



Pesticide Poisoning of Animals 1998:

**Investigations of Suspected Incidents
in the United Kingdom**

**A Report of the Environmental Panel
of the Advisory Committee on Pesticides**

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of the Advisory Committee on Pesticides

1999

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Preface

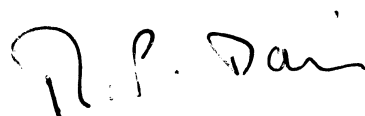
The Wildlife Incident Investigation Scheme is run by the UK's Agriculture Departments, with most of the post-registration surveillance being funded by the agrochemical industry via a levy on sales of products. The Environmental Panel provides advice to the Advisory Committee on Pesticides on environmental problems relating to pesticides. An annual report on pesticide incidents is produced by the Environmental Panel. This report covers incidents investigated in 1998.

The number of incidents being confirmed as resulting from the correct use of pesticides remains similar to previous years. However, of note this year are the incidents resulting from the misuse of pesticides. In 1998, there were 49 incidents which were considered to have resulted from misuse, more than double the number reported in 1997. This represents 26% of confirmed poisoning incidents in 1998 compared with 12% in 1997. This increase indicates the need for careful use of pesticides. These incidents have led to PSD issuing guidance to ensure that pesticides are used safely.

In 1998, increased emphasis was given to approved use incidents. Detailed investigations of approved use incidents may indicate that problems are occurring in the field, which might in turn precipitate regulatory action. Data from such incidents can be useful in validating risk assessment procedures and also help to monitor the effectiveness of remedial action or product stewardship.

The Scheme continues to give assurance that the approved use of pesticides results in very low numbers of reported incidents. The main problem continues to be the deliberate and illegal abuse of a range of pesticides to poison vertebrate animals. Positive enforcement action will continue to be a high priority of the Scheme and prosecutions will be taken wherever possible.

Please do continue to report casualties or suspected baits to the Scheme — the Freephone number is 0800 321600.



R. P. DAVIS
CHAIRMAN

Pesticides Poisoning of Animals Report 1997

Apology and correction

In the *Pesticides Poisoning of Animals Report 1997*, details were given of a case reported to PSD in which it was alleged that a hunt had placed ammonium nitrate and creosote on hay bales in order to deter foxes from hiding in the bales. It was reported that the farmer, a number of farm animals and wildlife were adversely affected.

Following enquiries made after publication of the 1997 report, it was established that a police investigation of the allegations had taken place, but no further action was taken. PSD is not aware of any other evidence that supports the allegation.

Additional procedures have now been put in place to ensure that the factual basis of all future reports is fully checked before a report is published.

PSD apologises for any embarrassment caused by its earlier report.

Contents

	Paras.	Page
Summary		vii
Introduction	1-6	1
The Campaign Against the Illegal Poisoning of Animals	7-8	2
Part 1: Incidents in 1998		3
Number of incidents in 1998	9-10	3
Part 2: Incidents in 1998 where regulatory and/or enforcement action was considered		5
Approved use incidents	11-19	5
Misuse incidents	20-25	7
Abuse incidents	26-31	7
Unspecified use incidents	32-36	8
Enforcement action	37-50	9
Part 3: Incidents in 1998: Species/Samples and the agricultural chemicals involved		11
Species/Samples involved	51-54	11
Vertebrate wildlife: Mammals	55-63	14
Vertebrate wildlife: Birds	64-87	16
Wildlife: Others	88	21
Livestock	89-91	21
Companion animals	92-103	22
Exotic species	104-105	25
Beneficial insects	106-123	25
Suspected poison baits and suspicious samples	124-126	30
Agricultural chemicals	127-128	31
Other causes of death	129	31
Part 4: Conclusions		32
Number of incidents	130-135	32
Vertebrate incidents	136-137	34
Beneficial insect incidents	138-139	35
Unknown causes of incidents	140-141	35
Seasonal distribution	142	36
Regional distribution	143	37
Acknowledgements		39
References		40
Appendices		
Appendix 1. Investigation procedures		41
Appendix 2. Pesticide incidents occurring in 1998		43
Appendix 3. Major WIIS publications		53

Summary

In the UK the Wildlife Incident Investigation Scheme investigates deaths of wildlife, including beneficial insects, pets and some livestock, where there is strong evidence to indicate that pesticide poisoning may be involved.

The Scheme provides a unique means of post-registration surveillance of pesticide use, so that registrations can be revised if necessary. In addition, it provides a measure of the success of the pesticide registration process, and helps in the verification and improvement of the risk assessments made in the registration of compounds. Evidence from the Scheme may also be used to enforce legislation on the use of pesticides and the protection of food, the environment and animals.

There were 612 suspected poisoning incidents registered by the Scheme in 1998. The causes were determined in 325 incidents of which 185 (30% of those registered) were pesticide poisoning. In the remaining incidents either sufficient information or suitable tissues were not available, and/or pesticide residues were not detected (see Table 1). Reassuringly, there were only five incidents arising from the approved use of pesticides (see Figure 1) in 1998 (includes one bee incident). This compares with six in 1997 (includes four bee incidents). Proportionately, both in 1998 and 1997, this is 3% of pesticide incidents.

The number of misuse incidents (see Figure 1), often the result of the careless use of pesticides, was 49 in 1998 (includes four bee incidents). This represents a large increase on the previous year. There were 23 incidents in 1997 (includes two bee incidents). This represents 26% of confirmed poisoning incidents in 1998, compared with 12% in 1997.

Deliberate abuse of pesticides was found in 96 incidents compared with 125 in 1998. This represents 52% of the pesticide incidents (see Figure 1), compared with 68% in 1997 and includes one bee related incident.

A further 28 poisoning incidents (15%) were attributed to unspecified use, including six bee incidents (see Figure 1). In 1997 there were 30 (16%) (includes nine bee incidents), where there was insufficient information available to identify the source of the poisoning.

There were 12 pesticide incidents involving bee deaths out of 43 incidents investigated (see Table 18), compared to 1997, when 15 pesticide incidents were confirmed out of 40 investigated. All pesticide incidents involved honeybees in 1998; there was one bumblebee incident in 1997.

There were seven incidents where veterinary products were thought to be involved (see Figure 1).

As in previous years, all incidents arising from the approved use and the illegal use of pesticides were thoroughly investigated. These are reported in Part 1 of the report. Where appropriate and with sufficient evidence, prosecutions were taken by MAFF and other agencies (see enforcement action) for the illegal abuse or misuse of pesticides. However, incidents of misuse or approved use can also highlight problems with the approval conditions or the label instructions for a pesticide and can provide valuable feedback into the regulatory process.

Of the 612 suspected poisoning incidents, vertebrates were involved in 505 incidents; beneficial insects in 43; suspected baits and suspicious samples, where no poisoned animals were found, in 62 and there were two incidents involving earthworms. These are reported in Part 2 of the report.

In England, 334 incidents were reported, of which 108 (32%) were found to be caused by pesticides; Scotland had 167 incidents registered of which 52 (31%) were found to be caused by pesticides; Wales, 32 incidents were registered, nine (28%) being identified as pesticide poisonings; and in Northern Ireland, 79 incidents were reported with 16 (20%) identified as pesticide poisonings (see Table 2 and Figure 3).

The number of suspected poisoning incidents registered by the Scheme in 1998 can be compared with 1997. In 1997 there were 607 incidents registered, and the causes were determined in 300 of these (49% of those registered). In 1998 the number of incidents identified as resulting from pesticides remained at a similar number and percentage (see Table 3).

Thirty-eight agricultural chemicals were identified in the pesticide poisoning incidents with a further four compounds detected from samples seized by the authorities (see Table 4); thirty-three compounds were found in 1997.

Introduction

1. In the United Kingdom, before approval is granted for the use of pesticides, the impact on wildlife and other animals, including beneficial insects such as honeybees, has to be assessed. If it is thought that an unacceptable risk may arise, restrictions on use in order to protect wildlife and domestic animals may be imposed in the conditions of approval under the Control of Pesticides Regulations (COPR) 1986 (as amended) and the COPR (Northern Ireland) 1987 or Plant Protection Products Regulations 1995, as appropriate.
2. The results of the four schemes, which investigate possible pesticide poisoning, which operate in the United Kingdom under the Wildlife Incident Investigation Scheme (WIIS), are reported. Fish are not usually covered by the Scheme.
 - (1) The Ministry of Agriculture, Fisheries and Food (MAFF) and the Welsh Office Agriculture Department (WOAD, now known as the National Assembly for Wales Agriculture Department (NAWAD)) examine cases of suspected poisoning by agricultural chemicals that involve vertebrate wildlife (chiefly birds and mammals) and companion animals in England and Wales. Over the years this scheme has widened its scope and now is able to detect most of the pesticides thought likely to cause animal deaths (Hardy *et al.* 1986).
 - (2) MAFF and WOAD investigate mortality of bees, usually reported by beekeepers, in England and Wales. This part of the WIIS has been in operation since 1981 (Fletcher *et al.* 1994b).
 - (3) In Scotland, the Scottish Office Agriculture Environment and Fisheries Department (SOAEFD, now known as the Scottish Executive for Rural Affairs Department (SERAD)) has operated a scheme covering incidents in all categories since 1972.
 - (4) In Northern Ireland, the Department of Agriculture for Northern Ireland (DANI) operates a scheme in the same way as SOAEFD. This scheme was introduced in 1992 in line with the existing schemes operating in Great Britain. Prior to that a scheme operated on an informal basis.
3. The majority of this post-registration surveillance work carried out by Government Departments is funded by the agrochemical industry, under the Food and Environmental Protection Act 1985 (FEPA).
4. During the reported year, incidents shown to involve pesticides were assigned to one of four categories:
 - Approved use** of the product, according to the specified conditions for use;
 - Misuse** of a product, by careless, accidental or wilful failure to adhere to the correct practice;
 - Abuse** of a pesticide, in the form of deliberate, illegal attempts to poison animals; and
 - Unspecified use**, where the cause could not be assigned to one of the above categories.

There is also a category of Veterinary use, where there is known involvement of veterinary products in incidents. These are investigated incidentally rather than deliberately. Veterinary incidents may include abuse, misuse, approved use or unspecified use of these compounds.

In addition, some reported animal deaths are subsequently found to be the result of causes unrelated to pesticide use, such as disease, starvation and trauma or other non-pesticide poisonings.

5. The results of investigations are reported to the Environmental Panel of the Advisory Committee on Pesticides (ACP). The information provided may result in a re-evaluation of the approvals previously granted to that product, or may affect the progress to full commercial use of products currently under provisional approval. Information from incidents assist in the validation and improvement of the risk assessment procedures for new and existing compounds.
6. In cases where there is evidence to indicate misuse or deliberate abuse of a pesticide, the results of investigations may also result in legal enforcement. Under FEPA and COPR, all aspects of pesticide advertisement, sale, supply, storage and use are fully regulated. If incidents reveal contravention of this Act, or of other legislation such as the Wildlife and Countryside Act 1981, Wildlife (Northern Ireland) Order 1985, Protection of Animals Act 1911, and the Welfare of Animals Act (Northern Ireland) 1972, then prosecution or other forms of enforcement may ensue. Any investigations carried out to enforce the legislation are paid for by the Home Departments.

Investigation procedures are described in Appendix 1.

The Campaign Against the Illegal Poisoning of Animals

7. During 1998 interested Government Departments led by MAFF, continued the long-term Campaign Against the Illegal Poisoning of Animals. The Scheme is now becoming much more widely known and there has been much press and media coverage throughout the years. The provision of a freephone number (0800 321600) has had a continuing good response, allowing ready access to the Scheme.
8. To prevent large numbers of dead animals being submitted and analysed, with the consequences on financial and resource implications, strict criteria are applied to potential incidents prior to acceptance. Incidents are accepted if they involve the death of animals or beneficial insects and where the approved use, misuse or deliberate abuse of pesticides may be implicated. Incidents involving the presence of baits intended or likely to cause deaths of animals are also accepted. Incidents are rejected for further analyses where they obviously involve trauma or disease or are confirmed as doing so after veterinary examination. Unless there are special circumstances, substantial delay in notification of incidents or the unavailability of bodies or baits also leads to rejection.

Part 1: Incidents in 1998

Number of incidents in 1998

9. All incidents that were registered to WIIS, and which were investigated during 1998 are included in this report. There were 612 suspected poisoning incidents registered by the Scheme in 1998. The cause of death or illness (including pesticides and non-agricultural chemicals, trauma, starvation and disease) was determined in 326 incidents (53% of those registered). In 185 of these incidents (30% of those registered) pesticide poisoning was identified. In the remaining incidents either sufficient information or suitable tissues were not available, and/or pesticide residues were not detected. Details of the animals and chemicals involved in all of the incidents reported to the Scheme are given in Part 3 of this report. For previous comparable data see Fletcher *et al.*, 1995, 1996, 1997 and 1998.

Table 1: Number of incidents investigated in 1998

	Incidents investigated	Pesticide poisoning incidents	Other cause of death found
Vertebrate wildlife	256	49 (19%)	109 (43%)
Livestock	10	4 (40%)	0
Companion animals	235	90 (38%)	30 (13%)
Exotic species	7	2 (29%)	2 (29%)
Earthworms	2	1 (50%)	0
Beneficial insects	43	12 (28%)	2 (5%)
Suspected baits and suspicious substances	62	29 (47%)	not applicable
TOTAL *	612	185 (30%)	141 (23%)

*Animals from more than one category may be involved in a single incident

10. There were only five incidents of approved use, 49 of misuse, 96 of abuse and 28 of unspecified use, where the source of the compound remained unknown despite thorough field investigations. Additionally there were seven incidents thought to involve veterinary products. Positive enforcement continued to be a priority in 1998 with prosecutions being taken against offenders following the investigation of incidents. These incidents together with any regulatory and /or enforcement activities are reported in Part 2 of this report.

Part 2: Incidents in 1998 where regulatory and/or enforcement action was considered

Approved use incidents

Introduction

11. Information from the WIIS on incidents suspected to have resulted from approved use is very important, and is fed into the pesticide regulatory process (see Fletcher and Grave 1992). Where significant concerns are highlighted, thorough consideration is given to the most appropriate action needed. If a suspected approved use incident arises, the approval holder is contacted as a matter of course, and is given the opportunity to comment. Useful feedback from the companies has been received. Farmers, growers and other members of the public are strongly encouraged to report any poisoning incident which may have resulted from the approved use of a pesticide to their local Farming and Rural Conservation Agency (FRCA) office or freephone 0800 321600.
12. There were five (3%) incidents (includes one bee incident) reported to the Scheme which resulted from the approved use of a compound (see Figure 1). This compares with six incidents (3%) in the previous year (four honeybee incidents). There were five different compounds identified in these incidents, compared with the same number in 1997. Reassuringly, this small number of incidents reported to the Scheme indicates that agricultural chemicals, if used in an approved manner, are apparently not causing major problems to wildlife and other animals.
13. Detailed summaries of individual incidents are set out below. Two of these incidents involved the use of a rodenticide and indicates the need to check baiting points frequently and to ensure adequate protection from dogs etc. Further details regarding baiting procedures etc can be found in an HSE information sheet entitled 'Safe use of rodenticides on farms and holdings' (Agricultural Information Sheet No 31).
14. There was one incident involving honeybees this year. This incident occurred when oilseed rape was sprayed with cypermethrin. The beekeeper had not been informed of the spray operation and as a result lost some bees. Whilst incidents of this type are rare, it does indicate the need for a good relationship between spray operator and the local spray liaison officer.

Incident summaries

15. A pest control operator had placed a rodenticide bait containing bromadiolone on a plastic tray which had then been placed under a shed. It was reported that in order that dogs and other non-target animals did not gain access to the bait, the tray had been placed as far under the shed as possible. A couple of days after the bait had been placed under the shed, a dog was found eating the bait. The dog was treated by a vet and showed no ill effects. It is believed that rats moved the bait tray to the edge of the shed. Following the incident, the pest controller returned to the site and placed bricks around the bottom of the shed. Whilst the pest controller had carried out the operation appropriately, the rodenticide marketing

company highlighted that they recommend the use of secure bait boxes which are fixed via securing rods. In this instance the use of such boxes may have prevented the incident.

16. In October 1998 there was an incident involving the use of slug pellets containing methiocarb. The farmer had applied the pellets to the crop at the approved rate using a fertiliser spreader. The soil conditions were described as clay with flint overlying chalk. At the time of the application the soil was described as moist, but not water logged. Over the next three or four days the weather was wet with light rain falling on most days. The farmer noticed dead worms and a site visit was made. During the site visit live and dead earthworms were collected from the treated field. Chemical analysis detected between 8 and 12 mg/kg of methiocarb in the earthworms. Given the fact that the slug pellets had been applied correctly, then this incident would appear to be the result of the correct use of methiocarb. Data held by PSD indicates that given the weather and soil conditions incidents of this type may occasionally occur, however, it is unlikely that the earthworm population would have been adversely affected. The concentration of methiocarb in the worms is considered unlikely to have posed a risk to birds and small mammals.
17. A pigeon fancier had treated his pigeon loft with malathion in order to control mites. The product was used according to the label, i.e. the loft was sprayed and not the birds. However, following the treatment the owner noticed that the young birds appeared to be disorientated. The birds were taken out twice in two weeks and flown, however the owner noticed that they took longer to return to the loft. It was noted that older birds were not affected. No birds died. Whilst the exact cause of the abnormal behaviour can not be determined, it is probable that it was due to exposure to malathion. No incidents of this type have occurred before. The mite control marketing Company highlighted that they have not experienced incidents of this type before. However, they felt that the birds may have been suffering from a condition known as "Young Bird Syndrome" and not due to malathion. PSD will be keeping a watching brief on incidents of this type.
18. A beekeeper with a small apiary in a garden in Scotland, observed a mortality of bees in mid-July. Analytical investigation demonstrated the presence of a residue of the pyrethroid insecticide cypermethrin in the dead bees. Field investigation by SOAEFD Agricultural staff revealed that a crop (24 hectares) of oilseed rape nearby had been sprayed with a cypermethrin formulation on the day of the mortality. The farmer involved had in the past informed beekeepers about spraying activities, however on this occasion he had no knowledge of the apiary in a built-up residential area. Steps have been taken to reinforce local spray liaison arrangements with the willing participation of the farmer.
19. During October, two collie puppies died on a farm in Scotland within days of each other. The second animal was subjected to a post-mortem and findings were indicative of possible anticoagulant poisoning. Analytical investigation revealed a residue (0.7mg/kg) of coumatetralyl in liver tissues from this animal. Field investigation at the farm confirmed that a grain based rodenticide bait material had been laid, prior to the incident on top of a four metre high wall and below the roof couples of the farm building where the dogs were penned. The puppies had been fed only with a proprietary pup food, however cereal grains and the remains of animal tissues were found in the stomach content material from the pup examined. It is possible that the puppies had eaten rats that had died from or were affected by consumption of the rodenticide bait.

Misuse incidents

20. A number of incidents was reported where misuse of pesticides was identified (see Figure 1). These result from poor storage, spillage, chemicals not being used in the approved manner (rodenticide baits being left uncovered, spraying of crops in full flower) or compounds being disposed of in an inappropriate way (Barnett and Fletcher, 1998). Thus, the chemicals found in this category tend to be rodenticides, molluscicides, seed treatments and spray compounds used where honeybees are at risk. In 1998, there were 49 incidents, including four honeybee incidents (26% in this category, involving 21 different compounds). In the previous year there were 23 incidents (12%, involving 13 compounds) and including two bee incident.
21. Many of the misuse incidents involved slug pellets, primarily uncleared spillages. There were ten incidents involving metaldehyde, nine involved dogs and in the other pellets were placed to control grey squirrels. Methiocarb poisoning of dogs occurred in three incidents because of uncleared spillages. A fourth incident resulted from the improper disposal of methiocarb treated maize. Potentially wild animals such as badgers and foxes, which are likely to find the pellets palatable, are equally at risk in such circumstances. Unfortunately the fact that they are likely to skulk in cover once affected, unlike dogs that are in close proximity to humans, will mean that they are less likely to be found and reported to the Scheme.
22. Uncovered rodenticide baits were found in 20 misuse incidents, involving six different compounds. Brodifacoum was found in one incident, brodifacoum and bromadiolone in two, bromadiolone in four, bromadiolone and difenacoum in two. There was a single incident involving chlorophacinone and another with chlorophacinone and coumatetralyl. Three misuse incidents involved coumatetralyl, four difenacoum and one warfarin. There was a single incident where brodifacoum, bromadiolone, coumatetralyl and difenacoum were involved.
23. There were single incidents of misuse of fonofos, oxydemeton-methyl, aldicarb, bendiocarb, strychnine, alphachloralose, asulam, DDT, and renardine and two involving cyanide.
24. Permethrin was involved in a honeybee misuse incident and dimethoate was found in three honeybee misuse incidents (one incident also involved gamma-HCH).
25. Further information about these incidents can be found in Appendix 2.

Abuse incidents

26. As in previous years, a large number of incidents involved deliberate abuse of pesticides (see Figure 1). The number of poisoning incidents attributed to abuse was 96 (52% of pesticide incidents); 125 were found in 1997, which represented 68% of pesticide incidents. There was one incident involving beneficial insects in this category (none in 1997).
27. Twenty-six different compounds were involved in these incidents compared with 22 in the previous year. The three compounds found to be most abused were carbofuran (30; 32% of abuse incidents), alphachloralose (16: 17% of abuse incidents) and aldicarb (13: 14% of abuse incidents). Carbofuran and aldicarb were the compounds most found in abuse incidents in the previous year, reflecting the continuing increase in incidents involving these compounds (see Figure 2). In 1997, carbofuran was involved in 26 (21%) abuse incidents, aldicarb in 21 (17%) and alphachloralose 16 (13%).

28. There were nine incidents (9%) involving the abuse of metaldehyde and eight incidents involving paraquat. There were three incidents involving strychnine abuse. However, there was only one abuse incident involving mevinphos (1997, 3 incidents, 1996, 11 incidents), reflecting the decrease in organophosphate compound incidents over the past years (see Figure 2).
29. Organophosphates found in abuse incidents, other than mevinphos mentioned above, included single incidents involving malathion, dichlorvos, pirimiphos-methyl and chlorpyrifos. Carbamate abuse incidents, other than aldicarb and carbofuran mentioned above, involved bendiocarb (two) and methiocarb (four).
30. There were seven incidents of anticoagulant rodenticide abuse, the same number as found in 1997. These involved warfarin (three), and single incidents with bromadiolone, difenacoum, coumatetralyl and brodifacoum present.
31. The remaining abuse incidents involved aluminium phosphide (four) and sodium cyanide (one) used at badger setts and fox earths; permethrin in a bait, bifenthrin in syrup, thought to poison bees, and one with 2,4D, dicamba and mecoprop all found in a bait. Seconal was found to be associated with one of the alphachloralose incidents.

Unspecified use incidents

32. In every year there is always a number of incidents where the source of the compound is unknown, despite detailed field investigations. Animals may take some time to die after exposure, especially with certain chemicals such as anticoagulant rodenticides, and in this time may travel some distance. In 1998, there were 28 incidents of unspecified use (15% of pesticide poisoning incidents), including six bee incidents; there were 30 in 1997 (16%) including nine bee incidents. There were 17 different compounds detected in these incidents, there were 15 in the previous year. In addition there was one incident attributed to anticoagulant rodenticide poisoning, but the actual compound involved was not identified.
33. Anticoagulant rodenticides take some time to poison animals. Their mode of action is to delay the onset of symptoms so as to prevent the intended target species, rodents, from becoming bait shy. There were nine incidents involving these compounds (there were 11 in 1997) and the incidents could have arisen from abuse, misuse or approved use. Compounds involved were brodifacoum, bromadiolone, coumatetralyl, difenacoum, and flocoumafen. Some of the incidents involved several of these compounds. There was also an incident involving an unspecified anticoagulant rodenticide.
34. Metaldehyde was implicated in six unspecified use incidents and methiocarb in a further two. Most are likely to have arisen from uncleared spillages of slug pellets or from the use of slug pellets to prepare poisonous baits. However, insufficient field information prevents them from being classified as misuse or abuse incidents.
35. Bendiocarb was involved with the poisoning of red kite chicks. Powder containing permethrin was found in another incident.
36. There were six incidents involving honeybees where the source of the residues detected could not be determined. There were single incidents involving the compounds; carbaryl, gamma-HCH, pirimiphos-methyl and malathion. Fenitrothion and dichlofluanid were detected in another incident and there was one incident suspected to involve lambda-cyhalothrin (no bees were available for testing).

Enforcement action

37. Positive enforcement action continues to be a priority, with prosecutions being taken following the investigation of incidents. The substantial fines and costs imposed by the courts, together with the publicity such cases attract, are intended to be an effective deterrent to those who may be considering the crime of illegal poisoning.
38. Even in cases where there is insufficient evidence to take a prosecution, the fact that a Government investigator has been seen to be enquiring about an incident is often sufficient to dissuade the culprit from re-offending. Government Departments therefore remain committed to using all available enforcement methods to help stamp out illegal poisoning. Where poisoning or the risk of poisoning arises from misuse, even where prosecution is not possible or appropriate, those involved receive advice on how to improve their practice.
39. In England, a total of 14 incidents involving the suspected poisoning of animals arising from misuse or abuse were investigated further by MAFF Investigation Officers. No prosecutions arose from these cases during 1998, although 8 cases remain to be resolved. In addition, 11 cases carried over from 1997 were resolved: 3 of these led to prosecutions. In one case the defendant was found not guilty.
40. A pest control operator was found guilty of failing to take all reasonable precautions to protect the health of human beings and creatures and of failing to comply with the conditions of approval for use. The operator carried out a flea control treatment with an approved product containing bendiocarb in a private dwelling. As well as treating the dwelling, the operator directly sprayed the four cats living at the premises. The pest control operator was conditionally discharged for six months and ordered to pay £240 costs.
41. A farmer was found guilty of failing to take all reasonable precautions to protect the health of human beings and creatures. A dog being walked was seen eating a substance that was later confirmed to be slug pellets containing metaldehyde and later died of metaldehyde poisoning. Slug pellets had been mixed with seed when the field was sown, and the slug pellets eaten by the dog had been left in the field for at least a year. The slug pellets may have been exposed by hedge trimming shortly before the incident. The farmer was fined £350 and ordered to pay £2000 costs.
42. In Wales six incidents were referred to WOAD for consideration of further action. One of which is still being investigated by MAFF Investigation Branch.
43. An incident that involved the poisoning of five magpies with strychnine in North Wales was discussed with the local police. Field notes and further assistance were made available, but no prosecutions resulted.
44. Following two incidents where red kites were poisoned by fenthion, a Welsh Office Press Release was issued appealing to farmers to take extra care with pesticides.
45. In another incident, a peregrine was found dead near its nest on MOD land. Further analysis showed that death was due to aldicarb poisoning but the source of the poison was not located. The police were informed of this incident due to their involvement in previous incidents involving aldicarb and peregrines across South Wales in previous years. A Press Release was issued by MOD.
46. Another incident that involved aldicarb was investigated by the police. Three cats became ill over a period of a week and two subsequently died. Despite the naming of a possible suspect to the police, no prosecution resulted.

47. In Scotland, eight incidents were reported to the Procurator Fiscal service for possible prosecution. A successful prosecution was taken against a gamekeeper on an estate in Grampian Region in relation to four related incidents of abuse involving poisoning of birds of prey. The defendant was fined £700 for contraventions of the Wildlife and Countryside Act and the Food and Environment Protection Act.
48. A second successful prosecution followed the abuse of dichlorvos, on a fish farm, to poison gulls. In this case the defendant was fined £250 for contravention of the Wildlife and Countryside Act.
49. Two other cases are pending, one relates to two incidents involving the poisoning of red kites, and the second to the poisoning of buzzards and a red kite.
50. SOAEFD issued a warning letter to a farmer following an incident where methiocarb had been improperly stored. SOAEFD Agricultural staff carried out investigations into the circumstances of 39 incidents, some of these in co-operation with other bodies such as the police and/or RSPB. Various Scottish police forces were the lead agency in the investigations into 15 incidents.

Part 3: Incidents in 1998: Species/Samples and the agricultural chemicals involved

Species/Samples involved

51. A total of 612 incidents was investigated during 1998. The categories of animals (animals of more than one category may have been involved in a single incident) and suspected baits involved are listed in Table 1. 488 incidents involved vertebrates (excluding exotic species, livestock and earthworms); 43 involved beneficial insects; 17 involved livestock and exotic species; 62 were suspected baits and/or seized samples. There were two incidents involving earthworms. The cause of death or illness (including pesticides and non-agricultural chemicals, trauma, starvation and disease) was established in 53% of all incidents. A further 34 (6%) were classed as 'not applicable', as they involved suspected baits where no dead animals were involved and analyses or further information failed to show the involvement of any pesticides. Pesticides were implicated in 185 (30%) of the incidents (compared with 185 (30%) in 1997); 19% of incidents involving vertebrate wildlife, 28% of those involving bees, 38% of companion animal incidents, 37% of other animal incidents, and 47% of suspected baits. A geographical breakdown of the data is shown in Table 2.

Table 2: Incidents investigated by country in 1998 (% pesticide as cause)

	England	Wales	Scotland	N. Ireland
Vertebrate wildlife	112 (13%)	20 (30%)	89 (26%)	35 (17%)
Livestock	6 (50%)	1	3 (33%)	0
Companion animals	130 (44%)	8 (38%)	56 (36%)	41 (24%)
Exotic species	2	0	3 (33%)	2 (50%)
Earthworms	2 (50%)	0	0	0
Beneficial insects	34 (15%)	1	8 (75%)	0
Suspected baits and suspicious substances	50 (54%)	2	8 (25%)	2
TOTAL*	334 (32%)	32 (28%)	167 (31%)	79 (20%)

*Animals from more than one category may be involved in a single incident

52. A comparison of the number of poisoning incidents for each category of animal from 1993 to 1998 is shown in Table 3.

Table 3: Number of incidents in which pesticides were identified as a likely cause of poisoning 1992–1998

	1993	1994	1995	1996	1997	1998
Vertebrate wildlife	91	76	62	77	54	49
Livestock	2	3	2	2	1	4
Companion animals	85	101	91	97	86	90
Exotic species	0	0	0	0	0	2
Fish	0	0	0	2	0	0
Earthworms	0	0	0	0	0	1
Beneficial insects	22	20	33	8	15	12
Suspected baits and suspicious substances	20	16	28	29	32	29
TOTAL *	212	211	208	204	185	185

*Animals from more than one category may be involved in a single incident

53. A list of the pesticides detected, including those involving beneficial insect incidents, is shown in Table 4, which also lists the species involved and the presence of compounds in seized samples. In addition low-level residues of pesticides are sometimes detected in tissues of animals, but these residues are not thought to have been involved in the death of the animal and probably reflect sub-lethal exposure to particular compounds.

Table 4: Numbers of incidents* involving individual pesticides in 1998 and species and/or bait involved

Organochlorine compounds		
DDT and metabolites	1	stored sample
gamma-HCH	2	honeybees
Organophosphorus compounds		
chlorpyrifos	1	seized sample
diazinon (veterinary product)	3	red kite, domestic duck, goose, chicken
dichlorvos (veterinary product)	1	herring gull
dimethoate	3	honeybees
fenitrothion	1	honeybees
fenthion (veterinary product)	3	red kite, cat
fonofos	1	spilt seed sample
malathion	3	feral pigeon, honeybee, seized sample
mevinphos	1	seized sample
oxydemeton-methyl	1	seized sample
phosmet (veterinary product)	1	rook
pirimiphos methyl	2	honeybee, seized sample

In addition a small residue of dichlorvos was detected in a honeybee sample.

Table 4: Numbers of incidents* involving individual pesticides in 1998 and species and/or bait involved (continued)

Carbamate compounds		
aldicarb	14	peregrine, feral pigeon, dog, cat, bait
bendiocarb	5	red kite, dog, cat, bait, seized sample
carbaryl	1	honeybee
carbofuran	29	fox, stoat, buzzard, golden eagle, red kite, peregrine, hen harrier, great black-backed gull, crow, dog, cat, bait, seized sample
methiocarb	11	badger, dog, cat, earthworms, bait, spilt seed
Rodenticides		
brodifacoum	9	grey squirrel, red kite, mallard, dog, cat, poultry, bait
bromadiolone	14	badger, fox, pheasant, dog, bait, cat, grey squirrel, mallard, red kite
chlorophacinone	2	bait
coumatetralyl	9	dog, cat, bait, seized sample, fox
difenacoum	9	buzzard, pheasant, dog, cat, bait
flocoumafen	1	tawny owl
warfarin	4	moorhen, dog, Ross's goose, bait
coumarin (unspecified)	1	cat
<p>In addition to the above, some residues of these compounds were detected and were considered to be background levels, eg., bromadiolone and difenacoum residues in incidents involving red kites.</p>		
Pyrethroid compounds		
bifenthrin	1	bait for honeybee
cypermethrin	2	honeybee, seized sample
lambda-cyhalothrin	1	honeybee
permethrin	3	honeybee, bait, powder sample, cat
<p>In addition small residues of fluvalinate were detected in honeybee samples. These were probably associated with varroa mite treatments.</p>		
Herbicides		
asulam	1	cattle
paraquat	9	fox, dog, cat
2,4 D, dicamba and mecoprop	1	bait
Other compounds		
alphachloralose	17	red kite, buzzard, peregrine, feral pigeon, jackdaw, magpie, starling, rabbit, cat, bait, seized sample
aluminium phosphide	4	badger sett, fox earth, dog
cyanide	3	badger sett, wasp nest
dichlofluanid	1	honeybee
metaldehyde	24	dog, cat, bait, badger sett, spilt pellets
renardine	1	badger sett
strychnine	5	magpie, dog, in abandoned bottle, seized sample

Table 4: Numbers of incidents* involving individual pesticides in 1998 and species and/or bait involved (continued)

Causes of death other than pesticides			
disease	55	ethylene glycol	3
starvation	22	urea fertiliser	1
trauma	62	paracetamol	1
		barbiturates	1
not applicable	34	lead	1
unknown	252	ionophores	1

* Some incidents will involve more than one pesticide, see later sections and Appendix 2.

54. Appendix 2 lists all the incidents involving agricultural chemicals from throughout the United Kingdom where poisoning was confirmed.

Vertebrate wildlife: Mammals

55. A total of 68 incidents involving wild mammals was investigated and the cause of incident established in 38 (56%) of which 8 (12%) involved pesticides (see Table 5). Table 6 shows the number and percentage of pesticide poisonings for the past six years.

Table 5: Numbers of incidents involving wild mammals in 1998

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Badger	England	15	2 (13%)	9 (60%)
	Scotland	3	0	3 (100%)
	N. Ireland	1	0	0
		19	2 (11%)	12 (63%)
Bat	England	3	0	0
	N. Ireland	1	0	0
		4	0	0
Deer	England	1	0	0
Fox	England	24	1 (4%)	14 (58%)
	Wales	1	1 (100%)	0
	Scotland	1	1 (100%)	0
	N. Ireland	1	1 (100%)	0
		27	4 (15%)	14 (52%)
Hare and rabbit	England	4	0	2 (50%)
Hedgehog	England	1	0	1 (100%)
Otter	Scotland	2	0	0
Polecat	Wales	1	0	0
Rabbit	N. Ireland	1	1 (100%)	0
Squirrel	England	2	1 (50%)	0
	Scotland	6	0	1 (17%)
		8	1 (13%)	1 (13%)
Stoat	England	1	0	1 (100%)
	Scotland	1	0	0
		2	0	1 (50%)
Wildcat	Scotland	1	0	0

Table 5: Numbers of incidents involving wild mammals in 1998 (continued)

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
TOTAL *	England	48	3 (6%)	26 (54%)
	Wales	2	1 (50%)	0
	Scotland	14	2 (14%)	4 (28%)
	N Ireland	4	2(50%)	0
		68	8 (12%)	30 (44%)

*Mammals from more than one category may be involved in a single incident

Table 6: Incidents involving wildlife mammals 1993–1998

	1993	1994	1995	1996	1997	1998
Incidents investigated	158	156	104	77	85	68
Pesticide incidents	19%	11%	13%	26%	19%	12%

Badgers

56. There were 19 incidents involving badgers submitted to the Scheme and the cause of death was established in 14, with pesticide poisoning confirmed in two incidents. The misuse of a rodenticide was implicated in one incident involving five badgers (and a fox). Haemorrhaging was noted in the carcasses at post mortem and residues of bromadiolone were detected in the tissues analysed. A rodent control operation had been carried out locally, but the way in which it was conducted and recorded was inadequate.
57. In a second incident, intentional abuse of methiocarb was suspected. A badger was found near a sett where slug pellets containing methiocarb had been placed. Residues of methiocarb were detected in tissues from the badger and in the pellets.
58. As in previous years, there were some incidents that involved the laying of poisoned baits outside badger setts (see other sections).

Foxes

59. As in previous years, there are always a large number of incidents involving foxes reported to the Scheme, particularly as they are considered a pest species and are often the target for illegal poisoning. Table 7 shows the number and percentage of pesticide poisonings for the past six years.

Table 7: Incidents involving foxes 1993–1998

	1993	1994	1995	1996	1997	1998
Incidents investigated	64	57	54	41	33	27
Pesticide incidents	25%	18%	17%	34%	33%	15%

60. There were 27 incidents involving foxes investigated in 1998. The cause of the incident was established in 18 (67%) incidents with agricultural chemicals found to be involved in 4 (15%). Two separate incidents involving carbofuran and paraquat were attributed to deliberate abuse. Misuse of bromadiolone was responsible for an incident (which also involved five badgers). In the other incident residues of bromadiolone and coumatetralyl were detected, but the source of the chemicals was not established.

Squirrels

61. There were eight incidents involving squirrels notified in 1998. Residues of brodifacoum and bromadiolone were detected in one grey squirrel. The incident was assigned as resulting from misuse as only warfarin is approved for squirrel control and brodifacoum should also not be used outside.

Rabbits

62. Two incidents involving rabbits were reported during 1998. Abuse of alphachloralose was found to be responsible for one incident.

Other mammals

63. The other mammal incidents reported include; four bat incidents, one roe deer incident, one hedgehog incident, three hare incidents, two otter incidents, one polecat incident, two stoat incidents and one wildcat incident.

Vertebrate wildlife: Birds

64. A total of 192 incidents involving wild birds was notified to the Scheme in 1998. The cause of incident was established in 122 (64%) and pesticides were involved in 42 (22%) (see Table 8). Table 9 shows the number and percentage of pesticide poisonings for the past six years.

Table 8: Number of incidents involving wild birds in 1998

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Birds of prey including owls	England	29	6 (21%)	12 (41%)
	Wales	14	4 (29%)	7 (50%)
	Scotland	49	19 (37%)	15 (29%)
	N. Ireland	5	0	4 (80%)
		97	29 (30%)	38 (39%)
Wildfowl and waterbirds	England	4	0	2 (50%)
	Scotland	3	0	1 (33%)
	N Ireland	13	1 (8%)	10 (77%)
		20	1 (5%)	13 (65%)
Gulls and waders	England	5	0	3 (60%)
	Scotland	12	2 (17%)	2 (17%)
	N. Ireland	2	0	2 (100%)
		19	2 (11%)	7 (37%)

Table 8: Number of incidents involving wild birds in 1998 (continued)

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Seabirds	N. Ireland	3	0	3 (100%)
Pigeon and doves	England	10	3 (30%)	4 (40%)
	Wales	1	0	1 (100%)
	Scotland	1	0	0
	N. Ireland	4	1 (25%)	2 (50%)
		16	4 (25%)	7 (44%)
Corvids	England	12	1 (8%)	6 (50%)
	Wales	5	1 (20%)	1 (20%)
	Scotland	7	2 (29%)	2 (29%)
	N. Ireland	2	0	1 (50%)
		26	4 (15%)	10 (38%)
Gamebirds	England	3	1 (33%)	1 (33%)
	Scotland	1	0	0
		4	1 (25%)	1 (25%)
Other birds	England	8	0	2 (25%)
	Scotland	4	0	1 (25%)
	N. Ireland	4	2 (50%)	0
		16	2 (13%)	3 (19%)
TOTAL*	England	67	11 (16%)	30 (45%)
	Wales	17	4 (24%)	8 (47%)
	Scotland	77	23 (30%)	21 (27%)
	N. Ireland	31	4 (13%)	21 (68%)
		192	42 (22%)	80 (42%)

*Birds from more than one category may be involved in a single incident

Table 9: Incidents involving wild birds 1993–1998

	1993	1994	1995	1996	1997	1998
Incidents investigated	263	267	232	199	155	192
Pesticide incidents	26%	24%	22%	30%	26%	22%

Birds of prey (including owls)

65. There were 97 incidents involving birds of prey (see Table 10) investigated and of these the cause of the incident was established in 67 (69%); 29 incidents (30%) were identified as involving pesticide poisoning. Table 11 shows the number and percentage of pesticide poisonings for the past six years.

Table 10: Number of incidents involving birds of prey (excluding owls) in 1998

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Buzzard	England	12	2 (17%)	6 (50%)
	Wales	4	0	3 (75%)
	Scotland	22	12 (55%)	4 (18%)
	N. Ireland	1	0	1 (100%)
		39	14 (36%)	14 (36%)
Red kite	England	6	3 (50%)	1 (17%)
	Wales	9	3 (33%)	4 (44%)
	Scotland	5	4 (80%)	0
		20	10 (50%)	5 (25%)
Golden eagle	Scotland	3	2 (67%)	0
Peregrine	England	3	0	1 (33%)
	Wales	1	1 (100%)	0
	Scotland	6	2 (33%)	1 (17%)
	N. Ireland	1	0	0
		11	3 (27%)	2 (18%)
Hen harrier	Scotland	2	1 (50%)	1 (50%)
Sparrowhawk	England	3	0	2 (67%)
	Scotland	5	0	2 (40%)
	N. Ireland	3	0	3 (100%)
		11	0	7 (64%)
Kestrel	England	1	0	1 (100%)
	Scotland	1	0	1 (100%)
		2	0	2 (100%)
Osprey	Scotland	1	0	1 (100%)

*Birds of prey from more than one category may be involved in a single incident

Table 11: Incidents involving birds of prey (including owls) 1993–1998

	1993	1994	1995	1996	1997	1998
Incidents investigated	140	134	131	122	84	97
Pesticide incidents	24%	28%	24%	34%	25%	30%

Common buzzards

66. There were 39 reported incidents involving common buzzards in 1998 and of these the cause of the incident was established in 28 (72%), with 14 (36%) poisoning incidents.
67. Thirteen of these 14 pesticide poisoning incidents resulted from the abuse of pesticides. Carbofuran was identified in nine of these incidents and alphachloralose in the four other incidents. There was one incident where difenacoum was identified in the liver of a bird, but the source of this compound was not identified.

Eagles

68. Three golden eagles were submitted in separate incidents. In two incidents the cause of death resulted from the abuse of carbofuran.

Red kites

69. There were 20 incidents involving red kites reported to the Scheme, some of which were introduced birds. The causes of the incidents were identified in 15 of these incidents (75%). Ten (50%) involved pesticide poisoning. The abuse of agricultural chemicals was found to be involved in four incidents (three alphachloralose and the other carbofuran). In addition, the abuse of the veterinary pesticide fenthion was suspected in two incidents from Wales.
70. Bendiocarb poisoning was found to be the cause of one incident, but the source of the chemical was not established. Diazinon poisoning was confirmed in another incident and again the source of the chemical was uncertain.
71. Anticoagulant rodenticide poisoning was confirmed as the primary cause of death in two separate incidents involving red kites. The incidents occurred in the same part of England and residues of brodifacoum were found in both. In response to concerns that red kites may be vulnerable to secondary rodenticide poisoning, tissues from a further ten red kites (two from England and four each from Scotland and Wales) were tested for the presence of anticoagulant rodenticide residues. Four of these birds contained residues, which confirms their exposure to these compounds; bromadiolone in a bird from England, difenacoum in two birds from Scotland and difenacoum and bromadiolone in another bird from Scotland. No residues were found in the birds from Wales.

Peregrine falcons

72. Eleven incidents involving peregrine falcons were reported to the Scheme. There were three pesticide poisoning incidents, all associated with abuse. These were single incidents involving poisoning with aldicarb, carbofuran and alphachloralose.

Hen harriers

73. Hen harriers were involved in two incidents during the reporting period. One bird was found to be a victim of the abuse of carbofuran.

Owls

74. Fifteen incidents involving owls were notified in 1998, five from England (two involving barn owls and four tawny owl) and ten from Scotland (four barn owl, one short-eared owl, one tawny and four other unspecified owls). Flocoumafen residues were confirmed in tissues from a tawny owl from England. The bird was in poor condition and the source of this compound has not been established.

Other raptor species

75. Other species of raptor were submitted as possible pesticide incidents although none were found to be caused by pesticide poisoning. These included two involving kestrel, one osprey, and eight sparrowhawks.

76. In five of the sparrowhawks background residues of DDE, the persistent organochlorine metabolite of DDT, were detected from the livers of the birds examined.

Wildfowl and water birds

77. In 1998 there were 20 incidents investigated by the Scheme that involved wildfowl and water birds. The cause was identified in 14 of these incidents, only one of which involved pesticide poisoning. A moorhen was found poisoned in Northern Ireland from the abuse of warfarin. Other species reported in incidents but where no pesticide residues were implicated were swans (eleven, one of which also included a great crested grebe), geese (two), mallard (two), one involving both mallard and canada goose, eider duck (one) and heron (two).

Gulls and waders

78. There were nineteen incidents involving gulls and waders in 1998. The cause was established in nine incidents, two of which involved the abuse of pesticides, both from Scotland.
79. In the first incident a great black-backed gull was killed through the abuse of carbofuran. In the second incident a number of herring gulls died near a fish farm. Poisoning by the organophosphorus insecticide dichlorvos was shown to be the cause of death. This material is used as a veterinary medicine to control sea lice in fish farming. Subsequent investigation revealed that the incident resulted from deliberate abuse of the veterinary medicine formulation.

Pigeons and doves

80. There were 16 incidents involving pigeons and doves reported in 1998; the cause of the incidents was found in eleven, four of these being attributed to pesticide poisoning.
81. Two incidents resulted from abuse of pesticides. Aldicarb abuse was found in one incident and alphachloralose abuse the other. The misuse of alphachloralose was recorded in an incident where an unlicensed narcotic treatment was carried out and in another incident malathion was thought to have poisoned pigeons in a loft after it had been used to control a red mite infestation.

Corvids

82. This group of birds is often the target of deliberate pesticide poisoning as they are considered by some to be pests. In 1998 there were 26 incidents reported; the cause of incidents was found in 14, with four of these attributed to pesticide poisoning. Table 12 shows the number and percentage of pesticide poisonings for the past six years.

Table 12: Incidents involving corvids 1993–1998

	1993	1994	1995	1996	1997	1998
Incidents investigated	40	39	29	30	22	26
Pesticide incidents	60%	33%	28%	57%	41%	15%

83. Deliberate abuse of alphachloralose was found in an incident involving a magpie and a jackdaw together with a rabbit bait. A crow was one of a number of birds poisoned with carbofuran in a case of abuse. In Wales, five magpies were found poisoned with strychnine, the source of which could not be ascertained. Finally a rook, one of several, found dead was found to contain traces of the organophosphorus compound phosmet. This material has been used as a pour-on veterinary medicine to control parasites on livestock. In the absence of any field information to the contrary this incident was attributed to the veterinary use of this chemical.

Gamebirds

84. There were four incidents notified in this category in 1998. The cause of two of these incidents was determined, one of which involved poisoning.
85. A pheasant was found to have been poisoned with anticoagulant rodenticides when residues of bromadiolone and difenacoum were confirmed in liver tissue. The field inquiry established that rodenticide baits were lying exposed on the premises.

Other birds

86. This category includes passerines (mainly garden birds) and other birds not dealt with in earlier sections. There were 16 incidents reported, the cause of the incident was determined in five of these, with two resulting from pesticide poisoning.
87. In two incidents from Northern Ireland, starlings were found to have been deliberately poisoned by alphachloralose.

Wildlife: Others

88. There were two incidents notified in 1998 that involved the possible poisoning by agricultural chemicals of earthworms. In both incidents numerous earthworms were found dead on the surfaces of fields. In one incident, residues of methiocarb were detected. The deaths had occurred shortly after the application of this compound to control slugs. In the second, the deaths were associated with the application of urea fertiliser to the field.

Livestock

89. Livestock are not normally included in the Scheme, but if there are other environmental samples associated with the incident they may be accepted. There were ten incidents involving livestock reported to the Scheme in 1998 (see Table 13). The cause was determined in four incidents, all of which involved pesticides. In the previous year there were also 16 incidents reported in this category; pesticide poisoning was identified in one.

Table 13: Number of incidents involving livestock in 1998

		Number of incidents investigated	Number (%) in which pesticide poisoning was identified	Number in which an other cause of death was identified
Cattle	England	1	1	0
	Scotland	1	0	0
Sheep	England	1	0	0
	Scotland	1	0	0
Pig	Wales	1	0	0
Poultry	England	4	2	0
	Scotland	1	1	0
TOTAL	England	6	3	0
	Wales	1	0	0
	Scotland	3	1	0
		10	4 (40%)	0

90. Two of these incidents involved anticoagulant rodenticides. In one misuse incident ducks were found to contain residues of brodifacoum and bromadiolone in their tissues. Wax blocks containing brodifacoum had been used to control rats in the vicinity of the ducks. In the second, a hen was found poisoned by brodifacoum, the source of which was not clearly identified.
91. In the remaining two incidents involving livestock, bracken poisoning was diagnosed in 25 cows which were allowed to graze shortly after asulam had been used for bracken control. Finally, six geese and a chicken were poisoned with the organophosphorus compound diazinon after they had access to a sheep dip containing this compound.

Companion animals

92. There were 235 incidents involving companion animals reported to the Scheme in 1998 (see Table 14). The cause of the incident was established in 122 (52%), with pesticides implicated in 90 (38%). Table 15 shows the number and percentage of pesticide poisonings for the past six years.

Table 14: Number of incidents involving companion and exotic and other animals in 1998

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Cat	England	56	21 (38%)	12 (22%)
	Wales	3	2 (67%)	0
	Scotland	21	9 (43%)	1 (5%)
	N. Ireland	11	3 (27%)	5 (45%)
		91	35 (38%)	18 (20%)

Table 14: Number of incidents involving companion and exotic and other animals in 1998 (continued)

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Dog	England	78	39 (50%)	4 (5%)
	Wales	5	1 (20%)	1 (20%)
	Scotland	35	13 (37%)	1 (3%)
	N. Ireland	31	7 (23%)	8 (26%)
		149	60 (40%)	14 (9%)
Horse	England	1	0	0
	Scotland	1	0	0
		2	0	0
Ferret	Wales	1	0	1 (100%)
Falconry bird	Scotland	1	0	0
TOTAL*	England	130	57 (44%)	16 (13%)
	Wales	8	3 (38%)	1 (13%)
	Scotland	58	22 (39%)	2 (3%)
	N. Ireland	41	10 (24%)	13 (32%)
		235	90 (38%)	32 (14%)
Wildfowl Collections	England	1	0	1
	Scotland	2	1	0
	N. Ireland	1	1	0
		4	2	1
Caged Birds	England	1	0	0
	N. Ireland	1	0	1
		2	0	1
Wolf	Scotland	1	0	1
Earthworm	England	2	1	1

*Animals from more than one category may be involved in a single incident

Table 15: Incidents involving companion animals 1993–1998

	1993	1994	1995	1996	1997	1998
Incidents investigated	239	313	271	275	253	235
Pesticide incidents	36%	49%	34%	35%	34%	38%

Cats

93. There were 91 incidents involving cats investigated by the Scheme. The cause of the incident was established in 53 (58%). Pesticides were implicated in 35 (38%), with over 50 individuals being poisoned. Table 16 shows the number and percentage of pesticide poisonings for the past six years.

Table 16: Incidents involving cats 1993–1998

	1993	1994	1995	1996	1997	1998
Incidents investigated	101	125	90	112	110	91
Pesticide incidents	35%	41%	33%	38%	37%	38%

94. Pesticide abuse accounted for 29 incidents, nine incidents involved aldicarb, eight carbofuran, three metaldehyde (one of which also involved bendiocarb), two alphachloralose (one of which also involved seconal), two bendiocarb (including the incident mentioned previously also involving metaldehyde) and three paraquat. There were single incidents involving methiocarb, bromadiolone, and coumatetralyl. In several of these incidents baits were also found.
95. The misuse of bendiocarb occurred in an incident where a treatment for a flea infestation in a house was carried out and the operator sprayed the cat.
96. Five incidents were attributed to unspecified use because the source of the pesticides involved could not be determined. Two of the incidents involved metaldehyde, another involved brodifacoum and another an unidentified anticoagulant rodenticide. In the fifth incident a residue of fenthion was detected in tissues from a cat. This may be the result of a flea treatment, but this could not be confirmed.
97. Ethylene glycol (anti-freeze) poisoning was found in two incidents.

Dogs

98. The Scheme registered 149 incidents involving dogs. The cause of the incident was determined in 74 (50%), with pesticides implicated in 60 (40%). Over 80 dogs were found to have been poisoned. Table 17 shows the number and percentage of pesticide poisonings for the past six years.

Table 17: Incidents involving dogs 1993–1998

	1993	1994	1995	1996	1997	1998
Incidents investigated	145	183	170	163	138	149
Pesticide incidents	39%	28%	39%	35%	33%	40%

99. The abuse of pesticides was found in 27 incidents. Poisoning with carbofuran was found in eight incidents, paraquat in five, strychnine in three and metaldehyde three. There were two incidents of abuse of methiocarb and two aldicarb. There were single incidents involving the abuse of brodifacoum, coumatetralyl and warfarin. Aluminium phosphide abuse was thought to be involved in the death of a dog in another incident.
100. There were 22 incidents involving the misuse of pesticides. The spillage or poor storage of slug pellets accounted for 12 misuse incidents, nine involving metaldehyde and three methiocarb. There were two incidents involving the misuse of carbamate compounds. In one, a dog was poisoned after aldicarb, supplied in a paracetamol bottle, was used in a garden area of a farm. In the other, a dog (and a cat) were poisoned by bendiocarb when treated as part of a treatment to control fleas. Anticoagulant rodenticides were involved in eight incidents with baits being left accessible. There were three incidents involving

difenacoum, two bromadiolone and two coumatetralyl. In addition, one incident involved a number of exposed baits with brodifacoum, bromadiolone, coumatetralyl and difenacoum being involved.

101. There were two incidents thought to have arisen after the approved use of anticoagulant rodenticides. One involved bromadiolone and one coumatetralyl. In addition to the above there were a further nine incidents that involved dogs where the sources of the compounds were not apparent. Four involved metaldehyde poisoning, two methiocarb, one bromadiolone, one coumatetralyl, and one paraquat.
102. There was one poisoning incident involving dogs where barbiturates were involved and another was caused by ethylene glycol poisoning.

Other companion animals

103. There were four incidents involving other companion animals. Two involved horses, one a ferret and one a falconry bird. Pesticide poisoning was not found to be the cause of death in any of these incidents

Exotic species

104. In each year a few incidents are reported which involve the suspected pesticide poisoning of exotic species (see Table 14). In 1998 there were seven such incidents. Four incidents involved wildfowl collections. In two of these pesticide poisoning. In one warfarin poisoning of a Ross's goose was suspected and in the other four ducks were poisoned by diazinon. The circumstances pointed to a discharge of a veterinary medicine formulation and the incident was notified to the Scottish Environment Protection Agency for further action.
105. Caged birds were involved in two incidents notified to the Scheme, as was a wolf in Scotland. No pesticides were found to be involved in these incidents.

Beneficial insects

106. There were 43 suspected beneficial insect poisoning incidents reported during 1998 (see Table 18), with 34 incidents reported from England, 1 incident reported from Wales and 8 incidents reported from Scotland. Pesticide poisoning was involved in 12 (28%) of these incidents, six poisoning incidents occurred in England and six in Scotland. There was one incident from England where pesticide residues were found in samples submitted for tests and there was clear evidence of illegal use of bifenthrin to kill honeybees. However, no pesticide residue was found on a small sample of honeybees submitted. There were a further three incidents from England where pesticide residues were detected and confirmed, but the residues found on the bees were not considered to be the cause of their death. In two of these incidents fluvalinate was confirmed and in another dichlorvos. Table 19 shows the number and percentage of pesticide poisonings for the past six years.

Table 18: Number of incidents involving beneficial insects in the UK during 1998

Number of incidents investigated:	43
Number of incidents where pesticides were detected and confirmed:	15
Number of incidents attributed to pesticides:	12
Number of incidents where bee diseases were detected (see Table 2):	13
Number of incidents attributed to disease:	2

Pesticide detected*	Number of incidents	Number of colonies affected
<i>Carbamate compounds</i>		
carbaryl	1	1
<i>Organophosphate compounds</i>		
dimethoate	3	14
fenitrothion	1	7
malathion	1	5
pirimiphos-methyl	1	2
<i>Organochlorine compounds</i>		
gamma-HCH	2	3
<i>Pyrethroid compounds</i>		
bifenthrin	1	not applicable
cypermethrin	1	2
lambda-cyhalothrin**	1	6
permethrin	1	21
<i>Fungicide</i>		
dichlofluanid	1	7
TOTAL ***	12	58

* There were three incidents where pesticides were detected and confirmed, but the incidents were not attributed to pesticide poisoning. These involved:- dichlorvos (1 incident), fluralinate (2 incidents).

** Pesticide poisoning determined by supporting information, no bees were available for tests.

*** There were two incidents where more than one pesticide was detected. In one incident dichlofluanid and fenitrothion were detected and in another residues of dimethoate and gamma-HCH were detected.

Table 19: Incidents involving beneficial insects 1993–1998

	1993	1994	1995	1996	1997	1998
Incidents investigated	58	45	56	40	40	43
Pesticide incidents	38%	44%	59%	20%	40%	28%

107. In thirteen of the incidents investigated diseased bees were found and in two of these incidents nosema or acarine were considered to be the cause of death of the bees. In three incidents with some diseased honeybees present, pesticide residues were also detected and confirmed (see Appendix 2).

108. The cause of death of the honeybees in the remaining incidents could not be determined. However, in three of these incidents there were small unconfirmed residues of fluvalinate noted in the bees examined. During 1998, there has been a total of five incidents with suspected fluvalinate residues (two were confirmed residues). This pesticide is not considered to be the cause of death of the bees, because at the recommended doses it is classed as not dangerous to bees. However, it is an indication that bees have been exposed to the compound, probably from its use to control varroa.
109. Ten different insecticides were implicated in the twelve suspected bee poisoning incidents (see Table 18). There were no incidents involving triazophos or bendiocarb during 1998 (In previous years there have been problems with these two compounds, but due to action taken by HSE and PSD these have now subsided). However, there were three incidents involving dimethoate and four incidents involving synthetic pyrethroids. For reviews of bee poisoning incidents refer to: Barnett E.A. *et al* 1997, Fletcher M.R. *et al* 1994a and Greig-Smith P.W. *et al* 1994. For a summary of the 1998 incidents where pesticides were involved refer to Table 20.

Table 20: Beneficial insect pesticide incidents in the UK during 1998

Month	Location	Number of colonies in apiary	Number of colonies affected	Pesticide involved	Level detected ($\mu\text{g}/\text{bee}$)
May	Bedfordshire	2	1	carbaryl	1.7
May	Gloucestershire	2	1	fluvalinate	0.002
May	Hampshire	2	2	bifenthrin*	no bee residue
May	Norfolk	2	1	dichlorvos	0.009
May	Suffolk	6	6	lambda-cyhalothrin	none available
May	Tyne and Wear	5	5	malathion	5.5
June	Cornwall	8	8	dimethoate	0.24
June	Gloucestershire	20	20	fluvalinate	0.04
June	Fife	7	7	fenitrothion	0.086
July	East Lothian**	3	3	dichlofluanid	3.33
July	unknown	unknown		dimethoate	0.058
July	East Lothian	3	3	dimethoate	0.034
July	Strathclyde	2	2	gamma-HCH	0.017
August	Suffolk	3	2	cypermethrin	0.06
August	Grampian**	15	15	pirimiphos-methyl	0.04
August	6	6	15	permethrin	0.008
September	Grampian	unknown	unknown	gamma-HCH	0.005

* Bifenthrin confirmed in five samples and four pesticide formulations confirmed as containing:- bendiocarb, bifenthrin, chlorpyrifos and pirimiphos-methyl.

** Two apiaries affected in these incidents, probably from the one pesticide treatment.

110. There was one approved use incident, four misuse incidents and an abuse incident (see paragraphs below). The approved use incident involved cypermethrin. Three of the misuse incidents involved dimethoate and the other incident involved permethrin. The abuse incident was bifenthrin found in syrup. In six incidents the source of the pesticide identified has not been established despite thorough field investigations. However, in two of these incidents the size of the residue suggested that abuse of malathion and in another carbaryl had occurred, but there was no other evidence to corroborate this.
111. A beekeeper in Buckinghamshire reported finding thousands of dead and dying honeybees outside the hive. A residue of 1.7µg carbaryl per bee was detected and confirmed in the sample examined, so these honeybee mortalities were due to pesticide poisoning. No further evidence to establish the source of this pesticide was found. However, the size of the residue is consistent with an improper use of the pesticide.
112. A hive in Norfolk had about seventy percent of the honeybees die. Analyses confirmed a residue of approximately 0.009µg dichlorvos per bee. It was considered unlikely that this small residue present on the honeybees examined, would cause the death of so many bees. Further enquiries revealed that the hive was obtained from an old beekeeper, who may have used this compound to control wax moth.
113. All eight colonies of an apiary in Cornwall suffered large scale losses of worker honeybees. The bees were thought to be foraging on hedgerow plants and garden flowers and large amounts of the flowering weed *Raphanus raphanistrum* which was present in a local bulb crop. Around midday on the day the mortalities occurred, this bulb crop was sprayed with dimethoate to control narcissus fly. Laboratory analyses detected and confirmed a residue of 0.24µg dimethoate per bee. This residue is consistent with the honeybees dying from pesticide poisoning following the misuse of dimethoate.
114. Two incidents involving dimethoate occurred in Scotland. At a field site in East Lothian a honeybee trial with spring oilseed rape was undertaken using dimethoate as a toxic standard. Although arrangements were made to notify beekeepers in the area, this was not done and two apiaries suffered losses. A residue of 0.058µg dimethoate per bee was found in both of the samples examined, so it is likely that these bees died from pesticide poisoning. In the other incident one of the same apiaries suffered more losses two weeks later. When the bees were analysed a residue of 0.034µg dimethoate per bee was confirmed and a residue of 0.017µg gamma-HCH per bee was also confirmed. The source of the dimethoate may be linked to the earlier mortality, but no source for the gamma-HCH was established. Given the presence of both of these residues it is likely that these bees died from pesticide poisoning.
115. All seven colonies of an apiary in Fife were affected by pesticides. The tests have confirmed residues of 0.086µg fenitrothion per bee and 3.33µg dichlofluanid per bee. The size of the fenitrothion residue indicates that these honeybees have died from pesticide poisoning. The field investigation did not identify any specific treatments in the area. However, an application to a raspberry crop is suspected due to the combination of pesticides identified.
116. In Tyne and Wear most of the honeybees in five colonies were found dead or dying outside of the hives. The laboratory tests detected and confirmed 5.5µg malathion per bee in the sample analysed. It is certain that these honeybees died from pesticide poisoning, but the source of the malathion was not established. The size of this residue suggests an illegal use of malathion.

117. A beekeeper in Suffolk suspected that a spray application to an orchard was responsible for the bee deaths in two of his three hives. Laboratory tests detected and confirmed 0.04µg pirimiphos-methyl per bee, so these honeybee mortalities may have been due to pesticide poisoning. It was reported that only fungicides had been used in the orchard and there is no further evidence to establish the source of this pesticide.
118. A beekeeper in East Lothian noticed more honeybee mortality a fortnight after a poisoning incident with dimethoate had occurred. A residue of 0.017µg gamma-HCH per bee was confirmed, but the source of this pesticide has not been established. See dimethoate section above. A beekeeper in Grampian had significant honeybee mortality a month after a poisoning incident involving permethrin (see permethrin section below). Analyses have detected and confirmed a residue of 0.005µg gamma-HCH per bee, which may have caused the death of these bees. The source of the gamma-HCH was not determined.
119. Although no honeybee mortalities were attributed to pesticide poisoning in this incident, there was clearly an intention to illegally poison honeybees. Verbal and written threats were received from the neighbour of a beekeeper in Hampshire who has two honeybee colonies. It was claimed that chemicals had been applied to garden plants in an attempt to poison the honeybees and the honey. This followed from a dispute over the honeybees as they had allegedly stung the neighbour's child. The police were involved and numerous vegetation samples and containers of pesticides were retrieved for analysis. The pesticides were confirmed to be, bendiocarb, chlorpyrifos, pirimiphos-methyl and bifenthrin. Only the synthetic pyrethroid, bifenthrin, was found in spraying equipment and on flower samples. Bifenthrin was also detected and confirmed in a tin of syrup. A small number of honeybee mortalities occurred and although these were collected and submitted for analysis, no pesticide residue was found on them.
120. Two colonies in a suburban garden in Strathclyde are thought to have been affected by an approved use of cypermethrin on oilseed rape. Mostly young honeybees were gathering pollen from an oilseed rape crop about 2.5km away. Farm spray records revealed that the crop was sprayed with cypermethrin on the day the bee mortality occurred. The farmer was unaware of apiaries in the area so he had not given a warning of his intention to spray. Analysis of the submitted bees revealed a residue of 0.06µg cypermethrin per bee. Therefore it is likely that these bees died from pesticide poisoning.
121. There were two incidents from Gloucestershire where confirmed residues of fluvalinate were detected. In one incident all twenty colonies in an apiary had dying bees outside over a three week period. In the sample of bees examined a residue of 0.04µg fluvalinate per bee was detected and confirmed. This confirms exposure to fluvalinate, but it is not the cause of death which has been attributed to disease, as nosema was noted in 70% of a sample of the bees. Dead honeybees were found outside the hive of a colony in an orchard. Analysis has revealed a residue of 0.002µg fluvalinate per bee, which again confirms exposure rather than the cause of death of the bees. Some nosema (30%) was also noted in these bees. There were three further incidents where fluvalinate was noted on the honeybees, but the residue was too small to confirm the identity of the compound. These residues probably originate from the use of fluvalinate as a treatment for varroa.
122. In Grampian a pesticide application is believed to have resulted in one beekeeper losing bees from two apiaries. There were fifteen colonies affected in one apiary and six in the other. The bees examined revealed a residue of 0.008µg permethrin per bee, so given residue losses before analysis it is possible that these honeybees died from pesticide poisoning. Investigations have revealed that permethrin treated saplings were being

planted in a nearby forestry plantation. A drench gun was also used to apply a follow-up treatment of permethrin to the saplings for weevil control. Flowering heather surrounds the area and it is suspected that this was oversprayed with permethrin, so this incident has been classified as a misuse of the compound.

123. All six colonies in an apiary in Suffolk suffered a loss of between 5-10,000 honeybees. Most of the bees had not returned to the hives and some that did were refused entry. Five hundred metres from the apiary a field of flowering winter oilseed rape had been sprayed between 9:00-10:00 hrs with lambda-cyhalothrin and carbendazim. The label conditions for this product allow application to flowering winter oilseed rape. As the dead bees around the apiary were eaten by free range chickens, analytical tests could not be completed so this incident has been classified as unspecified use. This incident is similar to those reported in the previous year involving a mixture of pyrethroids and fungicide (Fletcher *et al.* 1998). Although individual fungicides generally have a low toxicity to bees, some research suggests that fungicides may increase the toxicity of pyrethroids to bees (Johnston *et al.* 1990, Pilling and Jepson 1993).

Suspected poisoned baits and suspicious samples

124. Each year a number of suspected baits and suspicious samples are submitted for pesticide residue investigation, even though no dead animals have been found nor poisoning known to have occurred. There were 62 such samples notified to the Scheme in 1998. Pesticides were detected in 29 of these (47%). Table 21 shows the number of possible baits and suspicious samples submitted and the percentage in which pesticides were detected for the past six years. By their nature these samples are likely to be associated with either deliberate abuse or misuse of pesticides. There were eleven incidents of the former and 17 of the latter. In addition, there was one incident where the source could not be determined.

Table 21: Incidents involving possible baits and suspicious samples 1993–1998

	1993	1994	1995	1996	1997	1998
Incidents investigated	58	57	72	63	66	62
Pesticide incidents	34%	28%	39%	46%	48%	47%

125. Of the deliberate abuse incidents, metaldehyde was confirmed in two incidents with pellets incorporated into a bait in one and left in a pile outside a badger sett in the other. There were two incidents involving carbofuran in baits and one difenacoum. A mixture containing 2,4 D, dicamba and mecoprop were also found in an oatmeal bait. Potatoes containing methiocarb pellets were found inside a badger sett, which had also been subjected to phosphide gassing. Gassing of badger setts with cyanide occurred in one incident and phosphide in another. A fox earth was also found to have been gassed by phosphide. Alphachloralose, strychnine, mevinphos and malathion were identified in containers seized in a search in another incident.
126. The misuse of compounds included exposed rodenticide baits (seven). These were single incidents involving brodifacoum, bromadiolone, chlorophacinone, coumatetralyl, warfarin, bromadiolone and difenacoum and chlorophacinone and coumatetralyl. Treated grain spilt and not cleared up was found in two incidents. Fonofos treated grain in one and methiocarb treated maize in another. Metaldehyde was used to control squirrels in one incident and difenacoum in another. Strychnine was detected in a bottle that had been

discarded by a footpath. There were two incidents where cyanide was found in a store used for the control of wasp nests. Unapproved products, DDT in one and oxydemeton-methyl in another were found in a chemical store.

Agricultural chemicals

127. The chemicals found in the 173 vertebrate (also including the one earthworm incident) and bait incidents are listed in Table 4. Details of these incidents are also given in Appendix 2. Agricultural chemicals involved in beneficial insect incidents can also be found in Table 4 and Appendix 2 and above in the section involving this category.
128. A total of 34 different compounds was implicated from all incidents (except beneficial insect incidents) submitted during 1998 (26 in 1997). There were 29 different chemicals from England (23 in 1997), 14 from Scotland (11 in 1997), 7 from Wales (7 in 1997) and 5 from Northern Ireland (6 in 1997). In addition, some small non-significant residues were also detected. Table 22 shows the number of different pesticides implicated in all incidents (except beneficial insect incidents) in the past six years.

Table 22: The number of different pesticides implicated in all incidents (excludes beneficial insects) 1993–1998

	1993	1994	1995	1996	1997	1998
Number of compounds	32	35	36	29	26	34

Other causes of death

129. There were 139 vertebrate incidents where the cause was determined as other than pesticide poisoning. This represents 27% of vertebrate incidents (excluding those just involving baits). This compares with 112 (22%) in the previous year. It should be noted that disease, starvation or trauma victims are not usually sent for analyses (see Appendix 1). However, it is possible that a sub-lethal exposure to a pesticide contributed to death, apparently by natural causes. Within the remit of the Scheme it is not possible to monitor sub-lethal effects, but if pesticides are strongly implicated in an incident, tissues may still be sent for analyses.

Part 4: Conclusions

Number of incidents

130. In 1998, of the 612 incidents registered, pesticide involvement was found in 30% and other causes of death (non-agricultural chemicals, disease, starvation, etc.) were identified in 23% (see Table 1, Figure 3). In addition, there were 34 incidents reported that were found to be not applicable (baits which were not laced with a pesticide and no dead animals found). When compared with the numbers of incidents reported since 1994 (Table 23), there has been a continuing decrease over the past few years. A similar number of incidents were reported to the Scheme in 1998 when compared with the previous year. The total number of pesticide incidents has remained about the same over most of this time.

Table 23: Number of incidents reported to the Scheme 1994–1998 and number (%) of pesticides incidents identified

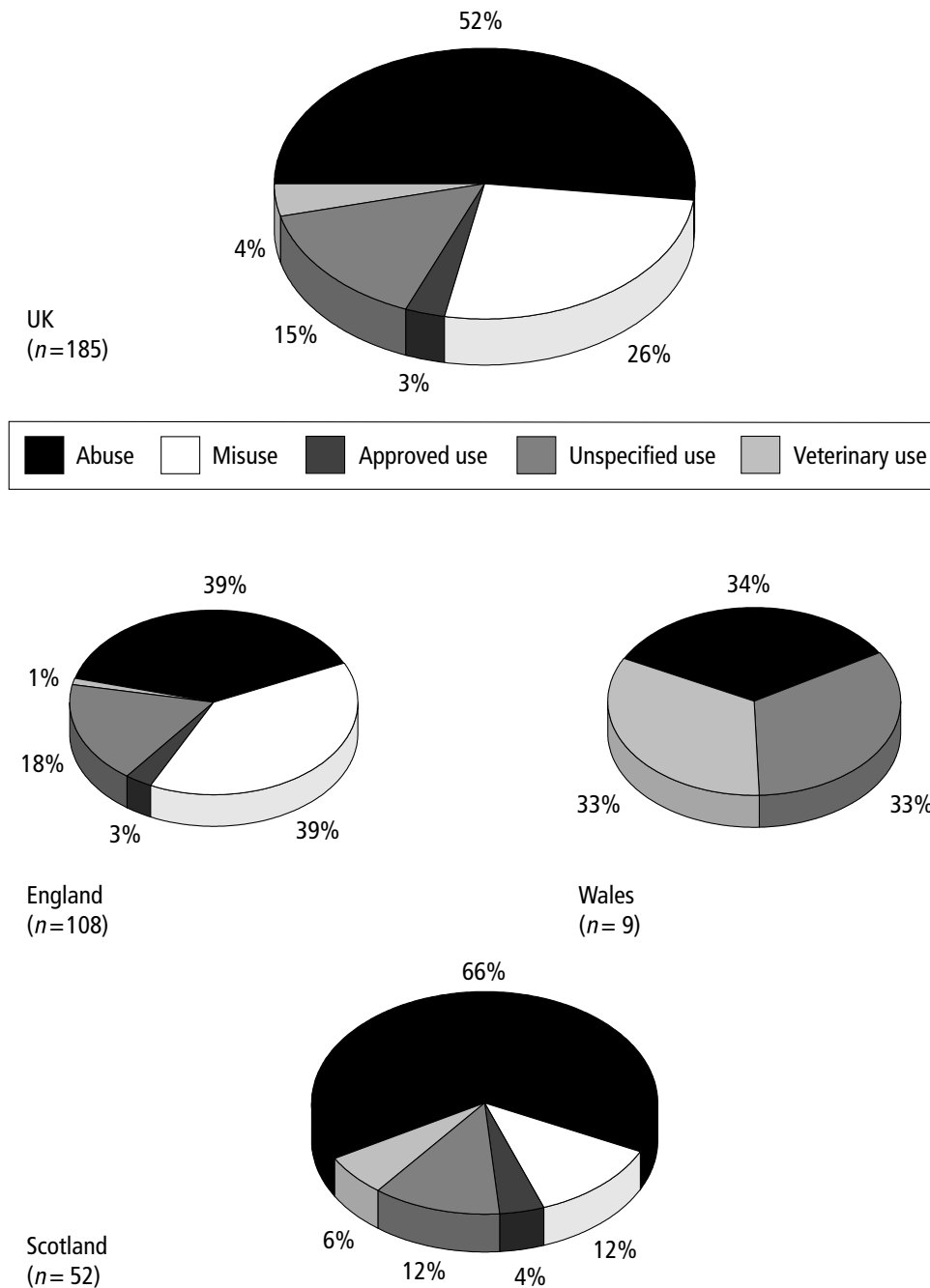
Year	1994	1995	1996	1997	1998
England					
No. of incidents reported	454	433	354	333	334
No. of pesticide incidents (%)	136 (30%)	151 (35%)	128 (36%)	118 (35%)	108 (32%)
Scotland					
No. of incidents reported	200	160	160	144	167
No. pesticide incidents (%)	42 (21%)	33 (20%)	34 (21%)	36 (25%)	52 (31%)
Wales					
No. of incidents reported	66	58	58	51	32
No. pesticide incidents (%)	11 (17%)	5 (9%)	24 (41%)	13 (25%)	9 (28%)
Northern Ireland					
No. of incidents reported	115	84	79	79	79
No. pesticide incidents (%)	22 (19%)	19 (23%)	18 (23%)	19 (24%)	16 (20%)
Total					
No. of incidents reported	835	735	651	607	612
No. pesticide incidents (%)	211 (25%)	208 (28%)	204 (31%)	185 (30%)	185 (30%)

131. Regionally, there was about the same number of incidents reported in England when compared to the previous year. For Wales the decrease was 37% but Scotland had an increase of 16% of the number of incidents reported. Northern Ireland had the same number reported as in the previous year. Overall the percentage of pesticide poisoning incidents remained the same (30%). There were decreases in percentage of poisoning incidents for England (32% from 35%) and Northern Ireland (20% from 24%) with a percentage increase of poisoning incidents in Scotland (25% to 28% in the reporting year) and Wales (25% to 28% in 1998).

132. Compared with the previous year, the overall number (185) and percentage (30%) of pesticide poisonings has remained about the same. However, in the years 1994-1996 the number of pesticide poisonings averaged at about 208 a year, but the percentage figure has remained about the same. In these pesticide poisoning incidents, thirty-eight different compounds were detected.

133. The percentages of categories of pesticide use resulting in poisoning are shown in Figure 1. There were five incidents involving the approved use of pesticides. This represented just over 3% of pesticide incidents reported. Reassuringly, this small number of incidents reported to the Scheme indicates that agricultural chemicals, if used in an approved manner, are apparently not causing major problems to wildlife and other animals.

Figure 1: Proportion of all incidents by category of pesticide involvement in 1998
(All pesticide incidents in Northern Ireland were abuse)



134. There were 49 incidents arising from the misuse of agricultural chemicals (26% of pesticide poisoning incidents). These resulted from poor storage, spillage, chemicals not being used in the approved manner or compounds being disposed of in an inappropriate way. This shows a large increase on previous years. In 1997, there were only 23 incidents representing 12% of poisoning incidents and misuse incidents had been at about this level for the past few years.
135. As in previous years, incidents involving deliberate abuse dominated those in which pesticides were implicated; there were 96 incidents arising from abuse (52%). However, the number of abuse incidents dropped by about a quarter in 1998 when compared with the previous year. Additionally there were 28 (15%) incidents where the cause of the poisoning could not be identified. In 1998, there were seven incidents reported that probably arose from veterinary compounds. All these poisoning incidents can be found in Appendix 2. Regulatory and/or enforcement action was taken as appropriate and 1998 saw growing co-operation between authorities resulting in successful prosecutions.

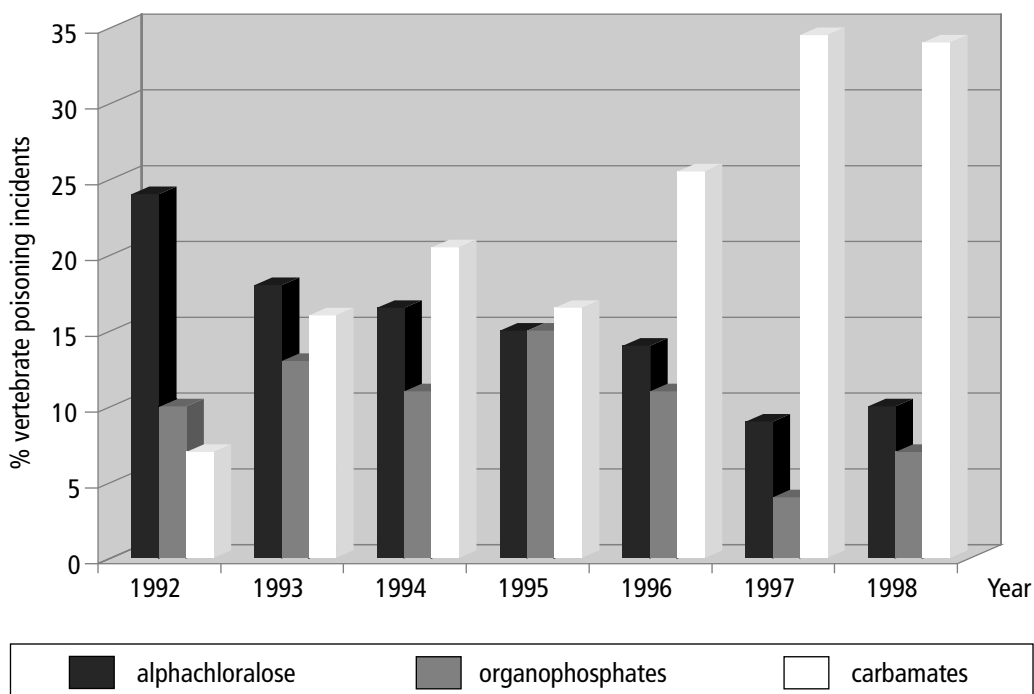
Vertebrate incidents

136. Of the 569 vertebrate related incidents reported (including the two earthworm incidents), 173 involved agricultural chemicals (30%). There were only four incidents (2%) arising from approved use (see Table 23). Incidents arising from misuse, amounted to 45 (26%), showing a large increase over the 12% found in 1997. Abuse of pesticides (95 incidents) accounted for 55% of all vertebrate related pesticide incidents, a figure that had been steadily rising over the past few years but now shows a decline. A similar number and percentage to that found in 1997 was found with unspecified use incidents; 22 (13%) in this reporting year. There were seven incidents involving pesticides formulated as veterinary medicine products during 1998. These were found as our multi-residue methods will also detect veterinary organophosphate or carbamate compounds.

Table 24: Numbers of vertebrate related incidents and category of use 1993–1998

	1993	1994	1995	1996	1997	1998
Number of pesticide poisoning incidents	190	191	175	196	170	173
Abuse	105 (55%)	115 (60%)	112 (64%)	136 (69%)	125 (74%)	95 (55%)
Misuse	22 (12%)	21 (11%)	21 (12%)	19 (10%)	21 (12%)	45 (26%)
Approved use	14 (7%)	12 (6%)	5 (3%)	11 (6%)	3 (2%)	4 (2%)
Unspecified use	41 (22%)	39 (20%)	32 (18%)	26 (13%)	21 (12%)	22 (13%)
Veterinary compounds	8 (4%)	4 (2%)	5 (3%)	4 (2%)	0	7 (4%)

137. Figure 2 shows the relative percentages of carbamate and organophosphorus compounds and alphachloralose found to be involved in incidents over the past few years. Again carbamate compounds dominate those found, many of which arise from abuse of these compounds.

Figure 2: Changing trends in the use of some pesticide classes in vertebrate incidents

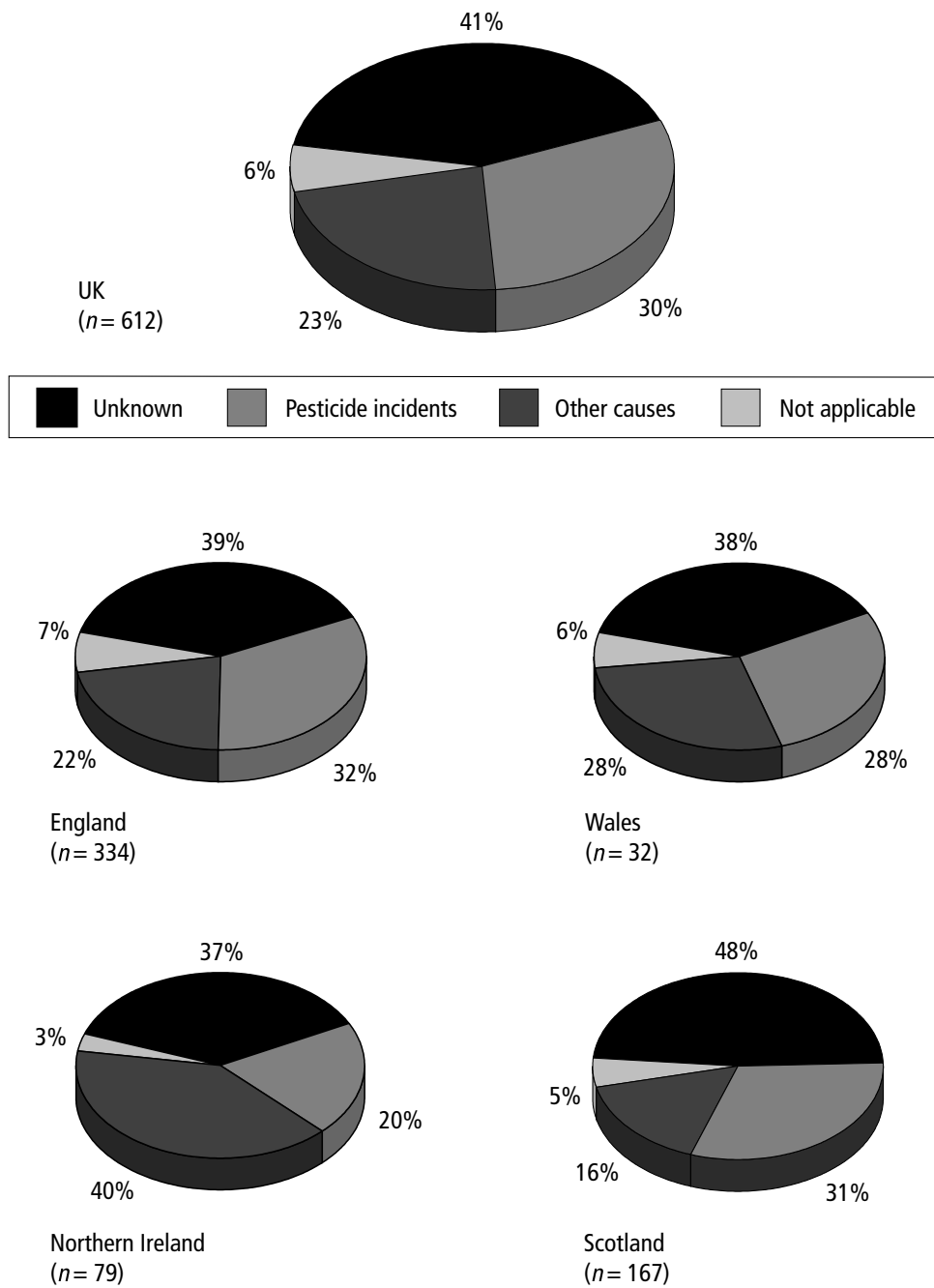
Beneficial insect incidents

138. The number of incidents reported involving beneficial insects was slightly up on the previous year (see Table 19). However, the number and percentage where poisoning was established fell from 40% to 28%. There was one incident arising from approved use, four misuse incidents, one abuse incident and six where the origin of the pesticides was not established. These incidents have been detailed in previous sections.
139. The number of colonies found to be affected by pesticides during 1998 was 58 (see Table 18). This is on a par when compared with the previous year, although resulting from fewer incidents. Reviews of pesticide poisoning of beneficial insects over past years can be found in Barnett *et al.*, 1997, Fletcher *et al.*, 1994a and Greig-Smith *et al.*, 1994.

Unknown causes of incidents

140. There is always a number of incidents reported where the cause remains unknown. This may be due to several factors, such as, insufficient or inappropriate tissues for analysis, an absence of disease diagnosis, poisoning by non-agricultural chemicals, or the absence of the appropriate analytical method for a particular compound. In 252 (41%) of incidents reported, the cause of the incident was not established (see Figure 3). This compares with 272 (45%) in 1997.
141. In addition, there were 34 incidents (5%) which were classified as not applicable (see Figure 3), compared with 35 (6%) in the previous year. These are suspected baits or suspicious substances where there are no dead or poisoned animals found. These are often found to be food placed for animals or birds or discarded food items.

Figure 3: Proportion of reported incidents in 1998 by cause of incident



Seasonal distribution

142. The seasonal distribution of incidents can be seen in Appendix 2. Incidents of abuse occur throughout the year, although there was a pronounced peak in February and March.

Regional distribution

143. The distribution of abuse incidents is found throughout counties and regions of the UK with certain areas having proportionately more incidents of abuse than are found elsewhere (see Appendix 2).

Publications

Appendix 3 gives a list of publications that have arisen from work carried out by the Scheme and its findings. In addition to these, the results of the Scheme have been widely used in several publications.

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Appendix 1

Investigation procedures

The investigation of potential wildlife poisoning incidents depends on a scheme which allows members of the public and interested organisations to submit carcasses or suspected baits for pesticide analysis. In England and Wales, this is organised on a regional basis with the relevant Farming and Rural Conservation Agency (FRCA) wildlife officer deciding, in consultation with others if necessary, whether an investigation should be started. This permits the screening-out of incidents which may not involve pesticides.

In England and Wales, after acceptance of an incident, the carcasses are taken to a local Veterinary Investigation Centre (VIC) where a post-mortem examination is undertaken. This may result in bacteriological or virological tests to determine whether disease contributed to the deaths.

A field visit may be made by an FRCA wildlife officer to gather information to help in identifying the cause of the incident. A further visit may be required in non-abuse incidents in order to obtain more information, for example to interview relevant contacts not previously available or to follow up the results of analyses.

Incidents may be rejected if they are outside the remit of the Scheme, for example if poisoning is thought to have involved non-agricultural chemicals or pollutants. If the field inquiry or the post-mortem identifies the cause of death as other than possible pesticide involvement, then tissues are not sent for analysis.

The field inquiry report, post-mortem findings and relevant tissues from casualties are forwarded to the Wildlife Incident Unit (WIU) at the Central Science Laboratory, Sand Hutton, York, where chemical and other analyses of the tissues are carried out.

The results are collated and interpreted by WIU to assess the probable cause of the incident and whether any residues detected contributed to the death or illness of the animal. Mortality is generally attributed to a pesticide if residues of a chemical or its derivatives are found above levels considered to represent lethal exposure. In some cases, the presence of residues in association with typical post-mortem findings may be used to determine mortality. Wherever possible, residues found are confirmed using an alternative analytical technique.

Honeybee deaths in England and Wales are investigated in a similar way. Samples of dead bees are passed by beekeepers to the National Bee Unit of the Central Science Laboratory at Sand Hutton, York to enable disease screening and other investigations to be carried out. Field visits are made by FRCA wildlife officers to gather relevant information. Bee samples are forwarded for residue analysis to the WIU, where reports of the incidents are also collated. There are experimental data, resulting from laboratory dosing of honeybees with pesticides, which can be used to assist in assessing the significance of residues in the insects.

The Scottish scheme is similar to those in England and Wales and covers wildlife, companion animals, livestock and beneficial insects. Samples are sent to the Scottish Agricultural Science Agency (SASA) in Edinburgh for investigation. Veterinary support is provided by the Veterinary Investigation Laboratories of the Scottish Agricultural College and by Lasswade Veterinary Laboratory. Field investigations by Scottish Office Agriculture Environment and Fisheries Department (SOAEFD) staff are normally only undertaken when pesticide poisoning has been confirmed unless there is clear evidence of deliberate abuse or misuse of a pesticide.

The Northern Ireland scheme is similar to the Scottish scheme. Samples are sent to specified analytical and veterinary laboratories in Northern Ireland. As with the Scottish scheme field investigations are normally only carried out when pesticide poisoning has been found. Investigations are usually carried out by the Department of Agriculture for Northern Ireland's (DANI) Health and Safety Inspectorate. The abuse and misuse of pesticides affecting wildlife may also contravene the provisions of the Wildlife (Northern Ireland) Order which is enforced by the Royal Ulster Constabulary (RUC) supported by the Countryside and Wildlife Branch of the Department of the Environment (Northern Ireland).

Where an incident is to be investigated for use in legal proceedings, evidence is gathered by the MAFF Investigation Section, in collaboration with the Pesticides Safety Directorate, who rely on information collected by the FRCA wildlife officers. SOAEFD staff in Scotland and the RUC, DANI staff and others in Northern Ireland carry out a similar role. Veterinary and analytical findings may also be used in evidence. The HSE and local authorities also have a regulatory role under FEPA and local liaison takes place between the departments to co-ordinate enforcement action. The police may also investigate cases.

All the schemes make use of analytical techniques and equipment capable of identifying low levels of residues of approved pesticides that are considered to present a possible hazard to vertebrates or beneficial insects. Multi-residue methods are used for the detection of organochlorine, organophosphate, some carbamate and pyrethroid compounds and for anti-coagulant rodenticides. These are supplemented by specific analyses for strychnine, alpha-chloralose, metaldehyde, paraquat and some other compounds.

Appendix 2

Pesticide incidents occurring in 1998

Month	County	Number and Species	Chemical	Cause	Comments
August (1997)	Somerset	25 cows	asulam	misuse	*Cows were not excluded from treated area and were diagnosed as poisoned from eating bracken.
January	Norfolk	seed	fonofos	misuse	Pile of fonofos treated seed left near a right of way
	South Yorkshire	3 cats	aldicarb	abuse	
	Suffolk	2 dogs	coumatetralyl	misuse	Exposed baits
	Suffolk	dog	difenacoum	misuse	Exposed baits
	Highland	red kite	alphachloralose/ difenacoum	abuse	Further tests detected a residue of difenacoum
February	Derry	dog	paraquat	abuse	
	Cheshire	dog	metalddehyde	misuse	Spillages occurred when application equipment turned around
	Greater Manchester	2 cats	alphachloralose	abuse	Small residue source unknown
	Hampshire	dog	metalddehyde	unspecified	Source unknown
	Norfolk	dog	coumatetralyl	misuse	Bait was left with the homeowner who then left it unprotected outside
	Norfolk	cat	alphachloralose/seconal	abuse	No licensed narcotic operations, stomach contents possibly pigeon remains
	North Yorkshire	sample	strychnine	misuse	Bottle allegedly found on a private road
	Northumberland	cat	carbofuran	abuse	
	Somerset	4 dogs	strychnine	abuse	Dogs seen eating a lamb carcase, but this was not found for testing

Month	County	Number and Species	Chemical	Cause	Comments
	Wiltshire	badger sett	sodium cyanide	abuse	*Positive result with gas detection equipment
	Powys	fox	bromadiolone/ coumatetralyl carbofuran	unspecified abuse	
	Fife	2 buzzards			
	Grampian	buzzard, crow, peregrine	carbofuran	abuse	Several baits and suspicious substances
	Highland	red kite, 7 buzzards	carbofuran	abuse	Rabbit used as a bait
	Highland	red kite	alphachloralose/ difenacoum/bromadiolone	abuse	Further tests detected residues of difenacoum and bromadiolone
	Strathclyde	dog	aldicarb	misuse	Aldicarb stored in a paracetamol bottle and used in a garden area of a farm
	Strathclyde	cat, dog	carbofuran	abuse	
	Tayside	buzzard	carbofuran	abuse	Woodpigeon used as a bait
	Tayside	cat, 4 dogs	carbofuran	abuse	Adulterated pet food laid as bait in a hotel car park
	Belfast	dog, fox	paraquat	abuse	
	Down	dog	paraquat	abuse	
	Tyrone	dog	warfarin	abuse	
	Cambridgeshire	dog	strychnine	abuse	
March	County Durham	2 cats	aldicarb	abuse	
	County Durham	dog	methiocarb	abuse	Meat bait used
	Derbyshire	jackdaw, magpie, mouse, vole	alphachloralose	abuse	Rabbit carcase used as a bait
	Essex	dog	carbofuran	abuse	Granules thrown into a garden
	Humberside	cat	aldicarb	abuse	
	Lincolnshire	fox, 5 badgers	bromadiolone	misuse	Badgers removed lids from wooden bait boxes, that contained too much bait
	Northumberland	dog	carbofuran	abuse	

Month	County	Number and Species	Chemical	Cause	Comments
	Staffordshire	cat	metalddehyde/bendiocarb	abuse	Meat / fish baits containing bendiocarb or metalddehyde
	Central	dog	metalddehyde	unspecified	
	Highland	buzzard	carbofuran	abuse	
	Lothian	dog, 6 foxes	carbofuran	abuse	
	Tayside	dog	carbofuran	abuse	Same dog affected as in previous incident in February
	Tayside	red kite	alphachloralose	abuse	
April	Buckinghamshire	badger sett	metalddehyde	abuse	Slug pellets left around a badger sett
	Cornwall	3 dogs	metalddehyde	abuse	
	Derbyshire	badger sett	methiocarb / aluminium phosphide	abuse	Potatoes mixed with methiocarb left at badger sett entrances, gassing with aluminium phosphide had also been carried out
	Derbyshire	badger sett	aluminium phosphide	abuse	*Sett deliberately gassed
	Essex	cat	metalddehyde	unspecified	*Stomach full of blue material
	Gloucestershire	meat / grain bait	difenacoum	abuse	Baits in a garden, likely victims were cats
	Gloucestershire	sample	warfarin	misuse	Spillage of bait from a hopper, probably placed for squirrel control
	Hereford and Worcester	2 dogs	methiocarb	misuse	Small spillage or test patch of pellets to monitor slug population levels
	Norfolk	fox earth	aluminium phosphide	abuse	*Old phosphine container near fox earth
	Somerset	cat, dog	methiocarb	abuse	Methiocarb pellets were mixed with what appeared to be milk powder
	Tyne & Wear	cat	metalddehyde	abuse	
	Tyne & Wear	cat	carbofuran	abuse	
	Dyfed	red kite	fenthion	veterinary	
	Grampian	cat	carbofuran	abuse	
	Grampian	pigeon bait	carbofuran	abuse	Continuation of incident in February

Month	County	Number and Species	Chemical	Cause	Comments
	Strathclyde	dog	carbofuran	abuse	
	Strathclyde	hen harrier	carbofuran	abuse	
	Tayside	cat	carbofuran	abuse	
	Tayside	buzzard	carbofuran	abuse	
	Belfast	moorhen	warfarin	abuse	
	Belfast	Ross's goose	warfarin	abuse	
	Donegal	dog	brodifacoum	abuse	
May	Bedfordshire	honeybee	carbaryl	unspecified	Source unknown, but residue large, which is consistent with illegal use
	Cambridgeshire	dog	metalddehyde	misuse	Careless dumping of slug pellets
	Cambridgeshire	dog	aluminium phosphide	abuse	*Aluminium phosphide placed in dogs kennel
	Cornwall	ring-necked pheasant	bromadiolone/difenacoum	misuse	Grain placed in rat burrows
	County Durham	cat, dog	bendiocarb	misuse	Animals sprayed directly during a flea treatment to a house
	Cumbria	2 dogs	metalddehyde	abuse	Metalddehyde pellets mixed with meat
	Gloucestershire	cat, dog	difenacoum	misuse	Exposed baits
	Gloucestershire	samples	chlorophacinone/ coumatetralyl	misuse	Multiple rodenticides in a bait point and these were accessible to non-targets
	Gloucestershire	honeybee	fluvalinate	unknown	Not the cause of death of the bees. 30% nosema noted
	Hampshire	honeybee	bifenthrin	abuse	Intentional abuse of pesticides to poison bees. Bendiocarb, bifenthrin, chlorpyrifos and pirimiphos-methyl also confirmed in samples submitted
	Isle of Wight	sample	methiocarb	misuse	Spillage in a field
	Lancashire	2 cats	aldicarb	abuse	
	Norfolk	honeybee	dichlorvos	unknown	
	Northamptonshire	6 red kite fledglings	bendiocarb/bromadiolone	unspecified	Not the cause of death of the bees

Month	County	Number and Species	Chemical	Cause	Comments
	Oxfordshire	red kite	brodifacoum	unspecified	
	Staffordshire	3 grey squirrel	brodifacoum/ bromadiolone	misuse	No baits found, but suspect use of amateur brodifacoum formulation outside Exposed bait
	Suffolk	sample	bromadiolone/difenacoum	misuse	Not confirmed by laboratory tests as no bees were available
	Suffolk	honeybee	lambda-cyhalothrin	unspecified	Source unknown, but residue large, which is consistent with illegal use
	Tyne & Wear	honeybee	malathion	unspecified	Metalddehyde pellets mixed with mince meat
	West Yorkshire	dog	metalddehyde	abuse	
	Clwyd	dog	metalddehyde	unspecified	
	Dyfed	peregrine	aldicarb	abuse	
	Dyfed	red kite	fenthion	veterinary	
	Dumfries & Galloway	hen	brodifacoum	unspecified	
	Grampian	buzzard, stoat	carbofuran	abuse	Thirteen baits found
	Grampian	great black-backed gull	carbofuran	abuse	Five baits found
	Grampian	baits	carbofuran	abuse	Collared dove and rabbit used as a bait
	Highland	cat	carbofuran	abuse	
	Highland	peregrine	carbofuran/alphachloralose	abuse	Grouse used as a bait
	Highland	golden eagle	carbofuran	abuse	
	Strathclyde	cat	bendiocarb	abuse	
June	Cornwall	honeybee	dimethoate	misuse	A bulb crop sprayed with flowering weeds present. 20% nosema noted
	Gloucestershire	bait	mixture of herbicides	abuse	Baits consisting of faggots and possibly dicamba, 2,4-D ester and mecoprop laid to control rats
	Gloucestershire	honeybee	fluvalinate	disease	Not the cause of death of the bees. 70% nosema noted.
	Dyfed	3 cats	aldicarb	abuse	

Month	County	Number and Species	Chemical	Cause	Comments
	Fife	honeybee	fenitrothion/ dichlofluanid	unspecified	Suspect raspberry crop treatment, but none were identified in the area
	Grampian	4 ducks	diazinon	veterinary	
	Strathclyde	herring gull	dichlorvos	abuse	
	Down	dog	paraquat	abuse	
	Northern Ireland	pigeons	alphachloralose	abuse	
	Northern Ireland	6 dogs	paraquat	abuse	
July	Cornwall	6 feral/ racing pigeons	aldicarb	abuse	Pesticide mixed with pigeon feed
	County Durham	cat	aldicarb	abuse	
	Lincolnshire	dog	metalddehyde	misuse	Slug pellets dumped with grass clippings
	Norfolk	dog	coumatetralyl	unspecified	
	Shropshire	2 buzzards	carbofuran	abuse	Pheasant carcass used as a bait
	Suffolk	wasp nest	sodium cyanide	misuse	*Farmer admitted using this for wasp control
	Tyne & Wear	cat, dog	coumatetralyl	abuse	Blue grains mixed with pet food
	West Yorkshire	15 ducks	brodifacoum/bromadiolone	misuse	Exposed baits
	Central	dog	methiocarb	misuse	
	East Lothian	honeybee	dimethoate	misuse	Bee field trial, oilseed rape in flower and no notification of spray treatment
	East Lothian	honeybee	dimethoate/gamma-HCH	misuse	Dimethoate may be from the bee field trial incident
	Highland	2 dogs	metalddehyde	unspecified	
	Strathclyde	honeybee	cypermethrin	approved	Applied to oilseed rape, farmer unaware of apiaries in the vicinity
	Strathclyde	golden eagle	carbofuran	abuse	Hare used as a bait
	Tyrone	cat	paraquat	abuse	
August	Berkshire	sample	permethrin	unspecified	
	County Durham	3 dogs	aldicarb	abuse	Some samples were submitted and confirmed to be pirimicarb and metalddehyde

Month	County	Number and Species	Chemical	Cause	Comments
	Devon	buzzard	difenacoum	unspecified	
	Essex	dog	metaldehyde	misuse	Poor storage of slug pellets
	Greater London	sample	brodifacoum	misuse	Exposed grain outside
	Hereford and Worcester	dog	methiocarb	unspecified	
	Norfolk	dog	bromadiolone	approved	*Tray of bait underneath shed was moved and became accessible to the dog
	Norfolk	feral/racing pigeon	malathion	approved	*Pigeon loft treated for red mite infestation and behaviour of birds affected
	North Yorkshire	2 cats	aldicarb	abuse	
	Shropshire	39 feral/racing pigeons	alphachloralose	misuse	*Narcotic treatment for pigeons without a licence
	Suffolk	2 cats	metaldehyde	unspecified	*Veterinary diagnosis of metaldehyde poisoning
	Suffolk	honeybee	pirimiphos-methyl	unspecified	Source unknown
	Grampian	honeybee	permethrin	misuse	Nearby flowering heather probably oversprayed during treatment of saplings
	Strathclyde	cat	fenthion	veterinary	
	Antrim	cat	metaldehyde	abuse	
September	Bedfordshire	sample	difenacoum	misuse	Unapproved rodenticide for squirrel control
	North Yorkshire	2 dogs	metaldehyde	misuse	Large spillages in a field
	North Yorkshire	tawny owl	flocoumafen	unspecified	Bird in poor condition
	Suffolk	wasp nest	sodium cyanide	misuse	*Farmer admitted using this to control wasps
	Tyne & Wear	sample	coumatetralyl	misuse	Exposed bait
	West Midlands	dog	metaldehyde	abuse	Metaldehyde pellets mixed with meat
	Wiltshire	sample	metaldehyde	misuse	Large piles of slug pellets in a garden, possibly for squirrels
	Clwyd	5 magpies	strychnine	unspecified	
	Powys	red kite	diazinon	veterinary	

Month	County	Number and Species	Chemical	Cause	Comments
October	Dumfries & Galloway	buzzard	alphachloralose	abuse	
	Grampian	honeybee	gamma-HCH	unspecified	
	Strathclyde	dog	aldicarb	abuse	
	Down	rabbit	alphachloralose	abuse	
	County Durham	2 cats	brodifacoum	unspecified	
	Cumbria	badger sett	renardine	misuse	*Sett entrances blocked and area doused with renardine
	Devon	dog	bromadiolone	unspecified	*Symptoms consistent with exposure
	Norfolk	cat	rodenticide	unspecified	*Rodenticide used not known, cat treated & recovered
	Nottinghamshire	dog	methiocarb	unspecified	Sample of pellets submitted contained metaldehyde
	Suffolk	sample	oxydemeton-methyl	misuse	*Pesticide approval withdrawn in 1995
	Suffolk	sample	DDT	misuse	*Dusting powder allegedly used to control wasps
	Suffolk	bait	metaldehyde	abuse	*Chicken leg bait retained by police, description consistent with metaldehyde. Bait found by cat which suffered no ill effects
	Warwickshire	chicken, 6 farmyard geese	diazinon	veterinary	Birds had access to an area where diazinon sheep dip used
	West Sussex	dog	bromadiolone	misuse	Exposed bait
	Wiltshire	earthworm	methiocarb	approved	Dead earthworms found on a field following pesticide application
	Gwent	3 cats	bromadiolone/permethrin	abuse	History of illegal poisonings in area, abuse of several pesticides suspected
	Dumfries & Galloway	rooks	phosmet	veterinary	
	Fife	cat	carbofuran	abuse	
	Grampian	dog	coumatetralyl	approved	Dog ate poisoned rat

Month	County	Number and Species	Chemical	Cause	Comments
	Strathclyde	buzzard	alphachloralose	abuse	
	Belfast	2 cats	paraquat	abuse	
	Down	starling	alphachloralose	abuse	
	Down	starling	alphachloralose	abuse	
November	Buckinghamshire	red kite	brodifacoum	unspecified	
	County Durham	3 cats	aldicarb	abuse	
	County Durham	cat	aldicarb	abuse	
	Dorset	dog	metaldehyde	misuse	Large piles of pellets under sacks to monitor slug population levels
	Dorset	samples	alphachloralose/ metaldehyde/ mevinphos/ malathion/ strychnine/ cypermethrin	abuse	Samples, many in unlabelled bottles, and syringes were found following allegations of illegal poisoning
	Hampshire	dog	metaldehyde	misuse	Dog must have found and consumed a spillage, but none were found
	Norfolk	dog	bromadiolone	misuse	A dog had access to an open bucket of rodenticide left in a vehicle
	Suffolk	dog	coumatetralyl	misuse	A mouse submitted contained brodifacoum, a rat brodifacoum and difenacoum and grain samples coumatetralyl and difenacoum
	Wiltshire	badger	methiocarb	abuse	Slug pellets found near a badger sett
	Border	cats	paraquat	abuse	
	Central	buzzards	alphachloralose	abuse	
	Grampian	dog	paraquat	unspecified	
	Grampian	3 buzzards	alphachloralose	abuse	Rabbit used as a bait
December	Essex	grain	chlorophacinone	misuse	Unsatisfactory baiting points
	Essex	dog	carbofuran	abuse	Piles of granules in a garden

Month	County	Number and Species	Chemical	Cause	Comments
	Hampshire	dog	metalddehyde	misuse	Slug traps used in an oil seed rape field. Too many slug pellets present
	Kent	dog	metalddehyde	misuse	Spillage of slug pellets on a verge due to filling of the hopper
	Leicestershire	dog	difenacoum	misuse	Exposed bait trays in a field
	North Yorkshire	grain	bromadiolone/warfarin	misuse	Exposed bait with very small amount of warfarin also present
	Tayside	buzzard	carbofuran	abuse	Grouse used as a bait
Unknown	Fife	dog	methiocarb	misuse	*

* Incidents where samples were not available for analysis, but information gathered during enquiries into the incident suggests the involvement of the pesticide.

Appendix 3

Major WIIS publications

(in chronological order since 1976)

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In addition to the above, the results of the Scheme have been widely used in several publications.



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