EA WATER QUALITY

PESTICIDES IN THE AQUATIC ENVIRONMENT 1996

ENVIRONMENT AGENCY

PESTICIDES IN THE AQUATIC ENVIRONMENT 1996

Produced by the Pesticides Section of the National Centre for Ecotoxicology and Hazardous Substances (EHS)

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1 Executive summary

This is the fourth in a series of reports on the monitoring of pesticides in the aquatic environment by the Environment Agency and one of its predecessor bodies, the National Rivers Authority (NRA, 1995; Environment Agency, 1996 and 1997). It assesses and analyses the 1996 surface water and groundwater monitoring data for pesticides. For the purposes of this report "pesticides" include agricultural and non-agricultural pesticides, sheep dip, moth-proofing agents, antifoulants and wood preservatives.

During 1996 the Agency monitored 167 pesticides. Samples were taken from 3,183 sites for both statutory and non-statutory purposes and almost 357,000 separate analyses of pesticides in water were recorded. Samples are taken for both statutory and non-statutory purposes. The water sources sampled included; freshwaters, groundwaters, marine waters, trade effluents and sewage treatment final effluents.

The data are compared against two criteria; 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, not drinking waters. However, comparisons of data against the drinking water standard 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 66 pesticide EQSs available (Appendix III). The data show that of the 1,381 freshwater sites monitored, 129 (nine per cent) failed at least one EQS. This was a similar failure rate to the previous year when eight per cent of sites failed at least one EQS.

In surface waters, the synthetic pyrethroid cypermethrin exceeded its EQS most frequently with a total of 60 out of 126 sites failing. Cypermethrin is used in sheep dips and agricultural insecticides. Most of the cypermethrin EQS exceedences were associated with its use as a sheep dip from both sheep dipping itself and from discharges from the washing of fleeces containing dip residue. Other sheep dip pesticides such as diazinon and propetamphos also had many EQS failures.

Of the 429 marine and estuarine water sites monitored, 64 (15 per cent) failed at least one EQS. The most frequent EQS exceedences were for the organo-tin pesticides, tributyl tin (63 sites) and triphenyl tin (five sites). EQSs for these substances became statutory in 1996 and were therefore included in the monitoring programmes for both freshwaters and marine/estuarine waters in all regions for the first time. This led to a substantial increase in the number of EQS failures in 1996 compared with earlier years.

As with previous years, the cereal herbicide isoproturon exceeded 0.1 µg/l most frequently in surfacewaters (20 per cent). Mecoprop (13 per cent), diuron (11 per cent), MCPA (seven per cent), simazine (six per cent) and 2,4-D (five per cent) were also found to frequently exceed 0.1µg/l. All except for diuron exceeded this level more frequently in 1996 than in 1995. The pesticides found above 0.1 µg/l most often in groundwater were atrazine, pentachlorophenol, isoproturon, diuron and mecoprop.

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, and as antifouling paints, timber treatments, surface biocides and for the protection of public health. Although classified as veterinary medicines, 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 run-off into drains. 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 modern pesticides break down quickly in soil or sunlight but are more likely to persist if they reach subsoil or groundwater because of reduced microbial activity, absence of light and lower temperatures.

New pesticides are continually being developed which, in general, are safer for users and the environment, more specific in action and require lower application rates. Nevertheless, the correct storage, appropriate use and safe disposal of all pesticides will remain of crucial importance in safeguarding the aquatic environment.

2.3 Agency monitoring programmes

The Agency's pesticide monitoring programme is strongly governed by statutory requirements to monitor pesticide concentrations in water, sediment and biota. The Agency is also required to undertake non-statutory monitoring of pesticides, tailored to known or predicted local problems. It is estimated that the cost of the Agency's pesticide analytical programme is in excess of £4 million annually. The Agency's pesticide monitoring 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 Ecotoxicology and Hazardous Substances.

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 incidents. However, when they do occur they can cause severe environmental damage. Data on specific pesticide pollution incidents and their effects are contained in the Pesticide Pollution Incidents Report (Reference 1) and the main Water Pollution Incident Report (Reference 2).

2.3.1 Statutory monitoring

2.3.1.1 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 V) and report the results annually to the Department of the Environment, Transport and the Regions (DETR). Additionally, List I substances must be monitored at background environmental monitoring sites, known as "national network" sites.

Abstraction points identified under the Surface Water Abstraction Directive (75/440/EEC) and designated waters under the Shellfish Waters Directive (79/923/EEC) must also be monitored for relevant pesticides. Exceedences of any EQSs must be reported annually to DETR.

2.3.1.2 Groundwater monitoring

Groundwater is extensively used for drinking water supplies, particularly in southern England. The major aquifers are chalk and Sherwood sandstone. Water supplies derived from groundwater are regularly monitored by water companies, which are required to notify the Agency of any exceedence of the drinking water standard. They normally make all their data from groundwater supplies available to the Agency. The Agency carries out a limited amount of groundwater monitoring.

2.3.1.3 Additional government monitoring requirements

The Agency undertakes monitoring as part of the Harmonised Monitoring Programme. This was set up by DETR in 1974 to provide a network of sites at which river quality at the lower end of surface water catchments can be assessed. Its purpose is to enable estimates to be made of the loads of materials carried through river catchments into estuaries and to allow long-term trends in river quality to be assessed. The list of substances is diverse and 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 VII). The Agency is required to monitor discharges 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 VIII).

2.3.1.4 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, when available, in the receiving water. Industries manufacturing or formulating pesticides, washing wool and manufacturing textiles are regulated by consents or authorisations under Integrated Pollution Control (IPC) to control pesticide levels in effluent discharges.

Effluent discharges containing one or a 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 consents

and, where appropriate, the EQS. The sampling frequency depends on the volume and location of the discharge, but is typically 12 times a year.

2.3.2 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 479 agricultural, horticultural and amenity active ingredients and 138 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. Therefore, 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 therefore aim to cover the most widely used agricultural pesticides in intensive arable farming areas. By contrast, upland areas have little arable land but more sheep farming, and monitoring should be targeted towards pesticides used in 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.

2.4 Analysis of pesticides

The Agency uses its own laboratories to analyse water samples for pesticides. A high priority is placed on analytical quality assurance and each laboratory produces its own Analytical Quality Control (AQC) procedures. Laboratories also participate regularly in AQC collaborative exercises organised externally.

It is Agency policy that its laboratories are quality controlled by the United Kingdom Accreditation Service (UKAS)).

2.5 Analytical constraints on monitoring

The main difficulties in analysing for trace levels of pesticides in water occur because:

i) the very low levels of detection required introduce problems of accuracy, reproducibility and reliability. The lower the concentrations being measured, the higher the cost, analytical skill required and degree of uncertainty;

ii) many pesticides are very soluble in water, for example glyphosate, making extraction and concentration difficult;

iii) it is difficult to identify organic pesticides among a wide range of other organic compounds which are present at higher concentrations in environmental samples.

Because of these difficulties and the costs associated with analysis, not all pesticides identified as high priority can be included in current monitoring programmes. Analytical methods need to be developed for these compounds.

2.6 Environmental Quality Standards

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

Under the Dangerous Substance Directive (76/464/EEC) the EC is responsible for setting EQSs for List 1 compounds and the member states are responsible for List 2 compounds. In the UK both DETR and the Agency have commissioned work on the derivation of EQSs. The substances considered for EQS development have appeared on international priority lists, such as the North Sea Conference, or are frequently discharged or found in the aquatic environment. In the UK EQSs are currently available for more than 100 substances, of which 66 are pesticides (Appendix III).

The majority of EQSs are proposed for the protection of aquatic life and are derived for both the marine and freshwater environments. EQSs are generally expressed as annual averages (AA) which are derived to protect against long-term exposure or maximum allowable concentrations (MACs) which are derived to protect against short-term exposure. In addition some EQSs, for example permethrin and cyfluthrin, are expressed as 95 percentiles which means that the concentration should not be exceeded for 95 per cent of the time.

The EC has set statutory standards for 18 List 1 compounds which 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 statutory standards and the results are reported annually to DETR. In addition a further 30 of the EQSs proposed by the Agency and DETR have recently become statutory via the Surface Water (Dangerous Substances) (Classification) Regulations 1997 and 1998. A number of these statutory standards are for pesticides (see Appendix III).

The Government Circular 7/89 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 these substances in the aquatic environment. They are termed operational standards.

3 Environment Agency monitoring data for 1996

During 1996 the Agency monitored 167 pesticides. Samples were taken from 3,183 sites and almost 357,000 separate analyses of pesticides in water were recorded. Water sources sampled included freshwaters, groundwaters, marine waters, trade effluents and sewage treatment final effluents.

The 1996 pesticide monitoring data have been compared against two criteria: the EQS, where one is available, and the EC Drinking Water Standard (0.1µg/l). EQS failures are largely an indication of point source pollution while the 0.1µg/l standard gives a better indication of diffuse pollution.

The data have been reported on an annual basis, not by crop year. Some agricultural pesticides that are used seasonally might be better presented on a crop year basis for some purposes. However, 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 limit of detection (LOD) are treated as zero.

3.1 EQS exceedences

3.1.1 EQS failures in surface freshwaters

The data from each site have been compared against all available EQSs. If an AA and a MAC were available, both were used for assessment. When investigating sites with EQS failures all samples, excluding those listed as known pollution incidents, are included. However, only one failure was counted where one site failed both EQSs.

The number of sites failing EQSs for individual pesticides in surface freshwaters and marine waters are shown in Tables 3.1 and 3.2, respectively. Of the 66 pesticides with EQS values that were monitored in 1996, 28 exceeded their EQS value at least one site. The most frequent EQS failure in surface freshwaters was cypermethrin (60 sites). This is likely to be from its use as a sheep dip.

The location of each surface freshwater EQS failure in England and Wales is shown in Figure 3.1. Of the 1,381 freshwater sites monitored, 129 sites (nine per cent) failed at least one EQS. This is similar to the eight per cent of freshwater sites exceeding an EQS in 1995. The slight increase is most likely a result of analytical development, the addition of more pesticides with EQSs and more targeting of monitoring, rather than an indication of declining freshwater quality. For example, in 1995 45 pesticides had EQSs set, compared with 66 pesticides in 1996.

Figure 3.1 Surface freshwater sites failing pesticide Environmental Quality Standards in England and Wales during 1996

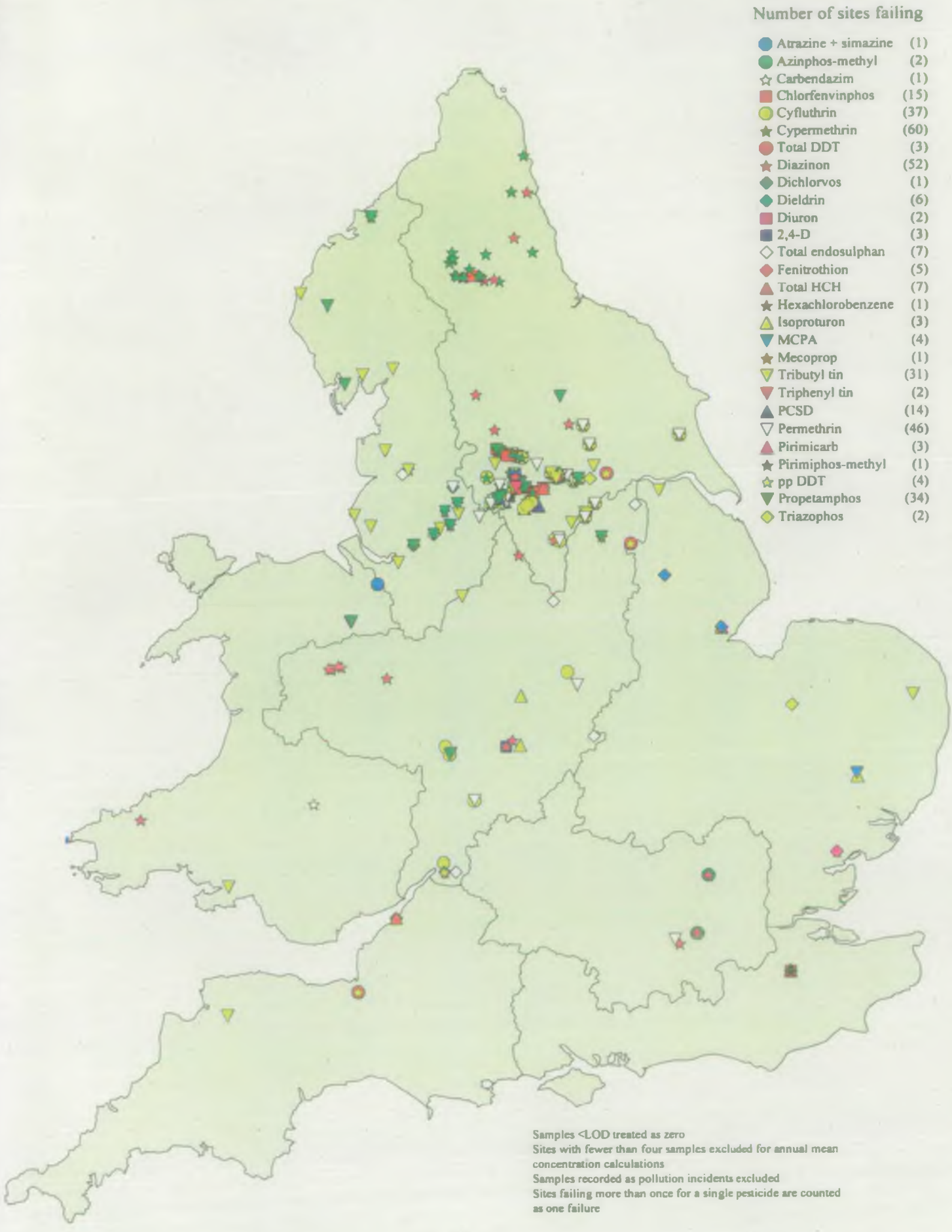


Table 3.1 Surface freshwater sites failing any EQS in 1996

Pesticide	Number of sites failing any EQS	Number of sites monitored	% of monitored sites failing any EQS*
Cypermethrin	60	126	47.6
Diazinon	52	447	11.6
Permethrin	46	183	25.1
Cyfluthrin	37	118	31.4
Propetamphos	34	420	8.1
Tributyl tin	31	195	15.9
Chlorfenvinphos	15	428	3.5
PCSD/eulan	14	113	12.4
Total HCH	7	1008	0.7
Total endosulphan	7	335	2.1
Dieldrin	6	963	0.6
Fenitrothion	5	416	1.2
MCPA	4	298	1.3
ppDDT	4	596	0.7
Pirimicarb	3	80	3.8
2,4-D	3	344	0.9
Isoproturon	3	415	0.7
Total DDT	3	596	0.5
Triphenyl tin	2	102	2.0
Triazophos	2	214	0.9
Diuron	2	407	0.5
Azinphos methyl	2	374	0.5
Pirimiphos-methyl	1	65	1.5
Carbendazim	1	394	12.3
Dichlorvos	1	415	0.2
Mecoprop	1	437	0.2
HCB	1	499	0.2
Total atrazine/simazine	1	513	0.2

Note.* The percentages of these sites are calculated from the number of sites monitored for each pesticide. In previous years the percentages were calculated from the total number of freshwater sites monitored.

3.1.2 EQS failures in marine waters

Of the 428 marine water sites monitored, 64 sites (15 per cent) failed at least one EQS. The most frequent EQS failure in marine water was tributyl-tin (63 sites) (Table 3.2). This is likely to be from its use in antifoulant paints on boats.

Compared with 1995, the number of sites failing any EQS appears to have dramatically increased from six (two per cent) to 64 sites (15 per cent). However, this increase is largely due to EQS failures for the organo-tin pesticides which were introduced into the national monitoring programme in 1996.

Figure 3.2 Estuarine and marine water sites failing pesticide Environmental Quality Standards in England and Wales during 1996

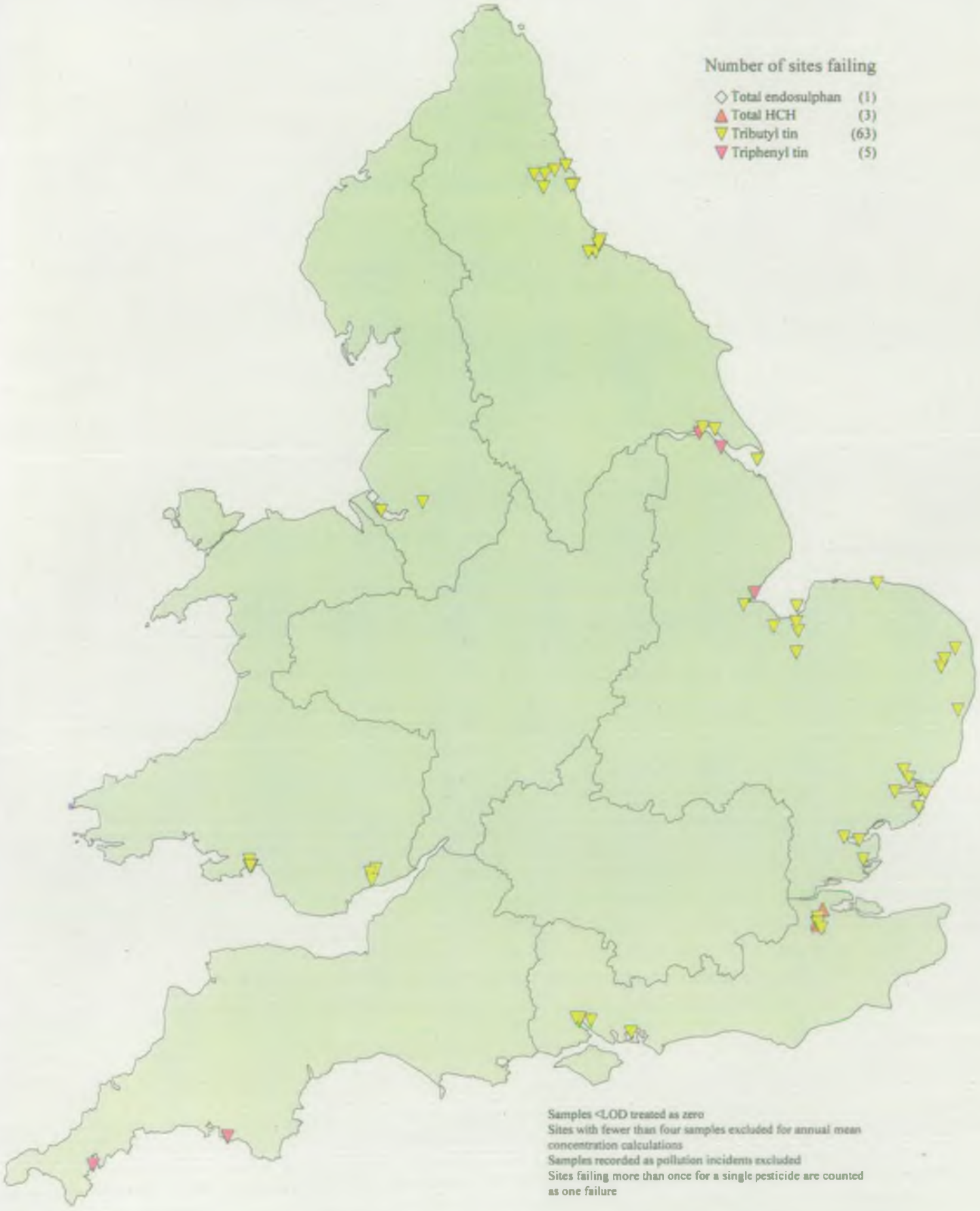


Table 3.2 Marine water sites failing any EQS in 1996

Pesticide	Number of sites failing any EQS	Number of sites monitored	% of monitored sites failing any EQS
Tributyl tin	63	188	33.5
Triphenyl tin	5	77	6.5
Total HCH	3	293	1.0
Total endosulphan	1	119	0.8

Figure 3.2 shows the locations of EQS failures in the marine water sites monitored.

3.1.3 Statutory EQS failures and EQS failures by pesticide user group

In the following sections details of EQS failures have been split into statutory EQS failures and four different categories of pesticides (grouped by pesticide usage) to allow for easier investigation and targeting of control measures, and advice to government for specific areas of pesticide use. Some pesticides appear both in the statutory EQS section and one of the pesticide use areas. A regional picture of pesticides in environmental waters is provided in Appendix I.

i) Statutory pesticide EQSs

Figure 3.3 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 List 1 pesticides failed their EQS in 1996 on at least one occasion and at 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 for these compounds. This is because 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 failures for HCH in the 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 two years after the event due to this pesticide's long persistence in the environment.

The organo-tin pesticides, tributyl tin and triphenyl tin, exceeded their EQSs frequently (see paragraph iv for more details).

ii) Plant protection products

Figure 3.4 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 water quality standard (0.1 µg/l), plant protection products represent a much greater proportion of exceedences (Section 3.1.2.1).

Figure 3.3 Surface water sites failing statutory Environmental Quality Standards in England and Wales during 1996

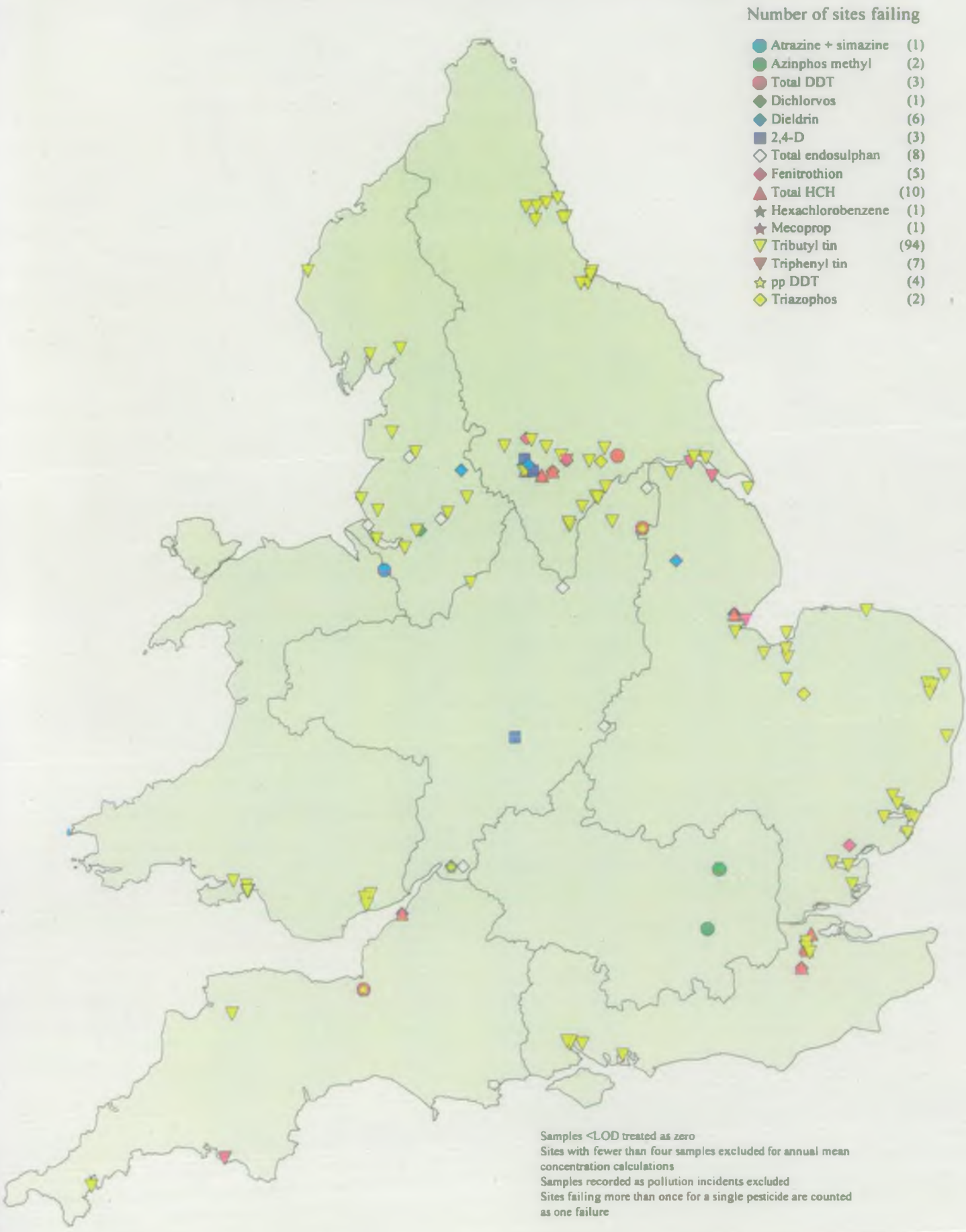
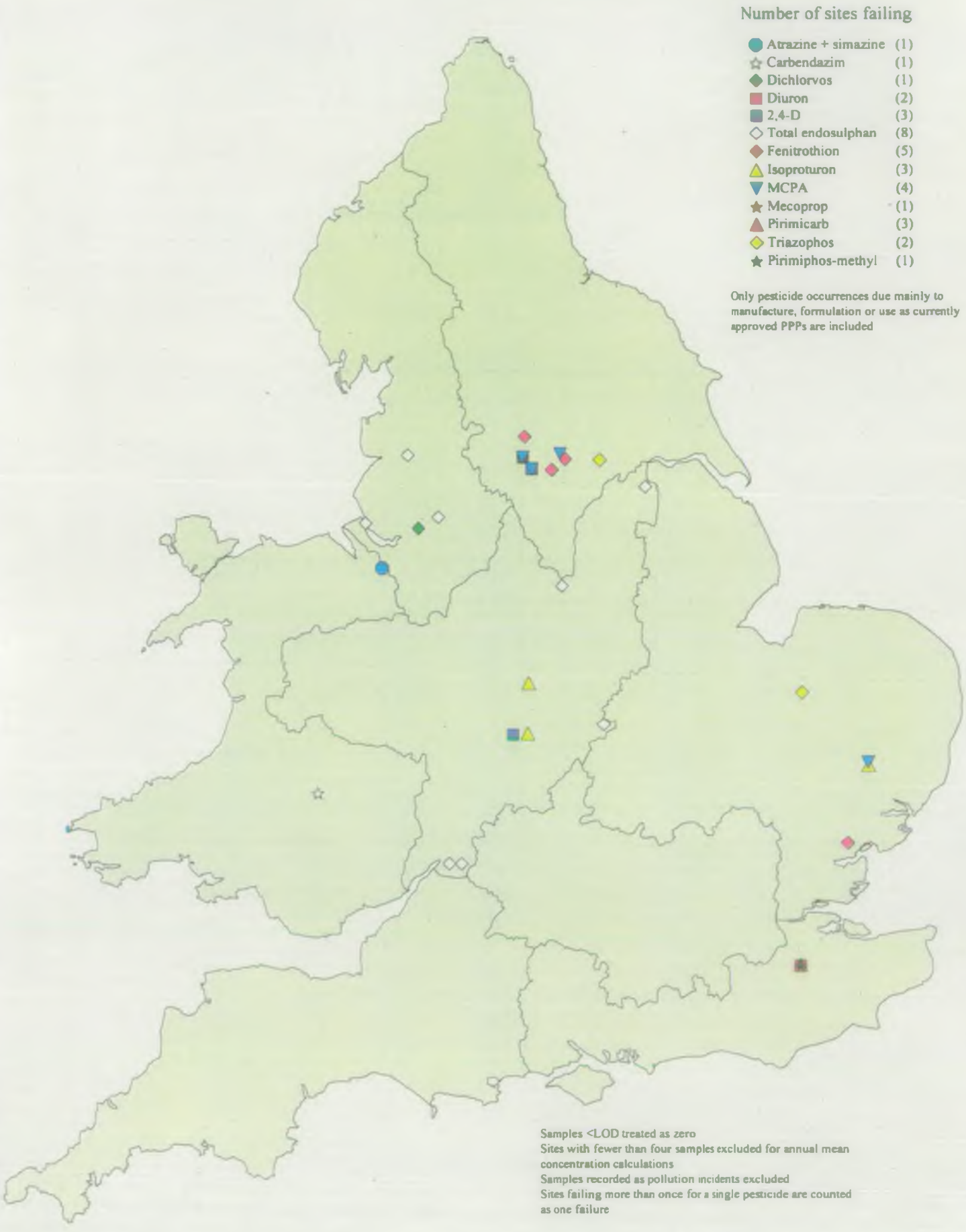


Figure 3.4 Surface water sites failing plant protection products Environmental Quality Standards in England and Wales during 1996



Herbicides such as diuron, mecoprop, isoproturon and 2,4-D are generally not very toxic to aquatic life and therefore have high EQS values. Only a small proportion of sites show concentrations above their EQS each year and these are likely to indicate point sources.

A significant proportion of the EQS failures for the plant protection products indicated on the map (Figure 3.4) are associated with their manufacture, rather than their agricultural use. For example, many of the EQS failures in the North East Region and Southern Region are due to discharges from pesticide manufacturing processes. However, it is worth noting that most of the Agency's sampling programme only covers reservoirs and rivers and is therefore less likely to pick up EQS failures resulting from the agricultural use of plant protection products.

iii) Sheep dip pesticides

The sheep dip pesticides cypermethrin (60 sites), diazinon (52 sites), propetamphos (34 sites) and chlorfenvinphos (16 sites)(see Figure 3.5) account for some of the highest number of sites failing EQSs.

Sheep dip pesticides are generally extremely toxic to aquatic life and hence have relatively low EQSs. Exceedences can be seen in clusters around the area of Leeds and Bradford which is associated with the textiles industry, wool washing, scouring and fellmongery. The exceedences probably reflect discharges to watercourses from trade effluents via the public sewage treatment works.

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

Cypermethrin exceeded its EQS most frequently of all monitored pesticides with EQSs in 1996. In 1996, 60 sites (48 per cent) exceeded the EQS, compared with 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 was also 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 replaced, it is considerably more toxic to aquatic life, hence the associated increase in pollution incidents involving cypermethrin.

Chlorfenvinphos is no longer marketed as a sheep dip in the UK. Some EQS failures for chlorfenvinphos may be due to its presence in old stocks of sheep dip or associated with the processing of imported wool containing residues of the pesticide.

Chlorfenvinphos and cypermethrin also have plant protection uses and it is possible that some of the failures have arisen from this use.

Some sheep dip pesticides, for example diazinon and propetamphos, often exceed the 0.1µg/l standard.

iv) Organo-tin pesticides

The organo-tin pesticides comprise tributyl tin and triphenyl tin. EQS failures for both pesticides in England and Wales for 1996 are shown in Figure 3.6.

Figure 3.5 Surface water sites failing sheep dip Environmental Quality Standards in England and Wales during 1996

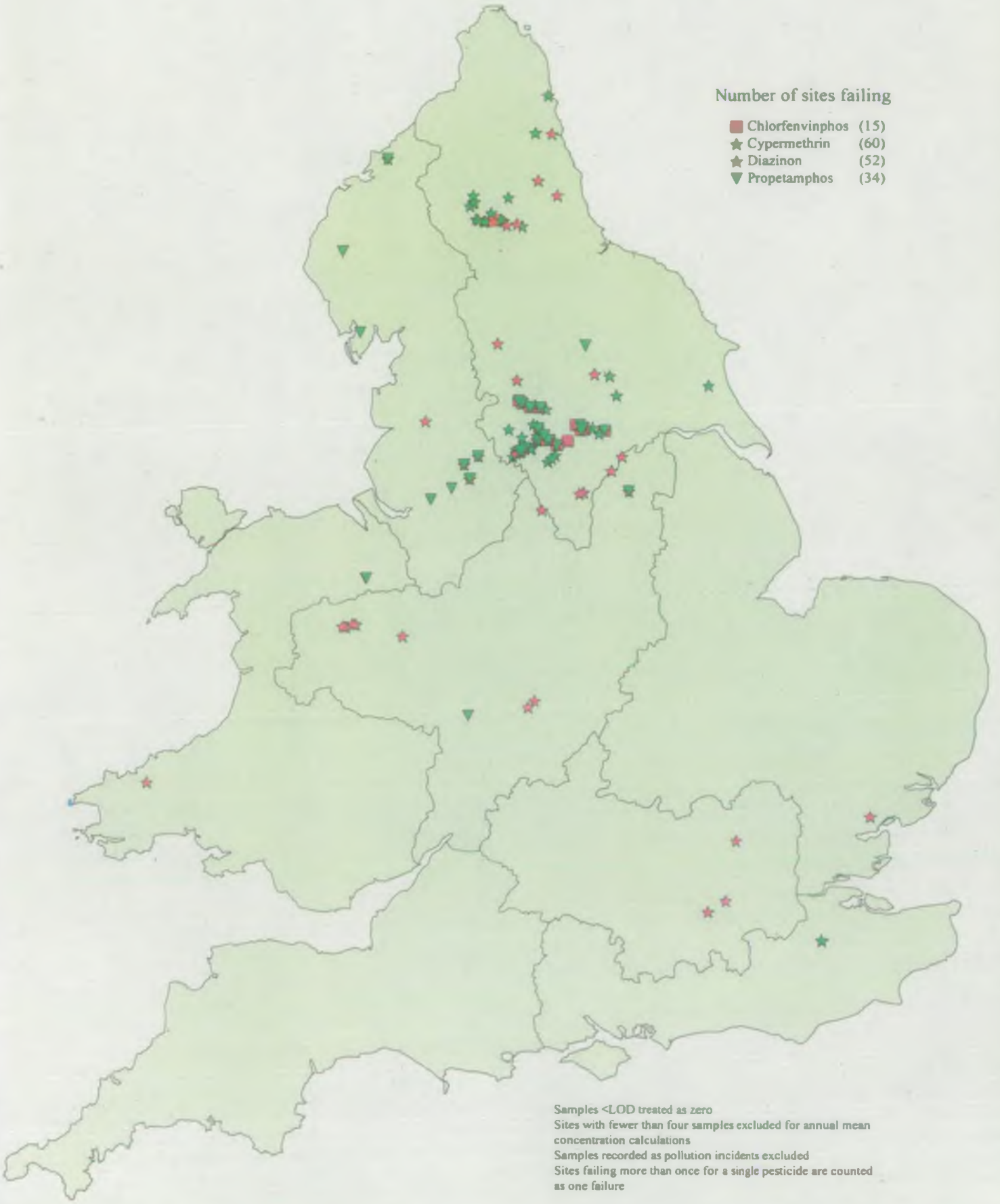
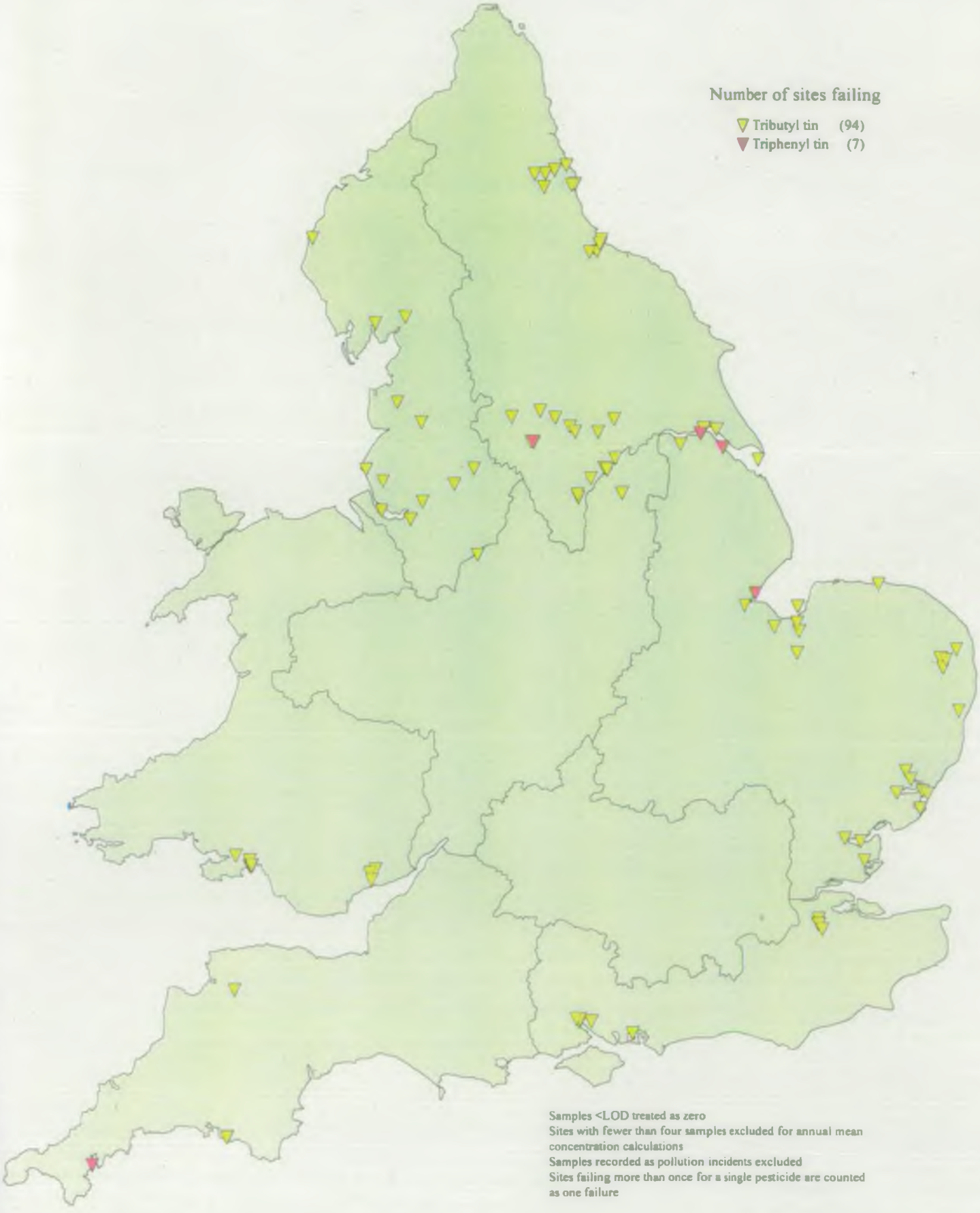


Figure 3.6 Surface water sites failing organo-tin pesticide Environmental Quality Standards in England and Wales during 1996



In 1996 the organo-tin pesticide EQSs became statutory. As a consequence, all regions monitored organo-tins in that year. South West Region and North West Region had monitored tributyl tin and triphenyl tin in previous years.

Most of the failures in estuarine and marine waters are most likely due to the use of the 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 boats over 25m in length were imposed in 1987.

There are some tributyl tin EQS failures in freshwaters, particularly in the North East Region. There is evidence of some illegal use of antifoulant paints containing tributyl tin on small craft. Leaching from resuspended sediments as a result of its historic use on small boats and its use as a wood preservative may also have contributed to the EQS failures. As this is the first year organo-tin pesticides have been monitored in most regions, not all sources of EQS failures in freshwaters have been identified.

Triphenyl tin is no longer used in antifoulants, but it 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 1996 are thought to be due to its past use in antifoulants, and not its use in plant protection products.

v) Moth-proofing pesticides

High numbers of EQS exceedences for the moth-proofing pesticides PCSD/eulan, cyfluthrin and permethrin are detected each year, mostly in the North East and Midland regions (see Figure 3.7). These pesticides are mainly associated with the textiles and carpet manufacturing industries and sampling is targeted in these areas to monitor discharges, hence the high number of EQSs recorded.

Although permethrin has other uses, including in agriculture, it is most likely that the EQS failures are due to its use as a moth-proofing agent.

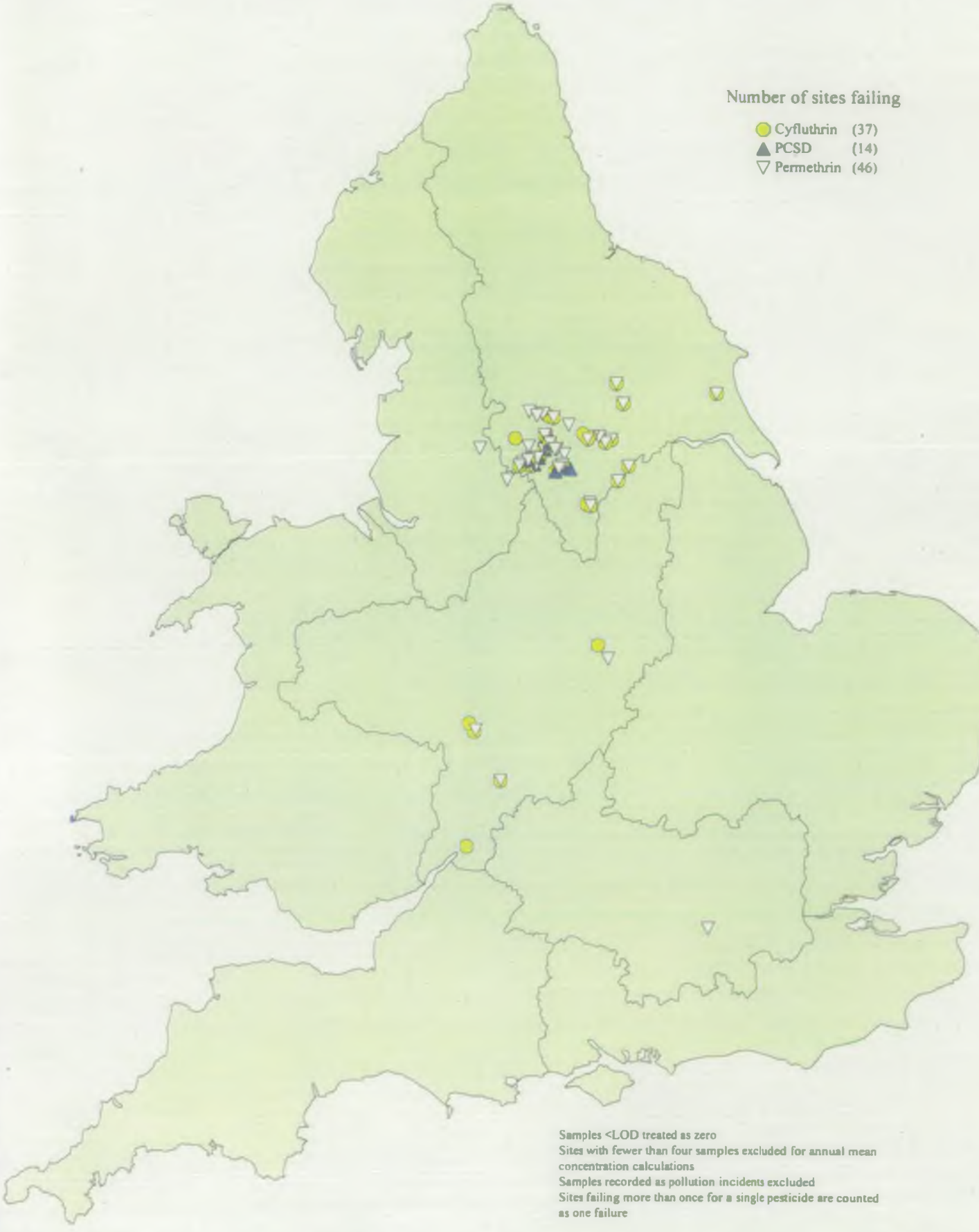
3.2 Drinking Water Directive standards

In addition to the EQSs, the 1996 data were also compared against the Drinking Water Directive standard. The Drinking Water Directive sets Maximum Allowable Concentration of 0.1µg/l (micrograms/litre) 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 0.1 µg/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 used, 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 "background" concentrations.

Of the 167 pesticides analysed in 1996, more than half (100 pesticides) were detected on at least

Figure 3.7 Surface water sites failing Environmental Quality Standards for moth-proofing agents in England and Wales during 1996



one occasion above 0.1 µg/l, a quarter (41 pesticides) were detected at least once but did not exceed 0.1 µg/l, and approximately a fifth (28 pesticides) were never detected above the limit of detection. Detailed information on all pesticides can be found in the Data Summary Document(Reference 3).

These figures indicate a slight increase in pesticide exceedences for 1996 compared with the data for 1995, where 75 of the 158 pesticides monitored were detected above 0.1µg/l, 43 were detected at least once but did not exceed 0.1µg/l, and the other 40 pesticides were not detected.

Overall, the numbers of pesticides detected above 0.1µg/l have risen from 52 in 1992 to 100 in 1996. This increase is probably more a reflection of improved analytical techniques and a wider range of determinands monitored (from 120 pesticides in 1992 to 167 pesticides in 1996) rather than a real increase in pesticide concentrations in water.

3.2.1 Exceedences of 0.1 µg/l in surface freshwaters

Of the 161 pesticides analysed in surface freshwaters, 99 pesticides (61 percent) were detected above 0.1 µg/l on at least one occasion, 34 pesticides (21 per cent) were detected but did not exceed the 0.1 µg/l limit, and 28 pesticides (18 per cent) were never detected above the limit of detection.

The herbicides diuron, atrazine, isoproturon, MCPA, simazine, 2,4-D and mecoprop exceeded the 0.1 µg/l standard most frequently in 1996 (Table 3.3). In addition pesticides used in industry, such as the moth-proofing agents PCSD/eulan and permethrin, and the timber preservative pentachlorophenol were also found quite often above 0.1 µg/l, as were the sheep dip pesticides diazinon and propetamphos.

Figure 3.8 illustrates the trends in exceedences of 0.1µg/l in surface freshwaters in England and Wales between 1992 and 1996. Here the top 10 pesticides are shown. The detailed data are given in the data summary document (Reference 3).

The cereal herbicide isoproturon (IPU) exceeded 0.1µg/l most frequently in surface freshwaters in England and Wales in 1996. The percentage failures have been increasing steadily since 1992 from 10 per cent, to 17 per cent in 1995 and 19.5 per cent in 1996. However, on a regional scale the percentage of samples above 0.1µg/l has declined in all but two regions, Southern and Welsh (Appendix I). Following recent restrictions on its use, isoproturon can only be applied post-emergence of the crop and the maximum rate is 2.5 kg per hectare. Many farmers use reduced application rates but high rates are used to control black-grass and brome on heavier soils.

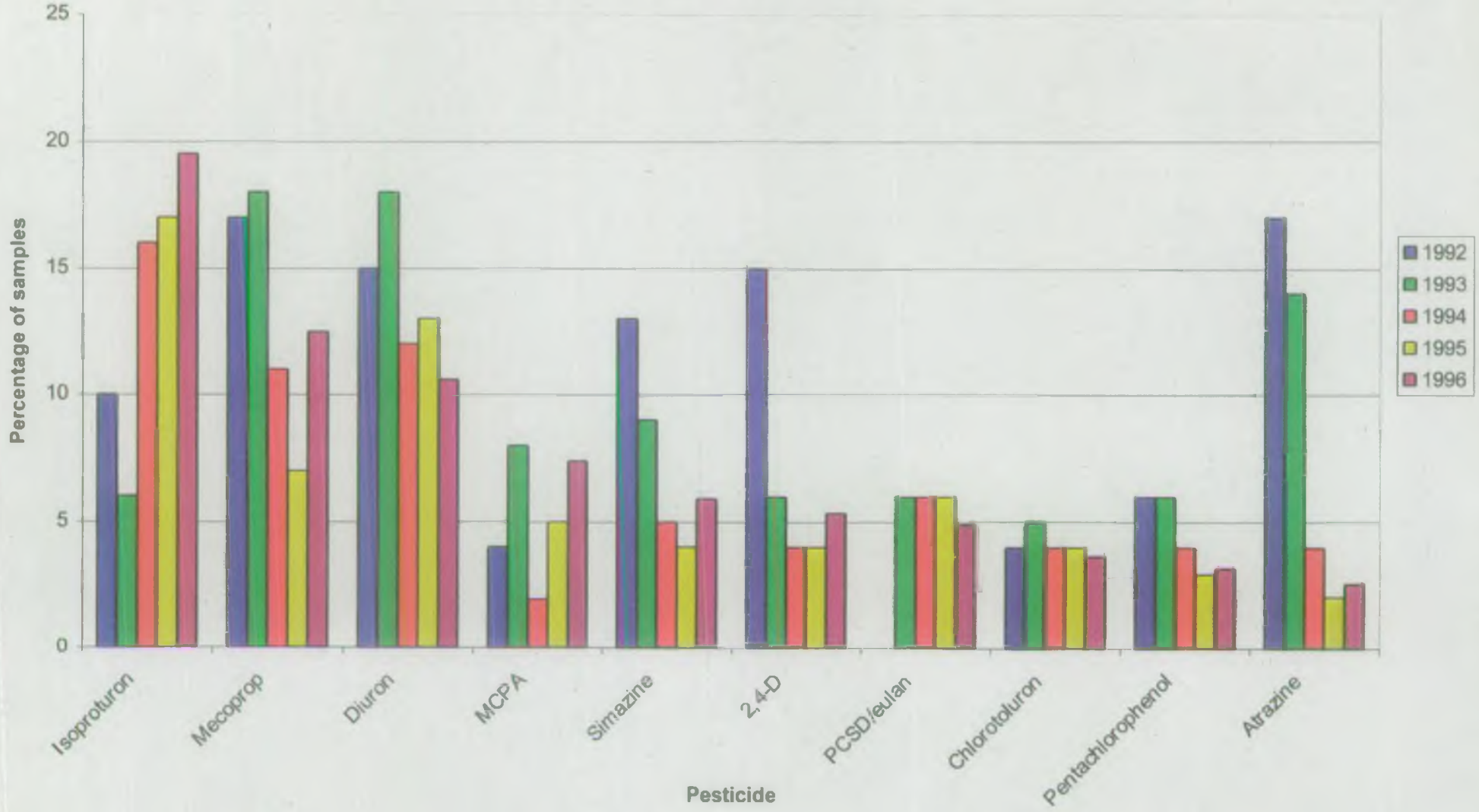
Table 3.3 The 25 pesticides most frequently exceeding 0.1 µg/l in surface freshwaters in England and Wales, 1996*

Pesticide	Total number of samples	Number of samples > 0.1µg/l	% samples > 0.1µg/l
Isoproturon	4116	804	19.5
Mecoprop	4042	504	12.5
Diuron	2586	381	10.6
MCPA	2423	179	7.4
Simazine	6034	358	5.9
2,4-D	2991	160	5.4
PCSD/eulan	898	44	4.9
Chlorotoluron	4003	147	3.7
Pentachlorophenol	3763	122	3.2
Atrazine	6173	160	2.6
Oxamyl	891	23	2.6
Diazinon	3716	92	2.5
Cyfluthrin	955	21	2.2
Benazolin	666	14	2.1
Propetamphos	3273	61	1.9
Bromoxynil	1326	24	1.8
Bentazone	1881	30	1.6
Permethrin	1284	19	1.5
Dichlorprop	1583	23	1.5
Cypermethrin	926	13	1.4
Carbofuran	1125	15	1.3
Aldicarb	970	12	1.2
Terbutryn	1698	19	1.1
Dichlobenil	1255	14	1.1
Carbaryl	1192	12	1.0

* Pesticides with low sample numbers have been excluded from the analysis. Raw monitoring data is contained in the data summary document (Reference 3).

For the previous three years mecoprop has steadily declined from 18 per cent of samples above 0.1µg/l in 1993 to seven per cent in 1995. However in 1996 the percentage of samples detected above 0.1µg/l increased to 12.5 per cent. Mecoprop and mecoprop-P are extensively used to control chickweed in herbage seed crops and short-term grass leys and it is a cheap form of controlling perennial weeds such as docks in established grassland. High rates are required and follow-up treatments are often necessary with heavy weed infestations. It is also applied to winter wheat crops, alone and in mixtures, and to control volunteer beans and broad-leaved weeds. The application rate for mecoprop-P is half that of mecoprop. Analysis in water does not distinguish between the two different forms of mecoprop. MAFF usage figures show that between 1994 (Reference 4) and 1996 (Reference 5), the area of land treated with mecoprop (mecoprop and mecoprop-P) has declined by 72,847 hectares. It was generally thought in 1995 that the reduction in mecoprop might have been related to the introduction of the more active form, mecoprop-P, and the subsequent gradual phasing out of mecoprop. However, the agreed two-year "use-up" period for mecoprop began in December 1996, when its manufacture ceased. Therefore it is

Figure 3.8 Pesticides most frequently exceeding 0.1µg/l in surface freshwaters in England and Wales, 1992-96



unlikely that any changes in concentrations of mecoprop in water would be apparent until after this period. The number of samples taken for mecoprop in 1996 almost doubled compared to 1995, from 2,608 to 4,042 samples. This may be an explanation for the increase in exceedences of 0.1µg/l in surface freshwaters in 1996.

Since 1992 there has been a downward trend in detections of simazine and atrazine above 0.1 µg/l from 13 per cent in 1992 to four per cent in 1995 for simazine and from 17 per cent in 1992 to two per cent in 1995 for atrazine. This is a direct result of the ban on the use of atrazine and simazine on non-cropped land in August 1993. In 1996 atrazine appears to have stabilised at around two to three per cent and simazine has increased slightly by two per cent. Simazine is recommended for a number of agricultural and horticultural crops, whereas atrazine is only recommended for grass weed control in maize (and sweetcorn). There is some concern that atrazine concentrations in surface waters may rise because of the increasing acreage of maize being grown. 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 appeared to be increasing in 1993 because of its increased usage. However, since then detections of diuron above 0.1µg/l have been declining. The manufacturers of diuron established a stewardship campaign to promote good practice, which may have helped to reduce the number of exceedences.

3.2.2 Exceedences of 0.1 µg/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 0.1 µg/l standard.

Of the 78 pesticides analysed in marine waters, 14 pesticides (18 per cent) were detected above 0.1 µg/l on at least one occasion, 31 pesticides (40 per cent) were detected but did not exceed the 0.1 µg/l limit, and 33 pesticides (42 per cent) were never detected above the limit of detection.

Many of the same pesticides were detected in saline waters as in freshwaters, with diuron, isoproturon, mecoprop and MCPA being detected most frequently above 0.1 µg/l (Table 3.4). The high number of exceedences for diuron in the Thames estuary may have been from its use in antifouling paints on boats as well as its use in amenity weed control.

Table 3.4 Pesticides exceeding 0.1 µg/l in estuaries and coastal waters in England and Wales, 1996

Pesticide	Total number of samples	Number of samples > 0.1µg/l	% samples > 0.1µg/l
Diuron *	71	41	57.8
Isoproturon*	67	24	35.8
Mecoprop*	69	23	33.3
MCPA*	68	10	14.7
Permethrin	58	2	3.5
2,4-D	72	2	2.8
Simazine	483	11	2.3
Tributyl tin	964	18	1.9
Chlorotoluron*	71	1	1.4
Triphenyl tin	606	4	0.7
Pentachlorophenol	1150	3	0.3
pp DDT	1012	2	0.2
Trifluralin	557	1	0.2
Atrazine	482	1	0.2

* Results from a special survey on the Thames estuary.

3.2.3 Exceedences of 0.1 µg/l in groundwaters

The water supplies derived from groundwater are regularly monitored by water companies and as a result Agency monitoring of these sources is limited.

A total of 98 pesticides were monitored in groundwater in 1996. As shown in Table 3.5 only nine of the 98 pesticides exceeded 0.1 µg/l, 36 pesticides (37 per cent) were detected but did not exceed the 0.1 µg/l limit, and 53 pesticides (54 per cent) were not detected above the limit of detection.

The pesticide most frequently exceeding 0.1µg/l was atrazine. This is thought to be mainly due to its historical use in amenity areas and its current use on maize crops.

Trends in groundwater data between years have not been represented as it is difficult to draw comparisons from a small selection of monitoring data.

The groundwater data are contained in the Data Summary Document (Reference 3).

Table 3.5 Pesticides exceeding 0.1 µg/l in groundwaters in England and Wales, 1996

Pesticide	Total number of samples	Number of samples > 0.1µg/l	% samples > 0.1µg/l
Atrazine	400	19	4.8
Pentachlorophenol	146	2	1.4
Isoproturon	276	3	1.1
Diuron	194	2	1.0
Mecoprop	218	2	0.9
Chlorotoluron	278	1	0.4
Linuron	275	1	0.4
Malathion	290	1	0.3
Gamma-HCH	483	1	0.2

Not all regions monitor groundwater. However, groundwater monitoring will be required in all regions in future as part of the National Groundwater Monitoring Programme which is currently being implemented for approximately 90 groundwater supplies.

4 Discussion

The sheep dip pesticides such as cypermethrin, diazinon and propetamphos exceed their EQSs frequently. A report has recently been produced by ADAS on behalf of the Agency to review the pollution problems associated with sheep dipping activities, provide a series of recommendations to promote better practice among users and hopefully reduce pollution. This report has been circulated for consultation. The Agency will be using the report and the responses to the consultation to develop a sheep dip strategy.

The sheep dip and textiles working group has been set up to tackle the concerns about the environmental impact of sheep dip pesticides in effluent 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. In addressing the problem, the group's considerations include effluent treatment technology, minimisation of the use of sheep dip and marketing of low-residue wool.

Organo-tin occurrences in marine waters are of concern to the Agency because of the possible adverse affects of these compounds on shellfish. Organo-tin compounds were banned from use as antifouling additives in paint for use on ships under 25m in length in 1987. However, the 1996 monitoring data show that these compounds are widely found in marine water and some freshwater environments above the EQS. This is an area where the Agency is working closely with DETR and Health and Safety Executive (HSE) to better quantify the problem and seek solutions.

A wide range of pesticides occur at low concentrations that are not sufficiently toxic to harm aquatic life. These cause concern where the drinking water standard needs to be met. Although the water companies are directly responsible for ensuring drinking water meets the 0.1 µg/l standard, the Agency must take appropriate action to minimise the occurrences of pesticides exceeding 0.1 µg/l in environmental waters. The majority of these pesticide exceedences arise from diffuse pollution sources.

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 pesticide 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. These are mainly applied to crops in the autumn and are therefore more likely to degrade slowly because of low temperatures and be prone to leaching into drainage waters. 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, to try to reduce the number of exceedences of 0.1 µg/l nationally. The Agency is working with the co-ordinators of the IPU stewardship campaign. Results from the 1996 monitoring effort show that since the IPU stewardship campaign was introduced in 1995, there has not been a significant decline in isoproturon exceedences of 0.1 µg/l. Data from some water companies show an increase in IPU exceedences in the 1997/98 cropping season compared with previous years. However, diuron exceedences do seem to be declining.

The Agency co-ordinates a voluntary agreement between Railtrack and water companies within England and Wales where the application of diuron has been restricted and substituted with glyphosate, on designated lengths of railway track, to protect drinking water abstraction sites. The restricted lengths of track account for approximately 5 per cent of the total railway track in England and Wales. The Agency is also part-funding a collaborative study into pesticide transport from hard surfaces and looking at ways to minimise the contamination of water.

It is clear that the ban on the use of atrazine and simazine on non-cropped land has had a dramatic effect on the frequency of exceedences above 0.1 µg/l. However, although atrazine concentrations look to have reached a stable low level, simazine levels have risen slightly in 1996. 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, for example in the south west. The Agency will continue to monitor atrazine levels in these areas.

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 (Reference 6). 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 the 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.

* POPPIE Interactive CD-ROM is available to all Agency staff and also to external organisations on a cost recovery basis through the National Centre for Ecotoxicology and Hazardous Substances (see Appendix X).

5 Glossary

ACP - Advisory Committee on Pesticides
Active ingredient - the component of a pesticide, with the pesticidal activity
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 an 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 and includes 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 (PPP) – 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 ammended) and the Plant Protection Products (Basic Conditions) Regulations 1997 for actual definition).
MAFF - Ministry of Agriculture, Fisheries and Food
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 therefore is persistent in the soil
Toxicity - the relative poisoning effect of a chemical
VMD - Veterinary Medicines Directorate

6) References

1) Environment Agency (1998) Pesticide Aquatic Pollution: Incidents in England and Wales, 1992-96. National Centre for Ecotoxicology and Hazardous Substances.

2) Environment Agency (1998) Water Pollution Incidents in England and Wales 1997. Report of the Environment Agency. The Stationery Office, London.

3) Data summary document – pesticide monitoring data 1996. Environment Agency, National Centre for Ecotoxicology and Hazardous Substances.

4) MAFF (1995) Pesticide usage survey report 127: arable farm crops in Great Britain 1994. MAFF publications.

5) MAFF (1997) Pesticide usage survey report 141: arable farm crops in Great Britain 1996. MAFF publications.

6) Environment Agency (1998) Monitoring of pesticide residues in environmental media – priorities for the Environment Agency. Environment Agency, National Centre for Ecotoxicology and Hazardous Substances.

7) Appendices

Appendix I – pesticides most frequently exceeding 0.1µg/l in surface freshwaters in each Agency region 1993-96

The regional picture

Detailed summaries of regional monitoring data for surface freshwater, marine water and groundwater are contained in the Data Summary Document (Reference 3). Figures 7.1 to 7.8 show the pesticides that most frequently exceed 0.1µg/l in each region between 1993 and 1996.

Anglian

Regular EQS failures within the region are mainly associated with the historic use of pesticides. At one site dieldrin is regularly detected due to its past use in the timber treatment industry (Figure 3.3). A treatment plant has now been installed to clean up contaminated run-off from the site so the situation is expected to improve. In addition to historic problems EQS exceedences for HCH may be as a result of run-off from agricultural land or from domestic use.

The EQS failures for tributyl tin in marine waters in the Anglian Region are most likely associated with their use in antifoulant paints (Figure 3.2).

The herbicides isoproturon, mecoprop, simazine, chlorotoluron and diuron exceed 0.1 µg/l most frequently in surface freshwaters and in saline waters (Figure 7.1). Isoproturon, chlorotoluron and mecoprop are major agricultural herbicides and the number of exceedences of 0.1 µg/l reflect the intensive arable farming in the region.

A special survey was undertaken in 1995 and 1996 in the vicinity of some potato washing plants. The survey indicated that there are elevated concentrations of chlorpropham and tecnazene (and its metabolites) associated with this industry. The Agency has been liaising with the manufacturers of tecnazene to promote "best practice" both with the growers and at potato washing sites.

Midlands

EQS failures occurred for mainly diazinon, propetamphos, cyfluthrin, permethrin, isoproturon and endosulphan in the Midlands Region (Figure 3.1).

Compared with 1995, there has been a reduction in EQS failures for both diazinon and propetamphos in the Midlands (Figure 3.5). The majority of EQS failures for diazinon are most likely due to sheep dipping activities. Exceedences of propetamphos and some diazinon EQSs may be associated with discharges from some textile and carpet manufacturers in the region.

The EQS failures for the moth-proofing pesticides cyfluthrin and permethrin also arise from their use in the textiles and carpet manufacturing industry (Figure 3.7). These levels remain unchanged from 1995.

Endosulphan 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.

Mecoprop, isoproturon, diuron, MCPA, simazine and 2,4-D most frequently exceeded 0.1 µg/l in surface freshwaters, reflecting the agricultural nature of the region (Figure 7.2). Mecoprop often exceeds the standard with more than 25 per cent of samples above 0.1 µg/l. This is closely

followed by isoproturon which remains at the same level as 1995, with about one-fifth of samples above 0.1 µg/l.

In 1996 the herbicides mecoprop, diuron, MCPA and 2,4-D have been detected above 0.1 µg/l more frequently than in previous years. With the exception of 1995, mecoprop and diuron have been detected increasingly more often since 1993. MCPA and 2,4-D detections have risen to levels similar to that in 1993.

Another pesticide detected above 0.1µg/l was pentachlorophenol. Although pentachlorophenol detections have increased slightly in 1996, the general trend appears to be declining.

Very little marine water sampling is usually undertaken due to the small amount of coastline within the region. In 1996 no marine water sampling took place.

Only four out of the 64 pesticides monitored in groundwaters in the region exceeded 0.1 µg/l. These were pentachlorophenol, atrazine, malathion and gamma-HCH. However, only a small proportion of samples (fewer than 10 per cent) for each pesticide were above the limit of detection.

North East

There were a number of EQS failures for the moth-proofing pesticides PCSD/eulan, cyfluthrin and permethrin in the North East Region (Figure 3.7). These are primarily due to point source discharges associated with the textile industry. They also frequently exceed the 0.1 µg/l limit. Both permethrin and cyfluthrin failures have increased in 1996, the direct result of more frequent monitoring. Discharges from sewage treatment works contribute to these pesticide levels in the River Calder and several of its tributaries, the worst being the Mag Brook where the stream biota have been very seriously affected. In order to improve the quality of the Mag Brook, Yorkshire Water Services re-sewered Meltham in September 1996 and the effluent is now being transferred to Huddersfield Sewage Treatment Works. This should reduce the EQS failures for 1997.

There are a number of EQS exceedences for the sheep dip pesticides diazinon, chlorfenvinphos and cypermethrin (Figure 3.5). The majority of these are in the Leeds/Bradford area and are again primarily due to point source discharges from industries associated with various stages of wool processing. Currently there are few cost-effective treatments capable of removing pesticides from these processes. However, the industries involved are liasing with VMD, DETR and the Agency to try to find a solution. Diazinon, propetamphos, chlorfenvinphos and cypermethrin also exceed the 0.1 µg/l limit. Some EQS failures of HCH relate to imported wool being processed in West Yorkshire, which resulted in a prosecution in 1995. EQS failures have continued into 1996 due to the very long persistence of HCH in the environment.

Some EQS failures for the sheep dip pesticides in the north of the region are most likely attributable to sheep dipping activities, probably as a result of small-scale spills and/or incorrect disposal. In 1995 and 1996 a research project was undertaken to look at the impact of sheep dips on selected watercourses. Catchments were targeted where problems were anticipated and this resulted in a greater monitoring effort and consequently more frequent detection of EQS failures than would have been observed under the normal monitoring programme.

North East Region has not monitored tributyl tin or triphenyl tin before 1996. Several sites failed EQSs for tributyl tin in freshwater and marine waters in 1996 (Figure 3.6). Some of these are most likely due to its manufacture or use as an antifouling agent. Further investigation work has been undertaken to identify sources of tributyl tin for some of the freshwater sites that failed.

EQS failures for the plant protection products MCPA, mecoprop, 2,4-D, fenitrothion and triazophos are most likely to be associated with discharges from pesticide manufacturers in the West Yorkshire area, rather than their agricultural usage (Figure 3.4).

The main exceedences of 0.1 µg/l in the region are for the herbicides mecoprop, isoproturon, MCPA, 2,4-D, diuron, simazine and atrazine (Figure 7.3). These may result from pesticide manufacturers' consented discharges and some agricultural use in lowland river catchments.

Other exceedences of 0.1 µg/l including pentachlorophenol, sulcofuron, diazinon, PCSD/eulan, propetamphos, cyfluthrin, permethrin and chlorfenvinphos, reflect the industrial nature of the region. Although the number of detections may have increased slightly in 1996, the general trend for most of these pesticides is declining.

The only exceedence of 0.1 µg/l in groundwater is for atrazine, due to its historic use in non-agricultural situations.

North West

EQS failures in North West Region include diazinon, propetamphos, endosulphan and tributyl tin.

EQS exceedences for diazinon and propetamphos in the north of the region are probably associated with sheep dipping (Figure 3.5). The cluster of failures in the south of the region most likely relate to discharges of textile finishing waste. Diazinon and propetamphos also exceed 0.1µg/l quite frequently.

The EQS failures for permethrin may result from discharges from the textiles finishing factories and sewage treatment works in the area (Figure 3.7). There has been a reduction in the number of failures for permethrin in 1996, compared with 1995. However, this may be due to reduced monitoring effort rather than actual concentrations.

There are four EQS failures for endosulphan in saline and freshwaters, most likely resulting from its use as an agricultural/horticultural insecticide. Further investigation work has been undertaken to identify sources of tributyl tin for some of the freshwater sites that failed.

The majority of EQS failures for tributyl tin occur around the Mersey as a result of its use on large ships (Figure 3.6). 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 tributyl tin use and some may result from manufacturing discharges in the area.

Exceedences of 0.1 µg/l are relatively low in the region. Pentachlorophenol, atrazine and simazine often exceeded 0.1 µg/l in surface freshwaters and were detected in saline waters (Figure 7.4).

Pesticides are not monitored in groundwaters in the region. The water companies notify the Agency of any exceedences of 0.1 µg/l. None were reported in 1996.

Southern

Detections of EQS failures for cypermethrin, diuron, fenitrothion, pirimicarb, pirimiphos methyl

and total HCH in freshwaters is the result of more frequent monitoring as part of a special survey initiated on the River Medway near to the site of a pesticide manufacturer. The EQS failures relate to historical contamination around the site.

EQS failures for total HCH have been detected in saline waters of the River Medway estuary (Figure 3.3). There is currently no explanation for these exceedences. They may be as a result of run off from agricultural land or from domestic use, and their source is being investigated further.

Tributyl tin and triphenyl tin were monitored for the first time in the region in 1996 (Figure 3.6). EQS failures for tributyl tin occurred in saline waters and are mostly due to contamination from marine vessels.

The pesticides that often exceeded 0.1 µg/l were the agricultural herbicides simazine, isoproturon, mecoprop, chlorotoluron and mecoprop (Figure 7.5). Diuron also exceeded 0.1 µg/l quite often, but appears to be declining from previous years.

Only three pesticides exceeded the 0.1 µg/l limit in groundwater. These were the agricultural herbicides isoproturon, mecoprop and atrazine.

South West

EQS failures occurred for five List I pesticides (Figure 3.3). These occurred at the Kings Weston Rhyne sampling site. The Rhyne drains a highly industrialised area of Avonmouth before passing underground through a culvert and discharging to the River Severn estuary. All of these List 1 pesticides exceeded 0.1 µg/l in surface freshwaters.

The tributyl tin and triphenyl tin EQS failures occurred in marine waters in three main sampling sites - the Falmouth Docklands, Yealm Estuary and International Paints surface boil (Figure 3.6). These EQS failures relate to their use on boats and marine vessels.

Only a small percentage of freshwater samples exceed 0.1 µg/l in the region each year (Figure 7.6). The main exceedences in 1996 were for mecoprop, atrazine, isoproturon and MCPB, resulting from their agricultural use. Other exceedences included tributyl tin, which occurred in both freshwater and saline waters.

Several pesticides were detected above the limit of detection in groundwater, but none were above 0.1 µg/l.

Thames

The number of EQS failures has declined in 1996. Failures occurred for diazinon, azinphos methyl and permethrin (Figure 3.1).

Atrazine, diuron and simazine regularly exceeded 0.1 µg/l in surface freshwaters (Figure 7.7). Other pesticides exceeding 0.1 µg/l included the agricultural group of herbicides, the "urons", which include chlorotoluron, linuron and isoproturon, and mecoprop.

Groundwater monitoring indicates that by far the most exceedences are associated with atrazine. However, linuron, diuron, isoproturon, mecoprop and chlorotoluron were also detected above 0.1 µg/l.

Welsh

There were very few EQS failures, apart from those for tributyl tin. Three sites failed for the sheep dip pesticides diazinon and propetamphos, which is believed to be a result of sheep dipping (Figure 3.5). One site failed for atrazine and simazine, which may be associated with changes in fodder production to maize, and one site in Herefordshire failed for carbendazim, a fungicide commonly used on agricultural crops and fruit (Figure 3.4).

The tributyl tin failures in both saline and freshwaters all occur in and around docks where contamination from marine vessels is the likely cause, or in estuaries with high levels of resuspended sediments, where tributyl tin inputs may be historic or current (Figure 3.6). Tributyl tin and triphenyl tin have not been monitored in previous years.

There were relatively few exceedences of 0.1 µg/l (Figure 7.8). Most frequent exceedences were for mecoprop, isoproturon, diuron, atrazine and simazine.

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, isoproturon, was detected above the 0.1 µg/l limit in one sample for groundwater.

Figure 7.1 Pesticides most frequently exceeding 0.1µg/l in surface freshwaters in Anglian Region 1993-96

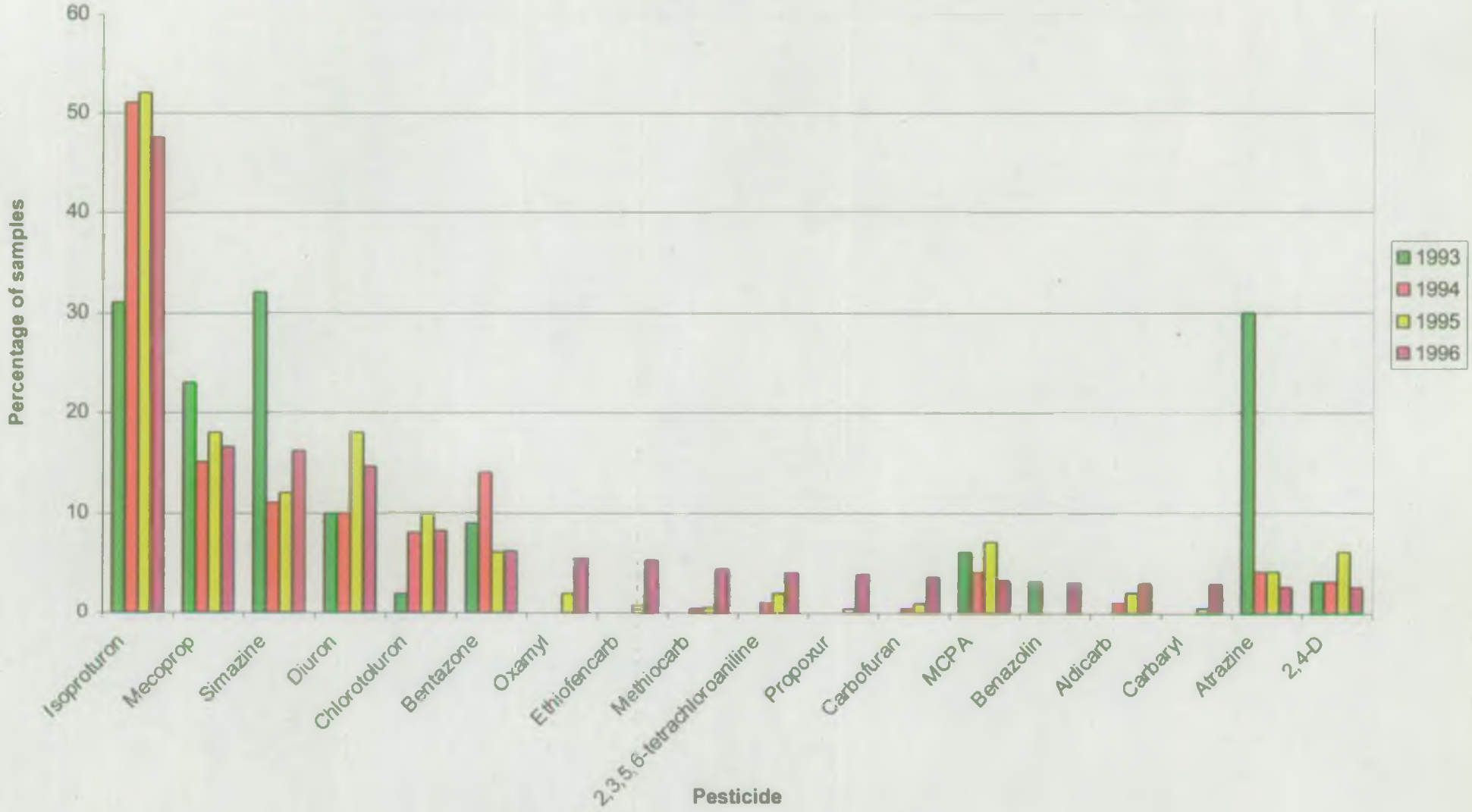


Figure 7.2 Pesticides most frequently exceeding 0.1µg/l in surface freshwaters in Midlands Region 1993-96

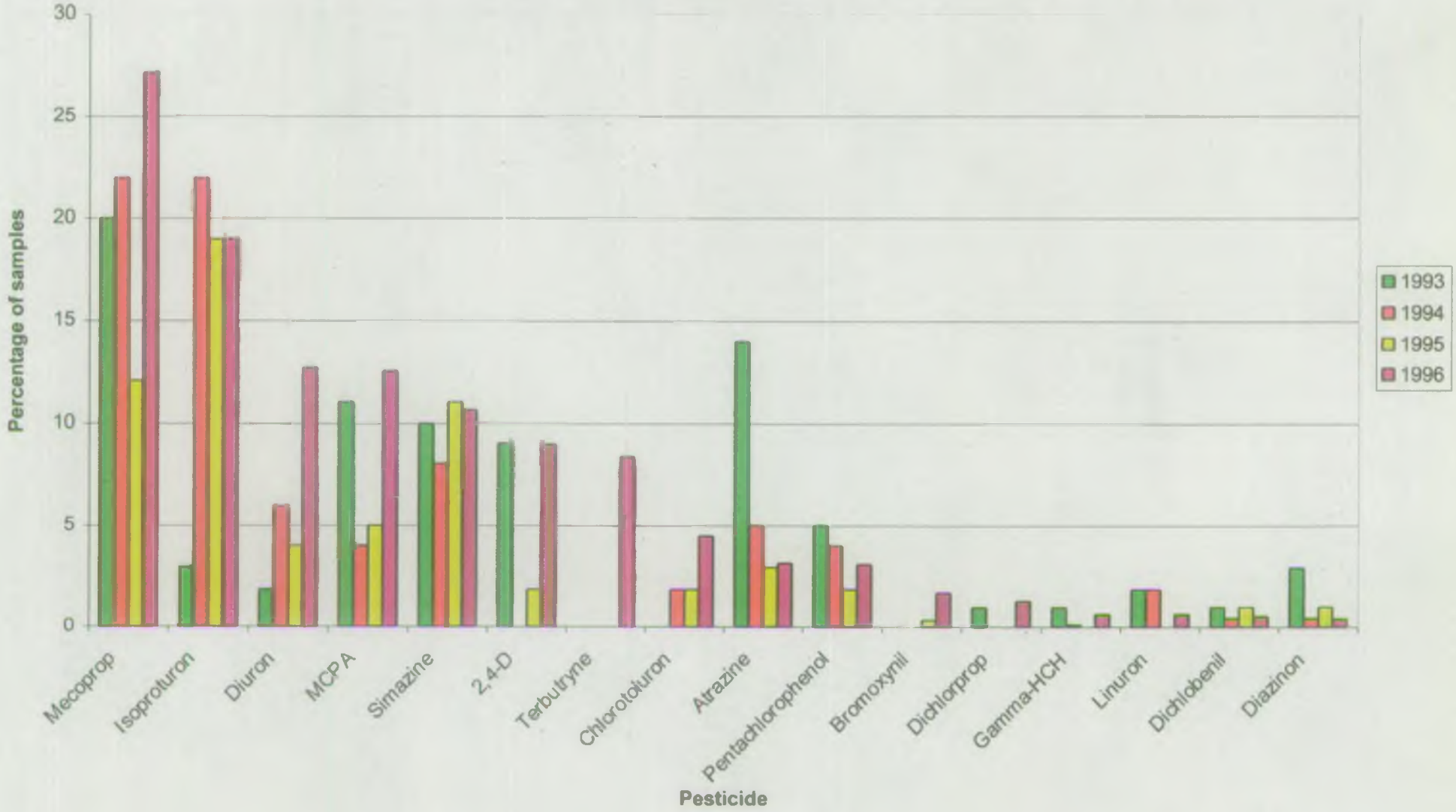


Figure 7.3 Pesticides most frequently exceeding 0.1µg/l in surface freshwaters in North East Region 1993-96

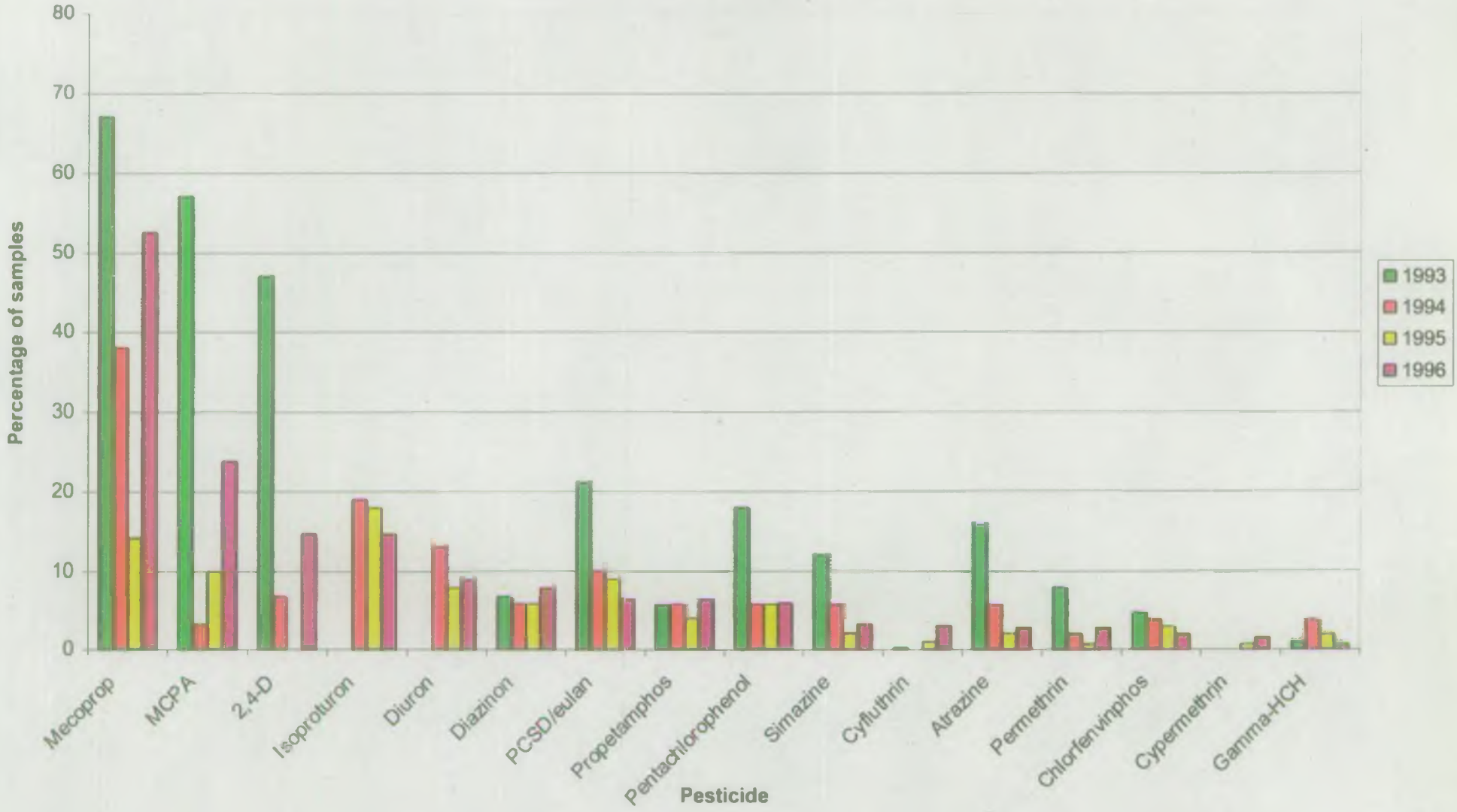


Figure 7.4 Pesticides most frequently exceeding 0.1µg/l in surface freshwaters in North West Region 1993-96

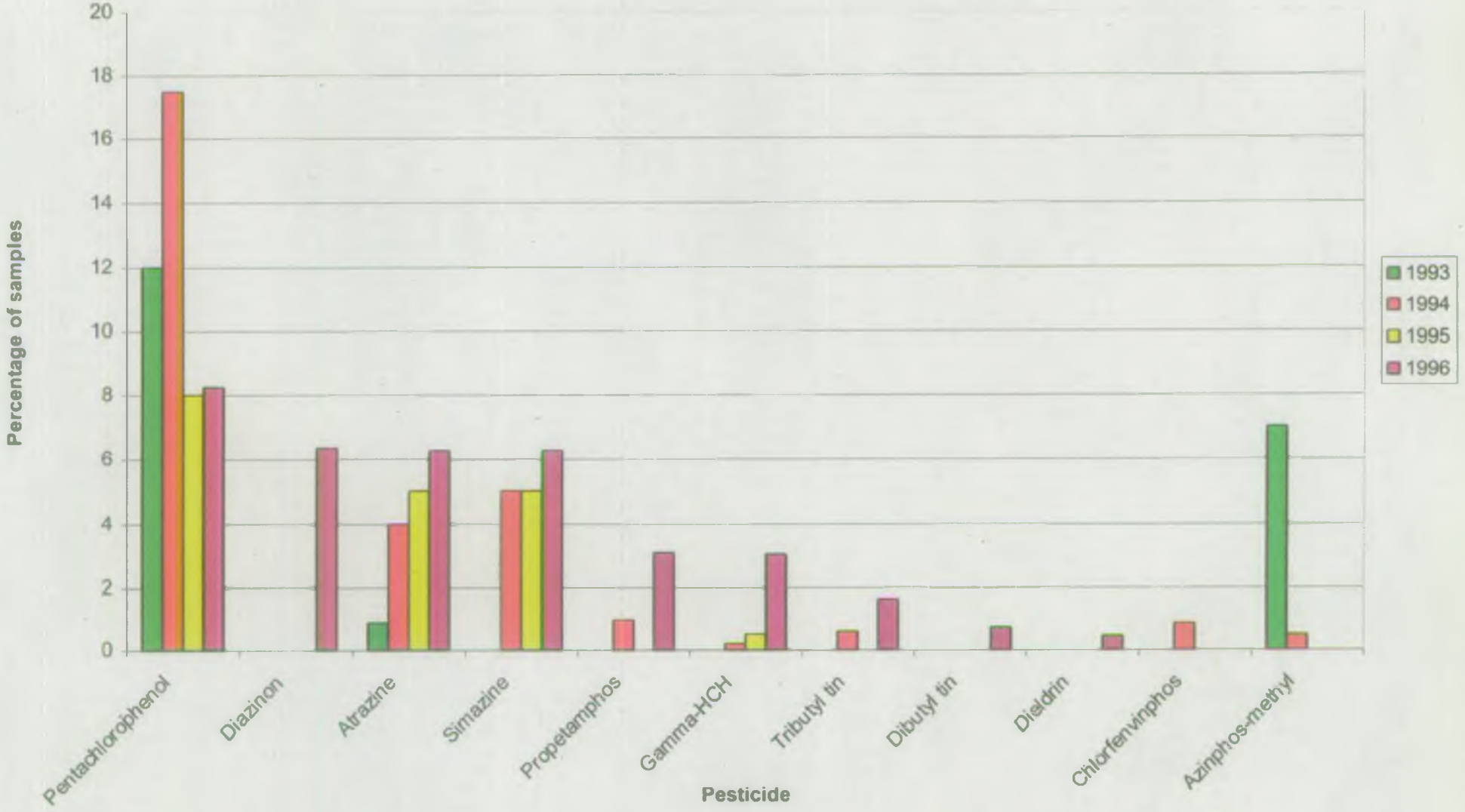


Figure 7.5 Pesticides most frequently exceeding 0.1µg/l in surface freshwaters in Southern region 1993-6

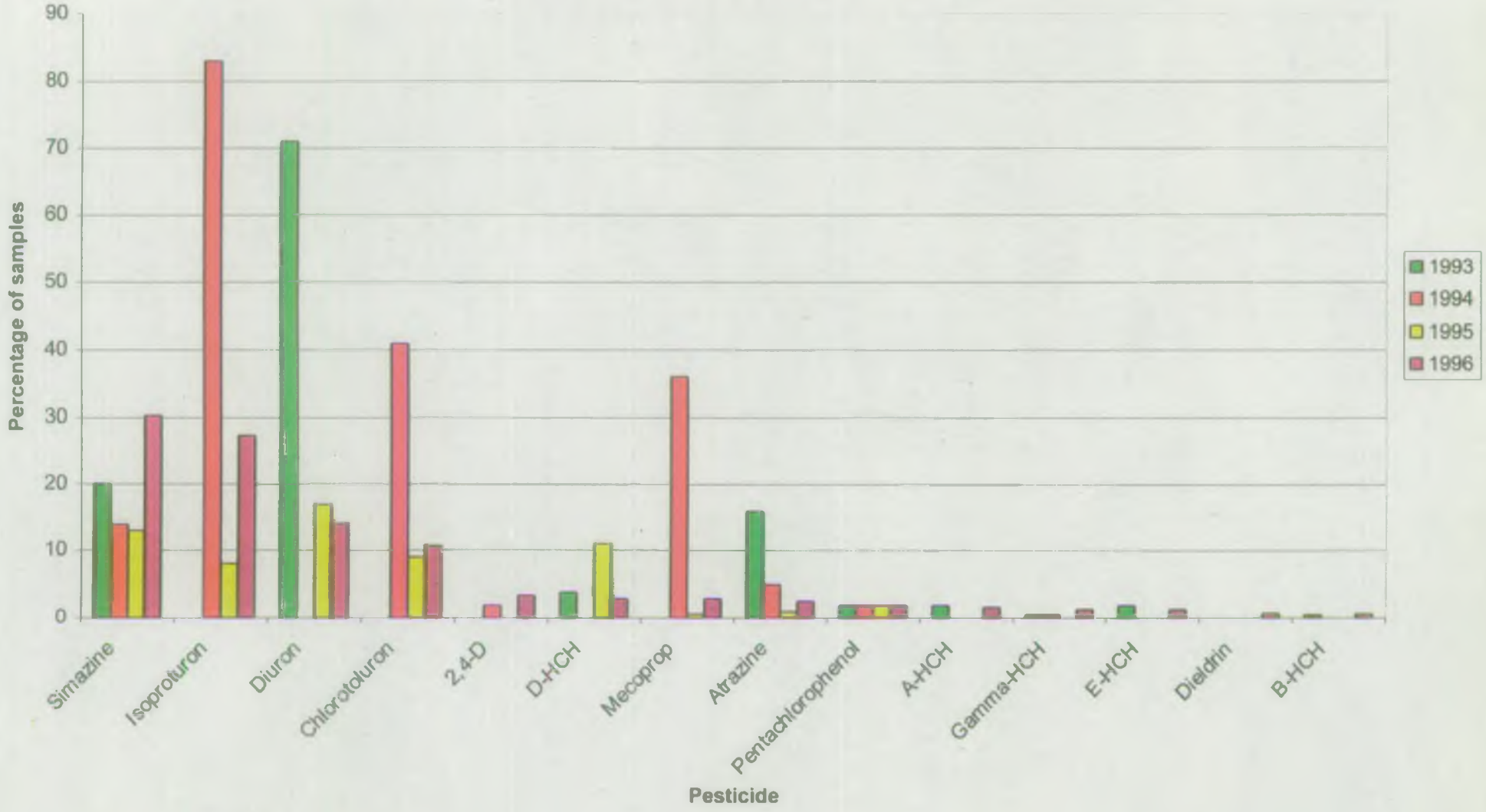


Figure 7.6 Pesticides most frequently exceeding 0.1µg/l in surface freshwaters in South West Region 1993-96

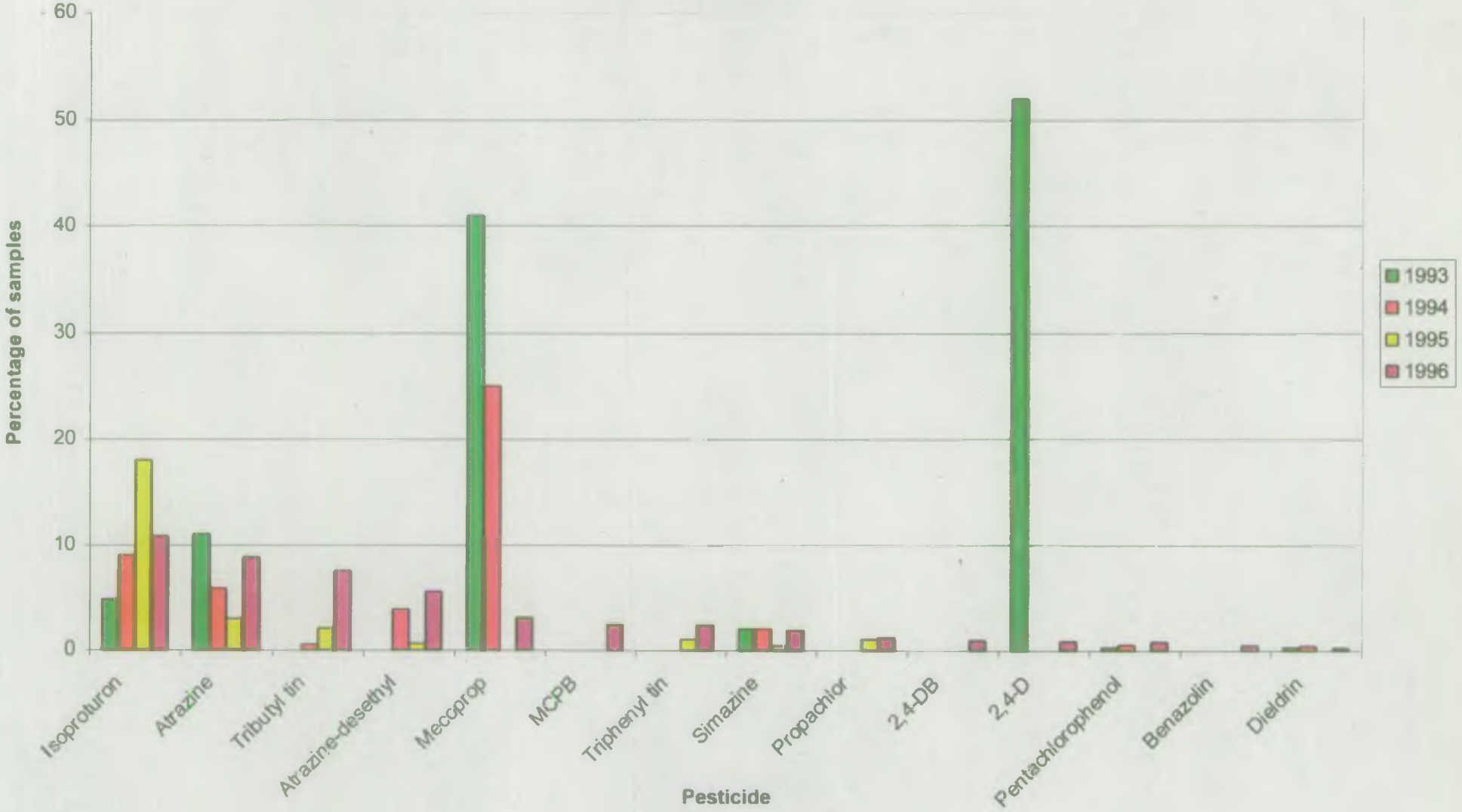


Figure 7.7 Pesticides most frequently exceeding 0.1µg/l in surface freshwaters in Thames Region 1993-96

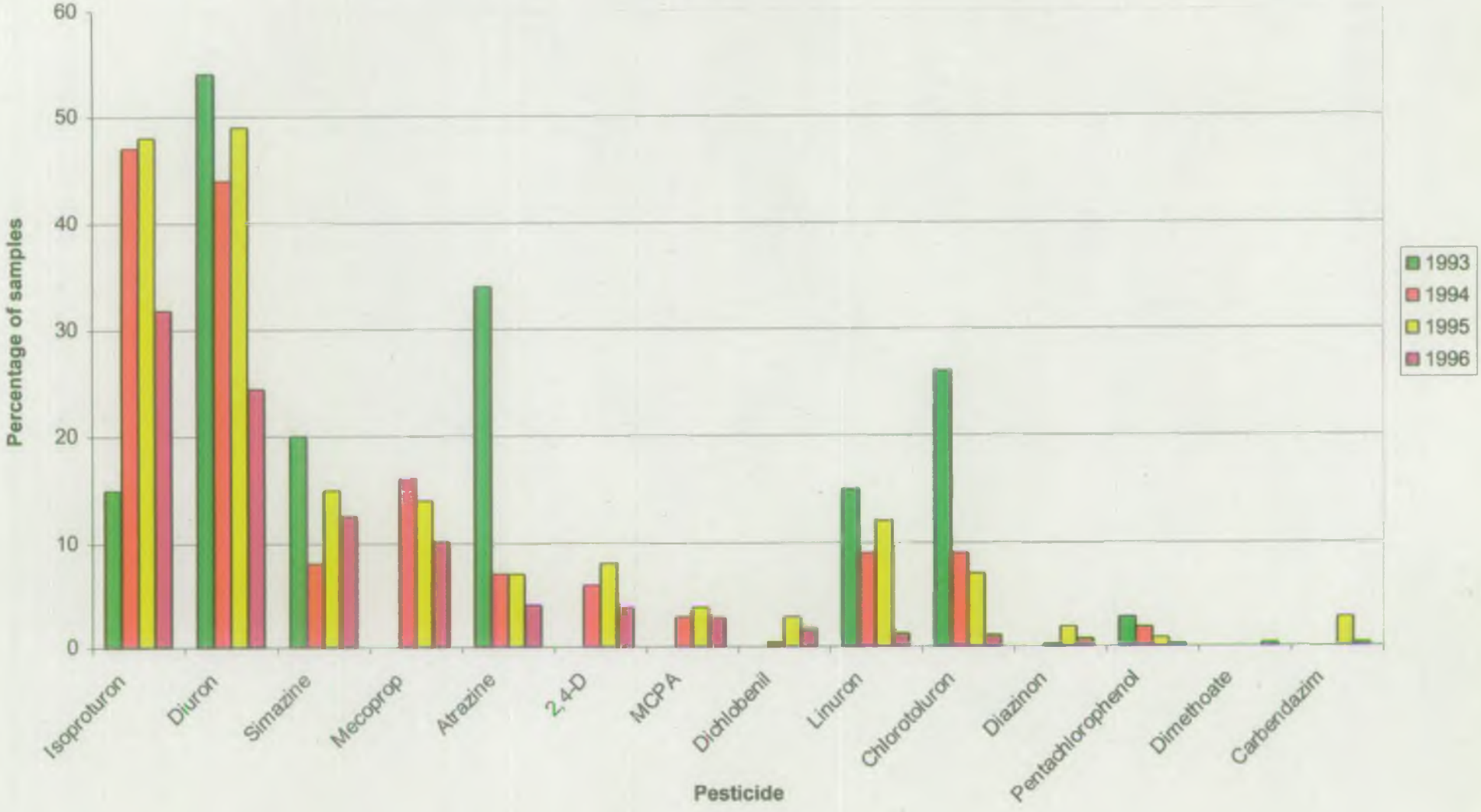
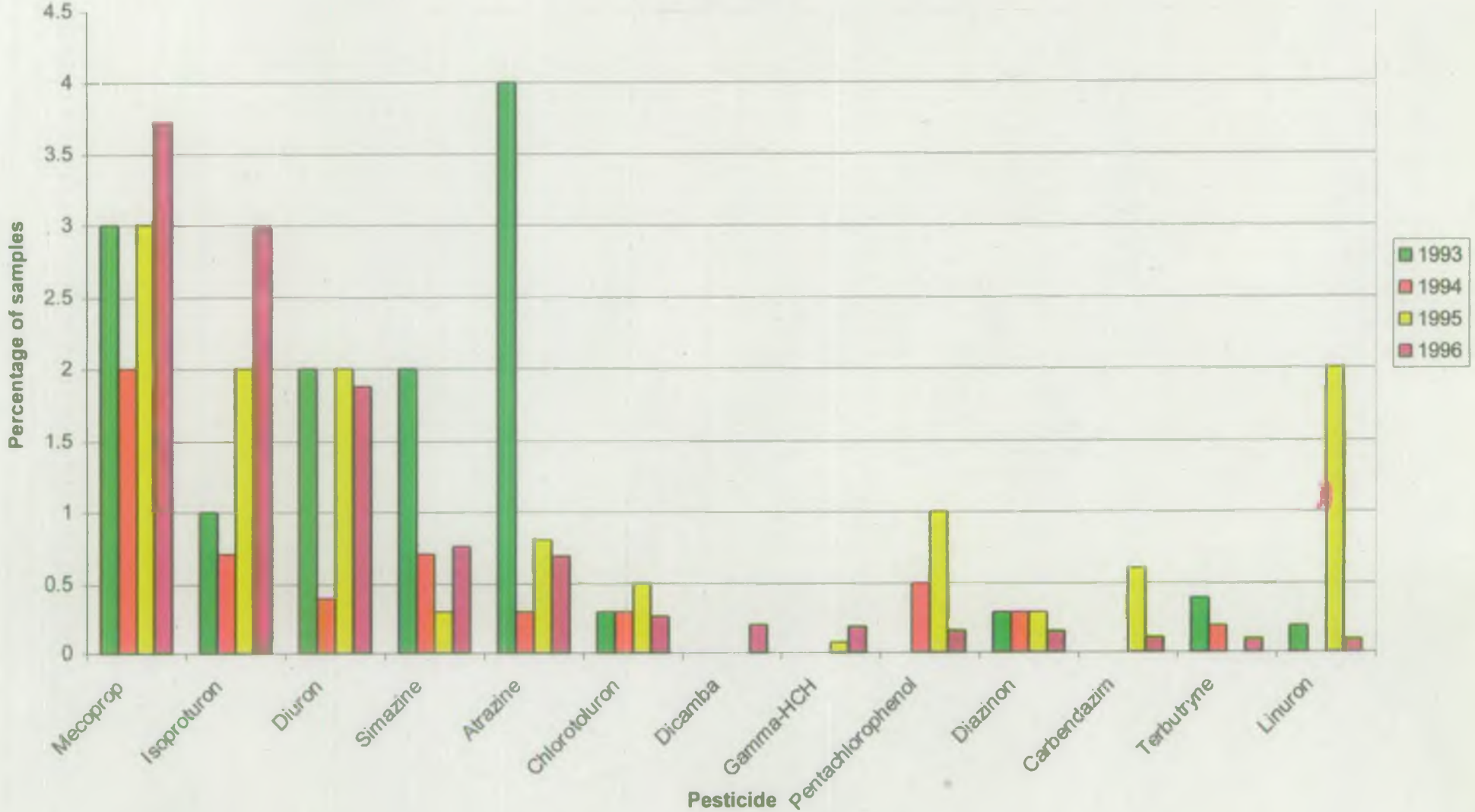


Figure 7.8 Pesticides most frequently exceeding 0.1µg/l in surface freshwaters in Welsh Region 1993-96



Appendix II - annual usage of pesticides in agriculture and horticulture in England and Wales in 1996 (MAFF, 1996)

No	Active ingredient	Area (ha)	% change on 1994	No	Active ingredients	Area (ha)	% change on 1994
1	Isoproturon	3,047,692	53	26	Choline chloride	606,951	369
2	Chlormequat	2,531,125	20	27	Glyphosate	571,673	-16
3	Cypermethrin	2,372,421	162	28	Gamma-HCH	560,080	4
4	Carbendazim	2,044,627	9	29	Guazatine	558,925	-33
5	Tebuconazole	1,923,917	50	30	Pendimethalin	549,902	184
6	Chlorothalonil	1,911,590	20	31	Bromoxynil	509,526	-31
7	Fenpropimorph	1,806,341	44	32	Phenmedipham	489,827	12
8	Flusilazole	1,528,072	44	33	Lambda-cyhalothrin	485,072	371
9	Fenpropidin	1,342,061	64	34	Trifluralin	468,548	71
10	Diflufenican	1,194,316	69	35	Ioxynil	456,232	-32
11	Fuberidazole	1,141,847	178	36	Mecoprop	408,917	-28
12	Flutriafol	975,297	14	37	Fenoxaprop-P-ethyl	395,194	-13
13	Propiconazole	964,273	2	38	Thiabendazole	390,284	-73
14	Metsulfuron-methyl	955,869	-18	39	2-chloroethylphosphonic acid	364,058	18
15	Triadimenol	905,619	-13	40	Fludioxonil	335,003	-
16	Fluroxypyr	895,980	7	41	Pirimicarb	309,008	-30
17	Epoxiconazole	834,794	-	42	Metaldehyde	296,965	-32
18	Tridemorph	817,603	41	43	Deltamethrin	295,165	21
19	Mancozeb	815,577	-8	44	Cymoxanil	293,990	-5
20	Cyproconazole	805,428	-3	45	Carboxin	291,912	-78
21	Bitertanol	749,321	>5,000	46	Dimethoate	291,578	-52
22	Thiram	667,962	<1	47	Sulphur	284,185	20
23	Prochloraz	664,497	4	48	Ethofumesate	283,902	4
24	Mecoprop-P	653,592	4	49	Metamitron	282,779	24
25	Triazoxide	622,521	4,806	50	Imazalil	280,564	-61

Appendix III - pesticide EQS values (at June 1998)

DETERMINAND	ENVIRONMENTAL QUALITY STANDARD		ORGANISATION	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	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
Hexachlorobutadiene	0.1µg/l (AA)	0.1µg/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	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	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 - pesticides monitored by the Environment Agency in 1996 and their uses

Pesticide	Type	Use	Pesticide	Type	Use
2,3,5,6-Tetrachloroaniline	F	Metabolite of tecnazene	Fenthion	I	VM
2,3,5,6-Tetrachlorothioanisole	F	Metabolite of tecnazene	Fenuron	H	V, H
2,3,6 TBA	H	Amateur, G	Fluazifop-butyl	H	A, F, V
2,3,5 T	H	Not approved	Fluazinam	F	A
2,4 D	H	Aq, C, G	Flucofuron	I	Mo
2,4 DB	H	C, G	Flumethrin	I	VM, S
2,4 DCPA	H	NA	Fluroxypyr	H	C, G
4-chlorophenoxyacetic acid	PGR	Not approved	Flutriafol	F	C
A HCH	I	See gamma HCH	Fomesafen	H	H
Aldicarb	I	A, H, SB	Fonofos	I	C, ST
Aldrin	I	A, F, H, V	Gamma HCH	I	A, H, W, ST, G
Asulam	H	A, F, G	Glyphosate	H	A, Aq, H, NA, T
Atrazine	H	M, NA	Heptachlor	I	Not approved
Atrazine desethyl		Metabolite of atrazine	Heptachlor epoxide	I	Not approved
Atrazine desisopropyl		Metabolite of atrazine	Hexachlorobenzene	F	Not approved
Azinphos ethyl	I, A	Not approved	Hexaconazole	F	Not approved
Azinphos methyl	I, A	F, V	Imazapyr	H	NA
B HCH	I	See gamma HCH	Ioxynil	H	C, G
Benazolin	H	A, B, C, G	Iprodione	F	A, H, V
Bendiocarb	I	ST, H, M	Isodrin	I	Not approved
Bentazone	H	A, B, H	Isoproturon	H	C
Bromoxynil	H	A,C, M	Imazapyr	H	NA
Bupirimate	F	F, H	Lambda-cyhalothrin	I	A, H, V
Buprofezin	I	H	Linuron	H	B, V
Carbaryl	I	G, F	Malathion	I	V
Carbendazim	F	A,B, C, G,H, F	Maneb	F	A, C, B, V
Carbetamide	H	A, B	MCPA	H	C, G
Carbofenothion	I	Not approved	MCPB	H	C, G
Carbofuran	I, N	H, V	Mecoprop	H	A, C, G

Pesticide	Type	Use	Pesticide	Type	Use
Chlordane cis		See chlordane	Metazachlor	H	A, H, V
Chlordane trans		See chlordane	Methabenzthiazuron	H	C
Chlorfenvinphos	I	A, H, S	Methiocarb	I, M	A, H
Chloridazon	H	SB	Methomyl	I	Fly
Chlorofen	I	Not approved	Methoxychlor	I	Not approved
Chlorothalonil	F	A,B, C, F, V	Metoxuron	H	C, V
Chlorotoluron	H	C	Mevinphos	I	Not approved
Chloroxuron	H	Not approved	Monobutyl tin	AF	NA
Chlorpropham	H, SS	H, A	Monolinuron	H	A, B, V
Chlorpyrifos	I	A, C, F, G	Monuron	H	Not approved
Chlorpyrifos methyl	I	GS	Neburon	H	Not approved
Clopyralid	H	C, G, H, SB	Napropamide	H	B, F
Coumaphos	I	Fly	Oxamyl	I, N	B
Cyanazine	H	A	Paclobutrazol	PGR	F, H
Cyfluthrin	I	Mo, VM, S	Paraquat	H	A, F, H
Cyhexatin	A	Not approved	Parathion	I, A	Not approved W
Cypermethrin	I	A, B, C, F, S, V	Parathion methyl	I, A	Not approved
D HCH	I	See gamma HCH	PCSD/Eulan	I	Mo
DDE op	I	Not approved	Pendimethalin	H	A, B, C, F, H,
DDE pp	I	Not approved	Pentachlorophenol	I	W
DDT op	I	Not approved	Permethrin	I	F, Fly, GS, Mo, VM
DDT pp	I	Not approved	Permethrin cis	I	See Permethrin
Deltamethrin	I	A, H, F, V	Permethrin trans	I	See Permethrin
Demeton S methyl	I, A	B, C, F, H, V	Phenmedipham	H	SB
Desmetryn	H	K	Phorate	I	B, V
Diazinon	I	H, S, V	Phosalone	I, A	K
Dibutyl tin	AF	NA	Picloram	H	NA
Dicamba	H	C, G, NA	Pirimicarb	I	A, B, C, F, H
Dichlobenil	H	Aq, F, NA, T	Pirimiphos methyl	I	C, GS, Fly
Diclobutrazol	F	Not approved	Pirimiphos ethyl	I	Not approved
Dichlorprop	H	C, G	Prochloraz	F	B, C
Dichlorvos	I	Fly, FF	Prometryn	H	B, V
Dieldrin	I	Not approved	Propachlor	H	H, K
Diflubenzuron	I	NA, H, V	Propazine	H	Not approved

Pesticide	Type	Use	Pesticide	Type	Use
Dinoseb	H	Not approved	Propoxur	I	H
Disulfoton	I, A	F, V	Propyzamide	H	B, F
Diquat	H	A, Aq	Simazine	H	B, F, NA
Diuron	H	NA	Sulcofuron	I	Mo
DNOC	I	Not approved	TDE op	I	Not approved
E HCH	I	See gamma HCH	TDE pp	I	Not approved
Endosulfan a	I	Not approved	Tecnazene	F, SS	Potatoes
Endosulfan b	I	Not approved	Terbutryn	H	Aq, C
Endrin	I	Not approved	Tetrabutyl tin	AF	NA
EPTC	H	Not approved	Thiabendazole	F	A, B, G, H
Ethiofencarb	I	Not approved	Tri-allate	H	A, B, C, V
Ethion	A, I	Not approved	Triazophos	I	C, G, V
Ethirimol	F	A,ST Metabolite of bupirimate	Tributyl tin	AF	NA
Ethofumesate	H	G, SB	Triclopyr	H	G, NA
Eulan	I	Mo	Trietazine	H	A, B
Fenchlorphos	I	Not approved	Trifluralin	H	A, C, F, V
Fenitrothion	I	C, F, GS	Triphenyl tin (tpt)	AF	NA
Fenoprop	PGR	Not approved	Vinclozolin	F	A, V
Fenpropimorph	F	A, B, C			

N.B. There may be a few additional pesticides monitored occasionally

Key to type

A = Acaricide
F = Fungicide
H = Herbicide
I = Insecticide
N = Nematicide
M = Molluscicide
SS = Sprout suppressant
P = Potato storage
SB = Sugar beet (beets)
T = Trees (fruit)
W = Wood preservative
PGR = Plant growth regulator
AF = Anti-foulant

Key to use

A = Agriculture
B = Broad-leaved crops
F = Fruit
Fly = Fly control
GS = Grain stores
K = Kale (and related crops)
Mo = Moth-proofing
S = Sheep dip
ST = Seed treatment
V = Vegetables
VM = Veterinary medicine

Aq = Aquatic
C = Cereals
FF = Fish farms
G = Grass
H = Horticulture
M = Maize
NA = Non-agricultural

APPENDIX V - 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 } triorganotin compounds
12 Triphenyl tin}
13 PCSDs] moth-proofing agents
14 Cyfluthrin]
15 Sulcofuron]
16 Flucofuron]
17 Permethrin]

APPENDIX VI - substances governed by the Groundwater Directive (80/68/EEC)

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

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
chrome	lead	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 VII - 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 (%)
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
Tichlororthylene	50
Tetrachloroethylene	50
Trichlorobenzene	50
1,2 Dichloroethane	50
Trichloroethane	50
Dioxins	70

APPENDIX VIII - 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 IX - 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

Appendix X

POPPIE – Prediction of Pesticide Pollution in the Environment

POPPIE (Prediction of Pesticide Pollution In the Environment) is a combined database, model and Geographical Information System (GIS) for the investigation and prediction of contamination of controlled waters by pesticides. The system has been developed by the Pesticides Section of the EHS National Centre.

POPPIE is used by the Agency to assist in the targeting of monitoring resources for pesticides. Modelling scenarios for the prediction of contamination of waters by new or existing pesticides or by changes in cropping patterns can also be carried out.

Component databases

- Cropping data
- Pesticide usage data
- Pesticide physico-chemical properties
- Soil characteristics data
- Weather data
- Modelled pesticide concentrations
- Agency pesticide monitoring data

The desktop system runs in the Arc-View desktop GIS under Windows 95. Maps and graphical output derived from the base data can be printed and viewed on screen.

The data will be updated annually to build a time series of data, enabling trends in pesticide use and occurrence to be investigated.

The system contains all Agency monitoring data for pesticides for several years, allowing the user to display and interpret monitoring data nationally. POPPIE is available to all Agency staff and on a cost-recovery basis to external organisations. The national pesticide monitoring database (1992-97) is available as a separate CD free of charge.

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