

Pesticide poisoning of animals 2002

Investigations of suspected incidents
in the United Kingdom

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



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Published by the Department for Environment, Food and Rural Affairs. Printed in the UK, December 2003.
Printed on recycled paper containing 80% post consumer waste and 20% Totally Chlorine Free virgin pulp.

Product code PB 9038

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A report of the Environmental Panel
of the Advisory Committee on Pesticides

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“Pesticides – Friend or Foe” was the title I was asked to speak on at a recent public meeting. This title reflects two common views of pesticides amongst the general public. We enjoy the benefits of increased crop yields, minimal contamination of foodstuffs and improved public health, yet many worry about the health effects of consuming pesticide residues and the environmental effects of the widespread application of pesticidal chemicals to crops. The process of approving pesticides in the UK and Europe is refined and thorough and I believe that human health is very well protected by the approvals process. I also think it very unlikely that we will see a repeat of any of the historical environmental disasters linked to pesticide use. At the same time, we recognise that many pesticides have measurable environmental effects, and judgements must be made about the acceptability of adverse effects, which to some extent means balancing the environmental costs against the economic and health benefits of pesticide use to stakeholders. The monitoring process that follows registration of a pesticide provides an important check of predictions, and the UK Wildlife Incident Investigations Scheme (WIIS) is an essential element of post-registration monitoring.

Comparison of the 2002 report with previous years is complicated by the effects of the Foot and Mouth outbreak in 2001. Compared with 2000, however, there were fewer incidents reported in 2002 and a smaller number and percentage (5%) of pesticide incidents related to approved use. Thus there is no need for alarm, but no room for complacency either. Fifteen percent of pesticide incidents are the result of careless misuse and 59% (78 incidents) represent deliberate abuse, which shames us all. We still need to educate ignorant people as to why they must not misuse pesticides, and we must vigorously pursue those who abuse pesticides cynically and criminally when they really do know better. It is essential that resources continue to be provided to the responsible government agencies at an adequate level for this purpose.

Finally, it has been a pleasure to work with all those involved with the WIIS scheme, who have kept me informed with regular updates and been ready to provide additional information when requested.

A handwritten signature in black ink that reads "Robert Smith". The signature is written in a cursive style and is underlined with a single horizontal stroke.

PROF. ROBERT SMITH
CHAIRMAN

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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 suggest 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 450 suspected poisoning incidents registered by the Scheme in 2002. The causes were determined in 213 incidents of which 131 (29% 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). The investigations undertaken during 2001, were affected by Foot and Mouth Disease. Therefore, data from 2000 has been used for the previous year comparisons throughout this report. In 2000, there were 506 suspected poisoning incidents registered by the Scheme and the causes were determined in 266 incidents, of which 162 (32%) were pesticide poisoning.

There were six incidents arising from the approved use of pesticides (see Figure 1) in 2002 (includes one bee incident). This compares with sixteen in 2000 (includes seven bee incidents). Proportionately, this is 5% of pesticide incidents reported in 2002 compared with 10% in 2000. This is a decrease in number and proportion of approved use incidents, but it is not exceptional when compared with years prior to 2000 (see Table 24).

The number of misuse incidents (see Figure 1), often the result of the careless use of pesticides, was 20 in 2002 (includes one bee incident). There were 23 incidents in 2000 (includes one bee incident). This represents 15% of confirmed poisoning incidents in 2002, compared with 14% in 2000.

Deliberate abuse of pesticides was identified in 78 incidents compared with 95 incidents in 2000. This represents 59% of all pesticide incidents (see Figure 1) and is the same proportion as that for 2000.

A further 25 poisoning incidents (19%) were attributed to unspecified use, including three bee incidents (see Figure 1). In 2000, there were 24 incidents (15%) (includes five bee incidents), where there was insufficient information available to identify the source of the poisoning.

For honeybees, there were 5 pesticide incidents involving bee deaths out of 25 incidents investigated (see Table 17), compared to 2000, where 13 pesticide incidents were confirmed out of 48 investigated.

There were two incidents where a veterinary product was thought to be involved (see Figure 1), compared to four in 2000.

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

Of the 450 suspected poisoning incidents: vertebrates were involved in 378 incidents; beneficial insects in 25; suspected baits and suspicious samples, where no poisoned animals were found, in 47.

In England, 188 incidents were reported, of which 80 (42%) were found to be caused by pesticides; Scotland had 156 incidents registered, 34 (22%) were found to be caused by pesticides; Wales had 50 incidents registered, 10 (20%) were found to be caused by pesticides; and in Northern Ireland, 56 incidents registered, 7 (13%) were found to be caused by pesticides (see Table 2 and Figure 3).

Overall, the proportion of pesticide incidents is the lowest reported to date, but there are regional differences contributing to this proportion (see Table 22). The proportion of pesticide incidents for England is high, at 42% compared to only, 13% for Northern Ireland.

Twenty-six pesticides were identified in these poisoning incidents (see Table 4); Thirty-two compounds were found in 2000.

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 Department for Environment, Food and Rural Affairs (Defra) and the Welsh Assembly Government Agricultural Rural Affairs Department (ARAD) examine cases of suspected poisoning by pesticides 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) Defra and ARAD 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 Executive Environment and Rural Affairs Department (SEERAD) operates a scheme covering incidents in all categories.

(4) In Northern Ireland, the Department of Agriculture, Food and Rural Development (DARD) operates a scheme in the same way as SEERAD. 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;

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

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unspecified use of these compounds. Incidents suspected of involving veterinary medicines should be reported to the Veterinary Medicines Directorate (Tel. 01923-338427).

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 2002, interested Government Departments led by Defra, continued the long-term Campaign Against the Illegal Poisoning of Animals. There has been much press and media coverage throughout the years and as a result the Scheme is now becoming much more widely known. 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.

Number of incidents in 2002

9. All incidents that were registered to WIIS, and which were investigated during 2002 are included in this report. There were 450 suspected poisoning incidents registered by the Scheme in 2002. The cause of death or illness (including pesticides and other chemicals, trauma, starvation and disease) was determined in 213 incidents (47% of those registered). In 131 of these incidents (29% 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, 1998, 1999 and Barnett *et al.*, 2000, 2002 & 2002 (2001 data affected by FMD).

10. There were 6 incidents of approved use, 20 of misuse, 78 of abuse and 25 of unspecified use, where the source of the compound remained unknown despite thorough field investigations. Additionally, there were two incidents thought to involve a veterinary product. Positive enforcement continued to be a priority in 2002, 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.

Table 1: Numbers of incidents investigated in 2002

	Incidents investigated	Pesticide poisoning incidents	Other cause of death found
Vertebrate wildlife	232	63 (27%)	73 (31%)
Livestock	1	1 (100%)	0
Companion animals	150	45 (30%)	7 (5%)
Beneficial insects	25	5 (20%)	2 (8%)
Suspected baits and suspicious substances	47	20 (43%)	not applicable
TOTAL *	450	131 (29%)	82 (18%)

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

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 Defra Rural Development Service office or freephone 0800 321600.

Incident summaries

12. A young green woodpecker was found dead the day after an application of ant powder in a large garden. The product, 'Ant Stop Powder' containing bendiocarb, had been applied in the evening, at 21:00, to suppress the activity of a large number of 'red ants' during the laying of some crazy paving. It appeared that excessive amounts had not been applied and that the directions of use had been complied with. The following morning green woodpeckers were present in the garden as usual but one, judged to be a youngster, possibly a fledgling, was less active than normal and within a couple of hours it was dead. Analysis showed a residue of bendiocarb in the gizzard which was sufficient to have caused the bird's death.

13. Two dead partridges were found on consecutive days adjacent to a sugar beet field which had been treated with aldicarb about one week previously. The first bird had five black granules in its gizzard and the second a quantity of leafy material and one black granule. Both birds were in good condition and there was evidence that the second bird had been in some distress before death (disturbed ground around the carcass). There were a number of very small black granules on the surface of the sugar beet field. Analysis of the granules confirmed that they were aldicarb and that the levels in the birds were significant and sufficient to have caused death. The sugar beet had been drilled to a depth of 3 cm with an old but well-maintained drill. The soil was sandy with some stone and there had been no rain. It is possible that due to the dry conditions and shallow drilling depth wind blow was able to bring the granules to the surface where they were picked up by the birds, or that soil may have been very uneven and caused a localised presence of granules on the surface.

14. One partridge was found dead in a field recently planted with potatoes. The bird was in good bodily condition. Post mortem examination showed four dark red marks over the pectoral muscle, sandy black material around the beak and black foci in the gizzard together with mixed grain and feed. The carcass was very autolytic and the lungs were very dark red and wet. Analysis confirmed aldicarb in the gizzard at levels consistent with death by poisoning. A few widely dispersed aldicarb granules were found on the soil surface at the edges of the field. The soil was dry and sandy and the presence of granules at the surface was considered to have been either insufficient soil in the rows at the headland, caused by the de-stoning process, or inadequate cultivation of the headlands leading to granules of aldicarb being left exposed.

Part 2: Incidents in 2002 where regulatory and/or enforcement action was considered

15. Tissues were submitted from two dogs that died quickly after access to a field where potatoes were being planted on a farm near Kelso. SEERAD officials immediately carried out a field investigation. The stomach content material from one of the dogs appeared to consist of pieces of potato tuber with a few small blue granules adhering to them. Analysis of a sample of this material revealed the presence of aldicarb. Residues of this substance were found in the stomach content of the second dog and in liver tissues of both animals. These residues were consistent with aldicarb poisoning being the cause of death. Field information confirmed that a contractor had been applying an aldicarb formulation, during the planting of potatoes at the farm. The chemical was stored and transported in sealed polypropylene flasks (20 kg), and was dispensed, via a sealed system, through the planting machinery. Most of the 7.9 ha field had been planted on 10 April, and seed potatoes, pesticide and tractor fuel had been sited on the headland ready for cultivation and planting of that area on the next day. A co-owner of the field walked five dogs across the field on the morning of 11 April. Two of the animals were restricted to leads, but the other three ranged free. The dogs were kept largely to the headland, a 20 m stubble strip. All five dogs were seen to eat whole or damaged potato tubers on this unplanted strip. The dog owner thought that damaged potatoes had been more apparent in the areas where he had observed the contractor load the hopper on the potato planter. The field investigation revealed that the operator had stopped the potato planter on the headland to check for a possible blockage in the flow of the formulation. He had removed a rubber dispensing hose at the flask end to check, and a very small amount of granules may have spilled onto the ground. The investigation also indicated the possibility that the delivery mechanism could have permitted a small amount of granules to be dispensed as the vehicle crossed deep ruts, or very uneven ground. A sample of soil and a sample of potato tuber material were collected from the headland area where the dogs had been walked. No aldicarb was detected in the soil sample, and only a small residue was detected in the tuber sample. The dogs were evidently exposed to the aldicarb by ingesting parts of potato tubers contaminated with the granular formulation. Whilst the precise detail of how the contamination arose has not been resolved; the incident would appear to have resulted from an approved use of aldicarb.

[NB Early in 2003 the European Council adopted a decision under which authorisation for all uses of aldicarb in the EC will be withdrawn by 2007.]

16. Several hundred dead and dying bees were found at the entrances to 12 honeybee colonies in a single apiary in the late afternoon/evening of 17 June. There was evidence that the bees had been foraging on nearby bean crops which were in full flower. Two fields had been sprayed with 'Pearl Micro' (deltamethrin) and 'Alto Elite' (chlorothalonil and cyproconazole) between 18:00 and 19:00 on 17 June. Use of these products on flowering crops is approved. Neither the local spray liaison officer nor the beekeeper had been informed that spraying would take place and the relevant fields were shielded from view by trees, so that the beekeeper was unaware that spraying was in progress. Analysis of bee samples showed residues of deltamethrin which are considered sufficient to have caused the death of the bees. In the report dated 13 September it was stated that the colonies were recovering, which is consistent with poisoning with pyrethroids. Residues of fluvalinate consistent with treatment of hives for varroa were also found. Fluvalinate is not toxic to bees and would not have been the cause of the incident. Residues of two fungicide active substances, chlorothalonil and cyproconazole, which had been applied in tank mix with 'Pearl Micro' as the product 'Alto Elite', were

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also present. These active substances are not themselves toxic to bees and their use in tank mix with deltamethrin is within the conditions of approval. It is considered that this incident was as a result of the approved use of 'Pearl Micro' deltamethrin. (A small number of incidents over the years have led to the suggestion that some fungicides in tank mix with pyrethroids might potentiate the activity of the latter against bees. A research and development project has been commissioned to look at possible synergism between pesticides and the Environmental Panel is giving this issue careful consideration.)

17. A dog presented for veterinary treatment in March at Dunkeld, Tayside was diagnosed as having severe haemorrhaging into the body cavities. The animal died within a short space of time. A residue of chlorophacinone was identified in liver tissue from the animal. This residue and the symptoms observed were consistent with anticoagulant poisoning being the cause of death. The field investigation established that the owner of the dog had requested a local gamekeeper to lay some rat bait on her property. The gamekeeper laid the bait under cover in a woodshed, which in normal circumstances the dog would have had no access. The bait material had been well covered, and it was not clearly established exactly how the dog had ingested the rodenticide bait material. The gamekeeper involved was known to SEERAD officials and was considered to be professionally competent.

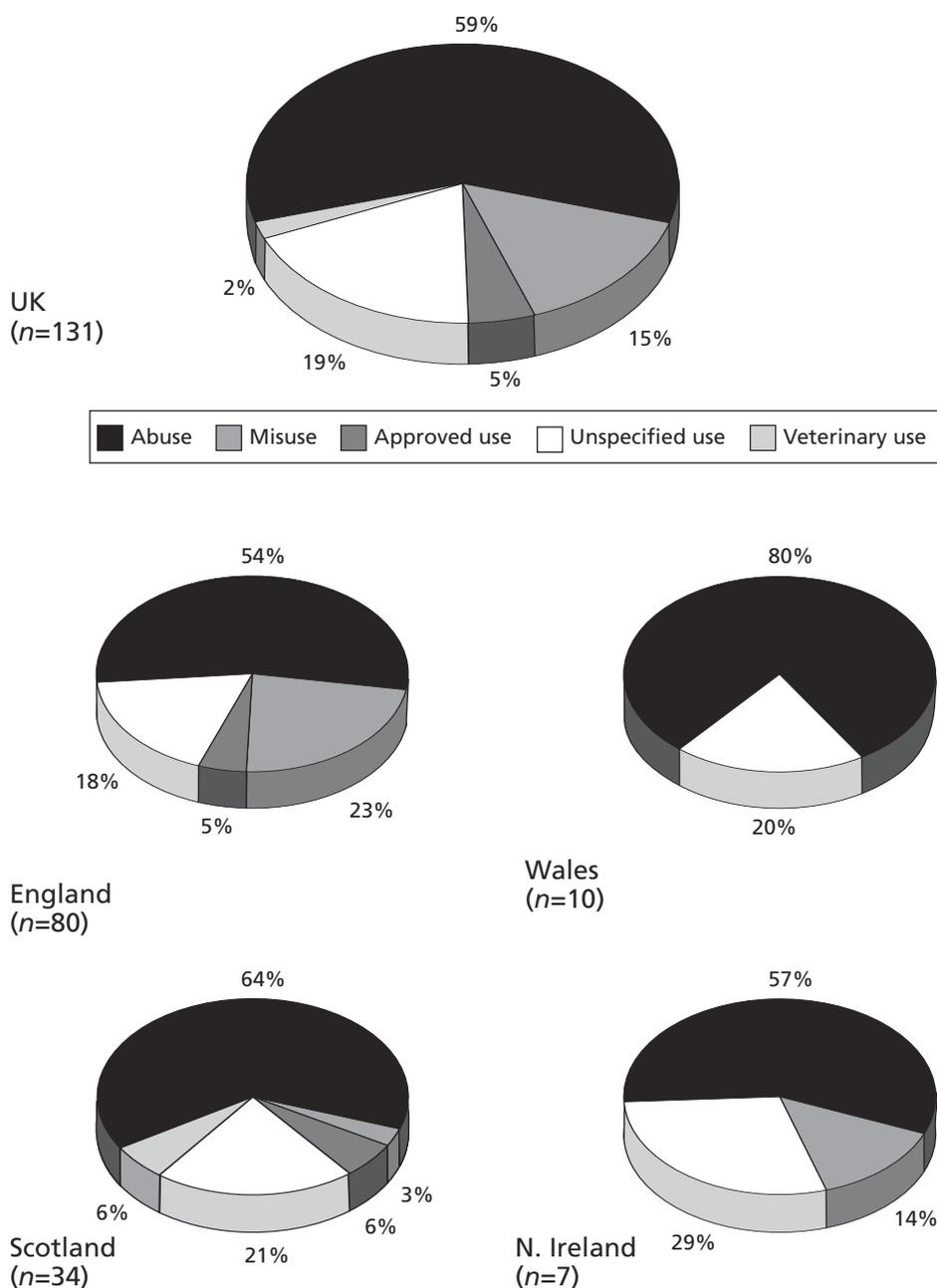
18. There were three incidents, which have not been included in the number of incidents investigated and other statistics for 2002. There was an incident with a pied wagtail which occurred in 2000, but was not reported until 2002, so no carcass was available. The bird was seen shaking and in distress, following a drilling operation with aldicarb and potatoes. There was about a ten minute delay between application and incorporation of the granules. As this is reported evidence only and no carcass is available it has not been included. The death of a rat from bromadiolone poisoning was believed to be a direct result of a rodenticide poisoning operation on the Isle of Skye. Rats are the target species for this pesticide, and initially it was thought that misuse may have been involved as the carcass had not been buried or destroyed. Subsequent field information indicated that the rat had been submitted to confirm that it had been poisoned during a rodenticide baiting operation. This incident represented an approved use of bromadiolone and only the target animal died, so it has not been included. A dog received veterinary treatment in September after being sick. The animal exhibited an elevated temperature and pain in the abdomen. A quantity of partly digested blood was found in the bowel. The veterinary practitioner diagnosed poisoning as the likely cause, but no samples were submitted for analytical investigation. The onset of symptoms had come soon after local streets and amenity areas had been treated with a herbicide by the local authority. A second owner in the same area was said to have indicated that her dog had shown similar symptoms at various times following spraying activities by the local authority. The product used by the local authority was identified as containing glyphosate formulated as the isopropylamine salt. The circumstantial evidence suggests that the adverse effects on the dogs' health were the result of exposure to glyphosate following an approved use.

Part 2: Incidents in 2002 where regulatory and/or enforcement action was considered

Misuse incidents

19. A number of incidents were reported where misuse of pesticides was identified (see Figure 1). These often result from poor storage, spillage, chemicals not being used in the approved manner (eg. rodenticide baits being left uncovered), or compounds being disposed of in an inappropriate way (Barnett and Fletcher, 1998). The chemicals found in this category tend to be predominantly rodenticides, and molluscicides. However, in 2002 there were three misuse incidents where treatments at badger setts, two with aluminium phosphide and one with Renardine (bone oil), were involved. In 2002, there were 20 (15%) misuse incidents (includes one honeybee incident) and 10 different compounds involved. In 2000, there were 23 (14%) misuse incidents (includes one honeybee incident) and 15 different compounds involved.

Figure 1: Proportion of all incidents by category of pesticide involvement in 2002



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20. Six misuse incidents with metaldehyde slug pellets, were associated with poor storage, uncleared spillages or incomplete burning of residues following an application. Two of the incidents occurred because too much of the product had been used, in a slug trap and in a garden application. Six dogs were ill or died after exposure to these slug pellets and there was an incident where several sheep died and a metaldehyde slug pellet bag was found nearby. Their rumens contained pellets similar to those in the bag, but tissue tests were negative. However, pellets from the bag were confirmed as metaldehyde. Potentially wild animals, such as badgers and foxes, are likely to find the pellets palatable and are equally at risk when spillages are left uncleared. The fact that they are likely to skulk in cover once affected, will mean that they are less likely than are dogs to be found and reported to the Scheme.

21. Uncovered bait, inadequately secured bait boxes, or storage in unlabelled containers, were found in six rodenticide misuse incidents. In four incidents, difenacoum was involved (one incident also involved bromadiolone) and there was an incident with chlorophacinone and one with warfarin. Most of these incidents only involved poisoned grain, but dogs were also involved in two of the incidents. In addition, there was also an incident where, warfarin and bromadiolone, were used to control edible dormouse. This is a protected species and control with anticoagulants is an illegal use.

22. There were three incidents where the misuse of pesticides at badger setts occurred. In two incidents, setts were gassed with aluminium phosphide during a rabbit control treatment and in the other, Renardine appeared to have been poured onto soil and vegetation around a badger sett. In another incident, a pest controller had aluminium phosphide in an unlocked vehicle and reportedly, used it without any personal protective equipment. The same pest controller also had metaldehyde slug pellets (not included in paragraph 20) in an unlabelled bag and over 75 empty bottles of strychnine which appeared not to have been washed out. Finally, a fox died following the use of strychnine for mole control in a domestic garden and about 30 feral pigeons died following a suspected unlicensed pigeon control operation. The honeybee misuse incident involved triazophos, which has no approved uses, and may have been applied to a bean crop.

23. Further information about these incidents can be found in Appendix 2.

Abuse incidents

24. As in previous years, a large number of incidents involved the deliberate abuse of pesticides (see Figure 1, no incidents involved beneficial insects). During 2002, 78 incidents were attributed to abuse (59% of pesticide incidents); 95 were found in 2000, which represented the same proportion of pesticide incidents.

25. These abuse incidents involved 15 different compounds, compared with 19 in 2000. Alphachloralose and carbofuran accounted for over a half of these abuse incidents and aldicarb and strychnine were the next most abused compounds. Birds, mainly raptors, and cats were the species usually involved in the alphachloralose abuse incidents. In carbofuran incidents, raptors, corvids, foxes and cats were the species usually involved. The aldicarb incidents involved raptors, cats and dogs and the

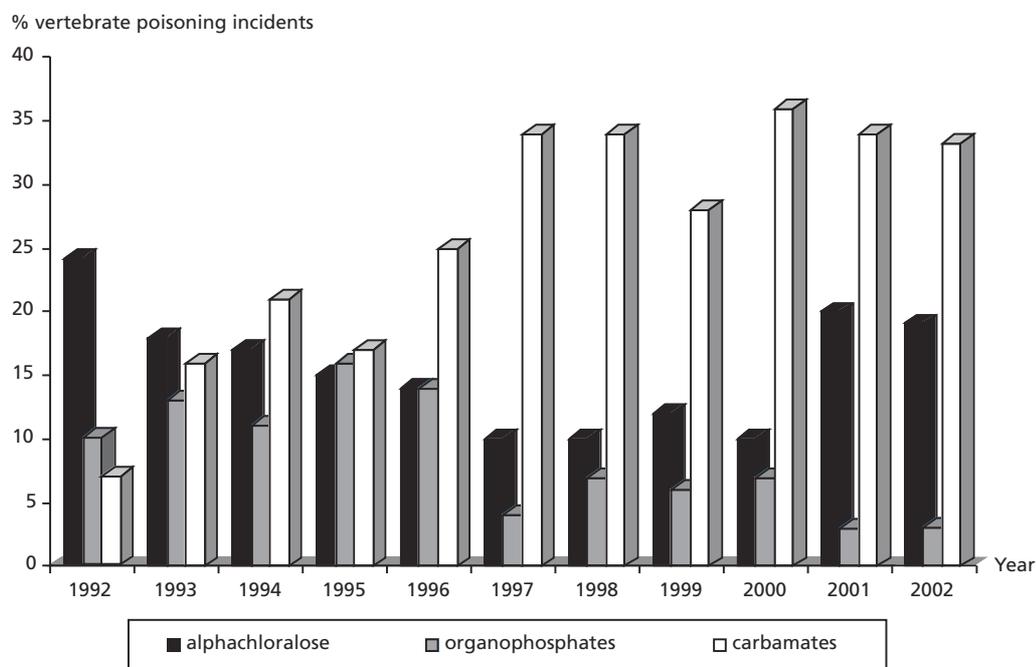
Part 2: Incidents in 2002 where regulatory and/or enforcement action was considered

strychnine incidents a red kite and dogs. The number of incidents attributable to these compounds were: alphachloralose, 22 (28%); carbofuran, 21 (27%); aldicarb, 10 (13%); and strychnine, 7 (9%). Compounds found in abuse incidents in 2000 were: carbofuran, 24 (25%); aldicarb, 16 (17%); alphachloralose, 15 (16%); strychnine, 8 (8%). Six of the abuse incidents involved more than one compound: carbofuran and alphachloralose (two incidents); carbofuran, bromadiolone and warfarin; sodium cyanide, paraquat and diquat; strychnine and aldicarb; and an incident with a kestrel poisoned with aldicarb which lead to a range of samples seized containing alphachloralose, aldicarb, paraquat and difenacoum.

26. There were five (6%) incidents which involved the abuse of bendiocarb and the same number involved metaldehyde. A fox, dogs, duck, magpies and a sparrowhawk were affected in the bendiocarb incidents and cats, dog, greylag geese and badgers in the metaldehyde incidents.

27. The number of abuse incidents with anticoagulant rodenticides was seven (9%) during 2002 and there were ten (11%) in 2000. There were three incidents where difenacoum grain was used to feed birds and in two of these feral pigeons were poisoned. Two incidents involved dogs, warfarin in one and difenacoum in the other. The other two incidents involved several compounds: carbofuran, bromadiolone and warfarin in one; and aldicarb and difenacoum in the other.

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



28. There were two abuse incidents with sodium cyanide (one also involved seized samples of paraquat and diquat). These involved badger setts and in one incident, dogs were also poisoned. In another incident, dogs were poisoned with a bait containing paraquat. In 2000, there were three incidents with vertebrate gassing agents and three

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incidents with paraquat. The abuse of mevinphos occurred in only one incident (badger, dog, magpie) in 2002, compared to five incidents in 2000 (see Figure 2). Finally, there was one abuse incident, where dogs were poisoned from eating chicken containing lindane.

Unspecified use incidents

29. Every year there are 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 2002, 25 incidents of unspecified use (19% of pesticide poisoning incidents) were identified and three of these were bee incidents. There were 24 in 2000 (15%), with five bee incidents. There were 13 different compounds detected in these incidents, compared with 15 in 2000.

30. A dog was poisoned with aldicarb. A kestrel and two barn owls had organochlorine residues which may have caused sub lethal effects. Racing pigeons, in an area with arable land, were poisoned with demeton-S-methyl. A cat (strychnine) and a dog (paraquat) were poisoned in separate incidents.

31. The compounds identified in the honeybee incidents were, bendiocarb (two incidents) and permethrin (one incident). It is possible that feral bee treatments were the source of the bendiocarb, but none were known of in the area. The permethrin was found on imported queen bees.

Anticoagulant rodenticide incidents

32. There is increasing concern over the number of incidents involving anticoagulant rodenticides, particularly where birds of prey, mainly red kites, are killed. Therefore these incidents are being highlighted in this separate section. Given the species involved and the size of the residues present, it is likely that rodent control operations are the cause of these incidents. These compounds take some time to poison animals, as their mode of action is to delay the onset of symptoms so as to prevent target rodents from becoming bait shy. This, combined with a large hunting area, makes it difficult to trace all sources of rodenticide use in an area. Birds of prey are almost certainly being poisoned by eating poisoned rodents, secondary poisoning, and this emphasizes the need for thorough carcass searching during baiting operations. There have been some training initiatives undertaken by MAFF (now Defra) and advice leaflets produced by English Nature highlighting the risks to red kites within the release areas. A leaflet has also been produced for Scotland by the RSPB, in partnership with Scottish Natural Heritage, Scottish Executive and Partnership for action Against Wildlife crime.

33. During 2002, there were 17 unspecified use incidents with these compounds (there were eight in 2000). Ten incidents occurred in England, four in Scotland, one in Wales and two in Northern Ireland. Two incidents involved mixtures of rodenticides. In one dog poisoning incident, it was difenacoum, warfarin and bromadiolone. Where three foxes were poisoned, it was bromadiolone, brodifacoum and difenacoum. The red kite was the species most often poisoned in this unspecified use category, with difenacoum in five incidents and bromadiolone in one. The three other difenacoum poisoning incidents involved a buzzard, two dogs and a cat. In the five other bromadiolone

Part 2: Incidents in 2002 where regulatory and/or enforcement action was considered

poisoning incidents, there were foxes poisoned in two incidents, and single incidents with a barn owl, a badger and a dog. Therefore, in 2002 there have been seven incidents involving birds of prey and the unspecified use of anticoagulant rodenticides. In 2000, there were only two such incidents, but there were seven reported in 1999. Although rodent control operations were known of in the vicinities of many of these incidents, it was difficult to establish all sources of rodenticide use in each area.

Anticoagulant rodenticide sub-lethal exposure

34. During 2002, all raptors continued to be screened for anticoagulant rodenticides, even when death was from another cause. In the eighteen incidents where sub-lethal exposure had occurred, seven were from England, six from Scotland and five were from Wales. In six of the incidents, three red kites and three buzzards, deaths resulted from the abuse of pesticides, but exposure to anticoagulant rodenticides had also occurred (In 2000, there were eight such incidents, five red kites and three buzzards). In four of the incidents, two with red kites and two with buzzards, exposure to difenacoum and bromadiolone had occurred. In one buzzard incident, exposure to difenacoum only had occurred and in a red kite incident exposure to brodifacoum and difenacoum had occurred. Two buzzards and two red kites, that had died of natural causes (disease/trauma) in four separate incidents, had been exposed to difenacoum as well. A tawny owl victim of a road traffic accident, had also been exposed to brodifacoum. Finally, the cause of death was uncertain in seven separate incidents with, three buzzards, two red kites, a sparrowhawk and a fox. Bromadiolone was found in four incidents and difenacoum in three incidents.

Enforcement action

35. Government Departments remain committed to use all available enforcement methods to help stamp out illegal poisoning. Where the information collected on an incident indicates that breaches of pesticides legislation may have occurred, a range of regulatory action is considered.

36. Where there appears to be sufficient evidence of illegal activity, cases are referred for formal investigation and ultimately court action may be taken. Any fines and costs subsequently imposed, together with the publicity such cases attract, are an incentive to use pesticides properly.

37. Even where a formal investigation or prosecution action is not warranted other regulatory action, for example the issue of Enforcement Notices or warning letters, may be taken. Also, it may sometimes be appropriate to transfer a case to another regulatory authority, such as the police. In these circumstances, Defra will remain on hand to offer technical and legal assistance.

38. England had 27 cases considered for enforcement action in 2002. Sixteen cases were closed in 2002 and eleven were carried over to 2003. One case was taken to prosecution, three were transferred to another enforcement authority and an enforcement notice or warning letters were issued in four.

Pesticide poisoning of animals 2002: investigations of suspected incidents in the United Kingdom

39. A farm owner and one of his employees pleaded guilty to, and were convicted of, charges of using pesticides without taking all reasonable precautions and failing to comply with the approval conditions of a slug pellet product. This prosecution arose after two dogs had been poisoned by eating metaldehyde slug pellets that had been left carelessly spilt on a farm. Fines and costs were imposed totalling £1,180 and £1,000 respectively, together with a compensation award of £115.

40. An enforcement notice resulted when the executor of an estate was reported to be feeding wild geese with blue metaldehyde slug pellets, which were mixed with feed. No dead geese were found but an Enforcement Notice was issued requiring the executor to stop the practice immediately and to remove the contaminated feed.

41. In Wales, an incident of paraquat abuse from 2001 was thoroughly investigated, but there was not enough evidence to base proceedings. However, the investigation and interaction with witnesses and suspects has had the desired effect and there has been no recurrence. In 2002, no incidents from Wales were investigated with a view to possible proceedings.

42. Positive enforcement action continues to be a priority as a measure to counteract pesticide abuse. SEERAD officials frequently work in partnership with wildlife liaison officers from the various police forces in Scotland, as well as staff from other organisations. Where possible, cases are referred to the Procurator Fiscal Service for prosecution. Where there is insufficient evidence to support prosecution, the fact that an investigation has been seen to take place around the locus may act as a deterrent to re-offending. Where poisoning or the risk of poisoning arises from misuse, and enforcement action is not possible or appropriate, those involved receive advice on how to employ better practice.

43. Three cases were reported to the Procurator Fiscal Service for prosecution. In one, the defendant pleaded guilty to charges under the Protection of Animals Act (7) (b) and 11 (b), after poisoning birds with bendiocarb in East Kilbride. The other two cases, both from Tayside, have not been heard as yet.

44. SEERAD officials carried out 19 field investigations during 2002. Thirteen of these were joint operations with the police, and some also involved RSPB Investigation Officers. The police pursued five incident investigations independently and the SSPCA undertook one investigation relating to pesticide abuse and other offences.

Part 3: Incidents in 2002: Species/samples and the pesticides involved

Species/samples involved

45. A total of 450 incidents was investigated during 2002. 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. 378 incidents involved vertebrates (one incident livestock), 25 involved beneficial insects and 47 were suspected baits and/or seized samples. The cause of death or illness (including pesticides and other chemicals, trauma, starvation and disease) was established in 213 (47%) of all incidents. A further 27 (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 131 (29%) of the incidents (compared with 162 (32%) in 2000); 63 (27%) of incidents with vertebrate wildlife, 5 (20%) of incidents with bees, 45 (30%) of companion animal incidents and 20 (43%) of suspected bait incidents. A geographical breakdown of the data is shown in Table 2.

Table 2: Incidents investigated by country in 2002 (% pesticide as cause)

	England	Wales	Scotland	N.Ireland
Vertebrate wildlife	87 (39%)	35 (20%)	99 (21%)	11 (9%)
Livestock	0	0	0	1 (100%)
Companion animals	55 (58%)	7 (14%)	44 (18%)	44 (11%)
Beneficial insects	19 (16%)	1 (0%)	5 (40%)	0
Suspected baits and suspicious substances	30 (50%)	8 (25%)	10 (40%)	0
TOTAL*	188 (42%)	50 (20%)	156 (22%)	56 (13%)

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

46. A comparison of the number of poisoning incidents for each category of animal from 1994 to 2002 is shown in Table 3.

Table 3: Number of incidents in which pesticides were identified as a likely cause of poisoning 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Vertebrate wildlife	76	62	77	54	49	57	68	55	63
Livestock	3	2	2	1	4	2	0	0	1
Companion animals	101	91	97	86	90	48	58	34	45
Exotic species	0	0	0	0	2	0	0	0	0
Fish	0	0	2	0	0	0	0	0	0
Earthworms	0	0	0	0	1	1	0	0	0
Beneficial insects	20	33	8	15	12	9	13*	5	5
Suspected baits and suspicious substances	16	28	29	32	29	22	28	16	20
TOTAL**	211	208	204	185	185	139	162	109	131

* Four of these incidents are likely to be associated with one pesticide application.

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

Pesticide poisoning of animals 2002: investigations of suspected incidents in the United Kingdom

47. A list of the pesticides detected (including beneficial insect incidents), is shown in Table 4, which also lists the species involved and the presence of compounds in seized samples. Residues of pesticides, mainly anticoagulant rodenticides (see earlier section), are sometimes detected at sub-lethal levels in the tissues of animals.

Table 4: Numbers of incidents* involving individual pesticides in 2002 and species and/or bait involved

Organochlorine compounds

DDE, dieldrin	1	barn owl, kestrel.
gamma-HCH	1	dog, bait.

Organophosphorus compounds

demeton-S-methyl	1	feral pigeon.
diazinon (veterinary product)	2	red kite, dog, bait.
mevinphos	1	magpie, badger, dog, bait.
triazophos	1	honeybee.

Carbamate compounds

aldicarb	14	grey partridge, kestrel, peregrine, sea eagle, cat, dog, bait, sample.
bendiocarb	8	duck, green woodpecker, magpie, sparrowhawk, fox, dog, honeybee, bait.
carbofuran	21	buzzard, crow, herring gull, golden eagle, magpie, rook, fox, cat, bait, sample.

Rodenticides

brodifacoum	1	fox.
bromadiolone	13	barn owl, buzzard, red kite, badger, edible dormouse, fox, dog, bait, grain.
chlorophacinone	2	dog, grain, sample.
coumatetralyl	1	mallard duck, bait.
difenacoum	24	buzzard, feral pigeon, red kite, fox, cat, dog, bait, grain.
warfarin	6	edible dormouse, dog, bait, sample.

In addition to the above, there were 18 incidents where residues of one or more of these compounds were detected and were considered to be background levels.

Pyrethroid compounds

deltamethrin	1	honeybee.
permethrin	1	honeybee.

In addition to the above small residues of fluvalinate were detected in 11 honeybee incidents. These were probably associated with varroa mite treatments. The fungicides, cyproconazole and chlorothalonil, were also present in the deltamethrin incident.

Herbicides

diquat	1	sample.
paraquat	4	dog, bait, sample.

Part 3: Incidents in 2002: Species/samples and the pesticides involved

Table 4: Numbers of incidents* involving individual pesticides in 2002 and species and/or bait involved (continued)

Other compounds			
alphachloralose	24	buzzard, crow, feral pigeon, kestrel, magpie, peregrine, red kite, rook, sea eagle, sparrowhawk, cat, dog, bait, powder.	
cyanide	2	badger sett, dog.	
metaldehyde	12	greylag geese, badger, badger sett, sheep, cat, dog, bait, pellets.	
phosphine	3	badger sett, sample.	
renardine	1	badger sett.	
strychnine	10	red kite, fox, cat, dog, bait, sample.	
Causes of death other than pesticides			
disease	20	ethylene glycol	2
starvation	15	lead poisoning	2
trauma	43	creosote	1
unknown	209	not applicable	27

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

48. Appendix 2 lists all the incidents where pesticides were detected from throughout the United Kingdom.

Vertebrate wildlife: mammals

49. A total of 52 wild mammal incidents was investigated in 2002 and the cause of death was established in 26 of these incidents, with 11 confirmed as pesticide poisoning (see Table 5). Table 6 shows the number and percentage of pesticide poisonings for the past nine years.

Table 5: Numbers of incidents involving wild mammals in 2002

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which another cause of death was identified
Badger	England	10	3 (30%)	4 (40%)
	Wales	3	0	2 (67%)
	Scotland	2	0	0
	N. Ireland	1	0	0
		16	3 (19%)	6 (38%)
Fox	England	21	6 (29%)	5 (24%)
	Wales	2	1 (50%)	1 (50%)
	Scotland	1	0	0
		24	7 (29%)	6 (25%)

Pesticide poisoning of animals 2002: investigations of suspected incidents in the United Kingdom

Table 5: Numbers of incidents involving wild mammals in 2002 (continued)

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which another cause of death was identified
Polecat	England	1	0	0
	Wales	1	0	0
	Scotland	1	0	1 (100%)
		3	0	1 (33%)
Hedgehog	England	1	0	1 (100%)
	Scotland	1	0	1 (100%)
		2	0	2 (100%)
Squirrel	England	1	0	0
	Wales	1	0	0
		2	0	0
Bat	England	1	0	0
Edible dormouse	England	1	1 (100%)	0
Ferret	Scotland	1	0	1 (100%)
Hare	N. Ireland	1	0	0
Otter	Scotland	1	0	0
Seal	N. Ireland	1	0	0
Stoat	Scotland	1	0	0
Weasel	Wales	1	0	0
Wolf cub	N. Ireland	1	0	0
TOTAL *	England	32	10 (31%)	9 (28%)
	Wales	8	1 (13%)	3 (38%)
	Scotland	8	0	3 (38%)
	N. Ireland	4	0	0
		52	11 (21%)	15 (29%)

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

Table 6: Incidents involving wild mammals 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Incidents investigated	156	104	77	85	68	54	56	30	52
Pesticide incidents	11%	13%	26%	19%	12%	31%	16%	23%	21%

Part 3: Incidents in 2002: Species/samples and the pesticides involved

Badger

50. Sixteen incidents with badgers were submitted to the Scheme in 2002 and the cause of death was established in nine of these, with three confirmed as pesticide poisoning. Two incidents involved the abuse of mevinphos and of metaldehyde. In the remaining incident a badger death was attributed to bromadiolone, but no source for this chemical was established.

51. Badger setts were involved in five incidents. Two involved the misuse of aluminium phosphide and one the misuse of Renardine. The abuse of sodium cyanide and metaldehyde slug pellets in potatoes made up the other two incidents.

Fox

52. 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 nine years.

Table 7: Incidents involving foxes 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Incidents investigated	57	54	41	33	27	24	28	9	24
Pesticide incidents	18%	17%	34%	33%	15%	42%	25%	33%	29%

53. In 2002, 24 incidents with foxes were investigated. The cause of death was established in thirteen of these incidents, with seven confirmed as pesticide poisoning. Three incidents occurred following the abuse of carbamate pesticides, two with carbofuran and one with bendiocarb. The anticoagulant rodenticide, bromadiolone, was involved in three incidents of unspecified use and difenacoum was also confirmed in two of these (one incident also had brodifacoum present). There was also an incident of strychnine misuse, used in a domestic garden for mole control.

Other mammals

54. Sixteen incidents with other mammals were investigated in 2002 (see Table 5). The cause of death was established in five of these incidents, with one confirmed as pesticide poisoning. Bromadiolone and warfarin were misused to control edible dormouse in a loft space.

Vertebrate wildlife: birds

55. A total of 184 wild bird incidents were investigated in 2002 and the cause of death was established in 106 of these incidents, with 56 identified as pesticide poisoning (see Table 8). Table 9 shows the number and percentage of pesticide poisonings for the past nine years.

Pesticide poisoning of animals 2002: investigations of suspected incidents in the United Kingdom

Table 8: Number of incidents involving wild birds in 2002

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which another cause of death was identified
Birds of prey including owls	England	34	16 (47%)	5 (15%)
	Wales	20	5 (25%)	10 (50%)
	Scotland	70	19 (27%)	24 (34%)
	N. Ireland	5	1 (20%)	0
		129	40 (31%)	39 (30%)
Wildfowl and waterbirds	England	3	2	0
	Wales	1	0	0
	Scotland	10	1 (10%)	3 (30%)
	N. Ireland	2	0	0
		16	3 (19%)	3 (19%)
Gulls and waders	England	5	1 (20%)	2 (40%)
	Scotland	3	0	0
		8	1 (13%)	2 (25%)
Pigeon and doves	England	6	3 (50%)	2 (33%)
	Wales	1	1 (100%)	0
	Scotland	1	0	0
		8	4 (50%)	2 (25%)
Corvids	England	6	2 (33%)	2 (33%)
	Wales	3	0	2 (67%)
	Scotland	12	5 (42%)	2 (17%)
	N. Ireland	1	1 (100%)	0
		22	8 (36%)	6 (27%)
Gamebirds	England	3	2 (67%)	0
Other birds	England	6	1 (17%)	3 (50%)
	Wales	1	0	1 (100%)
	Scotland	2	0	1 (50%)
		9	1 (11%)	5 (56%)
TOTAL*	England	58	25 (43%)	6 (10%)
	Wales	27	6 (22%)	14 (52%)
	Scotland	92	24 (26%)	30 (33%)
	N. Ireland	7	1 (14%)	0
		184	56 (30%)	50 (27%)

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

Table 9: Incidents involving wild birds 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Incidents investigated	267	232	199	155	192	151	178	150	184
Pesticide incidents	24%	22%	30%	26%	22%	28%	33%	32%	30%

Part 3: Incidents in 2002: Species/samples and the pesticides involved

Birds of prey (including owls)

56. There were 129 incidents with birds of prey (see Table 8 and 10) investigated in 2002. The cause of death was established in 79 of these incidents, with 40 identified as pesticide poisoning. Table 11 shows the number and percentage of pesticide poisonings for the past nine years.

Table 10: Number of incidents involving birds of prey (excluding owls) in 2002

		Number of incidents investigated	Number (%) in which pesticide poisoning was identified	Number (%) in which another cause of death was identified
Buzzard	England	16	8 (50%)	3 (19%)
	Wales	6	1 (17%)	3 (50%)
	Scotland	38	9 (24%)	14 (37%)
	N. Ireland	2	1 (50%)	0
		62	19 (31%)	20 (32%)
Red kite	England	5	5 (100%)	0
	Wales	6	2 (33%)	3 (50%)
	Scotland	10	3 (30%)	3 (30%)
		21	10 (48%)	6 (29%)
Eagle	Scotland	7	4 (57%)	2 (29%)
Peregrine	England	2	0	1 (50%)
	Wales	4	2 (50%)	1 (25%)
	Scotland	2	1 (50%)	0
	N. Ireland	2	0	0
		10	3 (30%)	2 (20%)
Sparrowhawk	England	4	1 (25%)	0
	Wales	2	0	2 (100%)
	Scotland	2	1 (50%)	1 (50%)
		8	2 (25%)	3 (38%)
Kestrel	England	2	2 (100%)	0
	Scotland	3	0	0
	N. Ireland	1	0	0
		6	2 (33%)	0
Rough-legged buzzard	England	1	0	0

Table 11: Incidents involving birds of prey (including owls) 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Incidents investigated	134	131	122	84	97	98	136	111	129
Pesticide incidents	28%	24%	34%	25%	30%	34%	38%	37%	31%

Pesticide poisoning of animals 2002: investigations of suspected incidents in the United Kingdom

Common buzzard

57. There were 62 reported incidents with common buzzards in 2002. In 39 of the incidents, the cause of death was established and 19 of these were attributed to pesticide poisoning.

58. Deliberate abuse of pesticides accounted for eighteen incidents and unspecified use, one incident. Carbofuran abuse was involved in eleven incidents and one of these incidents also involved, alphachloralose. There were eight incidents of alphachloralose abuse (carbofuran also present in one incident). The other pesticide incident involved the unspecified use of difenacoum. There was a total of eight buzzard incidents, where anticoagulant rodenticide residues were confirmed as present, but were not considered to be the cause of death (see anticoagulant rodenticide sub-lethal exposure and Appendix 2).

Red kite

59. There were 21 reported incidents with red kites in 2002, some of which were introduced birds. The cause of death was identified in 16 of the incidents, with 10 attributed to pesticide poisoning. More than half of these incidents were from the unspecified use of anticoagulant rodenticides; five incidents with difenacoum and one with bromadiolone. The abuse of pesticides occurred in three incidents; two of these were with alphachloralose and one with strychnine. There was one incident with a veterinary compound, diazinon and the source of this could not be established.

60. There were six red kite incidents where anticoagulant rodenticide residues were confirmed, but were not considered to be the cause of death (see anticoagulant rodenticide sub-lethal exposure and Appendix 2). In three of these incidents the cause of death was attributed to abused pesticides.

Eagle

61. Four golden eagle incidents and three sea eagle incidents were submitted in 2002. The cause of death was established in six incidents, with four the result of pesticide abuse. Two golden eagles were poisoned with carbofuran, one sea eagle with aldicarb and another with alphachloralose.

Peregrine falcon

62. There were ten peregrine falcon incidents reported to the Scheme during 2002. The cause of death was established in five incidents, with three the result of pesticide abuse. There were two incidents with alphachloralose and one with aldicarb. No anticoagulant rodenticide residues were found.

Part 3: Incidents in 2002: Species/samples and the pesticides involved

Other raptor species

63. Other species of raptor were submitted as possible pesticide poisoning victims. These included eight sparrowhawks, six kestrels and a rough-legged buzzard. The cause of death was determined in five of the sparrowhawk incidents and two of the kestrel incidents. Two sparrowhawk incidents were attributed to pesticide abuse, alphachloralose in one incident and bendiocarb in the other incident. The kestrel incidents were also due to pesticide abuse, alphachloralose in one incident and aldicarb in the other incident. One sparrowhawk, where the cause of death was uncertain, also had residues of bromadiolone present. No anticoagulant rodenticide residues were found in the kestrels.

Owls

64. There were fifteen owl incidents notified in 2002, eleven were barn owls and four were tawny owls. The cause of death of the birds was identified in seven of the incidents, but only one was due to pesticide poisoning. A barn owl, which had some traumatic injuries, had a significant residue of bromadiolone. There were also two tawny owl incidents where residues of anticoagulant rodenticides were present. One owl was a possible road traffic accident victim, but had been exposed to brodifacoum. The other had no cause of death determined, but had been exposed to bromadiolone.

Wildfowl and water birds

65. In 2002, there were sixteen incidents investigated by the Scheme that involved wildfowl and water birds. The cause of death was identified in six of these incidents and three involved pesticide abuse. Mallards were the victims in an incident of coumatetralyl abuse and also an incident of bendiocarb abuse. Greylag geese were involved in an incident of metaldehyde abuse.

Gulls and waders

66. There were eight incidents with gulls and waders in 2002 and the cause of death was established in three of these incidents, with one attributed to carbofuran abuse (an incident with herring gulls and several other species).

Pigeons and doves

67. Pigeons and doves were reported in eight incidents in 2002 and the cause of death was determined in six of the incidents, with four attributed to pesticide poisoning. Abuse of pesticides accounted for two of the incidents, with feral pigeons poisoned with difenacoum. An unlicensed narcotic treatment, using alphachloralose, was suspected in a misuse incident, where over 30 feral pigeons died. Four woodpigeons died in an incident with demeton-S-methyl, but no source for the compound was found.

Pesticide poisoning of animals 2002: investigations of suspected incidents in the United Kingdom

Corvids

68. This group of birds is often the target of deliberate pesticide poisoning as they are considered by some to be pests. In 2002, there were 22 incidents reported and the cause of death was found in 14, with 8 attributed to pesticide poisoning. Abuse of pesticides occurred in all these incidents and many involved other species, such as raptors or pets. Table 12 shows the number and percentage of pesticide poisonings for the past nine years.

Table 12: Incidents involving corvids 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Incidents investigated	39	29	30	22	26	19	13	12	22
Pesticide incidents	33%	28%	57%	41%	15%	47%	31%	33%	36%

69. Carbofuran was implicated in five of the incidents and in two of these alphachloralose was also found. Magpies, crows and rooks were involved in these incidents. A mevinphos incident involved a magpie and a bendiocarb incident involved two magpies. There was also an incident, with alphachloralose only detected and crows, rooks and magpies were involved.

Gamebirds

70. There were three incidents notified in this category in 2002 and pesticide poisoning was determined in two. Both incidents are discussed in the approved use section and involved grey partridge that had been poisoned with aldicarb.

Other birds

71. This category includes passerines (mainly garden birds) and other birds not dealt with in earlier sections. There were nine incidents reported and the cause of death was determined in six. The only poisoning incident was attributed to approved pesticide use, where a green woodpecker was poisoned with bendiocarb (see approved use section).

Companion animals

72. There were 150 incidents with companion animals reported to the Scheme in 2002 (see Table 13). The cause of death was established in 52 incidents, with pesticides implicated in 45 of these. Table 14 shows the number and percentage of pesticide poisonings for the past nine years.

Part 3: Incidents in 2002: Species/samples and the pesticides involved

Table 13: Number of incidents involving companion and other animals in 2002

		Number of incidents investigated	Number (%) in which pesticide poisoning was identified	Number (%) in which another cause of death was identified
Cat	England	23	12 (52%)	4 (17%)
	Wales	2	0	1 (50%)
	Scotland	8	0	0
	N. Ireland	7	0	0
		40	12 (30%)	5 (13%)
Dog	England	32	19 (59%)	0
	Wales	4	1 (25%)	0
	Scotland	35	8 (23%)	2 (6%)
	N. Ireland	33	5 (15%)	0
		104	33 (32%)	2 (2%)
Budgerigar/parakeet	N. Ireland	2	0	0
Chinchilla	N. Ireland	1	0	0
Guinea pig	Scotland	2	0	0
Horse	Scotland	1	0	0
Rabbit	Scotland	1	0	0
Snowy owl (captive)	Wales	1	0	0
TOTAL*	England	55	31 (56%)	4 (7%)
	Wales	6	1 (17%)	1 (17%)
	Scotland	45	8 (18%)	2 (4%)
	N. Ireland	44	5 (11%)	0
		150	45 (30%)	7 (5%)
Sheep	N. Ireland	1	1 (100%)	0

Table 14: Incidents involving companion animals 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Incidents investigated	313	271	275	253	235	149	160	109	150
Pesticide incidents	49%	34%	35%	34%	38%	32%	36%	31%	30%

Cat

73. There were 40 incidents with cats in 2002 and the cause of death was determined in 17. In the 12 pesticide incidents, about 23 individuals were poisoned. Table 15 shows the number and percentage of pesticide poisonings for the past nine years.

Table 15: Incidents involving cats 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Incidents investigated	125	90	112	110	91	58	63	41	40
Pesticide incidents	41%	33%	38%	37%	38%	24%	30%	29%	30%

Pesticide poisoning of animals 2002: investigations of suspected incidents in the United Kingdom

74. Pesticide abuse accounted for ten incidents: four incidents involved carbofuran; three aldicarb; two alphachloralose; and one involved metaldehyde. Strychnine in one incident and difenacoum in another, were categorised as unspecified use. However, the strychnine may have been from an unprofessional mole control treatment.

75. Ethylene glycol (anti-freeze) poisoning was diagnosed in two incidents and creosote poisoning in another.

Dog

76. The Scheme registered 104 incidents with dogs in 2002. The cause of death was determined in 35 incidents. In the 33 pesticide incidents, about 46 dogs were poisoned. Table 16 shows the number and percentage of pesticide poisonings for the past nine years.

Table 16: Incidents involving dogs 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Incidents investigated	183	170	163	138	149	89	98	63	104
Pesticide incidents	28%	39%	35%	33%	40%	38%	41%	33%	32%

77. The abuse of pesticides was found in 18 incidents and involved a wide range of compounds. Vertebrate control products were abused in nine incidents. Five of these involved strychnine, and there were single incidents with alphachloralose, difenacoum, warfarin and sodium cyanide. Carbamate abuse was identified in four incidents, two with aldicarb and two with bendiocarb. There were two incidents with slug pellets, containing metaldehyde and single incidents with gamma-HCH, mevinphos and paraquat.

78. The misuse of pesticides accounted for six incidents and four of these involved spillage, or high application rates, of metaldehyde slug pellets. There were two incidents where difenacoum rodenticide bait was accessible to non-target species.

79. There were six incidents where the source of the pesticides was uncertain. Four of these incidents involved anticoagulant rodenticides and were incidents with bromadiolone, warfarin, difenacoum and a mixture of all these compounds. There was also an incident with paraquat and one with aldicarb.

80. The veterinary compound, diazinon, was probably abused in one incident and there were approved use incidents, with aldicarb and chlorophacinone, which are discussed in the earlier section of this report.

Other companion animals

81. There were seven incidents with other companion animals (see Table 13 for species) and an incident with a captive snowy owl. No cause of death was found for these incidents.

Part 3: Incidents in 2002: Species/samples and the pesticides involved

Livestock

82. Livestock are not normally included in the Scheme, but if there are other environmental samples associated with the incident they may be accepted. There was one incident reported to the Scheme in 2002, where two ewes, two rams and nine sheep died. A metaldehyde slug pellet bag was found nearby and rumens contained pellets similar to those in the bag.

Beneficial insects

83. There were 25 suspected beneficial insect poisoning incidents investigated during 2002 (see Table 17), with 19 incidents reported from England, 1 incident reported from Wales and 5 incidents reported from Scotland. There was one bumble bee incident from England, where the cause of death was not identified, but all the other incidents involved honeybees. Pesticides were implicated in five of these incidents; three were from England and two from Scotland.

Table 17: Number of incidents involving beneficial insects in the UK during 2002

Number of incidents investigated:	25
Number of incidents attributed to pesticides:	5
Number of incidents where bee diseases were detected:	4
Number of incidents attributed to disease:	2

Pesticide detected*	Number of incidents	Number of colonies affected
<i>Organophosphate compounds</i>		
triazophos	1	14
<i>Carbamate compounds</i>		
bendiocarb	2	3
<i>Pyrethroid compounds</i>		
deltamethrin	1	12
permethrin	1	200 (queens)
TOTAL	5	229

*There were 11 incidents where small residues of fluvalinate were detected, see Appendix 2 for further details.

84. Diseased bees were found in four incidents investigated and in two of these incidents the levels of disease were considered to be the likely cause of death. The cause of death in one bumble bee incident, and the remaining honeybee incidents, could not be determined. In 2002, there have been 11 incidents where small residues, approximately 0.005 micrograms fluvalinate per bee, were noted in the bees examined. These residues have not been confirmed by an alternative method, but are reported here and at Appendix 2 to show the frequency that residues of this compound are noted. Two of these incidents with fluvalinate residues, had significant residues of other pesticides (see Table 19). At these levels fluvalinate is not thought to be the cause of death of the bees, but an indication of the use of the compound to control varroa mites.

Pesticide poisoning of animals 2002: investigations of suspected incidents in the United Kingdom

85. Four different compounds have been detected in the incidents attributed to pesticides (see Table 17). In the deltamethrin incident, the sample of bees also had confirmed residues of two fungicides, chlorothalonil and cyproconazole. For reviews and articles on bee poisoning incidents refer to: Barnett, Libby. 2002; Barnett, E.A. *et al.*, 1997; Fletcher, M.R. *et al.*, 1994; and Greig-Smith, P.W. *et al.*, 1994. For the incidents investigated and the percentage of pesticide poisonings for the past nine years refer to Table 18, and for a summary of the 2002 incidents, where pesticides were involved, refer to Table 19.

Table 18: Incidents involving beneficial insects 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Incidents investigated	45	56	40	40	43	28	48	23	25
Pesticide incidents	44%	59%	20%	40%	28%	32%	27%	22%	20%

Table 19: Pesticides detected in beneficial insect incidents in the UK during 2002

Month	Location	Number of colonies in apiary	Number of colonies affected	Pesticide involved	Level detected (µg/bee)
April	West Midlands	2	2	fluvalinate*	0.01
				permethrin*	0.01
April	In transit	200 queens		permethrin	0.7
June	Oxfordshire	12	12	deltamethrin	0.009
				fluvalinate*	0.03
				cyproconazole	0.32
				chlorothalonil	0.72
June	Hertfordshire	14	14	triazophos	0.02
August	Fife	6	2	bendiocarb	0.11
August	Fife	1	1	bendiocarb	0.028

*Residues not confirmed by an alternative method.

86. The incidents where pesticides were detected are also summarised in Appendix 2. There was one approved use incident, with deltamethrin applied to a flowering bean crop (see approved use section). Pyrethroid insecticides, although very toxic to honeybees under laboratory conditions, are normally considered to be safe to apply to some flowering crops in the field. However, the Scheme has reported some incidents with these compounds and often they are associated with a pyrethroid/fungicide mix. Beekeepers must continue to be vigilant and report any suspected pesticide poisoning incidents. The possible risks of pesticide applications to honeybees can not be effectively reviewed unless the regulatory authority, the Pesticides Safety Directorate, has data to recommend changes to approval conditions, or highlight areas for research. There also appears to have been a misuse incident with triazophos applied to a bean crop. At present, despite thorough field investigations, the source of the pesticides in three incidents has not been established. However, it is likely that the bendiocarb residues were due to honeybees robbing bendiocarb treated comb, which had not been sealed off or removed adequately, during a feral bee control treatment. The permethrin is thought to be from an insecticidal spray, used at some point during the transit of queen bees.

Part 3: Incidents in 2002: Species/samples and the pesticides involved

87. An apiary, at Furneux Pelham, lost a high proportion of flying bees from all 14 hives. The hives were inspected about ten days before the incident and then the colonies had been strong, with multiple supers. Dead bees were found with their tongues protruding and the remaining honeybees seemed more aggressive. There were few flowering crops in the area, although a field of beans might have been in flower at the time of the incident and appeared to have been recently sprayed. A residue of 0.02 micrograms triazophos per bee was confirmed during analysis, so these bees had died from pesticide poisoning. Given this result a sample of the bean crop, which had been collected, was submitted for testing and a triazophos residue was confirmed. There are no approved uses for triazophos, so an illegal spray application to a bean crop is suspected.

88. Two beekeepers in Cupar, Fife, found dead bees in front of a total of three hives and believed that they had died from pesticide poisoning. The residue confirmed was 0.11 and 0.028 micrograms bendiocarb per bee, so these bees had died from pesticide poisoning. The source of this pesticide has not been established, as the beekeepers were not aware of any pesticide applications in the area. However, it is likely that the bendiocarb was from a feral bee or wasp treatment, which either had not been adequately sealed off, or in which the treated comb had not been removed.

89. Those honeybees that were actively foraging were found dead or dying at all 12 colonies in an apiary in Watlington, Oxfordshire. The beekeeper has more than 50 years experience and has had poisoning incidents in the past. A tall hedge obscures a bean crop, which is close to the apiary, so the beekeeper was unaware of the spray application to the field. The beekeeper was working in the apiary and noticed the dead/dying honeybees in the afternoon/early evening. It was reported that Alto Elite – chlorothalonil and cyproconazole and Pearl Micro – deltamethrin had been sprayed on the flowering beans on the day of the incident, between 18:00 and 19:00. The current label instruction allows application to certain flowering crops, but the spray liaison scheme was not notified, so the beekeeper was unaware of the application. The residue analysis noted some fluvalinate, probably from a varroa mite treatment. However, a small residue, about 0.009 micrograms deltamethrin per bee, was confirmed. Further analytical work also confirmed the presence of the two fungicides, chlorothalonil and cyproconazole, that were used in the pesticide application. Therefore, it is considered likely that these honeybees died from an approved application of deltamethrin, which had been mixed with two fungicides and applied to a flowering bean crop.

90. A consignment of 200 queen bees and attendants were imported, under licence, from Australia and all found to be dead on arrival. The analyses detected and confirmed 0.7 micrograms permethrin per bee, so clearly these bees had died from pesticide poisoning. The source of the compound is uncertain at present, but it probably originated from an insecticidal spray used during transit. In another incident, all the bees from two hives were found dead around the end of March. The hives are in a residential, urban area, with no crop in the immediate area. The hives had been in good condition for four years and neighbours had not shown any animosity towards the bees. However, something may have been sprayed on the hives, as a light had been seen at the end of the garden, a few days prior to finding the dead bees. An unconfirmed residue of permethrin, at about 0.01 micrograms per bee, was noted and a residue of fluvalinate. The source of the permethrin is not known and it may not have been the cause of death of the bees.

Pesticide poisoning of animals 2002: investigations of suspected incidents in the United Kingdom

Suspected poisoned baits and suspicious samples

91. 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 47 such samples notified to the Scheme in 2002 and pesticides were detected in 20 (43%) of these. Table 20 shows the number of possible baits and suspicious samples submitted and the percentage in which pesticides were detected for the past nine years. There were twelve incidents of abuse and eight incidents of misuse. Some of the baits were indiscriminate attempts at pest control, where no mortalities were found. However, protected species can also be involved, for example, peregrine falcons were the likely intended target, in incidents with the abuse of strychnine and aldicarb. There were also badger setts (see section on badgers) involved in three incidents of pesticide misuse and one of abuse.

Table 20: Incidents involving possible baits and suspicious samples 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Incidents investigated	57	72	63	66	62	67	64	35	47
Pesticide incidents	28%	39%	46%	48%	47%	33%	44%	46%	43%

92. Carbamate compounds and alphachloralose account for just over half of the abuse incidents. Three incidents were with carbofuran baits and three incidents were with alphachloralose, but one of these was a seized sample. There was also a suspected abuse incident, when samples of strychnine and aldicarb were seized and an incident where aldicarb was abused. Carbofuran and the anticoagulant rodenticides, bromadiolone and warfarin, were seized in another abuse incident. Finally, paraquat and diquat samples were seized in a suspected abuse incident, difenacoum was present in baits in another incident and potatoes and metaldehyde slug pellets were left at a badger sett.

93. The eight misuse incidents all involved vertebrate control products. There were two incidents with aluminium phosphide and one with Renardine, which all occurred at badger setts. Anticoagulant rodenticides, warfarin, difenacoum, chlorophacinone were involved in three separate incidents and there was one incident with a mixture of bromadiolone and difenacoum. There was also an incident with improper storage of strychnine and metaldehyde.

Pesticides

94. The chemicals found in the 126 vertebrate and bait incidents are listed in Table 4. Details of these incidents are also given in Appendix 2. Pesticides involved in beneficial insect incidents can also be found in Table 4 and Appendix 2 and above in the section for this category.

95. A total of 23 different compounds was implicated from all incidents (except beneficial insect incidents) submitted in 2002 (29 in 2000). There were 20 different chemicals from England (22 in 2000), 9 from Scotland (17 in 2000), 6 from Wales (6 in 2000) and 5 from Northern Ireland (5 in 2000). Table 21 shows the number of different pesticides implicated in all incidents (except beneficial insect incidents) in the past nine years.

Part 3: Incidents in 2002: Species/samples and the pesticides involved

Table 21: The number of different pesticides implicated in all incidents (excludes beneficial insects) 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Number of compounds	35	36	29	26	34	27	29	23	23

Other causes of death

96. There were 80 vertebrate incidents where the cause was determined as other than pesticide poisoning. This represents 21% of vertebrate incidents (excluding those just involving baits). This compares with 98 (25%) in 2000. 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.

Number of incidents

97. In 2002, of the 450 incidents registered, pesticide involvement was found in 131 (29%) and other causes of death (other chemicals, disease, starvation, etc.) were identified in 82 (18%) (see Table 1, Figure 3). In addition, there were 27 (6%) incidents reported that were classified as “not applicable” (alleged bait materials where no pesticides were identified and where no dead animals were found). Since 1999, the number of incidents reported each year has averaged 470 (not including data for 2001, due to FMD). However, prior to this there were about 620 incidents reported per year (see Table 22). Despite this difference in the number of incidents reported, the overall proportion of pesticide incidents has remained at around 30%. Therefore, people should be actively encouraged to report suspected incidents to the Scheme, as to date, the more incidents that are reported, the more pesticide incidents have been detected.

Table 22: Number of incidents reported to the Scheme 1996-2002 and number (%) pesticide incidents identified

Year	1996	1997	1998	1999	2000	2001	2002
England							
Incidents reported	354	333	334	232	244	133	188
Pesticide incidents	128 (36%)	118 (35%)	108 (32%)	84 (36%)	83 (34%)	51 (38%)	80 (42%)
Wales							
Incidents reported	58	51	32	41	42	34	50
Pesticide incidents	24 (41%)	13 (25%)	9 (28%)	9 (22%)	11 (26%)	6 (18%)	10 (20%)
Scotland							
Incidents reported	160	144	167	135	167	127	156
Pesticide incidents	34 (21%)	36 (25%)	52 (31%)	40 (30%)	57 (34%)	35 (28%)	34 (22%)
Northern Ireland							
Incidents reported	79	79	79	45	53	52	56
Pesticide incidents	18 (23%)	19 (24%)	16 (20%)	6 (13%)	11 (21%)	17 (33%)	7 (13%)
TOTAL							
Incidents reported	651	607	612	453	506	346	450
Pesticide incidents	204 (31%)	185 (30%)	185 (30%)	139 (31%)	162 (32%)	109 (32%)	131 (29%)

98. There are regional variations in the number of incidents reported and pesticide incidents. In England, between 1996 and 1998, the average number of incidents reported was 340 (proportion of pesticide incidents 34%), but since 1999, this number is 220 (proportion of pesticide incidents 38%). This decrease in incidents reported, may in part account for the increase in the proportion of pesticide incidents, from 34% in 2000, to 42% in 2002. In Wales, the number of incidents reported peaked in 1996, at 58, then only 32 incidents were reported in 1998 (see Table 23). Therefore, the number of incidents reported for 2002 is within the range seen in previous years, but the proportion of pesticide incidents has been lower in 2001 and 2002. In Scotland, the number of incidents reported and the number and proportion of pesticide incidents, is within the variation seen in previous years. In Northern Ireland, 1999 saw only 45 incidents reported, compared to 79 in previous years. For the last three years, there have been around 52 incidents reported. The proportion of pesticide incidents, at 13%, is low this year and the same proportion occurred in 1999, so this may reflect year on year variation.

99. The percentages of poisoning incidents in the various categories of pesticide use are shown in Figure 1. In 2002, there were six incidents where the approved use of pesticides occurred, representing 5% of the pesticide incidents reported. In 2000, there were 16 (10%) approved use incidents. Although this is a decrease in number and proportion of approved use incidents, it is within the range seen for vertebrate incidents in years prior to this (see Table 23). This small proportion of approved use incidents indicates that when label instructions are followed, pesticides are apparently not causing major problems to wildlife and other animals. However, the Scheme relies on incidents being found and reported and some incidents, particularly those involving small vertebrates, are not reported. The Scheme only monitors acute, lethal effects and sublethal, or chronic, effects may not be identified.

100. There were 20 incidents arising from the misuse of pesticides (15% of pesticide poisoning incidents) in 2002. In 2000, there were 23 (14%) misuse incidents. This number and proportion of incidents, is within the range seen for vertebrate incidents in years prior to this (see Table 23). Misuse incidents are often associated with poor storage, unprotected rodenticide treated grain, or pellet spillages on fields.

Table 23: Number of vertebrate pesticide poisoning incidents in each category of use 1994-2002

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002
Abuse	115	112	136	125	95	61	95	81	78
(%)	(60)	(64)	(69)	(74)	(55)	(47)	(63)	(78)	(62)
Misuse	21	21	19	21	45	31	22	6	19
(%)	(11)	(12)	(10)	(12)	(26)	(24)	(15)	(6)	(15)
Approved use	12	5	11	3	4	7	9	2	5
(%)	(6)	(3)	(6)	(2)	(2)	(5)	(6)	(2)	(4)
Unspecified use	39	32	26	21	22	29	19	14	22
(%)	(20)	(18)	(13)	(12)	(13)	(22)	(13)	(13)	(17)
Veterinary	4	5	4	0	7	2	4	1	2
(%)	(2)	(3)	(2)		(4)	(2)	(3)	(1)	(2)
TOTAL	191	175	196	170	173	130	149	104	126

101. As in previous years, deliberate abuse incidents account for the major proportion of those in which pesticides are implicated. In 2002, the number of abuse incidents was 78, which is less than the 95 incidents in 2000. However, the proportion of abuse incidents, at 59% (see Figure 1), is the same for both these years. The proportion of vertebrate abuse incidents has ranged from 47%, in 1999, to 74%, in 1997. Additionally, there were 25 (19%) incidents where the source of the pesticide could not be identified. This number and proportion is within the range seen in previous years. In 2002, there were two incidents reported that involved a veterinary compound, one was suspected abuse of the compound and in the other the source was uncertain. Details of all these poisoning incidents can be found in Appendix 2. Regulatory and/or enforcement action was taken as appropriate (see earlier sections).

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Vertebrate incidents

102. Of the 425 vertebrate related incidents reported, 126 (30%) involved pesticides. There were 5 incidents (4%) arising from approved use (see Table 23). Incidents arising from misuse, amounted to 19 (15%) and abuse of pesticides, 78 (62%) incidents. There were 22 (17%) unspecified use incidents. During 2002, there were two incidents with a pesticide formulated as a veterinary medicine product. These are identified as the multi-residue methods employed will also detect various veterinary compounds.

103. Figure 2 shows the relative proportion of incidents with alphachloralose, carbamate and organophosphorus compounds over several years. Since 1994, carbamate compounds have consistently been involved in a larger percentage of vertebrate poisoning incidents than either organophosphates or alphachloralose and there is no sign of this trend changing. Between 1997 and 2000, incidents with either an organophosphate or alphachloralose, have fluctuated around a proportion that is generally lower than that seen in years prior to 1997. However, the increase in proportion of alphachloralose incidents in 2001, to a level not observed for nearly ten years, appears to be continuing in 2002. The Environmental Panel of the Advisory Committee on Pesticides has considered the inclusion of alphachloralose in the Poison Rules 1982 and has recommended that it be classified under Part one. All of the alphachloralose incidents were attributable to abuse and most of the carbamate incidents also arose from abuse of these compounds.

104. For the animals involved in these incidents, birds of prey are the group with the highest number of pesticide poisoning incidents. Buzzards are the species most often associated with pesticide poisoning incidents and then red kites. In England, all five of the red kite incidents investigated were attributed to pesticide poisoning and half of the sixteen buzzard incidents investigated were attributed to pesticide poisoning.

Beneficial insect incidents

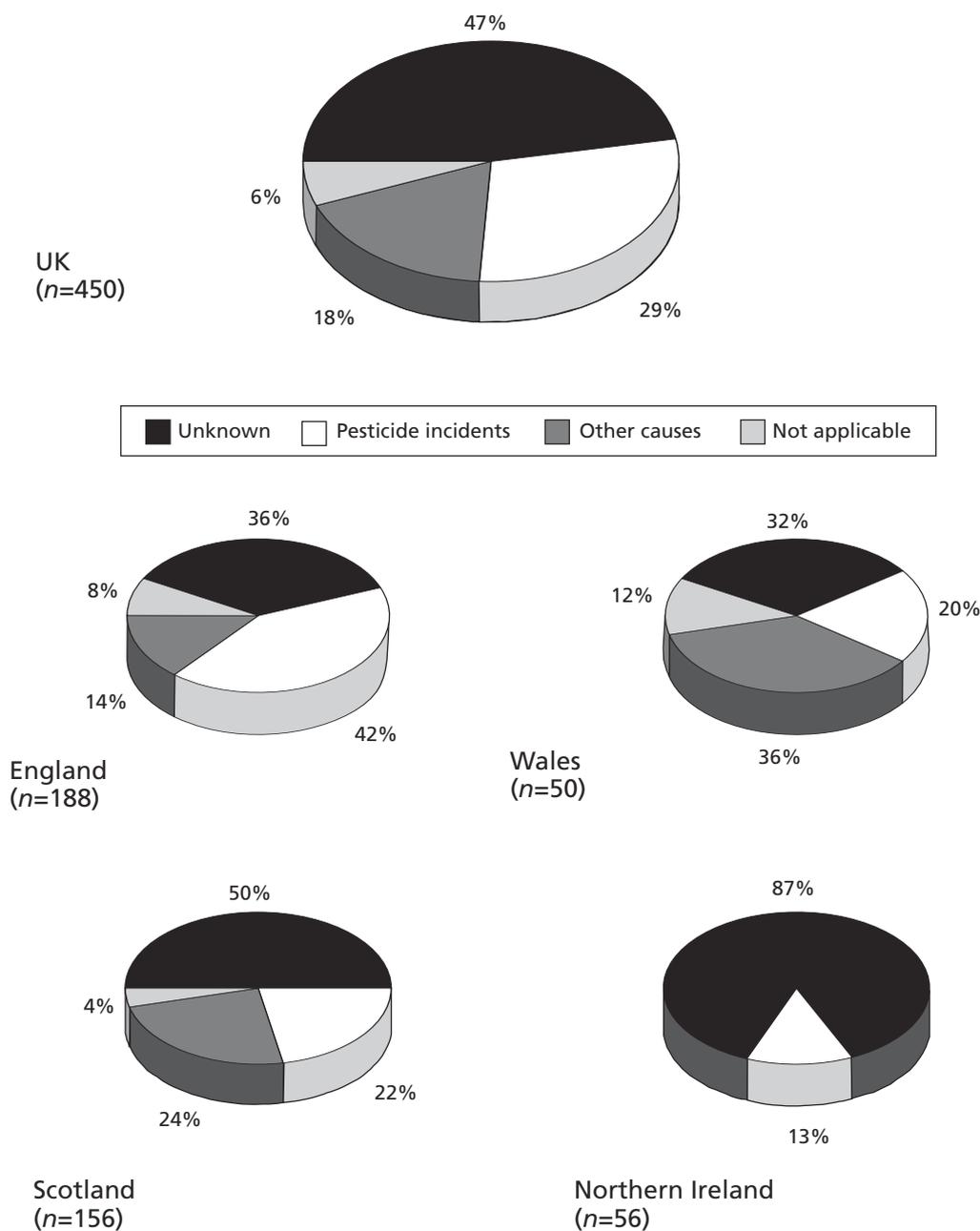
105. The 25 beneficial insect incidents in 2002 were far fewer than the number reported in 2000 (see Table 18). The proportion of pesticide poisoning has also decreased, compared to 2000, but it is within the range seen to date. There was one approved use incident, one misuse incident and three where the origin of the pesticides was not established. These incidents have been detailed in previous sections, but of note this year was the approved use incident with deltamethrin and a mixture of fungicides and the misuse incident with triazophos. Until now, 1997 was the last year a bee poisoning incident with triazophos occurred.

106. The number of colonies found to be affected by pesticides during 2002, was 229 (see Table 17), but this includes the death of 200 queen bees. There were 51 colonies affected in poisoning incidents in 2000. 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

107. There are 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 other chemicals, or no appropriate analytical method for a particular compound. In 210 (47%) incidents reported in 2002, the cause of death was not established (see Figure 3). This compares with 204 (40%) in 2000.

Figure 3: Proportion of reported incidents in 2002 by cause of incident



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108. In addition, there were 20 incidents (6%) that were classified as not applicable (see Figure 3), which is a small decrease in number, compared to the 36 in 2000, but a similar proportion (7%). These are suspected baits or suspicious substances where there are no dead or poisoned animals found. Often these are just food placed for animals or birds, or discarded food items.

Seasonal distribution

109. The seasonal distribution of incidents can be seen in Appendix 2. Incidents of abuse occur throughout the year, but April had the most incidents (15) and December the least (1). March (11) and May (10), are the months with the next highest level of abuse incidents. More than half of the incidents in March and April involved raptors and there were five incidents with dogs. This spring time peak in abuse incidents is likely to reflect illegal pest control by some farmers or gamekeepers. Nearly half (six incidents), of the eight abuse incidents in June and six in July, involved companion animals and only three involved raptors. Two of these, were incidents with peregrines, where pigeon carcasses are often laced with pesticides. Unspecified use incidents occurred in all months, except January and September and most occurred in April (seven incidents) and May (six incidents). Anticoagulant rodenticides accounted for nine of these incidents. November (four incidents), January (three incidents) and June (three incidents) were when most misuse incidents occurred. Poor storage of metaldehyde, or spillages, accounted for two incidents in October and two in November.

Regional distribution

110. Given the rural practices that predominate in some counties and regions of the UK, there is some bias towards certain categories of incidents in these areas. For example, two approved use incidents, with aldicarb, occurred in Norfolk. There were five misuse incidents in Suffolk, three involved anticoagulant rodenticides and one aluminium phosphide and the other metaldehyde. Northamptonshire had three unspecified use incidents with anticoagulant rodenticides and all involved red kites. Somerset (two incidents) and Dumfries and Galloway (two incidents), also had unspecified use incidents with anticoagulant rodenticides. The abuse incidents occurred in many counties, but North Yorkshire had six incidents, three with alphachloralose and single incidents with metaldehyde, strychnine and carbofuran. Five incidents, two with alphachloralose and three with carbofuran, occurred in Grampian. Finally, there were several counties with four abuse incidents, including; Cumbria, Essex, Highland, Strathclyde and Tayside. Apart from the alphachloralose abuse in North Yorkshire and carbofuran abuse in Grampian mentioned above, South Yorkshire had companion animals poisoned with aldicarb in three incidents. There were also four incidents in Wales where peregrines were involved, or the likely targets and those in Gwynedd involved alphachloralose, whereas those in Gwent, involved aldicarb.

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.

Acknowledgements

We should like to thank Fiona Garrett of DARD for providing the results from Northern Ireland. Tricia Brobyn of PSD supplied details of the approved use incidents from England. Kathy Wood of PSD provided the information on enforcement action in England and Gary Spiller, that for Wales. For determination of the pesticide residues in this report, we should like to thank the analytical chemists, particularly Andrew Charlton and Sheonaidh Charman at Central Science Laboratory (CSL), and Laura Melton at Scottish Agricultural Science Agency (SASA). We are also grateful to colleagues in Defra, SEERAD, ARAD, DARD, SASA and CSL, who have participated in incident investigations during 2002, and to all individuals and organisations who have supported the Wildlife Incident Investigation Scheme by submitting carcasses, providing information or contributing in other ways.

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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 Rural Development Service (RDS) or Agricultural Rural Affairs Department (ARAD) wildlife officer deciding, in consultation with others if necessary, whether an investigation should be started. This permits the screening-out of incidents that may not involve pesticides.

In England and Wales, after acceptance of an incident, the carcasses are taken to a local Veterinary Laboratories Agency 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 RDS or ARAD 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 other 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 RDS or ARAD 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 Executive Environment and Rural Affairs Department (SEERAD) 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 Health and Safety Executive Northern Ireland. The abuse and misuse of pesticides affecting wildlife may also contravene the provisions of the Wildlife (Northern Ireland) Order 1985 which is enforced by the PSNI 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 Defra Investigation Section, in collaboration with the Pesticides Safety Directorate, who rely on information collected by the RDS and ARAD wildlife officers. SEERAD staff in Scotland and the PSNI, DARD 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 anticoagulant rodenticides. These are supplemented by specific analyses for strychnine, alphachloralose, metaldehyde, paraquat and some other compounds.

Incidents where pesticides were detected in 2002

Month	County	Number and Species	Chemical	Cause	Comments
March 2000	Norfolk	pied wagtail	aldicarb	approved	*Not included in statistics.
January	Essex	badger sett	aluminium phosphide	misuse	*Badger sett gassed during rabbit control treatment.
January	Greater Manchester	dog, fox	bendiocarb	abuse	History of abuse incidents, but source uncertain.
January	Kent	30 feral pigeon	alphachloralose	misuse	An illegal pigeon control operation is suspected.
January	North Yorkshire	buzzard	alphachloralose	abuse	Source uncertain, history of abuse incidents in area.
January	North Yorkshire	kestrel, bait	alphachloralose	abuse	Raw chicken or other poultry used as a bait on this grouse moor.
January	Suffolk	grain, sample	chlorophacinone	misuse	Game cover crop with inadequately protected rodenticide bait points.
January	Dyfed	buzzard, fox	carbofuran	abuse	Farmland adjacent to the coast, source uncertain.
January	Gwynedd	red kite	difenacoum	asphyxia	Small residue, sub-lethal exposure.
January	Highland	buzzard	difenacoum	trauma	Sub-lethal residue, cause of death trauma.
February	Cambridgeshire	dog	paraquat	unspecified	
February	County Durham	buzzard	alphachloralose	abuse	History of abuse incidents.
February	Essex	dog	bendiocarb	abuse	Dog recovered.
February	Hertfordshire	badger sett, 2 dogs	sodium cyanide	abuse	*Two dogs disappeared, a dead dog retrieved from gassed badger sett.
February	Suffolk	grain	difenacoum/bromadiolone	misuse	Pest control company inadequately protected bait points.
February	Tyne & Wear	2 cats	aldicarb	abuse	Urban area, with a history of abuse incidents.
February	Central	buzzard	difenacoum	disease	Sub-lethal residue, cause of death – acute septicaemia.
February	Grampian	2 buzzard, bait	carbofuran	abuse	Buzzards found next to rabbit bait.
February	Highland	red kite	diazinon	veterinary	Near skeletal remains of bird, unspecified use.
February	Strathclyde	golden eagle	carbofuran	abuse	
March	County Durham	2 cats	aldicarb	abuse	History of incidents in this area.
March	Cumbria	sample	carbofuran	abuse	History of carbofuran abuse in the area.
March	Cumbria	4 dogs	strychnine	abuse	
March	Cumbria	dog, bait	strychnine	abuse	Meat, chicken like material used as a bait.
March	Hereford and Worcester	2 buzzards, bait	carbofuran	abuse	Pheasant carcass used as a bait and difenacoum also found in one bird.

Month	County	Number and Species	Chemical	Cause	Comments
March	Norfolk	2 dogs, sample	metaldehyde	misuse	Large accumulation of slug pellets left in an area.
March	Norfolk	2 grey partridges, sample	aldicarb	approved	SSSI with dry, sandy soil, shallow drill depth and some poor covering of aldicarb.
March	Suffolk	kestrel, 2 barn owls	DDE/dieldrin	unspecified	Kestrel, DDE; barn owl, DDE, dieldrin, sub-lethal effects suspected.
March	Warwickshire	badger sett, bait, 3 samples	sodium cyanide/ paraquat/diquat	abuse	Badger sett intentionally gassed and illegal use suspected for the paraquat and diquat seized.
March	West Sussex	dog, grain	difenacoum	misuse	Treatment around farmbuildings, with bait boxes not secured.
March	Worcestershire	bait	difenacoum	abuse	Urban area, used as bird food, probably for pigeons.
March	Gwent	peregrine	aldicarb	abuse	Quarry face, with a history of peregrine persecution.
March	Highland	buzzard	difenacoum	unknown	Sub-lethal residue, cause of death unknown.
March	Highland	2 buzzard, 3 rook, bait	carbofuran/alphachloralose	abuse	Rabbit used as a bait.
March	Tayside	crow, buzzard, chemicals	carbofuran	abuse	Referred to Procurator Fiscal for prosecution.
March	Tayside	dog	chlorophacinone	approved	
March	Tayside	buzzard, sparrowhawk, bait	alphachloralose	abuse	Pheasant used as a bait.
April	Cheshire	buzzard	difenacoum	unspecified	Small residue, but thought to be significant.
April	Cheshire	badger, dog, magpie, bait	mevinphos	abuse	"Rat poison" put on a rabbit bait, which was found to contain mevinphos.
April	County Durham	seized sample	alphachloralose	abuse	Sample found during search of gamekeepers premises.
April	Derbyshire	2 dogs, sample	difenacoum	unspecified	Two dogs were shut in a stable and were found dead later the same day.
April	Norfolk	grey partridge	aldicarb	approved	Dry, sandy soil, drilled with aldicarb and potatoes.
April	North Yorkshire	red kite	strychnine	abuse	Sub-lethal exposure to bromadiolone and difenacoum and history of red kites illegally poisoned in this area.
April	Northumberland	buzzard	alphachloralose	abuse	A history of incidents in the area and a lamb bait suspected.
April	Northumberland	3 cats	carbofuran	abuse	History of carbofuran abuse in the area.
April	Oxfordshire	6 mallard duck, bait	coumatetralyl	abuse	Possible action against a large number of ducklings in the area.
April	Somerset	fox	bromadiolone	unspecified	
April	In transit	honeybee	permethrin	unspecified	200 queens imported and all dead on arrival.
April	West Midlands	honeybee	fluvalinate**/permethrin**	unknown	Small, unconfirmed, residue of permethrin and the source is uncertain

Month	County	Number and Species	Chemical	Cause	Comments
April	Dyfed	red kite	difenacoum	unknown	Sub-lethal exposure to difenacoum.
April	Gwent	3 baits	aldicarb	abuse	Three pigeon carcasses tethered on a cliff top, probably to attract peregrines.
April	Gwent	2 dogs, bait	gamma-HCH	abuse	Chicken wrapped in newspaper used as a bait, near a golf course.
April	Gwent	buzzard	difenacoum	unknown	Sub-lethal exposure to difenacoum.
April	Border	2 dogs	aldicarb	approved	
April	Dumfries & Galloway	red kite	difenacoum	unspecified	Haemorrhages in lungs, liver pale.
April	Dumfries & Galloway	buzzard	carbofuran	abuse	
April	Dumfries & Galloway	red kite	difenacoum	trauma	Sub-lethal residue, cause of death trauma.
April	Dumfries & Galloway	buzzard	carbofuran	abuse	Sub-lethal bromadiolone and difenacoum residues also present.
April	Dumfries& Galloway	barn owl	bromadiolone	unspecified	Sub-lethal residue, cause of death trauma.
April	Grampian	buzzard	alphachloralose	abuse	Found beside pigeon carcass.
April	Strathclyde	dog	bromadiolone	unspecified	
April	Tayside	duck	bendiocarb	abuse	
April	Tayside	buzzard, crow, baits, chemicals	carbofuran/alphachloralose	abuse	Referred to Procurator Fiscal for prosecution.
April	Antrim	dog	alphachloralose	abuse	
April	Londonderry	3 buzzards, 9 rooks, 1 crow, 4 magpies, 2 other wild birds	alphachloralose	abuse	All birds and baits found in fields.
May	East Sussex	3 cats	alphachloralose	abuse	Similar cat deaths had occurred before, but not reported.
May	Essex	dog	metaldehyde	abuse	Dog walked in an urban area.
May	Gloucestershire	badger sett	renardine	misuse	*Renardine probably poured onto soil and vegetation around a badger sett.
May	Hertfordshire	3 foxes	bromadiolone/brodifacoum/ difenacoum	unspecified	
May	Leicestershire	honeybee	fluvalinate**	unknown	
May	Norfolk	cat	difenacoum	unspecified	Cat recovered after treatment, small residue confirmed in a faeces sample.
May	North Yorkshire	red kite, bait	alphachloralose	abuse	Rabbit used as a bait and sub-lethal exposure to brodifacoum and a significant residue of difenacoum present.
May	Northamptonshire	red kite	difenacoum	unspecified	

Month	County	Number and Species	Chemical	Cause	Comments
May	Northamptonshire	red kite	difenacoum	unspecified	Rats often part of diet, only bromadiolone treatments reported in the area.
May	Northumberland	sparrowhawk	bromadiolone	unknown	Sub-lethal residue.
May	South Yorkshire	dog	aldicarb	abuse	
May	Suffolk	cat	strychnine	unspecified	Unprofessional mole control treatment may have been the source.
May	Dyfed	red kite	difenacoum	unspecified	Some signs of trauma, exacerbated by presence of small residue.
May	Gwynedd	bait	alphachloralose	abuse	Pigeon carcass, left near a peregrine nest.
May	Argyll	sea eagle, bait, chemicals	alphachloralose	abuse	
May	Grampian	golden eagle	carbofuran	abuse	
May	Grampian	peregrine	alphachloralose	abuse	
May	Highland	sea eagle, baits	aldicarb	abuse	
May	Highland	dog	strychnine	abuse	
June	Cheshire	honeybee	fluvalinate**	unknown	
June	Essex	badger sett	aluminium phosphide	misuse	*A company was employed to gas rabbits in the area.
June	Essex	8 greylag geese, sample	metaldehyde	abuse	Semi-wild geese were fed grain which also contained slug pellets.
June	Greater Manchester	2 tawny owls	bromadiolone	unknown	Sub-lethal exposure to bromadiolone.
June	Hertfordshire	honeybee	triazophos/fluvalinate**	misuse	No approved uses for triazophos, spray to a bean crop suspected.
June	Norfolk	honeybee	fluvalinate**	unknown	
June	North Yorkshire	badger sett, baits	metaldehyde	abuse	Baked potatoes and slug pellets placed in badger setts.
June	North Yorkshire	sample, 2 baits	carbofuran	abuse	
June	Northamptonshire	red kite	bromadiolone	unspecified	
June	Oxfordshire	honeybee	deltamethrin/cyproconazole chlorothalonil/fluvalinate**	approved	Alto Elite and Pearl Micro applied to a flowering bean crop, between 18:00-19:00.
June	Suffolk	dog	metaldehyde	misuse	Large quantity of slug pellets applied to a garden.
June	Tyne & Wear	2 cats	carbofuran	abuse	
June	Clwyd	3 peregrines, bait	alphachloralose	abuse	Three peregrines behaving strangely, two were caught and recovered following veterinary treatment. Pigeon carcass used as a bait.
June	Gwynedd	peregrine	alphachloralose	abuse	Peregrine site which has been persecuted before.

Month	County	Number and Species	Chemical	Cause	Comments
June	Gwynedd	tawny owl	brodifacoum	trauma	Possible road traffic accident victim, but also exposed to brodifacoum.
June	Border	dog	aldicarb	unspecified	
June	Highland	dog, bait	strychnine	abuse	Chicken skin used as a bait.
June	Lothian	egg bait	carbofuran	abuse	Prosecution, guilty plea.
July	East Sussex	cat, crow, 2 magpies, 30 herring gulls	carbofuran	abuse	
July	Hertfordshire	green woodpecker	bendiocarb	approved	Ant stop powder, used responsibly for ant control on a garden patio. It was a fledgling bird.
July	Norfolk	12 pipistrelle bats	dieldrin/DDE/DDD**	unknown	Small, unconfirmed organochlorine residues.
July	Northumberland	2 cats	carbofuran	abuse	History of carbofuran abuse.
July	Warwickshire	3 dogs, bait	strychnine	abuse	Strychnine applied to raw sausages in a deer park.
July	Warwickshire	honeybee	fluvalinate**	unknown	
July	West Yorkshire	2 dogs, bait	paraquat	abuse	Meat like substance, laced with paraquat, thrown into a garden.
July	Powys	honeybee	fluvalinate**	unknown	
July	Grampian	2 buzzards, crow, baits	carbofuran	abuse	
July	Highland	red kite	difenacoum	unspecified	Some signs of trauma, exacerbated by presence of difenacoum.
July	Strathclyde	2 magpies, bait	bendiocarb	abuse	Peanut butter sandwiches, were intended for squirrels.
August	Buckinghamshire	edible dormouse, grain	bromadiolone/warfarin	misuse	Use of rodenticide formulations for controlling edible dormouse.
August	Dorset	fox	strychnine	misuse	Mole control in a domestic garden.
August	Hertfordshire	2 cats	alphachloralose	abuse	Blood sample tested as the cats recovered after treatment.
August	Norfolk	honeybee	fluvalinate**	unknown	
August	North Yorkshire	fox	bromadiolone	unknown	Fox has been exposed to bromadiolone.
August	Shropshire	2 cats	metaldehyde	abuse	
August	Border	chemicals	strychnine/aldicarb	abuse	
August	Fife	honeybees	bendiocarb	unspecified	
August	Fife	honeybees	bendiocarb	unspecified	
August	Down	dog	difenacoum	abuse	
September	Cumbria	buzzard	alphachloralose	abuse	Rabbit may have been used as a bait.

Month	County	Number and Species	Chemical	Cause	Comments
September	Devon	buzzard, 4 baits, 11 samples	carbofuran/ bromadiolone/warfarin	abuse	Buzzard also exposed to difenacoum and bromadiolone, at close to significant levels. Carbofuran and rodenticide abuse, using pheasant carcasses, occurring in this area.
September	Greater London	3 feral pigeon, bait	difenacoum	abuse	
September	Norfolk	honeybee	fluvalinate**	unknown	
September	Norfolk	kestrel, 2 baits, 12 samples	aldicarb	abuse	Pigeon and pheasant, laced with aldicarb. A range of non-pesticide containers also seized, containing alphachloralose, aldicarb, paraquat and difenacoum.
September	South Yorkshire	2 dogs, bait	aldicarb	abuse	Meat-like material used as a bait and one dog recovered.
September	Suffolk	2 samples	aluminium phosphide/ strychnine/metaldehyde	misuse	Pest controller with Phostoxin in an unlocked vehicle and used without any PPE. Metaldehyde in an unlabelled bag and over 75 empty bottles of strychnine.
September	Suffolk	honeybee	fluvalinate**	unknown	
September	Strathclyde	buzzard, baits	carbofuran	abuse	No residues detected in pheasant baits.
September	Strathclyde	dog	glyphosate	approved	*Not included in statistics, but illness in dog possibly associated with glyphosate use.
October	Greater London	fox	bromadiolone	unspecified	Small residue of difenacoum also noted.
October	Lincolnshire	dog, pellets	metaldehyde	misuse	Slug trap in a field with too much product used.
October	Somerset	buzzard, 3 foxes, 4 baits, sample	carbofuran	abuse	Pheasant carcasses used as a bait. Carbofuran found in an unlabelled container in a vehicle.
October	South Yorkshire	2 cats	aldicarb	abuse	
October	Worcestershire	dog, pellets	metaldehyde	misuse	Incomplete burning of slug pellet bags and residues in a field.
October	Dyfed	red kite	alphachloralose	abuse	Sub-lethal exposure to difenacoum and bromadiolone.
October	South Glamorgan	4 racing pigeon	demeton-S-methyl	unspecified	Source uncertain, approval for use expired in October 2000.
October	Strathclyde	sheep bait	alphachloralose	abuse	
October	Down	dog	warfarin	unspecified	Dog had scour and haematuria, depressed and very weak.
November	Cambridgeshire	dog, pellets	metaldehyde	misuse	Slug pellet spillage in a field and poor storage of the product.
November	Essex	2 feral pigeon, grain	difenacoum	abuse	
November	Lancashire	sparrowhawk, bait	bendiocarb	abuse	Bendiocarb applied to a partridge carcass.
November	Northumberland	grain	difenacoum	misuse	Pest control company left exposed baits in a domestic garden.

Month	County	Number and Species	Chemical	Cause	Comments
November	Somerset	badger	metaldehyde	abuse	Rescued badger passed blue faeces which appeared to contain peanuts.
November	Suffolk	cat, 2 samples	warfarin	misuse	Unprotected bait and formulation not stored in a proper container.
November	Fermanagh	dog	difenacoum/warfarin/ bromadiolone	unspecified	
November	Tyrone	2 ewes, 2 rams, 9 sheep	metaldehyde	misuse	Dead on farm over one day, metaldehyde slug pellet bag found nearby, rumens contained pellets similar to those in the bag.
December	Down	dog	warfarin	abuse	
December	Somerset	badger	bromadiolone	unspecified	Some signs of trauma present, but bromadiolone exposure may also have contributed to death.
December	Auchengavin	dog, bait	diazinon	veterinary	Abuse suspected.
December	Highland	buzzard	bromadiolone	unknown	Sub-lethal residue, cause of death unknown.
December	Highland	rat	bromadiolone	approved	Not included in statistics.
December	Tayside	dog, baits	difenacoum	misuse	

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

**Residue not confirmed, but reported here to show the frequency that residues of this compound are noted.

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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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