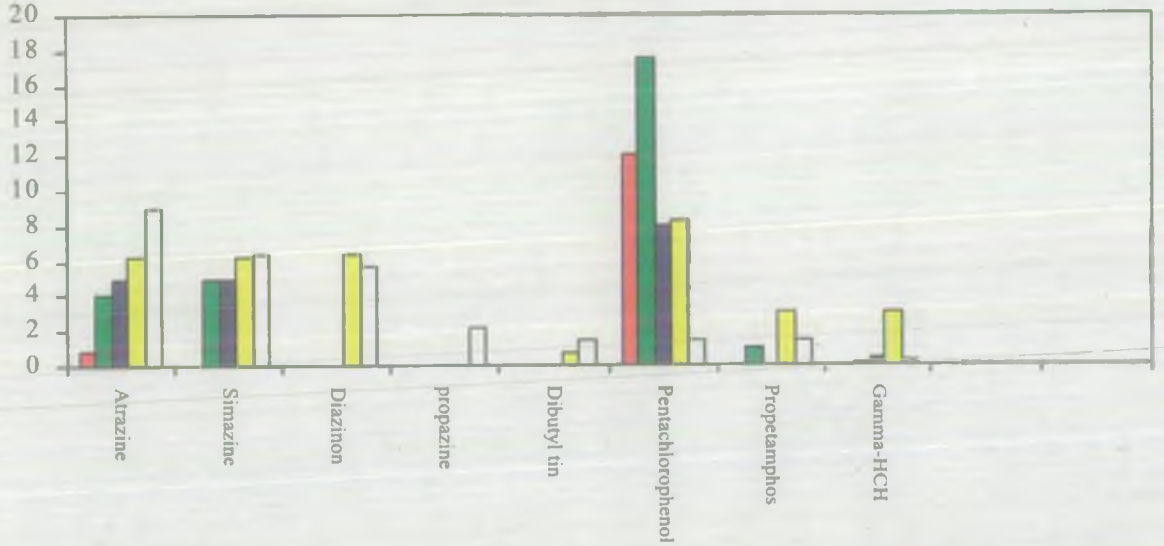
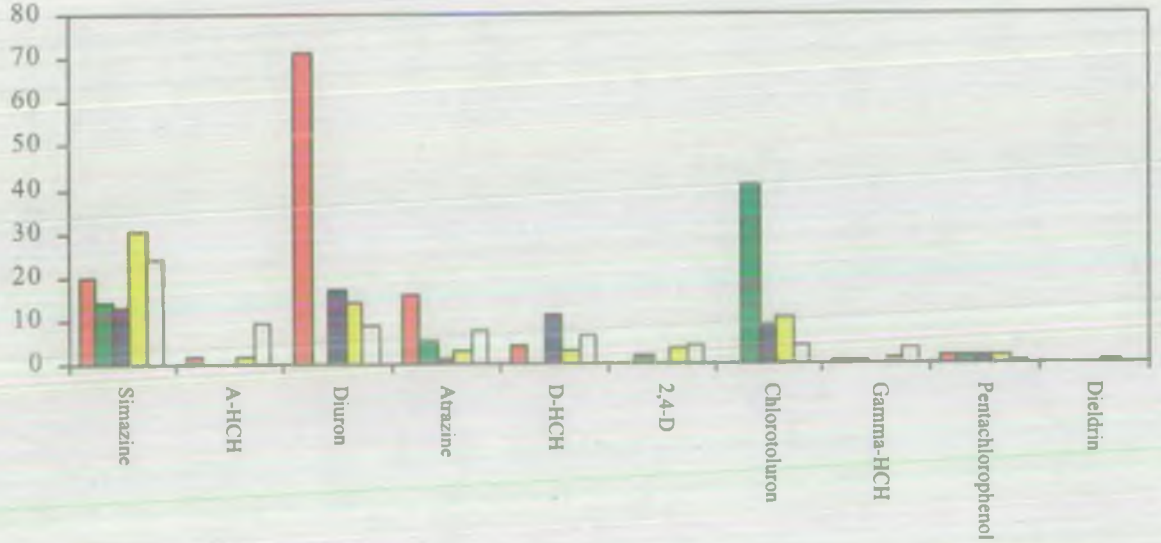


Figure 22. Percentage of samples greater than 0.1 µg/l in Southern Region (1993-97)


80
70
60
50
40
30
20
10
0
Simazine
A-HCH
Diuron
Atrazine
D-HCH
2,4-D
Chlorotoluron
Gamma-HCH
Pentachlorophenol
Dieldrin

j

Figure 23. Percentage of samples greater than 0.1 µg/l in South West Region (1993-97)

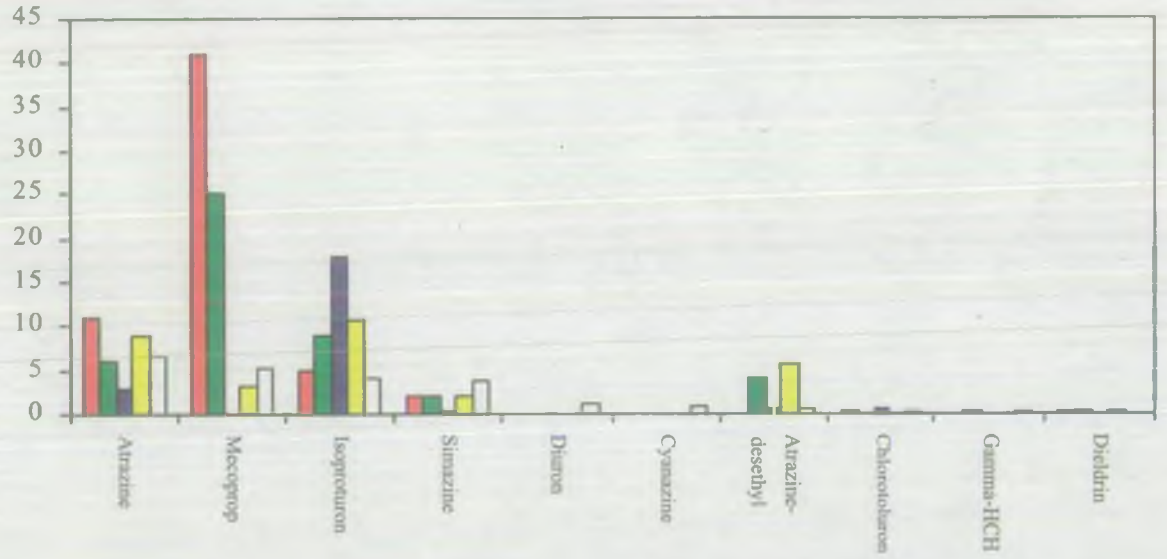
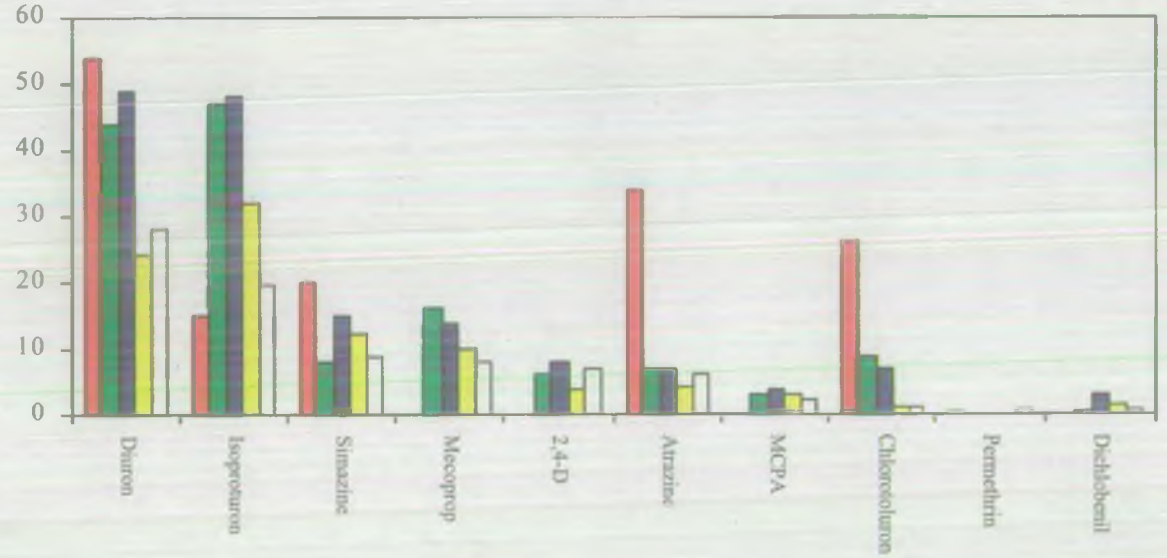
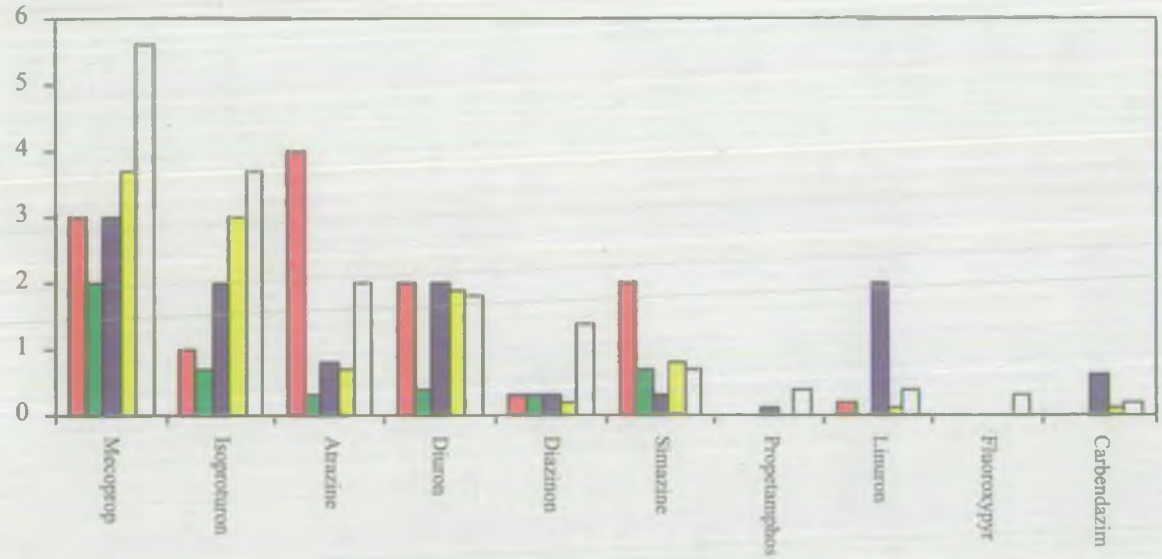


Figure 24. Percentage of samples greater than 0.1 µg/l in Thames Region (1993-97)



k

Figure 25. Percentage of samples greater than 0.1 µg/l in the Environment Agency–Wales (1993-97)



APPENDIX II – Pesticides and breakdown products monitored by the Environment Agency

aldicarb
aldrin
aldicarb sulphoxide
aldicarb sulphone (aldoxycarb)
allethrin
asulam
atrazine
atrazine desethyl
atrazine desisopropyl
azinphos-ethyl
azinphos-methyl
alpha HCH
benazolin
bendiocarb
bentazone
benzothiazole
bromacil
bromoxynil
bupirimate
buprofezin
beta HCH
2,3,5,6-tetrachloroaniline
2,3,5,6-tetrachlorothioanisole
captan
carbaryl
carbendazim
carbetamide
carbophenothion
carbofuran
chlordane
chlorofen
chlorpyriphos
chlorpyriphos-methyl
chlorothalonil
chlorotoluron
sodium trichlorophenoxide
tetrachloroanisole
chlorbufam
chlordane cis
chlordane trans
chlorfenvinphos
chloridazon
chlorithion
chlormequat
chlorpropham
clopyralid
chloroxuron
coumaphos
4-chlorophenoxyacetic acid
cruformate
cyanazine
cyfluthrin
cyhexatin
cyhalothrin
cypermethrin
cyromazine
cytamethrin
dalapon
2,4-DB
dichlobutrazole
DDE (OP)
PpDDE
opDDT
Demeton-o
demeton-s-methyl
desmetryn
diazinon
dicamba
dichlobenil
dichlofluanid
dichlorprop
dichlorvos
dichlofop-methyl
dichlorophen
dicofol
dieldrin
difenzoquat
diflufenican
diflubenzuron
dimethoate
dinocap
dinoseb
diquat
disulfoton
diuron
dnoc
dithiocarbamate
2,4-D
HCH delta
deltamethrin
endosulfan –a
endosulfan –b
endosulfan total (a+b)
endrin
EPTC
ethiofencarb
ethion
ethirimol
ethofumesate
e-HCH
fenchlorphos
fenitrothion
fenoprop
fenpropidin
fenpropimorph
fenthion
fenuron
fenvalerate
flucofenuron
flamprop-isopropyl
flucofuran
flumethrin
fluoroxypyr
flutriafol
fluazinam
fluazifop-butyl
fomesafen
fonofos
gamma –HCH, lindane
glyphosate
heptachlor
heptachlor-epoxide cis
heptachlor-epoxide
heptachlor-epoxide trans
hexaconazole
hexachlorobenzene
imazapyr
imazamethabenz-methyl
ioxynil
iprodione
isodrin
isoproturon (ipu)
lambdacyhalothrin
lenocil
linuron
malathion
mancozeb
maneb
MCPA
MCPB
mecarbam

mecoprop
mephosfolan
metalaxyl
metamitron
metham-sodium
metazachlor
methabenzthiazuron
methiocarb
methomyl
methoxychlor
metoxuron
metribuzin
metsulfuron methyl
mevinphos
monolinuron
monuron
napropamide
neburon
tot org tin as Sn
dibutyl tin
monobutyl tin
tetrabutyl tin
tributyl tin as tbt
triphenyl tin as tpt
oxamyl
paclobutrazole
paraquat
parathion
parathion-methyl
pcnb (quintozene)
pcsd or eulan
pendimethalin
permethrin
permethrin cis
permethrin trans
pentachlorophenol
phenmedipham
phorate
phosalone
picloram
piperonyl butoxide
pirimicarb
pirimphos ethyl
pirimiphos methyl
ppddt
prochloraz
prometryne
propachlor
propazine
propetamphos
propham
propiconazole
propoxur
propyzamide
pyrethrin
resmethrin
simazine
sulcofuran
sulcotrione
2,3,6-trichlorobenzoic acid
TCA
optde
pptde
tebuthiuron
tecnazene
tedion
terbuthylazine
terbutryne
thiabendazole
thiram
total CS_2
triallate
triazophos
trichlorfon
triclopyr
tridemorph
triadimefon
triadimenol
trietazine
tralkoxydim
2,4,5-T
trifluralin
tetramethrin
vinclozolin
dibutyl tin as cation
monobutyl tin as cation
tributyl tin as Sn
triphenyl tin as Sn
tetra butyl tin as cation
tributyl tin wet weight as cation

APPENDIX III – Pesticide EQS values (at August 1999)

DETERMINAND	ENVIRONMENTAL QUALITY STANDARD		ORGANISATION (year value finalised)	STATUS
	FRESHWATER	MARINE		
Abamectin	0.01µg/l (AA) 0.03µg/l (MAC)	0.003µg/l (AA) 0.01µg/l (MAC)	DETR (1998)	Proposed
Aldrin	0.01µg/l (AA)	0.01µg/l (AA)	EC	Statutory
Atrazine (a)	2µg/l (AA) 10µg/l (MAC)	2µg/l (AA) 10µg/l (MAC)	DoE (1991)	Statutory
Azinphos-methyl	0.01µg/l (AA) 0.04µg/l (MAC)	0.01µg/l (AA) 0.04µg/l (MAC)	DoE (1991)	Statutory
Bentazone	500µg/l (AA) 5000µg/l (MAC)	500µg/l (AA) 5000µg/l (MAC)	DETR (1996)	Statutory
Bromoxynil	100µg/l (AA) 1000µg/l (MAC)	100µg/l 1000µg/l	DoE (1995)	Proposed
Carbendazim	0.1µg/l (AA) 1µg/l (MAC)	0.1µg/l (AA) 1µg/l (MAC)	DETR (1998)	Proposed
Chlorfenvinphos	0.01µg/l (AA) 0.1µg/l (MAC)	0.01µg/l (AA) 0.1µg/l (MAC)	Agency (NRA) (1993)	Proposed
Chlorpropham	10µg/l (AA) 40µg/l (MAC)	10µg/l (AA) 40µg/l (MAC)	DoE (1995)	Proposed
Chlorothalonil	0.1µg/l (AA) 1.0µg/l (MAC)	0.1µg/l (AA) 1.0µg/l (MAC)	DoE (1995)	Proposed
Chlorotoluron	2µg/l (AA) 20µg/l (MAC)	2µg/l (AA)	Agency (1996)	Proposed
Coumaphos	0.01µg/l (AA) 0.1µg/l (MAC)	0.01µg/l (AA) 0.1µg/l (MAC)	Agency (NRA) (1993)	Proposed
Cyfluthrin	0.001µg/l (95%ile)	0.001µg/l (95%ile)	DoE (1988)	Proposed
Cypermethrin	0.0001µg/l (AA) 0.001µg/l (MAC)	0.0001µg/l (AA) 0.001µg/l (MAC)	Agency (1998)	Proposed
2,4-D (ester)	1µg/l (AA) 10µg/l (MAC)	1µg/l (AA) 10µg/l (MAC)	Agency (1996)	Statutory
2,4-D (non-ester)	40µg/l (AA) 200µg/l (MAC)	40µg/l (AA) 200µg/l (MAC)	Agency (1996)	Statutory
DDT (total)	0.025µg/l (AA)	0.025µg/l (AA)	EC	Statutory
ppDDT	0.01µg/l (AA)	0.01µg/l (AA)	EC	Statutory
Demetons (approved)	0.5µg/l (AA) 5µg/l (MAC)	0.5µg/l (AA) 5µg/l (MAC)	DoE (1995)	Statutory
Demetons (total)	0.05µg/l (AA) 0.5µg/l (MAC)	0.05µg/l (AA) 0.5µg/l (MAC)	DoE (1995)	Proposed

DETERMINAND	ENVIRONMENTAL QUALITY STANDARD		ORGANISATION (year value finalised)	STATUS
	FRESHWATER	MARINE		
Diazinon	0.01µg/l (AA) 0.1µg/l (MAC)	0.01µg/l (AA) 0.1µg/l (MAC)	Agency (NRA) (1993)	Proposed
Dichlorophen	Limited data. No EQS proposed	Limited data. No EQS proposed	DETR (1998)	
Dichlorvos	0.001µg/l (AA)	0.04µg/l (AA)	DoE (1991)	Statutory
Dieldrin	0.01µg/l (AA)	0.01µg/l (AA)	EC	Statutory
Diflubenzuron	0.001µg/l (AA) 0.015µg/l (MAC)	0.005µg/l (AA) 0.1µg/l (MAC)	DETR (1997)	Proposed
Dimethoate	1µg/l (AA)	1µg/l (AA)	DoE (1994)	Statutory
Diuron	2µg/l (AA) 20µg/l (MAC)	2µg/l (AA)	Agency (1996)	Proposed
Doramectin	0.001µg/l (AA) 0.01µg/l (MAC)	0.001µg/l (AA) 0.01µg/l (MAC)	DETR (1998)	Proposed
Endosulphan (total)	0.003µg/l (AA) 0.3µg/l (MAC)	0.003µg/l (AA)	DoE (1991)	Statutory
Endrin	0.005µg/l (AA)	0.005µg/l (AA)	EC	Statutory
Ethofumesate	Limited data. No EQS proposed	Limited data. No EQS proposed	DETR (1997)	
Fenchlorphos	0.01µg/l (AA) 0.1µg/l (MAC)	0.01µg/l (AA) 0.1µg/l (MAC)	Agency (NRA) (1993)	Proposed
Fenitrothion	0.01µg/l (AA) 0.25µg/l (MAC)	0.01µg/l (AA) 0.25µg/l (MAC)	DoE (1991)	Statutory
Flucofuron	1.0µg/l (95%ile)	1.0µg/l (95%ile)	DoE (1988)	Proposed
Flumethrin	Limited data. No EQS set	Limited data. No EQS set	Agency (NRA) (1993)	
Flusilazole	Limited data. No EQS proposed	Limited data. No EQS proposed	DETR (1998)	
Hexachlorobenzene	0.03µg/l (AA)	0.03µg/l (AA)	EC	Statutory
Hexachlorocyclohexane	0.1µg/l (AA	0.02µg/l (AA)	EC	Statutory
Imazethpyr	Limited data. No EQS proposed	Limited data. No EQS proposed	DETR (1998)	
Ioxynil	10µg/l (AA) 100µg/l (MAC)	10µg/l (AA) 100µg/l (MAC)	DoE (1995)	Proposed
Isodrin	0.005µg/l (AA)	0.005µg/l (AA)	EC	Statutory

DETERMINAND	ENVIRONMENTAL QUALITY STANDARD		ORGANISATION (year value finalised)	STATUS
	FRESHWATER	MARINE		
Isoproturon	2µg/l (AA) 20µg/l (MAC)	2µg/l (AA)	Agency (1996)	Proposed
Ivermectin	0.0001µg/l (AA) 0.001µg/l (MAC)	0.001µg/l (AA) 0.01µg/l (MAC)	DETR (1998)	Proposed
Linuron	2µg/l (AA) 20µg/l (MAC)	2µg/l (AA)	Agency (1996)	Statutory
Malathion	0.01µg/l (AA) 0.5µg/l (MAC)	0.02µg/l (AA) 0.5µg/l (MAC)	DoE (1991)	Statutory
Mancozeb	2µg/l (AA) 20µg/l (MAC)	2µg/l (AA) 20µg/l (MAC)	DETR (1997)	Proposed.
Maneb	3µg/l (AA) 30µg/l (MAC)	3µg/l (AA) 30µg/l (MAC)	DETR (1997)	Proposed
MCPA	2µg/l (AA) 20µg/l (MAC)	2µg/l (AA) 20µg/l (MAC)	DoE (1995)	Proposed
Mecoprop	20µg/l (AA) 200µg/l (MAC)	20µg/l (AA) 200µg/l (MAC)	Agency (NRA)	Statutory
Methiocarb	0.01µg/l (AA) 0.16µg/l (MAC)	0.01µg/l (AA) 0.16µg/l (MAC)	DETR (1997)	Proposed
Mevinphos	0.02µg/l (MAC)	No standards proposed	Agency (1997)	Statutory
Omethoate	0.01µg/l (AA)	No standard proposed	DoE (1994)	Statutory
PCSDs	0.05µg/l (95%ile)	0.05µg/l (95%ile)	DoE (1988)	Proposed
Pendimethalin	1.5µg/l (AA) 6µg/l (MAC)	1.5µg/l (AA) 6µg/l (MAC)	DETR (1997)	Proposed
Pentachlorophenol	2µg/l (AA)	2µg/l (AA)	EC	Statutory
Permethrin	0.01µg/l (95%ile)	0.01µg/l (95%ile)	DoE (1988)	Proposed
Pirimicarb (total)	1.0µg/l (AA) 5.0µg/l (MAC)	1.0µg/l (AA) 5.0µg/l (MAC)	DoE (1996)	Proposed
Pirimiphos-methyl	0.015µg/l (AA) 0.05µg/l (MAC)	0.015µg/l (AA) 0.05µg/l (MAC)	DETR (1997)	Proposed
Prochloraz	4µg/l (AA) 40µg/l (MAC)	4µg/l (AA) 40µg/l (MAC)	DETR (1998)	Proposed
Propetamphos	0.01µg/l (AA) 0.1µg/l (MAC)	0.01µg/l (AA) 0.1µg/l (MAC)	Agency (NRA) (1993)	Proposed
Propyzamide	100µg/l (AA) 1000µg/l (MAC)	100µg/l (AA) 1000µg/l (MAC)	DETR (1998)	Proposed
Simazine (a)	2µg/l (AA) 10µg/l (MAC)	2µg/l (AA) 10µg/l (MAC)	DoE (1991)	Statutory

DETERMINAND	ENVIRONMENTAL QUALITY STANDARD		ORGANISATION (year value finalised)	STATUS
	FRESHWATER	MARINE		
Sulcofuron	25µg/l (95%ile)	25µg/l (95%ile)	DoE (1988)	Proposed
Tecnazene (b) (total)	1.0µg/l (AA) 10µg/l (MAC)	1.0µg/l (AA) 10µg/l (MAC)	DoE (1995)	Proposed
Thiabendazole	5µg/l (AA) 50µg/l (MAC)	5µg/l (AA) 50µg/l (MAC)	DoE (1995)	Proposed
Triallate	0.25µg/l (AA) 5µg/l (MAC)	0.25µg/l (AA) 5µg/l (MAC)	DETR (1998)	Proposed
Triazophos	0.005µg/l (AA) 0.05µg/l (MAC)	0.005µg/l (AA) 0.05µg/l (MAC)	DoE (1994)	Statutory
Tributyl tin cmpds (total)	0.02µg/l (MAC)	0.002µg/l (MAC)	DoE (1988)	Statutory
Trifluralin	0.1µg/l (AA) 20µg/l (MAC)	0.1µg/l (AA) 20µg/l (MAC)	DoE (1990)	Statutory
Triphenyl tin cmpds (total)	0.02µg/l (MAC)	0.008µg/l (MAC)	DoE (1988)	Statutory

(a) Sum of atrazine and simazine

(b) Total tecnazene = sum of tecnazene, 2,3,5,6-tetrachloroaniline and 2,3,5,6-tetrachloroanisole

N.B. For those standards that are statutory, only the AA is statutory and included in regulations apart from tributyl and triphenyl tin compounds

APPENDIX IV – substances governed by the Dangerous Substances Directive (76/464/EEC)

List I substances (also known as the "Black List")

1 Mercury
2 Cadmium
3 Hexachlorocyclohexane (HCH)
4 DDT
5 Pentachlorophenol (PCP)
6 Carbon tetrachloride
7 Aldrin
8 Dieldrin
9 Endrin
10 Isodrin
11 Hexachlorobenzene (HCB)
12 Hexachlorobutadiene (HCBD)
13 Chloroform (CHCl3)
14 Trichloroethylene (TRI)
15 Tetrachloroethylene (PER)
16 Trichlorobenzene (TCB)
17 1,2-Dichloroethane (EDC)

List II substances (also known as the "Grey List")

1 Lead
2 Chromium
3 Zinc
4 Copper
5 Nickel
6 Arsenic
7 Boron
8 Iron
9 pH
10 Vanadium
11 Tributyl tin } triorgano-tin compounds
12 Triphenyl-tin }
13 PCSDs]
14 Cyfluthrin]
15 Sulcofuron] moth-proofing agents
16 Flucofuron]
17 Permethrin]

APPENDIX V – Annex 1A, substances and target reductions

The following list of 36 substances comprises Annex 1A of the Final Declaration of the 3rd North Sea Conference

Substance	Target reduction (%) (1995 compared with 1985)
Mercury	70
Cadmium	70
Copper	50
Zinc	50
Lead	70
Arsenic	50
Chromium	50
Nickel	50
Drins	50
HCH	50
DDT	50
Pentachlorophenol	50
Hexachlorobenzene	50
Hexachlorobutadiene	50
Carbon tetrachloride	50
Chloroform	50
Trifluralin	50
Endosulfan	50
Simazine	50
Atrazine	50
Tributyl tin compounds	50
Triphenyl tin compounds	50
Azinphos ethyl	50
Azinphos methyl	50
Fenitrothion	50
Fenthion	50
Malathion	50
Parathion	50
Parathion methyl	50
Dichlorvos	50
Trichloroethylene	50
Tetrachloroethylene	50
Trichlorobenzene	50
1,2 Dichloroethane	50
Trichloroethane	50
Dioxins	70

APPENDIX VI – Annex 1B, pesticides

In addition to the commitment regarding the 36 substances in Annex 1A of the 3rd North Sea Conference Declaration, further common actions were agreed with respect to the reduction of inputs of specific substances and groups of substances, namely:

1 Pesticides – to aim for a substantial reduction in the quantities of pesticides reaching the North Sea and thus, by 31/12/92, to strictly control their use and application and reduce, where necessary, emissions to the environment. Annex 1B part (c) lists 18 substances, employed as pesticides, the use of which must be strictly prohibited or banned:

aldrin
atrazine
carbon tetrachloride
chlordane
chlorpicrin
1,2 dibromoethane
1,2 dichloroethane
dieldrin
endrin
fluoroacetic acid (and derivatives)
heptachlor
hexachlorobenzene
hexachlorocyclohexane
mercury compounds
nitrofen
pentachlorophenol
polychlorinated terpenes
quintozene

2 PCBs – to prevent PCBs and hazardous PCB substitutes from entering the marine environment, including the phasing-out of and destruction of all identifiable PCBs as soon as possible

3 Nutrients – in applying the precautionary principle, to co-ordinate initiatives to reduce nutrient inputs, in order to meet the aim of a reduction of around 50 per cent for inputs between 1985 and 1995 into areas where they are likely to cause pollution

APPENDIX VII - Environment Agency definitions of pollution incident categories

Category 1
A major incident involving one or more of the following:

a) persistent effect on water quality
b) closure of public water supply
c) extensive fish mortality – greater than 100 notable fish
d) excessive breaches of consent conditions
e) substantial remedial measures
f) substantial effect on amenity /conservation

Category 2
A significant incident involving one or more of the following:

a) notification of abstractors necessary
b) significant fish mortality – 10 to 100 notable fish
c) significant impact on invertebrate fauna
d) water unfit for stock
e) bed of watercourse contaminated
f) reduced amenity value

Category-3
Minor pollution incident, one or more of:

a) fewer than 10 notable fish deaths
b) only local contamination
c) minimal impact on amenity/conservation

Unsubstantiated
Introduced from January 1995. A reported incident which, on investigation, was not substantiated.

Causes of incidents

Accidental – pollution occurred as an unavoidable accident although the polluter was following the rules for good practice.

Malpractice – pollution occurred due to disregard or ignorance of the rules of good practice by the polluter.

Deliberate – pollution was deliberately caused by the pesticide user.

Vandalism – pollution was deliberately caused by a person other than the pesticide user.

Dumping – pollution caused by dumping of pesticide waste.

Fire – pollution incident caused by fire.

APPENDIX VIII - Substantiated pollution incidents 1997

	Incident	Pesticide	Environmental effect	Incident category	Incident source	Cause	Prosecution
	Anglian Region						
1	900 litres diluted pesticide lost from sprayer in field	Insecticide (unknown)	None, pollution prevented	3	Agriculture: arable	Accident	N
2	300 litres diluted pesticide spilt on roadway when sprayer moved off while still connected to filling point. Spillage was absorbed with sand and road gulley cleaned out	Dimethomorph and mancozeb	None, pollution prevented	3	Agriculture: arable	Accident	N
3	Pesticide spilt from sprayer onto road and into roadside ditch	Dimethylamine salt	None reported	3	Agriculture: arable	Accident	N
4	Lorry hit spray boom on tractor causing it to crash and fracture its tanks losing 2000 litres of pesticide. Absorbed with chemical sheets and contaminated soil removed	Unknown pesticide	None, pollution prevented	3	Transport	Accident	N
5	Spillage of pesticide to road gully. Gully was blocked so liquid was pumped out and silt spread on land	MCPA	None, pollution prevented	3	Agriculture: arable	Accident	N
6	10 litres pesticide spilt in road, but contained	Promox mixed ester	None, pollution prevented	3	Transport	Accident	N
7	Five packages found on foreshore marked "Gastoxin phosphine fumigant. Danger. Poison". Packages removed	Aluminium phosphide	None reported	3	Transport	Malpractice	N
8	While filling spray tank, quantity of foam overtopped and ran across ground towards watercourse	Chlorthal dimethyl Propachlor	None reported	3	Agriculture: arable	Malpractice	N

9	Pesticide spilled from sprayer to surface water drain. Drain flushed out and contents disposed of on arable land	Unknown	None, pollution prevented	3	Agriculture: arable	Accident	N
10	Drum of sheep dip exploded on battle area at army ground. 10 litres lost to ground. Contaminated soil removed	Unknown sheep dip	None, pollution prevented	3	Agriculture: sheep	Accident	N
11	Barrel of pesticide found in dyke. Not leaking and removed to local county council depot	Metham sodium	None reported	3	Other	Dumping	N
	Midlands Region						
12	Contamination of ditch with drainage from irrigated gravel beds of pot plants treated with herbicide	Oxadiazon	None reported	3	Agriculture: horticulture	Malpractice	N
13	Discharge of synthetic pyrethroid sheep dip to stream via soakaway and farm surface water drainage pipe. Decline in biological quality detected by a survey over a 7km length	High cis cypermethrin	Invertebrate mortality	2	Agriculture: sheep	Malpractice	N
14	Discharge of cooling water containing biocides to surface water drainage system. Discharge redirected to foul sewer	Unknown biocide	None, pollution prevented	3	Industry	Malpractice	N
15	Fire water from farm building containing dressed sugar beet seed entered brook. Estimated total active ingredient on seed – 2g. All other insecticide removed from building prior to fire service arrival.	Imidacloprid	None reported /pollution prevented	3	Agriculture: arable	Fire	N
16	Spillage of 25 litres of fungicide over very large section of road. Possible dilute discharge to highway drain	Unknown fungicide	None reported	3	Transport	Accident	N
17	Biological monitoring revealed major impact on invertebrates for 3km along a stream. Dipped sheep drained off on a lane which slopes to watercourse. Communal sheep dip for several farmers adjacent to watercourse	Unknown sheep dip. SP and OP used	Invertebrate mortality	2	Agriculture: sheep	Malpractice	Y
18	Biological survey work revealed no invertebrate life in stream with major decline in invertebrates for 5km. Contractor left farmer to dispose of diazinon dip. Farmer pulled plug four weeks later and dip bath drained to stream	Diazinon	Invertebrate mortality	2	Agriculture: sheep	Malpractice	Y
19	Cause of invertebrate mortality in stream traced to leaking dip bath that discharged to soakaway and land drain. Structural improvements to bath and other measures required	High cis Cypermethrin	Invertebrate mortality	2	Agriculture: sheep	Malpractice	N
20	Creosote smell reported in culverted spring overflow to a watercourse. Source traced to a small leak from a five gallon drum containing a vertebrate control agent	Bone oil	None reported	3	Other	Dumping	N

21	Monitoring revealed significant impact on biology in stream. Cause traced to a very old leaky tank used for dipping and sited adjacent to stream. Tank to be abandoned.	Unknown sheep dip	Invertebrate mortality	2	Agriculture: sheep	Malpractice	N
22	Survey work on a stream highlighted a reduction in biology for 3.5km. Probable cause was drainage from dipping area and sheep walking through the stream after dipping.	High cis Cypermethrin	Significant impact on biology	3	Agriculture: sheep	Malpractice	N
23	Large decline in invertebrate population and biology of brook. Source traced to dip bath used by at least five farmers. SP dip detected in land drain near bath.	High cis Cypermethrin	Significant impact on biology	2	Agriculture: sheep	Malpractice	N
24	Biological monitoring identified poor invertebrate population in brook. Problem due to ineffective bung in sheep dip bath and discharge to yard drain. Dripping pen also drained to yard drain.	High cis Cypermethrin	Significant impact on biology	3	Agriculture: sheep	Malpractice	N
25	Monitoring highlighted poor biology in stream for 8km. Source identified as unsatisfactory operation of dip bath and drainage from dipping area entering watercourse.	High cis Cypermethrin	Significant impact on biology	2	Agriculture: sheep	Malpractice	Y
26	Survey identified severely depleted invertebrate life and dead crayfish for 16km in river. Source traced to dip bath in poor structural condition adjacent to watercourse that had overflowed during dipping.	High cis Cypermethrin	Invertebrate mortality/dead crayfish	2	Agriculture: sheep	Malpractice	Y
27	Spray tank on tractor lost 700 litres of organophosphate pesticide (diluted 100:1) onto roadway. Spillage washed onto roadside verge with dilutionratio 2000:1	Dimethoate	None, pollution prevented	3	Agriculture: arable	Accident	N
28	Aerial spraying of bracken over watercourse	Asulam	None reported	3	Other	Malpractice	N
29	Distressed fish reported in fishery nursery pond. Cause traced to adjacent farm where recent spraying had taken place. Probable that heavy rainfall had washed residual pesticide into the tributary that feeds pond	Propachlor Simazine	Fish kill	2	Agriculture: arable	Malpractice	N
30	Container of hoof dip dropped off lorry. Spillage of approximately 3 litres contained on site	Hoof dip	None, pollution prevented	3	Transport	Accident	N
31	Tractor and container of agricultural spray fell into watercourse upstream of carp fishery. Stream dammed and contents tankered off	Chlormequat Flusilazole Tridemorph	None, pollution prevented	3	Agriculture: arable	Accident	N
32	250 dead fish in river. Incident caused by poor operation of mobile dipping unit sited over a yard drain resulting in sheep dip entering watercourse	High cis Cypermethrin Propetamphos	Fish kill	1	Agriculture: sheep	Malpractice	Y

33	Significant impact on biology in river identified. Cause was post-dipping drainage off sheep while contained in compound with hardcore base. Dip passed through ground and entered river via field drains	High cis Cypermethrin	Invertebrate mortality	1	Agriculture: sheep	Malpractice	Y
34	Impact on 4km of stream biology. Overflow from slurry pit used to store sheep dip prior to disposal	High cis Cypermethrin	Invertebrate mortality	2	Agriculture: sheep	Malpractice	N
	North East Region						
35	Containers of herbicide spilled on roads. Quantity involved unlikely to cause significant pollution if washed to surface water drains by rainfall	Atrazine, diuron and potato sprout suppressant	None reported	3	Transport	Accidental	N
	North West Region						
36	Pollution found during routine ecology survey. Expected river quality was class 1A but found to be Class 4. Pollution traced to overflowing sheep dip	Unknown sheep dip	Significant effect on invertebrates	2	Agriculture: sheep	Malpractice	N
37	Pollution found during routine monitoring visit. 2-5km of river affected. Pollution probably caused by drippings from sheep and overflowing tank	High cis Cypermethrin	Significant effect on invertebrate life. No fish kill	2	Agriculture: sheep	Malpractice	Area warning letter
38	Drainage from sheep dip pens was connected to watercourse. Approximately 20km of river was affected	High cis Cypermethrin	Dead crayfish and significant effect on invertebrate life. No fish kill	2	Agriculture: sheep	Malpractice	Y
39	1-2km of river polluted, precise cause not determined but probably due to drippings from sheep in draining pen leading to run-off residues in high rainfall	High cis Cypermethrin	Significant effect on invertebrate life. No fish kill	2	Agriculture: sheep	Malpractice	N
40	Pollution caused by poor operation of the sheep dip facility	OP Sheep Dip	Persistent effect on water quality and invertebrate life for more than one week.	1	Agriculture: sheep	Malpractice	Y

41	Pollution found in routine biological survey. Cypermethrin found in sediment from land drainage system. Possibly occurred during spreading to unsuitable land	High cis Cypermethrin	Persistent effect on water quality and invertebrate life for more than one week.	1	Agriculture: sheep	Malpractice	N
42	Pollution related to sheep dip but precise cause was not proven	High cis Cypermethrin Flumethrin	Water unfit for stock	2	Agriculture: sheep	Malpractice	N
43	Pollution caused by poor operation of sheep dip facility	Sheep dip	Major invertebrate mortality	2	Agriculture: sheep	Malpractice	Y
44	Routine biological investigation revealed pollution in the river. This was linked to inadequate construction of the sheep dip facility; drainage from the dip area led to the surface water drain	Sheep dip	Major invertebrate mortality	2	Agriculture: sheep	Malpractice	Y
45	6km of river was polluted due to land drains discharging to the watercourse	Sheep dip	Major effect on water quality and invertebrate life	1	Agriculture: sheep	Malpractice	Y
46	Pollution found on routine ecology survey and traced to farm drainage. Sediment in drainage contained sheep dip. Facility was poorly constructed and operated	Sheep dip	Measurable effect on invertebrate life. Water use affected	2	Agriculture: sheep	Malpractice	N
47	Deterioration in water quality was noticed in course of routine monitoring. Pollution was caused by inadequate maintenance of sheep dip facility. Sheep dip was not emptied	Flumethrin	Effect on water quality and invertebrate life	1	Agriculture: sheep	Malpractice	Area warning letter
48	Pollution found by ecologist and linked to inadequate construction of sheep dipping facility which had drains connected to surface water drain	Sheep dip	Effect on water quality and invertebrate life	1	Agriculture: sheep	Malpractice	Y

49	Pollution due to discharge of trade effluent which contained pesticide following an accidental spillage	Unknown	Persistent effect on water quality and invertebrate life, extensive fish kill 100-500	1	Industrial	Accidental	Y
50	Cause not determined; possibly due to drainage from quarry area which is used for waste dumping	Diazinon	Significant effect on water quality and invertebrate life; fewer than 10 fish killed	1	Other	Dumping	N
51	Pollution caused by a leaking drum. The drum was damaged due to an act of vandalism	Unknown veterinary medicine	Minor effect on water quality	3	Other	Vandalism	N
52	2km of canal polluted by pesticide	Cypermethrin	Fish kill 10-100 notable species	2	Agriculture: Sheep	Unknown	N
53	5km of river affected. Precise cause not established but possibly caused by sheep having access to watercourse following dipping	Cypermethrin	Significant effect on water quality and invertebrate life. No fish kill	2	Agriculture: Sheep	Malpractice	N
54	Pollution caused by traffic incident. Spray linkage failed as tractor carrying spray equipment drove over the crest of a railway bridge; 90 per cent of the spray leaked but was absorbed by sand and a contractor was called to conduct clean-up	Fungicide	Amenity affected, pollution of watercourse prevented	3	Transport	Accident	N
	Southern Region						
55	Pesticide drum found in stream. Shed adjacent to stream contained five similar drums disturbed by vandals	Technical HCH (ie containing all five isomers)	40 dead fish, elevated HCH levels at potable water abstraction site	1	Agriculture: arable	Vandalism	N

56	Fire destroyed farm buildings. Drum of fungicide melted. Fire-fighting water isolated in farm ditch to prevent egress further down catchment	Bordeaux mixture.	None, pollution prevented.	1	Agriculture: horticulture	Fire	N
57	Herbicide drift caused water plant death in a feed ditch. Plants in main water channel unaffected	Unknown	Non-target plants killed	3	Agriculture: arable	Malpractice	N
58	Water pumped from stream to mix pesticides in tank over culvert. Empty containers in stream and on bank	Unknown	None reported	3	Agriculture: arable	Malpractice	N
	South West Region						
59	Possible spray drift to sensitive fish. Unable to locate localised spraying	Unknown	Few dead trout fry.	3	Agriculture: arable	Malpractice	N
60	1/4 hectare pond treated, allowing treated water to escape to a tributary of River Dart and abstraction point for waste water treatment works. Extensive engineering work to isolate pond and pollutant. Monitored until natural biodegradation reduced to acceptable levels	Dichlobenil	None, pollution prevented.	1	Other	Malpractice	N
61	Maize fields sprayed with lindane. Intakes shut down when lindane and atrazine detected. No source found for atrazine. Possible yard run-off due to heavy rain	Lindane and atrazine	None, pollution prevented	1	Agriculture: arable	Malpractice	N
62	NFU dealing with claim from farmer after neighbour sprayed tennis court with pesticide. Escaped substance killed off crops in neighbouring field	Terbuthiuron	Minor fish kill	3	Other	Malpractice	N
	Thames Region						
63	Low levels of herbicides identified in ditch. Possibly washed into drainage system through steam cleaning of equipment close to pesticide store	Isoproturon and pendimethalin	Few dead worms.	3	Agriculture: arable	Malpractice	N
64	Pesticide leaked from two reject containers stored on a lorry. Pesticide leaked on hardstanding, but was contained and removed. Background levels of lindane increased for short time in watercourse from <0.005µg/l to 0.20µg/l	Lindane	None reported.	3	Transport	Malpractice	N
65	Contents of a bowser full of dilute pesticide escaped into a dry ditch. Contaminated land dug out	Pendimethalin and Isoproturon	None	1	Agriculture: arable	Accident	N
	Environment Agency – Wales						

66	Agency alerted through automatic monitoring of exceedence of tigger level. Subsequent samples revealed a return to below trigger level	Diuron	None reported	2	Other	Unknown	N
67	Biological monitoring revealed severe impact, which led to farm inspections and identification of likely source where dipping recently carried out. Effects on invertebrates up to 9km	Pyrethroid sheep dip	Major invertebrate mortality	2	Agriculture: sheep	Malpractice	N
68	Used dip and rainwater pumped out of dip bath, ran to highway drainage	OP sheep dip	No known impact on watercourse	3	Agriculture: sheep	Malpractice	N
69	Lorry involved in road traffic accident, and eight gallons of wood preservative spilled into brook	Wood preservative	None, spillage contained in brook and disposed of via waste contractors	3	Transport	Accident	N
70	Herbicide sprayed on railway track over aquifer	Diuron	Contamination of surface and groundwater	2	Other	Malpractice	N
71	Sheep dipping carried out close to watercourse, and sheep draining area included part of lake. Farmer stopped using dipping facility as Agency staff approached	OP sheep dip	No damage to invertebrates evident	3	Agriculture: sheep	Malpractice	N
72	Inadequate design of sheep dip bath allowed discharge to tributary	Cypermethrin	Complete invertebrate kill in 2.5km stream	2	Agriculture: sheep	Malpractice	N

APPENDIX IX - Substances governed by the Groundwater Directive (80/68/EEC)

The Annex to the EC Directive on Protection of Groundwater against pollution caused by certain dangerous substances contains two lists of families and groups of substances:

List I of families and groups of substances

1 Organohalogen compounds and substances which may form such compounds in the aquatic environment
2 Organophosphorus compounds
3 Organo-tin compounds
4 Substances which possess carcinogenic, mutagenic or teratogenic properties in or via the aquatic environment
5 Mercury and its compounds
6 Cadmium and its compounds
7 Mineral oils and hydrocarbons
8 Cyanides

List II of families and groups of substances

1 The following metalloids, metals and their compounds:

nickel	zinc	copper
chromelead	selenium	
arsenic	antimony	molybdenum
titanium	tin	barium
beryllium	boron	uranium
vanadium	cobalt	thallium
tellerium	silver	

2 Biocides and their derivatives not appearing in List I
3 Substances which have a deleterious effect on the taste and/or odour of groundwater, and compounds liable to cause the formation of such substances in such water and to render it unfit for human consumption
4 Toxic or persistent organic compounds of silicon, and substances which may cause the formation of such compounds in such water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances
5 Inorganic compounds of phosphorus and elemental phosphorus
6 Fluorides
7 Ammonia and nitrites

APPENDIX X – UK priority Red List substances

1	Mercury and its compounds
2	Cadmium and its compounds
3	Gamma-hexachlorocyclohexane
4	DDT
5	Pentachlorophenol
6	Hexachlorophenol
7	Hexachlorobutadiene
8	Aldrin
9	Dieldrin
10	Endrin
11	Polychlorinated biphenyls
12	Dichlorvos
13	1,2-Dichloroethane
14	Trichlorobenzene
15	Atrazine
16	Simazine
17	Tributyl tin compounds
18	Triphenyl tin compounds
19	Trifluralin
20	Fenitrothion
21	Azinphos-methyl
22	Malathion
23	Endosulphan

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.

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