

**PESTICIDE POISONING OF ANIMALS 2002**

**A REPORT OF INVESTIGATIONS IN SCOTLAND**

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## SUMMARY

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

The scheme, together with sister schemes throughout the United Kingdom, provides a means of post-registration surveillance of pesticide use, so that registration may be revised if necessary. They also provide a measure of the success of the pesticide registration process, and help in the verification and improvement of the risk assessments made in the registration of compounds. Incidents of approved use and of misuse can highlight problems with the approval conditions or the label instructions for a pesticide, and can provide valuable feedback into the regulatory process.

The scheme in Scotland also furnishes evidence that can be used by SEERAD, or by the police, to enforce legislation on the use of pesticides, and in the protection of food, the environment, and animals.

There were 158 suspected incidents registered for investigation by the scheme in 2002. The causes were determined in 76 incidents, of which 35 (22% of those investigated) involved pesticide poisoning or exposure to pesticides. Only three incidents were attributed to the approved use of pesticides, one was a consequence of an application of aldicarb at a potato planting, and another involved the use of the rodenticide chlorophacinone. The third incident was associated with the legitimate use of a rodenticide, however it did not involve a non-target animal, and is only reported as part of the overall investigations undertaken. A single incident, involving difenacoum, was attributed to the misuse of a rodenticide formulation.

Deliberate abuse of pesticides was identified in 23 incidents in 2002 compared to 25 in 2001, and 29 in 2000. This represents 58% of pesticide incidents in 2002 compared to 71% in 2001, and 51% in 2000. Carbofuran formulations and chloralose were the most actively abused pesticides.

A further 8 incidents were attributed to unspecified use of a pesticide, where there was insufficient information available to positively identify the source of the poison. One incident was associated with some form of exposure to aldicarb. Each of the remaining incidents involved exposure to an anticoagulant rodenticide. No incidents resulted from exposure to pesticides formulated as veterinary medicines.

Nine agricultural chemicals were identified in the pesticide poisoning incidents, compared to eight in 2001.

## INTRODUCTION

1. In the United Kingdom the impact of all pesticide uses on wildlife and other animals, including beneficial insects such as honeybees, is assessed before approval is granted by the regulatory body. Where it is thought that an unacceptable risk would arise, restrictions on use may be imposed in the conditions of approval under the Control of Pesticides Regulations (COPR) 1986 (as amended) or the Plant Protection Products Regulations (1995), in order to protect wildlife and domestic animals.

2. The Scottish Wildlife Incident Investigation Scheme (WIIS) is one of four schemes, operating in the United Kingdom, which investigate possible pesticide poisoning of animals. The scheme in Scotland is operated by the Scottish Agricultural Science Agency (SASA) on behalf of the Environment and Rural Affairs Department of the Scottish Executive (SEERAD). The procedures for incident investigation are described in Appendix I.

3. Incidents confirmed as involving pesticides are assigned to one of four categories:

- **Approved use** of the product, according to the specified conditions of use;
- **Misuse** of a product, by careless, accidental or willful 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 subsequent investigation identifies the involvement of a pesticide formulated as a veterinary medicine. Such cases are investigated incidentally rather than deliberately, and may include abuse, misuse, approved use, or unspecified use of the relevant compounds. Incidents suspected of involving veterinary medicines should be reported to the Veterinary Medicines Directorate (Tel. 01923-338427).

4. 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 products, or may affect the progress to full commercial use of products currently under provisional approval. Information from incidents assists in the validation and improvement of the risk assessment procedures used by the regulatory body for new and existing compounds.

5. The majority of this post-registration surveillance activity is funded jointly by the agricultural and non-agricultural sectors of the pesticide industry, under the Food and Environment Protection Act 1985 (FEPA). 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 investigations reveal contravention of this Act, or other legislation such as the Wildlife and Countryside Act

1981, then prosecution or other forms of enforcement may ensue. All activities carried out to enforce the legislation in Scotland are funded by SEERAD.

6. SEERAD is a partner in the Campaign against the Illegal Poisoning of Animals led by DEFRA. The freephone number (0800 321600) is routed to SASA and provides ready access for incident notification. To prevent large numbers of dead animals being submitted and analysed, with the consequential impact on resources and finances, strict criteria are applied to potential incidents prior to acceptance. Incidents are only accepted where the use of pesticides may be implicated. Incidents are rejected for further analysis where they obviously involve trauma or disease. Unless there are special circumstances, substantial delays in the notification of incidents or the unavailability of bodies or baits may also lead to rejection.

## INCIDENTS IN 2002

### NUMBER OF INCIDENTS IN 2002

7. A total of 169 suspected poisoning incidents were notified to SASA in 2002 (134 in 2001). Thirteen of these were rejected for investigation because the acceptance criteria were not met or because of post mortem evidence, leaving 158 incidents registered for onward investigation. The outbreak of Foot And Mouth disease in 2001 probably led to a reduction in the number of submissions made in that year.

8. The cause of death or illness (including pesticides and non-agricultural chemicals, disease, starvation and trauma) was established in 76 incidents (48% of those registered). Pesticides were identified in 35 of these incidents (22% of those registered). In other incidents, either no residues were detected, or investigations were terminated because of insufficient information or lack of suitable tissue samples.

**Table 1: Number of incidents investigated in 2002**

	Incidents Investigated	Pesticide poisoning incidents	Other cause of death found
Vertebrate wildlife	100	22 (22%)	33 (33%)
Livestock	0	0	0
Companion animals	45	8 (18%)	2 (4%)
Beneficial insects	5	2 (40%)	0
Suspected baits and suspicious substances	9	3 (33%)	not applicable
<b>TOTAL</b>	<b>158*</b>	<b>35 (22%)</b>	<b>35 (22%)</b>

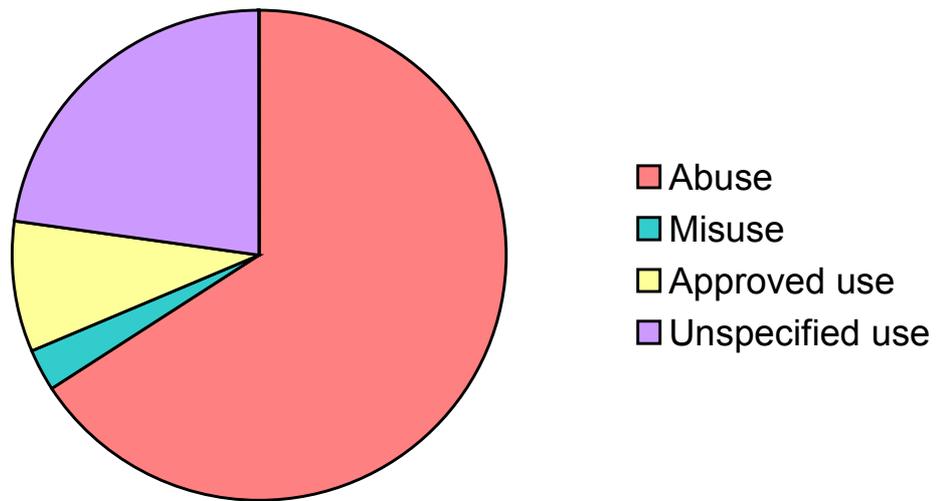
\* one incident involved a cat and a crow.

9. Three incidents (9%) were attributed to the approved use of the pesticides involved, 1 (3%) involved an element of misuse, 23 (58%) were associated with abuse and the remaining 8 resulted from some kind of unspecified use (Figures 1, 2). A breakdown

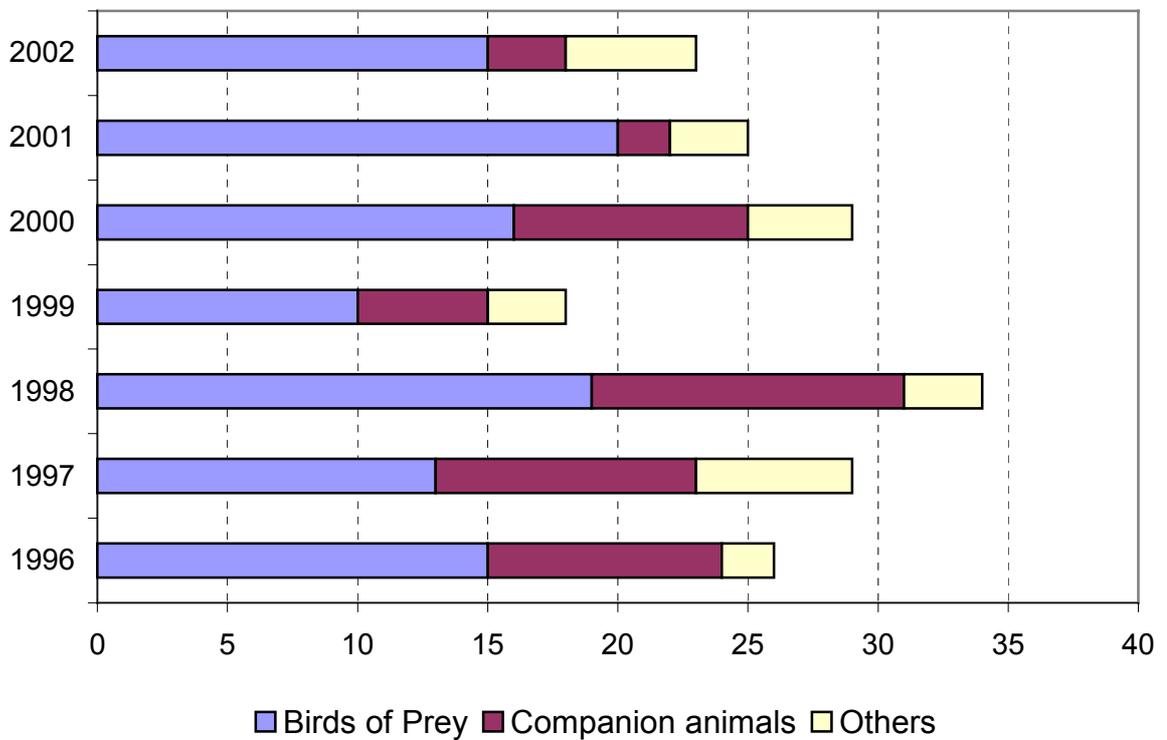
of incidents by animal category is shown in Table 1. A listing of the pesticides involved, and other causes of death, is presented in Table 2.

**Table 2: Number of incidents involving individual pesticides in 2002 and species and/or bait involved.**

<b>Carbamates</b>		
aldicarb	4	chemical, dog, sea eagle
bendiocarb	4	bait, duck, honeybees, magpie
carbofuran	11	bait, buzzard, chemical, crow, golden eagle, rook
<b>Organophosphates</b>		
diazinon	2	dog, red kite
<b>Rodenticides</b>		
bromadiolone	5	barn owl, buzzard, dog, rat
chlorophacinone	1	dog
difenacoum	8	buzzard, dog, red kite
<b>Other Compounds</b>		
chloralose	7	bait, buzzard, chemical, rook, peregrine, sea eagle, sparrowhawk
strychnine	3	bait, chemical, dog
<ul style="list-style-type: none"> <li>• <i>two incidents involved carbofuran and chloralose</i></li> <li>• <i>one incident involved carbofuran and strychnine</i></li> <li>• <i>one incident involved carbofuran, bromadiolone, and difenacoum</i></li> </ul>		
Cause of death other than pesticides		
disease	6	
starvation	9	
trauma	18	
lead poisoning	2	
unknown	77	
Not applicable	6	



**Figure 1. Pesticide Incidents in Scotland 2002**



**Figure 2. Abuse of pesticides in Scotland (number of incidents)**

## VERTEBRATE WILDLIFE: MAMMALS

**10.** A total of 9 incidents involving wild mammals were investigated (Table 3). The cause of death was established in 4 incidents, with pesticide involvement being confirmed in one of these. A rat submitted from Skye was shown to have been poisoned, when a residue (7.4 mg/kg) of bromadiolone was identified in it's liver.

**11.** Trauma was the cause of death in three of the other incidents in this category involving a ferret, a hedgehog, and a polecat.

**Table 3: Number of incidents involving wild mammals in 2002**

	<i>Number of incidents investigated</i>	<i>Number (%) in which pesticide poisoning was identified</i>	<i>Number (%) in which another cause of death was identified</i>
Badger	2	0	0
Ferret	1	0	1
Fox	1	0	0
Hedgehog	1	0	1
Otter	1	0	0
Polecat	1	0	1
Rat	1	1 (100%)	0
Stoat	1	0	0
<b>TOTAL</b>	<b>9</b>	<b>1 (12%)</b>	<b>3 (33%)</b>

## VERTEBRATE WILDLIFE: BIRDS

### *Birds of Prey (including owls)*

**12.** A total of 70 incidents involving birds of prey were notified. The cause of death was established in 43 (61%) incidents; with pesticide poisoning accounting for 18 (26%) of these (Table 4).

### *Buzzards*

**13.** Common buzzards were involved in 38 incidents in 2002. The cause of death was established in 22 of these incidents, with 9 of them attributed to pesticide poisoning or exposure. The nine incidents linked with pesticides were clearly associated with deliberate abuse, the chemicals involved being carbofuran (7) and chloralose (3) with both carbofuran and chloralose abused in one of these. In the case of a buzzard poisoned with carbofuran in Dumfries and Galloway, sub-lethal residues of bromadiolone (0.1 mg/kg) and difenacoum (0.03 mg/kg) were also detected in liver

tissue from the bird. Residues of bromadiolone (1) and difenacoum (3) were identified in buzzards, however all four incidents involved sub-lethal exposure with the measured residues being out with the range usually associated with the onset of haemorrhagic symptoms. Other causes of death included trauma (4), disease (2), and starvation (7).

**Table 4: Number of incidents involving wild birds in 2002**

	<i>Number of incidents investigated</i>	<i>Number (%) in which pesticide poisoning was identified</i>	<i>Number (%) in which another cause of death was identified</i>
Birds of prey including owls	70	19 (27%)	24 (34%)
Wildfowl and waterbirds	10	1 (10%)	3 (30%)
Gulls and waders	3	0	0
Pigeons and doves	1	0	0
Corvids	12	5 (42%)	2 (16%)
Other birds	2	0	1 (50%)
<b>TOTAL</b>	<b>92 *</b>	<b>25* (27%)</b>	<b>30 (33%)</b>

\* Seven incidents involved birds of prey and corvids

### ***Eagles***

14. Golden eagle (4) and sea eagle (3) deaths were notified in 2002. Two golden eagles and 2 sea eagles were victims of abuse in four separate incidents. Both golden eagles were poisoned with carbofuran, and one sea eagle died from aldicarb poisoning and the second from chloralose poisoning. The cause of death of the remaining sea eagle and one of the golden eagles was trauma.

### ***Red Kites***

15. Ten incidents involving red kites were reported during the year. Pesticides were identified in 3 of the birds, and trauma was believed to be the cause of death of another 3 birds. A residue (7 mg/kg) of diazinon was identified in a sample taken from the body cavity from a red kite carcass that was in a state of advanced autolysis. In the absence of reliable field information, the incident was attributed to unspecified use. The death of a red kite from anticoagulant rodenticide poisoning in Dumfries and Galloway was diagnosed when a residue (0.13 mg/kg) of difenacoum was identified in liver tissue. Evidence of haemorrhages in the lungs and pallor of the liver were observed at post mortem examination. Another kite from Highland Region was shown to carry a residue of difenacoum of similar magnitude, however the immediate cause of death appeared to have been trauma. The carcass had been severely disrupted, restricting assessment of any pre-existing haemorrhaging. Both rodenticide incidents were attributed to unspecified use of the relevant products. In another incident a red

kite carried a sub-lethal residue of a rodenticide.. In 3 of the 6 remaining incidents, death was due to trauma, and no cause of death was established in the other 3 cases.

### ***Other Raptor Species***

**16.** Peregrine falcons were the casualties in two incidents. In May a bird died as a result of the abuse of chloralose at a locus in Grampian Region. A buzzard had been poisoned at the same location in April. No cause of death was established for the second peregrine.

**17.** Two incidents involving sparrowhawks were reported. In one, a bird was poisoned with chloralose after feeding from a pheasant bait in Tayside. In the other the bird died from trauma.

**18.** All of the owls (9) received during the year were barn owls. In one case a significant residue (0.16 mg/kg) of bromadiolone was present in liver tissue. This residue is within the range where the onset of symptoms has been observed, although the immediate cause of death appeared to be trauma. Field information indicated that a rodenticide baiting operation was being undertaken in the area. Two of the other owls were believed to have died from trauma, and another 2 from starvation.

**19.** No evidence of pesticide involvement was identified in 3 incidents where kestrels were submitted, and no cause of death was established in any of these incidents.

### ***Wildfowl and Waterbirds***

**20.** In 2002 there were ten incidents involving wildfowl and waterbirds. The cause of death was only associated with pesticide poisoning in one incident. Several ducks were found dead near a bridge over a river in Tayside region, in what was thought to have been a malicious act. Light brown pasty material, possibly bread, was found in the proventriculus of the bird examined. Residues of bendiocarb were found in this material (13 mg/kg) and in liver tissue (0.3 mg/kg) from the duck.

**21.** Seven of the remaining incidents involved swans. Lead poisoning resulted in the deaths of a mute swan in Highland Region and of several whooper swans in Strathclyde. The deaths of several ducks in an incident was associated with a DV enteritis infection. No cause of death was established for other incidents involving swans (5) or a heron (1).

### ***Pigeons***

**22.** Only one incident was reported that involved a pigeon. A wood pigeon that was observed apparently convulsing in garden adjacent to farmland was submitted. The bird had apparently been feeding on clover. No pesticides were identified in the laboratory investigation.

### *Corvids*

23. A total of 12 incidents involving crows (9), rooks (1), magpies (1), and a raven (1) were notified in 2002. Pesticide poisoning was found to be the cause of death in 5 incidents. In one incident rooks and a buzzard were poisoned with chloralose, but another buzzard collected in the same area had been poisoned with carbofuran. In a related incident a crow died as result of poisoning by chloralose, and again a buzzard collected in the same area had been poisoned with carbofuran. Two magpies were poisoned in an incident where a peanut butter sandwich had been adulterated with bendiocarb and placed on a roof in East Kilbride in an attempt to poison squirrels. Each of these incidents was attributed to the deliberate abuse of the pesticide involved. Trauma and disease resulted in the deaths of crows in separate incidents, and no cause of death was established for the remaining crows (4) and raven (1).

### *Other birds*

24. Song thrushes were submitted in two incidents, one died of trauma, the cause of death of the other was not established.

## COMPANION ANIMALS

25. Forty five of the incidents registered in 2002 involved companion animals (Table 5). The cause of death was established in 10 (22%) of cases, with pesticide poisoning being responsible for 8 (18%) incidents and disease being the cause in the remaining case.

**Table 5: Number of incidents involving companion animals in 2002**

	<i>Number of incidents investigated</i>	<i>Number (%) in which pesticide poisoning was identified</i>	<i>Number (%) in which another cause of death was identified</i>
Cats	8	0	0
Dogs	35	8 (23%)	2 (6%)
Guinea pig	2	0	0
Horse	1	0	0
Rabbit	1	0	0
<b>TOTAL</b>	<b>45*</b>	<b>8 (18%)</b>	<b>2 (4%)</b>

\* One incident involved both a guinea pig and a rabbit

### *Cats*

26. No cause of death was ascertained in any of the 8 incidents investigated.

## ***Dogs***

27. Dogs featured in 35 incidents in 2002. The cause of death was established in 10 of the incidents, with 8 being attributed to pesticide poisoning, and 2 being associated with disease.. Deliberate abuse of pesticides accounted for 3 of the pesticide, incidents, the chemicals involved were diazinon (1) and strychnine (2). A dog developed seizures and died apparently after chewing on a bone. Examination of a suspected bait, consisting of bone and meat, revealed a residue of diazinon. Strychnine (0.9 µg/ml) was identified in the urine of a dog from Highland Region that had exhibited seizures. Subsequently in a second incident at this location, the same dog developed fits but again recovered. A significant residue of strychnine was identified on a piece of chicken skin found in the garden of the owner. Another dog from the same street had died unexpectedly prior to these events. One dog died from some form of autoimmune haemolytic anaemia, and another died as a result of haemorrhagic enteritis.

28. Two incidents involved exposure to aldicarb, one appeared to be associated with the approved use of a Temik formulation. Two of several dogs walked across part of a field where potato planting was in progress died suddenly. Residues of aldicarb were identified in stomach content material and in liver tissue from the animals. The other incident resulted from some unspecified use of this pesticide.

29. Rodenticide poisoning was linked with the deaths of dogs in 3 incidents. One was attributed to the approved use of chlorphacinone, one with misuse of difenacoum, and one with an unspecified use of bromadiolone.

## ***Other animals***

30. Three incidents involved a horse, a guinea pig, and a guinea pig and a rabbit. No cause of death was found for any of these incidents.

## **BENEFICIAL INSECTS**

31. Only incidents of suspected honeybee poisoning were accepted into the Scheme in 2002 (Table 6). The analytical investigations provided evidence to implicate pesticide poisoning with 2 out of 5 incidents.

**Table 6. Number of incidents involving beneficial insects during 2002**

<b>Number of incidents investigated:</b>		<b>5</b>
<b>Number of incidents attributed to pesticides:</b>		<b>2</b>
Pesticide detected	Number of incidents	Number of colonies affected
Bendiocarb	2	3

32. Residues of bendiocarb were detected in samples of honeybees submitted in August by two beekeepers from Cupar, Fife. No definite circumstantial evidence was forthcoming to indicate the source of exposure, so these incidents were attributed to an unspecified use of the pesticide.

### **SUSPECTED POISONOUS BAIT**

33. Nine items were submitted for investigation as suspected poisonous baits or related materials during 2002 (Table 1). In each case there were no known animal casualties associated with the alleged bait. Pesticides were detected in 2 suspected baits, and in a collection of chemicals. Part of an egg left on top of a fence post was shown to have constituted a poisonous bait, when a significant residue of carbofuran was identified. It appeared that a series of such baits may have been placed in small depressions formed on the top of posts, in a fence line in an upland area of Lothian. A low residue of chloralose was detected in a sample taken from the remains of a sheep's head found in Strathclyde. This may be consistent with anecdotal information from the area, describing the sudden fall of a buzzard from the sky. Several substances were seized during a wildlife crime investigation undertaken by SEERAD, the police, and the SSPCA. One item was a pharmacist's bottle containing strychnine hydrochloride, and another was a plastic medicine pot containing a granular aldicarb formulation. In the 6 remaining cases the analytical investigations failed to reveal any evidence to substantiate the belief that the items had been prepared as potential poisonous baits.

## **INCIDENTS WHERE REGULATORY AND/OR ENFORCEMENT ACTION WAS CONSIDERED**

### **APPROVED USE INCIDENTS**

34. Information from incidents thought to have arisen from approved use is fed back into the pesticide regulatory process for evaluation<sup>1,2</sup>. If significant concerns are highlighted by post registration monitoring, thorough consideration is given to the need to adjust the approval status or conditions of use of the pesticide in question. If a specific product is identified in this way, then the approval holder is contacted and given the opportunity to comment and provide additional feedback from their experience with the product.

35. Only four incidents investigated during 2002 were attributed to the approved use of the pesticide product involved, compared to 1 in the year 2001. They involved the poisoning of dogs by aldicarb during the planting of potatoes, the death of a dog by chlorophacinone poisoning following a rodenticide baiting operation, the poisoning of a rat with bromadiolone, and the illness of a dog exposed to glyphosate.

## Incident Summaries

**36.** Tissues from two dogs that appeared to have been poisoned after access to a field where potatoes were being planted on a farm near Kelso were submitted. The prevailing circumstances, and the fact that the animals had died both very suddenly and quickly, was judged sufficient to trigger off an immediate field investigation by SEERAD officials. 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 (720 mg/kg). Residues of this substance were found in the stomach content (17 mg/kg) of the second dog and in liver tissues of both animals (1.6 & 2.1 mg/kg respectively). These residues were consistent with aldicarb poisoning being the cause of death. Field information confirmed that a contractor had been applying a nematocide formulation, Temik 10G, 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 5 dogs across the field on the morning of 11 April. Two of the animals were restricted to leads but the other 3 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 residue of less than 0.005 mg/kg 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 be associated with an approved use of the formulation.

**37.** 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 (0.59 mg/kg) 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 also known to SEERAD officials as a mole trapper, and was considered to be professionally competent.

**38.** 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. Therefore this incident represented part of an approved use of bromadiolone, however the casualty did not constitute a non-target animal.

## **MISUSE INCIDENTS**

**39.** A dog had to receive veterinary treatment after exposure to a rodent bait at a locus near Blairgowrie, Tayside. The animal, a black Labrador, was observed ingesting the bait in the grounds of a neighboring property. Subsequent investigation established that a rodent baiting was being carried out, in and around a building used to house a large scale honey extraction plant, by a contractor. Pieces of plastic tube (18 x 3 inches), containing plastic bags with blue coloured grain were found. The rodenticide bait was said to be a difenacoum formulation, Neokil. Samples were taken for laboratory investigation. One length of plastic drain pipe carried a label 'Poison – rodent bait. Do not handle' on the outside. A small red plastic tray inside the pipe contained a small polythene bag. The bag was partly open, and contained dark coloured cereal seed. A second polythene bag was inside the tube. It had been torn open, and still contained some green-coloured cereal seed. A smaller quantity of what appeared to be fresher, green-coloured cereal seed was free inside the pipe. A sample of the grain was shown to contain difenacoum. A second pipe was recovered from a site within 1.25 m of a shed, and a sample of blue-coloured seed was spread out beside it. The contents of this pipe were similar in nature to the first pipe examined. Analysis of the loose grain revealed that it contained difenacoum (30.6 mg/kg). It appeared that insufficient care had been exercised in the preparation and/or maintenance of the pipe baiting points, putting non-target animals at risk.

## **ABUSE INCIDENTS**

**40.** As in all previous years the illegal practice of deliberately abusing pesticide products to generate poisonous baits claimed numerous victims. Such acts remain the cause of the majority of pesticide related poisonings throughout the U.K. The indiscriminate nature of the process puts at risk any animal that finds the bait material attractive. In 2002, twenty three incidents (58% of pesticide incidents) were attributed to the abuse of pesticides in Scotland. A high proportion of these incidents involved birds of prey (Figure 2), but for the second consecutive year relatively few companion animals were involved compared to previous years.

**41.** Six pesticides were identified in abuse incidents in 2002, compared to only three in 2001. The chemicals were aldicarb (2), bendiocarb (2), carbofuran (11), chloralose (7), diazinon (1), and strychnine (3); with both carbofuran and chloralose being identified in two incidents.

42. The re-introduction programme for the sea eagle suffered badly with the poisoning of two birds in separate incidents. In one case the dead bird was discovered lying on top of a lamb carcass near Kilmelford, Highland region. It had clearly fed on the lamb, forcing its beak through the upper ribs to extract some of the organs and viscera as well as ingesting some of the flesh. Residues of chloralose were found in samples from the sea eagle and from the lamb. The second sea eagle was poisoned with aldicarb at a locus near Mallaig, Highland Region. No mortalities of red kites were attributed to the abuse of pesticides in 2002, in contrast to 2001 where illegal poisoning had exacted a heavy toll on the re-introduction programme for this species.

43. Buzzards were victims in 9 incidents throughout the country, with 7 resulting from carbofuran poisoning and 3 from chloralose poisoning (one incident involved both carbofuran and chloralose). A number of these incidents also involved corvid species. Two golden eagles died from carbofuran poisoning in separate incidents. A peregrine falcon was poisoned with chloralose at a locus near Huntley in Grampian Region in May, a buzzard had been poisoned with chloralose in the same vicinity a month earlier.

44. A bendiocarb formulation was abused in an urban situation in an attempt to poison squirrels. The same pesticide was also abused in a malicious act to poison ducks. The death, or illness, of dogs were linked to the abuse of diazinon (1) and strychnine (2).

#### **UNSPECIFIED USE INCIDENTS**

45. Each year there are always a few confirmed pesticide incidents where, despite detailed field investigations, the source of the compound cannot be definitely established. Animal bodies may be found in locations remote from the point of exposure in circumstances where the onset of toxic symptoms has been delayed. In 2002 a total of 8 incidents (26% of all pesticide incidents) fell into this category.

46. Bendiocarb was identified in a sample of honeybees submitted by a beekeeper from Cupar, Fife in August. The residue (1.3 mg/kg, 0.11 µg per bee) was consistent with bendiocarb poisoning being the cause of the mortality. The field investigation failed to identify the source of exposure, however it is likely to have resulted from an attempted control operation on feral bees or wasps. A second beekeeper in the area suffered losses at the same time and a residue (0.15 mg/kg, 0.02 µg per bee) of bendiocarb was identified in a sample of bees using GC-MSMS. Lack of sensitivity restricted the acquisition of further complementary confirmation data for the latter residue.

47. A red kite specimen submitted from Highland Region in February consisted of near-skeleton remains. Samples of soft autolysed material recovered from the pelvic area, and from pelvic bone and vertebrae, were analysed. A residue (7 mg/kg) of diazinon was identified in the autolysed tissue sample, and traces of the same substance appeared to be present in the bone sample. The absence of relevant field information and post mortem evidence restricted this incident to the unspecified use category.

48. A fairly low residue (0.45 mg/kg) of aldicarb was detected in a stomach content material from a young dog that had died suddenly in Border Region in early June. The stomach content material consisted of a limited quantity of soft brown material /

mucous. The animal was said to have developed convulsions whilst being walked near agricultural land on 5 June. Field investigation revealed that the incident appeared to occur near a crop of potatoes situated adjacent to a river. A 20 m strip of set aside land was situated between the crop and the riverbank. The dog was neither observed to enter the cropped area, or to dig, or to eat anything; it had been chasing and retrieving sticks thrown into the set aside strip. The dog developed convulsions shortly after taking a long drink from the river, and died within an hour. The landowner confirmed that the potatoes had been planted in early May and that a Temik formulation of aldicarb had been used for nematode control. The land sloped gently down towards the river before leveling off and rising slightly to the riverbank, leaving a slight hollow in the middle of the set aside strip. The potato drills mostly ran in the direction of the slope and a quantity of soil sediment, presumably erosion due to heavy rain, had been deposited in the hollow. No potato tubers, or parts thereof, were visible above ground. A sample of the soil from the hollow was analysed for the presence of aldicarb, but no residue was detected (limit of detection 0.003 mg/kg).

**49.** The circumstantial evidence about the symptoms exhibited by the dog is consistent with aldicarb poisoning being the cause of death. However the residue of aldicarb in the stomach content material is lower than might have been expected, and it is possible that the dog had vomited some ingested material at some point prior to death. What remains uncertain is how the animal was exposed to this pesticide. A period of up to 3-4 weeks had elapsed between the planting of the potatoes and the incident. There was no evidence of potatoes lying in either the cropped area or the set aside strip, and aldicarb was not detected in the soil sediment in the set aside strip. Aldicarb formulations have been subject to extensive abuse to form poisonous baits in the past, and the possibility that the animal had been exposed to some material of this nature cannot be totally excluded.

**50.** A dog from the Biggar area of Strathclyde, developed symptoms consist with exposure to an anticoagulant rodenticide and subsequently died. Laboratory investigation detected the presence of bromadiolone (0.62 mg/kg) in liver tissue, confirming bromadiolone poisoning as the cause of death. There was insufficient field information to identify the source of exposure.

**51.** A red kite submitted from Dumfries and Galloway in February was diagnosed as dying from anticoagulant poisoning, based on the presence of a difenacoum residue (0.13 mg/kg) in liver tissue, and evidence of haemorrhages at post mortem. Residues of rodenticides of a similar magnitude were found in liver tissues from a barn owl (0.16 mg/kg) submitted from Dumfries and Galloway in April, and from another red kite (0.16 mg/kg) submitted from Highland Region in July. The immediate cause of death appeared to have been trauma in both cases. However the extent of the injuries restricted assessment of any pre-existing anticoagulant symptoms.

## **ENFORCEMENT ACTION**

**52.** 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. In circumstances 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.

**53.** Only three cases were reported to the Procurator Fiscal Service for prosecution. In one, the defendant pled 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.

**54.** 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 5 incident investigations independently, and the SSPCA undertook one investigation relating to pesticide abuse and other offences.

## REFERENCES

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2. M R Fletcher and R C Grave, Post registration surveillance to detect wildlife problems arising from the approved pesticides. *Proceedings British Crop Protection Council – Pests and Diseases*, 2: 793-798, 1992
3. E A Sharp, S Le Bouhellec, L M Melton, M J Taylor, and K Hunter, Analytical diagnosis of chloralose poisoning in Scottish wildlife crime investigation. *Poster presentation at 'Emerging Analytical Science', The Royal Society of Chemistry, Glasgow, September 2001*
4. M J Taylor, E A Sharp, S Le Bouhellec, L M Melton, and K Hunter, The determination of chloralose residues in birds of prey by LCMSMS and LC-ooToFMS. *Poster presentation at the British Mass Spectrometry Society LCMS Symposium, Cambridge, December 2001*

## **APPENDIX 1.**

### **INVESTIGATION PROCEDURES**

The investigation of suspected pesticide poisoning incidents relies on a scheme, which allows members of the public and interested organisations to submit carcasses, suspected baits or other samples for pesticide analysis. The Wildlife Incident Investigation Scheme is operated in Scotland by the Chemistry Section at SASA, on behalf of SEERAD. Agricultural Staff in the area offices of SEERAD located throughout Scotland, provide support when necessary for field investigations, and also act as an additional point for notification of incidents.

A number of environmental and animal welfare organisations, such as RSPB or SSPCA, play an active role in some incident investigations. These bodies act not only by assisting members of the public to notify incidents, but also by screening out inappropriate cases prior to notification.

The SAC Veterinary Investigation Service acts in partnership with the scheme, in forwarding relevant samples to SASA from potential incidents notified indirectly via its laboratories, and by screening out incidents that are unlikely to involve pesticides. The Lasswade Veterinary Laboratory (VLA) is used to provide specialist pathological support to SASA on wild animals, and also furnishes an additional route into the scheme. The post mortem examinations undertaken by these laboratories may identify disease, trauma, starvation or other causes of death, eliminating the need for expensive analytical investigation.

As well as investigating incidents involving wildlife, the scheme covers suspected poisoning of livestock, companion animals, and honeybees. Incidents may be rejected if they fall outwith the remit of the scheme, or if other acceptance criteria are not met.

SASA makes use of analytical techniques and equipment capable of identifying low levels of pesticides considered to present a possible hazard to vertebrates or beneficial insects. Two multi-residue methods are used for carbamate, organochlorine, organophosphorus, and pyrethroid compounds, and for anticoagulant rodenticides. These are supplemented by compound specific analytical methods for chloralose, metaldehyde, paraquat, strychnine and other compounds. A simpler and more specific method<sup>3,4</sup> for the determination of chloralose in animal tissues based on liquid chromatography in tandem with mass spectrometric detection was introduced during 2001. Wherever possible residues are confirmed using an alternative analytical technique.

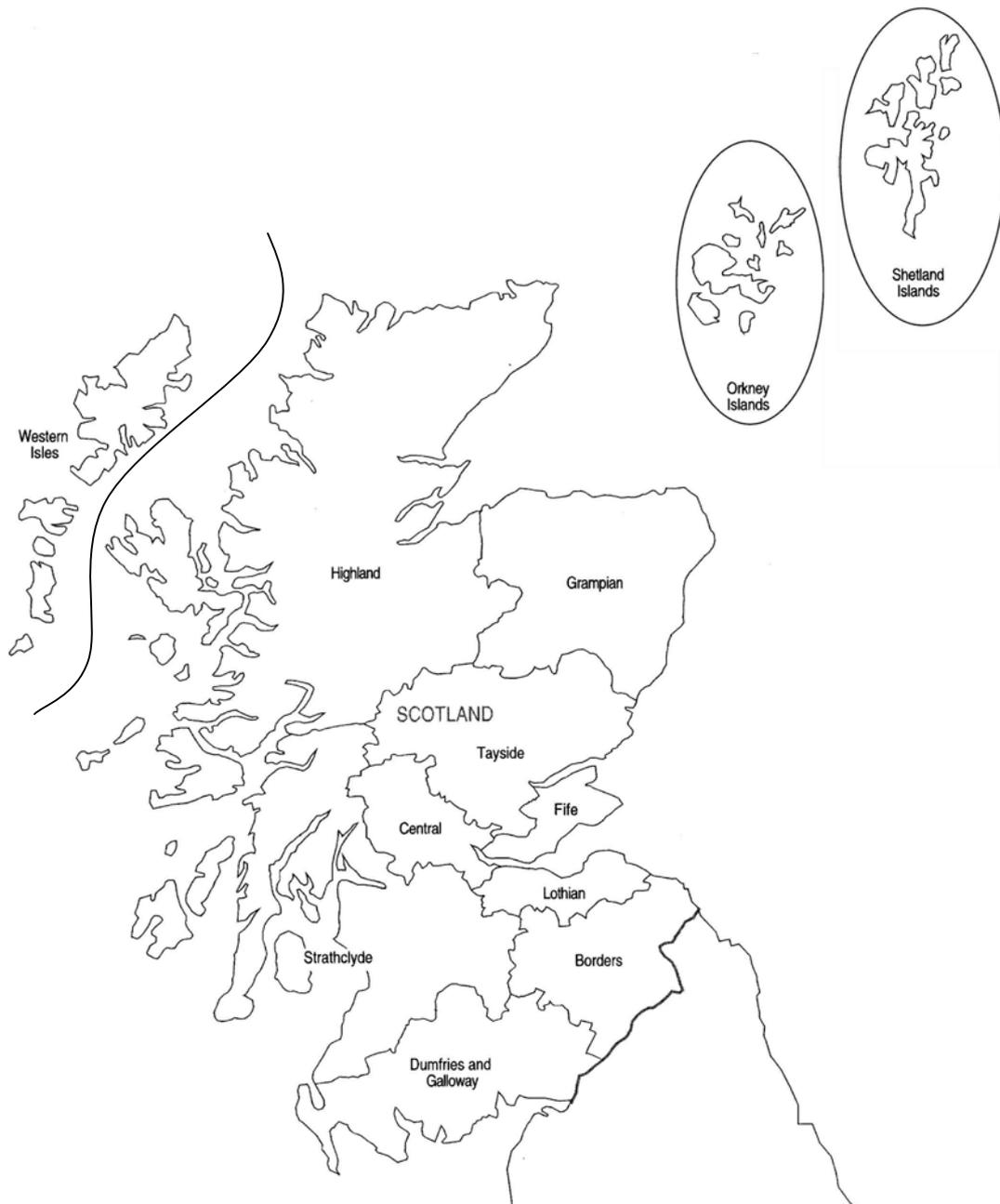
Field investigations are normally only triggered by SASA following the identification of a specific pesticide as the likely cause of poisoning. However field investigations may be initiated following either notification, or after post-mortem examination, if sufficient evidence of pesticide involvement is available.

Analytical results, post-mortem findings, and the field investigation report are collated and interpreted by SASA to assess the probable cause of the incident, and whether any residues detected contributed to the death or illness of the animal involved. Mortality is generally attributed to a pesticide if residues of a chemical or its derivatives are found

at 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.

The results of investigations are presented annually as part of an U.K. report published by the Environmental Panel of the Advisory Committee on Pesticides. The regulatory body, Pesticides Safety Directorate, is able to assess relevant incident information for any implications for the approval status of a particular pesticide or family of pesticides. Where legal proceedings are used as part of enforcement action, the evidence gathered by SASA, and by SEERAD Agricultural Staff, is presented in reports to the Procurator Fiscal Service. Police forces are active partners in countering pesticide abuse, and frequently take the lead in investigations and presentation of such cases to the Procurator Fiscal.

## APPENDIX 2. REGIONS IN SCOTLAND USED TO CLASSIFY INCIDENTS



**APPENDIX 3. PESTICIDE INCIDENTS OCCURRING IN 2002**

<b>Incident No.</b>	<b>Date</b>	<b>Location</b>	<b>Species</b>	<b>Pesticide</b>	<b>Conclusion</b>	<b>Enforcement Action</b>	<b>Comments</b>
02006	Jan	Nethybridge, Highland	Buzzard	Difenacoum	Trauma	None	Sub-lethal residue.
02024	Feb	Dingwall, Highland	Red Kite	Diazinon	Unspecified use	None	Near skeletal remains of bird
02028	Feb	Lecht Ski Centre, Grampian	2 Buzzard & Rabbit Bait	Carbofuran	Abuse	Police & SEERAD Investigation	Buzzards found next to rabbit bait
02030	Feb	Oude Dam, Argyll, Strathclyde	Golden Eagle	Carbofuran	Abuse	Police, SEERAD & RSPB Investigation	
02031	Feb	Alloa to Clackmannan Cycle Way, Central	Buzzard	Difenacoum	Disease	None	Sub-lethal residue, cause of death – acute septicaemia
02035	Mar	Aberargie, Tayside	Crow, Buzzard & Chemicals	Carbofuran	Abuse	Police & SEERAD Investigation	Referred to Procurator Fiscal for prosecution
02037	Mar	Derculich, Strathtay, Tayside	Dog	Chlorophacinone	Approved use	SEERAD Investigation	
02038	Mar	Edradynate Estate, Tayside	Buzzard, Sparrowhawk & Pheasant Bait	Chloralose	Abuse	Police Investigation	See also incident 02053

<b>Incident No.</b>	<b>Date</b>	<b>Location</b>	<b>Species</b>	<b>Pesticide</b>	<b>Conclusion</b>	<b>Enforcement Action</b>	<b>Comments</b>
02041	Mar	Reay, Caithness, Highland	Buzzard	Difenacoum	Unknown	None	Sub-lethal residue
02042	Mar	Grantown on Spey, Highland	2 Buzzard, 3 Rook & Rabbit Bait	Carbofuran & Chloralose	Abuse	Police Investigation	
02043	Apr	Bladnoch, Wigtonshire, Dumfries & Galloway	Barn Owl	Bromadiolone	Unspecified use	None	Immediate cause of death - trauma
02047	Apr	Methven, Tayside	Duck	Bendiocarb	Abuse	Police Investigation	
02049	Apr	Laurieston, Dumfries & Galloway	Red Kite	Difenacoum	Unspecified use	None	Haemorrhages in lungs, liver pale
02052	Apr	Edenmouth, near Kelso, Border	2 Dogs	Aldicarb	Approved-use	SEERAD Investigation	
02053	Apr	Edradynate Estate, Tayside	Buzzard & Crow, number of baits & chemicals	Carbofuran & Chloralose	Abuse	Police & SEERAD Investigation	Referred to Procurator Fiscal for prosecution
02054	Apr	Morton Woods, Dumfries & Galloway	Buzzard	Carbofuran	Abuse	Police, SEERAD & RSPB Investigation	
02056	Apr	Biggar, Strathclyde	Dog	Bromadiolone	Unspecified use		

<b>Incident No.</b>	<b>Date</b>	<b>Location</b>	<b>Species</b>	<b>Pesticide</b>	<b>Conclusion</b>	<b>Enforcement Action</b>	<b>Comments</b>
02057	Apr	Bin Quarry, Huntly, Grampian	Buzzard	Chloralose	Abuse	SEERAD Investigation	Found beside pigeon carcass
02061	Apr	Laurieston, Dumfries & Galloway	Red Kite	Difenacoum	Trauma	None	Sub-lethal residue
02062	May	Laurencekirk, Grampian	Golden Eagle	Carbofuran	Abuse	Police & SEERAD Investigation	
02066	Apr	Morton Woods, Dumfries & Galloway	Buzzard	Carbofuran, {Bromadiolone & Difenacoum}	Abuse	Police & SEERAD investigation	Rodenticide residues also present
02068	May	Kilmelford, Argyll	Sea Eagle, Bait & Chemicals	Chloralose	Abuse	Police, RSPB SEERAD & Investigation	
02075	May	Near Mallaig, Highland	Sea Eagle & Baits	Aldicarb	Abuse	Police & SEERAD Investigation	
02076	May	Bin Quarry, Huntly, Grampian	Peregrine Falcon	Chloralose	Abuse		Same location as incident 02057
02079	May	Kincraig, near Invergordon, Highland	Dog	Strychnine	Abuse	Police Investigation	
02086	Jun	Kincraig, near Invergordon, Highland	Dog & Chicken Skin Bait	Strychnine	Abuse	Police Investigation	See also 02079

<b>Incident No.</b>	<b>Date</b>	<b>Location</b>	<b>Species</b>	<b>Pesticide</b>	<b>Conclusion</b>	<b>Enforcement Action</b>	<b>Comments</b>
02087	Jun	Nisbet, Border	Dog	Aldicarb	Unspecified use	SEERAD investigation	
02089	Jun	Near Soutra Hill, Lothian	Egg Bait	Carbofuran	Abuse	Police, SSPCA & SEERAD Investigation	Prosecution Guilty plea
02097	Jul	East Kilbride, Strathclyde	2 Magpies & Bait	Bendiocarb	Abuse	Police, SSPCA & SEERAD Investigation	
02104	Jul	Hatton Castle Estate, Grampian	2 Buzzards, Crow & Baits	Carbofuran	Abuse	Police, SEERAD & RSPB Investigation	
02112	Aug	Chirnside, Border	None – chemicals	Strychnine & Aldicarb	Abuse	Police & SEERAD investigation	
02113	Jul	Tore, Black Isle, Highland	Red Kite	Difenacoum	Unspecified use	None	Immediate cause of death - trauma
B04/02	Aug	Cupar, Fife	Honeybees	Bendiocarb	Unspecified use	SEERAD investigation	
B05/02	Aug	Cupar, Fife	Honeybees	Bendiocarb	Unspecified use		
02120	Sep	Woolfords, near Forth, Strathclyde	Buzzard & Baits	Carbofuran	Abuse	Police & RSPB Investigation	No residues detected in pheasant baits

<b>Incident No.</b>	<b>Date</b>	<b>Location</b>	<b>Species</b>	<b>Pesticide</b>	<b>Conclusion</b>	<b>Enforcement Action</b>	<b>Comments</b>
02164	Sept	Cumbernauld, Strathclyde	Dog	Glyphosate	Approved		Illness in dog possibly associated with glyphosate use
02130	Oct	Ardmaddy, Argyllshire, Strathclyde	Sheep Bait	Chloralose	Abuse	RSPB investigation	
02155	Dec	Near Blairgowrie, Tayside	Dog & Baits	Difenacoum	Misuse	SEERAD investigation	
02156	Dec	Auchengavin	Dog & Bait	Diazinon	Abuse	SEERAD investigation	
02157	Dec	Sutherland, Highland	Buzzard	Bromadiolone	Unknown	None	Sub-lethal residue
02163	Dec	Isle of Skye, Highland	Rat	Bromadiolone	Approved use	Not required	Target species