PESTICIDE POISONING OF ANIMALS 2000

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 SERAD, or by the police, to enforce legislation on the use of pesticides, and in the protection of food, the environment, and animals.

There were 167 suspected incidents registered for investigation by the scheme in 2000. The causes were determined in 86 incidents, of which 57 (34% of those investigated) involved pesticide poisoning or exposure to pesticides. An unusually high number of incidents (15) were attributed to the approved use of pesticides. One of the main underlying causes in these incidents arose from the secondary poisoning of birds of prey by anticoagulant rodenticides. A second main cause, associated with bee mortalities, arose from the use of the herbicide paraquat to destroy GM contaminated oil seed rape crops. A single incident involving metaldehyde was attributed to the misuse of a molluscicide formulation.

Deliberate abuse of pesticides was identified in 29 incidents in 2000 compared to 18 in 1999. This represents 51% of pesticide incidents in 2000 compared to 44% in 1999. These data tend to confirm the view that there is no evidence to suggest a long-term decline in the extent of abuse.

A further 10 poisoning incidents were attributed to unspecified use, where there was insufficient information available to positively identify the source of the poison. Two incidents were caused by exposure to pesticides formulated as veterinary medicines.

Eighteen agricultural chemicals were identified in the pesticide poisoning incidents, including two compounds detected in samples seized by the enforcement authorities.

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 Rural Affairs Department of the Scottish Executive (SERAD). 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 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 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.

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 SERAD.

6. SERAD is a partner in the Campaign against the Illegal Poisoning of Animals led by MAFF. 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 2000

NUMBER OF INCIDENTS IN 2000

7. A total of 177 suspected poisoning incidents were notified to SASA in 2000 (146 in 1999). Nine of these were rejected for investigation because the acceptance criteria were not met or because of post mortem evidence, and one other incident was associated with a locus in the north of England, leaving 167 incidents registered for onward investigation.

8. The cause of death or illness (including pesticides and non-agricultural chemicals, disease, starvation and trauma) was established in 86 incidents (51% of those registered). Pesticides were identified in 57 of these incidents (34% 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.

9. Fifteen incidents (26%) were attributed to the approved use of the pesticide involved, 1 (2%) involved an element of misuse, 29 (51%) were associated with abuse, 2 incidents involved pesticides formulated as veterinary medicines, and the remaining 10 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 1: Number of incidents investigated in 2000

	Incidents Investigated	Pesticide poisoning incidents	Other cause of death found
Vertebrate wildlife	99	30 (30%)	28 (28%)
Livestock	3	0	0
Companion animals	46	15 (33%)	1 (2%)
Beneficial insects	13	9 (69%)	0
Suspected baits and suspicious substances	8†	3 (35%)†	not applicable
TOTAL	**167***	**57 (34%)**	**29 (17%)**

* Animals from more than one animal category were involved in two reports
† Includes one incident where substances were seized by enforcement bodies.

Table 2: Number of incidents involving individual pesticides in 2000 and species and/or bait involved.

Organochlorines		
DDE	3†#	peregrine falcon, sparrowhawk
dieldrin	1†#	peregrine falcon, sparrowhawk
HCB	1†	peregrine falcon
Organophosphates		
dichlorvos	1	gull
mevinphos	1	starling, jackdaw
propetamphos	1	dog
Carbamates		
aldicarb	1	cat
bendiocarb	3	cat, honeybee
carbofuran	19*♦	bait, buzzard, cat, crow, dog, formulation, golden eagle, red kite, tawny owl
Rodenticides		
brodifacoum	1	dog
bromadiolone	6*	buzzard, red kite
coumatetralyl	1	dog
difenacoum	4	buzzard, red kite
Other compounds		
alphachloralose	5	buzzard, golden eagle
cyanide	1♦	formulation
metaldehyde	3	dog
paraquat	8	honeybee
strychnine	4♦	dog, formulation

† one incident involved DDE, dieldrin and HCB
# one incident involved DDE and dieldrin
* three incidents involved bromadiolone and carbofuran
♦ one incident involved carbofuran, strychnine and cyanide

Cause of death other than pesticides

disease	3
starvation	8
trauma	18
unknown	76
not applicable	5

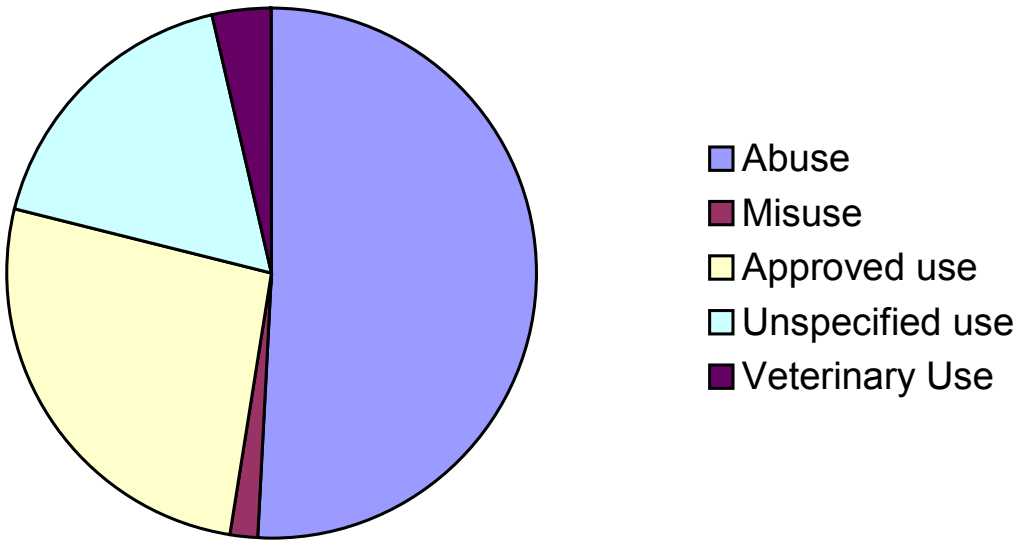

Figure 1. Pesticide Incidents in Scotland 2000

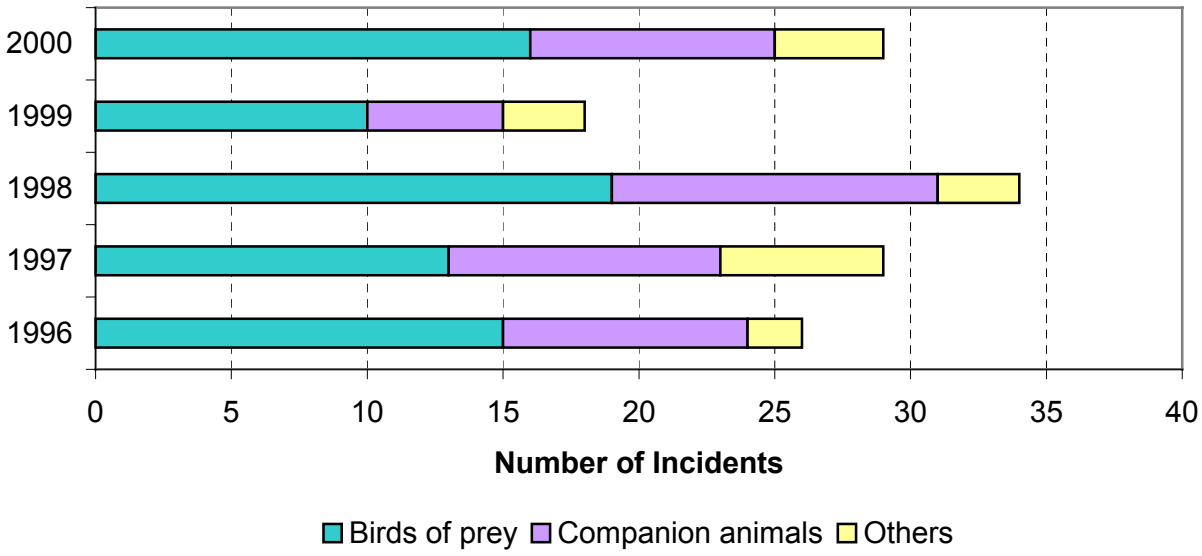

Figure 2. Abuse of Pesticides in Scotland

VERTEBRATE WILDLIFE: MAMMALS

10. A total of 9 incidents involving wild mammals were investigated. The cause of death was established in one incident only; pesticide poisoning was not identified in any of them (Table 3).

Table 3: Number of incidents involving wild mammals in 2000

	Number of incidents investigated	*Number (%) in which pesticide poisoning was identified*	*Number (%) in which another cause of death was identified*
Fox	3	0	0
Hare	2	0	0
Otter	3	0	1 (33%)
Squirrel	1	0	0
TOTAL	**9**	**0**	**1 (11%)**

Foxes

11. Three incidents involving foxes were reported during the period. In two cases the animals were suspected of being victims of deliberate abuse, however no analytical evidence to support this suspicion was forthcoming. The liver tissues from the animals in all 3 cases were analysed for the presence of rodenticides, as residues of this type of compound are identified at a relatively high frequency in this species. No residues were detected.

Other Mammals

12. Incidents involving hares (2), otters (3) and a squirrel were notified during the year. The death of an otter from Strathclyde was found to be associated with trauma. The cause of death was not established in any of the other incidents.

VERTEBRATE WILDLIFE: BIRDS

Birds of Prey (including owls)

13. A total of 76 incidents involving birds of prey were notified. The cause of death was established in 51 (67%) incidents; with pesticide poisoning accounting for 28 (37%) of these (Table 4).

Table 4: Number of incidents involving wild birds in 2000

	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	76	28 (37%)	23 (30%)
Wildfowl and waterbirds	2	0	1 (50%)
Gulls and waders	3	1 (33%)	0
Pigeons and doves	1	0	1 (100%)
Corvids	6	2 (33%)	1 (17%)
Other birds	5	1 (20%)	1 (20%)
TOTAL	**90***	**30* (33%)**	**27 (30%)**

* Three incidents involved birds from more than one category, pesticides were involved in two of these.

Buzzards

14. Common buzzards were involved in 42 incidents in 2000. The cause of death was established in 26 of the incidents, with 14 being attributed to pesticide poisoning. Deliberate abuse of pesticides accounted for 10 of these incidents; the chemicals involved were carbofuran (6) and chloralose (4). In 3 of these cases sub-lethal residues of bromadiolone and difenacoum were also detected in the liver tissues from the poisoned birds. Of the 4 remaining pesticide incidents, 3 were associated with the approved use of the rodenticide difenacoum, and one incident could only be ascribed to some unspecified use of carbofuran.

Eagles

15. Eagle deaths were notified in 8 incidents; five involved golden eagles and the other 3 were white-tailed eagles. Pesticide poisoning was established as the cause of death in 3 incidents, all involving golden eagles. Two of the poisoning incidents were associated with the abuse of carbofuran in Highland region and the third, from Tayside, involved the abuse of chloralose. Trauma was established as the cause of death in three separate incidents involving a golden eagle and two white-tailed eagle chicks from Strathclyde. No cause of death was established in the remaining 2 incidents.

Red Kites

16. Pesticide poisoning was the cause of death in 8 out of the 9 incidents notified in 2000. Carbofuran poisoning was confirmed in 4 incidents from Highland, with deliberate abuse being responsible for 3 of them. Sub-lethal residues of bromadiolone were also detected in liver tissues from 3 of the poisoned birds. The fourth incident involving carbofuran was associated with an unspecified use of the chemical. The other four confirmed incidents all involved the approved use of anticoagulant rodenticides; the chemicals involved were bromadiolone (3) and difenacoum (1).

17. One of the incidents caused by rodenticide poisoning involved the mortality of a female bird which had recently completed egg laying, whilst two others resulted in the deaths of chicks at nest sites.

Other Raptor Species

18. In 2000 five incidents involving sparrowhawks were notified to the scheme, of these the cause of death was established in 4 incidents. In 2 cases death was associated with the unspecified use of organochlorine insecticides. Trauma and starvation were responsible for the other two incidents. No cause of death was established for the remaining case.

19. Five incidents involving peregrine falcons were reported during 2000. A single incident associated with an unspecified use of organochlorine insecticides was the cause of death in one incident in Lothian. Trauma was the cause of death in 2 of the remaining cases. No cause of death was established in the other incidents.

20. Six incidents involving owls (4 barn owls and 2 tawny owl) were submitted for examination; abuse of carbofuran was responsible for the death of one tawny owl, two barn owls died as a result of trauma and a third died from starvation. Analysis of liver tissue from each of the owls failed to provide any evidence of exposure to anticoagulant rodenticides.

21. Single incidents involving a goshawk and an osprey were submitted as potential pesticide poisoning cases. No evidence of exposure to pesticides was detected; trauma was the cause of death in the incident involving the osprey.

Wildfowl and Waterbirds

22. In 2000 there were two incidents involving wildfowl and waterbirds. In one incident 2 ducks were found to have died from oviduct peritonitis. In the other, a heron and a buzzard were found dead on a river in Strathclyde. The cause of death was not established.

Gulls

23. There were three incidents involving gulls in 2000. One incident involved the poisoning of over 30 gulls by the organophosphorus insecticide, dichlorvos. It was suspected that abuse of a veterinary medicine had occurred. No cause of death was established in the other incidents.

Pigeons

24. Only one incident involving the death of approximately 16 feral pigeons was submitted during 2000. The suspicion that they had been the victims of pesticide poisoning was not confirmed. Further post mortem examination indicated that a paramyxovirus infection might have been responsible for the deaths.

Corvids

25. A total of 6 incidents involving 4 crows, a jackdaw and a rook were notified during 2000. Pesticide poisoning was found to be the cause of death in 2 incidents. The abuse of carbofuran in Tayside was responsible for the death of one crow and 6 buzzards. The other incident involved the abuse of the organophosphorus insecticide, mevinphos to kill a jackdaw and numerous starlings in Border region. Trauma was established as the cause of death in one of the other four incidents.

Other birds

26. Five incidents involving other birds were submitted in 2000. Pesticide poisoning was associated with only one incident where numerous starlings and a jackdaw (paragraph 25) were poisoned with mevinphos. Three incidents involved thrushes and in one of these death was found to have resulted from trauma, possible associated with a collision. A cause was not established for an incident involving a blackbird.

LIVESTOCK

27. Only three incidents, all concerned with the death of cattle, were notified in 2000 (Table 5). No evidence, to implicate pesticide poisoning or any other cause of death, was found in any of the incidents.

Table 5: Number of incidents involving livestock in 2000

	Number of incidents investigated	*Number (%) in which pesticide poisoning was identified*	*Number (%) in which another cause of death was identified*
Cattle	3	0	0
TOTAL	**3**	**0**	**0**

COMPANION ANIMALS

28. Forty-six of the incidents registered in 2000 involved companion animals (Table 6). The cause of death was established in 16 (35%) of cases, with pesticide poisoning being responsible for 15 (33%) incidents and disease being the cause in the one remaining case.

Cats

29. Six of the 19 incidents involving cats were associated with the abuse of carbamate insecticide formulations. Abuse of carbofuran accounted for three incidents, one each from Dumfries and Galloway, Lothian and Strathclyde. The other 3 incidents, all occurred in Strathclyde, and involved the abuse of aldicarb (1) and bendiocarb (2).

Table 6: Number of incidents involving companion animals in 2000

	Number of incidents investigated	*Number (%) in which pesticide poisoning was identified*	*Number (%) in which another cause of death was identified*
Cats	19	6 (32%)	0
Dogs	29	10 (34%)	1 (3%)
TOTAL	**46 ***	**15 **(33%)**	**1 (2%)**

* Two incidents involved a cat and a dog.
** One incident involved the poisoning of a cat and a dog with carbofuran.

Dogs

30. Dogs were affected by pesticide poisoning in 10 of the 29 incidents reported to the scheme during the year. The abuse of pesticides was found to be the cause of five incidents; the chemicals involved were carbofuran (1), chloralose (1) and strychnine (3). The misuse of metaldehyde was found to be the cause of an incident in Grampian. The death of a farm dog was attributed to the approved use of a coumatetralyl formulation as the field information concluded that reasonable care had been taken to lay the poison away from non-target animals. One incident resulted from the use of a veterinary medicine. Propetamphos, an organophosphorus insecticide used in sheep dip formulations, was believed to have caused illness in a farm dog. The dog recovered after receiving veterinary treatment. The other three cases were all attributed to some form of unspecified use, two incidents involved metaldehyde and the third involved brodifacoum.

BENEFICIAL INSECTS

31. Thirteen incidents of suspected honeybee poisoning were accepted into the Scheme in 2000. Pesticide poisoning was found to be the cause of death in 9 incidents (Table 7). Seven incidents were associated with the approved use of paraquat to destroy GM contaminated oilseed rape crops. Of the other two incidents, one was associated with an unspecified use of demeton-S-methyl, and the other with an unspecified use of bendiocarb.

SUSPECTED POISONOUS BAITS

32. Eight items were submitted for investigation as suspected poisonous baits or related materials during 2000. In each case there was no known animal casualties associated with the alleged bait. Pesticide residues were only detected in 3 of the items submitted. A number of hen's eggs recovered from a site in Grampian, were subsequently confirmed to have been adulterated with carbofuran. In Dumfries and Galloway, a rabbit carcase recovered in August had been heavily contaminated with

carbofuran to form a poisonous bait. In the third case, substances seized as part of a police investigation were confirmed as being pesticides. In the 5 remaining cases the analytical investigations failed to reveal any evidence to substantiate the belief that the items had been prepared as potential poisonous baits.

Table 7: Number of incidents involving beneficial insects in Scotland during 2000

Number of incidents reported:	**13**
Number of incidents where pesticides were detected and confirmed:	**9**

Pesticide detected	Number of incidents	Number of colonies affected
Carbamate compounds		
bendiocarb	1	1
Organophosphate compounds		
demeton-S-methyl	1	5
Herbicide		
paraquat	7	25
TOTAL	**9**	**31**

INCIDENTS WHERE REGULATORY AND/OR ENFORCEMENT ACTION WAS CONSIDERED

APPROVED USE INCIDENTS

33. Information from incidents thought to have arisen from approved use is fed back into the pesticide regulatory process for evaluation[1]. 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.

34. Fifteen incidents investigated during 2000 were attributed to the approved use of the products involved. Eight of these involved anticoagulant rodenticides where seven were associated with the exposure of birds of prey to either bromadiolone or difenacoum. In the eighth incident, a dog died from coumatetralyl poisoning at a pig-rearing unit. Seven bee mortalities resulted from the use of herbicide in the destruction of GM contaminated oil seed rape crops.

Incident Summaries

35. A buzzard was submitted from the Black Isle in early January, two other buzzard carcases had been found in the same area but were largely decomposed. Post mortem examination of the submitted bird showed the presence of extensive haemorrhaging in the carcase, and no indications of traumatic injury. Analytical investigation identified a residue (0.18mg/kg) of difenacoum in the liver tissue from the buzzard. This residue, together with the evidence of haemorrhaging, was interpreted as being consistent with death having resulted from anticoagulant poisoning. A field investigation confirmed that a number of holdings in the area used rodenticides from time to time to control rats. However, only a single property had been actively using this type of product at the time of the incident, and here Neosorexa bait was being used to control rats in a potato store. Dead rats, which were often found in potato boxes, were being buried as a matter of practice.

36. Two buzzards submitted from Tayside in February and March respectively, were shown to be carrying residues of difenacoum. In the first case the magnitude of the residue was 0.03 mg/kg in liver. The post mortem findings included evidence of haemorrhaging in the lungs and within the body cavity, however this could have been associated with blunt trauma. In the second case the magnitude of the residue was 0.04 mg/kg in liver, and the immediate cause of death appeared to be trauma. In both cases the exposure was attributed to approved use.

37. A dog that died on a farm in Grampian in May showed signs of loss of appetite, then vomiting prior to death. The mucous membranes of the dog were pale. It was suspected that the animal may have been exposed to an anticoagulant rodenticide. Analysis confirmed the presence of a coumatetralyl in liver tissue. The magnitude of the residue was consistent with anticoagulant poisoning being the cause of death. Field investigation confirmed that a coumatetralyl formulation (Racumin) had been used on the farm for a number of years. It had been the subject of particularly active use to control a severe infestation of rats at a feed store and around a pig-rearing unit in the preceding February. The formulation appeared to have been applied in compliance with the recommendations for rodenticides, and there was no evidence to indicate that rat bodies were not being properly disposed of.

38. An adult female red kite was found dead at it's nest site near Doune in May. Post mortem examination indicated that it had died from internal haemorrhaging, possibly resulting from a ruptured ovarian follicle. A significant residue (0.24 mg/kg) of bromadiolone was identified in the liver tissue of the bird. The territory regularly hunted over by the kite was defined from RSPB observation data. Field investigation established that 3 of 6 holdings in this area were actively using rodent control measures based on bromadiolone baits. There was no evidence to indicate either a lack of care in using the formulations involved, or a direct link with a single property. The possibility of multi-point exposure from more than one site could not be excluded. A significant residue of bromadiolone had been found in another red kite that died, nearby in the Dunblane area, from chloralose poisoning in February 1999.

39. In June, a red kite chick died whilst being ringed at a site near Muir of Ord. The chick was observed to be bleeding from the beak. Post mortem examination showed the liver and other organs to be very pale, and identified free blood in the body cavity in

addition to evidence of haemorrhage into the lungs. Difenacoum (0.36mg/kg) was identified in liver tissue from the chick. Subsequently a second chick was submitted from the same nest; again difenacoum (0.38mg/kg) was identified in liver. Field investigation established that rodenticides were in use on 5 out of 9 agricultural holdings in the area and also at a distillery site. Difenacoum baits (Neosorexa) were confirmed to be in use at 4 of the agricultural holdings. The source of exposure to difenacoum in this case could not be linked with a specific property. The possibility of a multi-point exposure could not be excluded.

40. Later in June, one of three red kite chicks, at a nest site on the Black Isle that was being monitored by CCTV, was observed to fall out of the nest. A post mortem examination showed that the liver was very pale, and that free blood was present in the body cavity. Blood was also present in the beak and throat, and there was evidence of subcutaneous haemorrhaging. The stomach contained the remains of a rodent, consistent with the CCTV evidence , which identified rats as frequent food items brought back to the nest by the parent birds. A residue (0.36mg/kg) of bromadiolone was detected in liver tissue from the chick; this and the evidence of extensive haemorrhaging, pointed to anticoagulant poisoning being the cause of death. Field investigation failed to provide a definite link with a single source of exposure. The two other chicks from the nest successfully fledged.

41. A significant residue (0.16mg/kg) of bromadiolone was identified in liver tissue from a red kite submitted in October from the Alness area. The bird was believed to be a road traffic casualty, and the immediate cause of death was trauma. The magnitude of the rodenticide residue is close to the range observed in birds where haemorrhagic symptoms have been expressed. Little is known about sub-lethal effects of rodenticides on birds, including any influence on their susceptibility to road traffic accidents.

42. In seven incidents involving mortalities of honeybees, there was either information pointing to a link with the spraying of an agricultural chemical on oil seed rape crops, or evidence of such a link was identified in the ensuing field investigations. In all of these cases, residues of paraquat were identified in samples of the bees. All of the incidents were associated with the use of this herbicide to destroy crops of GM contaminated Hyola oil seed rape. Four of the incidents near Nairn appeared to have resulted from the same spray event.

43. The crops, all in flower, were sprayed on dry calm days. In some cases the growers involved contacted local beekeepers, to warn of the intention to spray. However in one case a grower was unable to contact the secretary of the local beekeepers in the 2-day period prior to spraying. In most of the other cases, the presence of beekeepers in the vicinity was unknown to the grower. Finally in one case, a farmer thought that the herbicide was ‘bee friendly’.

44. In all cases the beekeepers observed not only dead bees at their hives, but also a high proportion of severely affected bees. The distressing effects on bees at the hives persisted for period of up to 3 weeks. One of the beekeepers involved in the incident near Nairn had closed his colonies up for a period of 18 hours to avoid exposure during the spray application, however his hives were still seriously affected. This would seem

to reflect exposure from the crop rather than direct overspraying at the time of application.

45. Despite active liaison with beekeepers in some of the cases, adverse effects on bee colonies were experienced. The product literature did not carry any warnings that the formulation was either harmful or dangerous to bees. The Environmental Information sheet states '*no requirement to avoid application of the product when bees may be foraging on flowering weeds in and around treated fields'*. The use of a herbicide in this way to destroy a developing crop was somewhat unique and completely atypical of the normal pattern of use. It would appear that growers tried to comply with the obligations placed on them, and that the subsequent effects could not have been reasonably anticipated. Ideally the crops should have been destroyed prior to flowering. If such unlikely circumstances were to occur again, SERAD will ensure that the danger to bees from destroying flowering crops is brought to the attention of the agricultural industry.

MISUSE INCIDENTS

46. Only one incident was reported where the misuse of a pesticide was identified. This involved the death of a dog at a farm near Banff in September, where the sowing of winter wheat and application of molluscicide pellets had been contracted out. A bag of pellets fell off a trailer at the entry to a field, and the resulting spillage was not cleared. The owner of the dog occupied a dwelling on the other side of the road. The farm business compensated the dog owner for the loss of the animal.

ABUSE INCIDENTS

47. The deliberate abuse of pesticides to poison animals has been a perennial problem in Scotland for many years. The victims of such practice may not always be restricted to the intended target species; any animal that finds a bait material attractive and available as a food source can be at risk. Once again in 2000, the incidents attributable to abuse continued to make up the majority of those confirmed as involving pesticides. The number was 29 (51% of pesticide incidents), which was disappointing in that 1999 saw the lowest annual total for the period from 1980.

48. Seven compounds were identified in abuse incidents in 2000 compared to 4 in 1999 and 6 in 1998. As in recent years carbofuran (17, 59% of abuse incidents) and chloralose (5, 17% of abuse incidents) were the most frequently abused pesticides (Figure 3). Strychnine was the subject of abuse in 4 incidents, bendiocarb in 2 incidents, and aldicarb and mevinphos each in single incidents. In one of the incidents involving carbofuran, only a formulation was recovered along with quantities of Cymag (cyanide) and strychnine.

49. Two incidents serve to illustrate the extent of abuse, and the difficulties in gathering sufficient evidence to support enforcement action. In mid-August an anonymous caller, on the Anti-abuse Campaign hotline, alleged that a number of poisonous baits had been observed in a partially derelict building at a remote site in Grampian. Investigation by SERAD officials and Grampian police officers led to the recovery of a large number of hens eggs that appeared to have been prepared as

poisonous baits. Egg boxes found at the locus indicated that in excess of 100 eggs had been used for this purpose. Date labeling on many of the eggs indicated a 'best by date' of late May. The eggs found at the site had all been drilled to make a small hole in the shell. On examination the egg content, and in particular the remains of the yolk, were of a dark blue colour. Carbofuran is only commercially available as granular formulations, and it would appear that some kind of solution or liquid suspension had been prepared from a formulation to inject into the eggs. The building was used as a store for the poisonous baits, which may have been produced in high numbers on-site, or at another place. Relevant landowners were interviewed but the limited evidence available restricted any possibility of formal enforcement action.

50. In the second case a number of starlings and a jackdaw were poisoned with mevinphos in the border town of Kelso. The exact nature of the bait used was not ascertained, gizzard content material from the birds examined looked like fragments of grain or nut. The approval for mevinphos formulations was withdrawn in the early 1980s and all use of the material was quickly phased out. The commercially available concentrates were highly toxic and these materials had been restricted to professional use only. No evidence to indicate where or by whom the bait had been laid was forthcoming, so no further action could be taken by either SERAD or Lothian and Borders Police.

VETERINARY USE INCIDENTS

51. In two incidents where pesticides were detected in the analytical investigation, field information indicated that exposure had resulted from situations in which the active ingredients had been formulated as veterinary medicine. In May a mortality of a large number of sea gulls was caused by dichlorvos poisoning on the island of Lewis. The stomach content material consisted of thick, buff-coloured paste, consistent with the ingestion of fish feed pellets. This incident appeared to have resulted from the abuse of the veterinary medicine formulation. Details of the incident were referred to VMD and SEPA for consideration. The second incident involved the illness of a dog in Aberdeenshire in September. Field information suggested that the animal may have been exposed to a sheep dip. Propetamphos was identified in a sample of water from a ditch at the locus. No residue was detected in serum from the dog, however only a very limited sample volume (0.2ml) was available. The incident may have involved misuse of the veterinary product.

UNSPECIFIED USE INCIDENTS

52. 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 is delayed. In 2000 a total of 10 incidents (18% of all pesticide incidents) fell into this category.

53. The death of a red kite found in Easter Ross during February was thought to have resulted from carbofuran poisoning. The residues detected in samples were relatively low compared to those frequently identified in abuse cases, 11 mg/kg in the

gullet content material and 0.4 mg/kg in liver tissue. The gullet content material consisted of a large number of earthworms. It was thought that this incident could have arisen from an approved use of carbofuran, however a field investigation was unable to associate the incident with a specific application. A similar situation occurred in the Borders in November, when a very low residue of carbofuran (0.8 mg/kg) was shown to be present in the gullet content material from a buzzard

54. Two dogs died from metaldehyde poisoning in separate incidents. One occurred near Perth in June and the other near Annan in September. Field investigations did not identify specific sources of exposure, however it is probably that they would have involved either poor storage or spillages that had not been cleared up.

55. In August on a property in Fife, a farmer's dog died in unexpected circumstances. The owner suspected that someone in the immediate area had been using rodenticide treatments, and he submitted a rat carcase. Analysis demonstrated the presence of a brodifacoum residue (1.05 mg/kg) in the liver from the rodent. The source of the rodenticide was not specifically identified. Given that the conditions of approval restrict brodifacoum to use in sewers or inside premises, then this incident almost certainly would have been associated with misuse of a rodenticide product.

56. In three incidents, the presence of significant residues of persistent organochlorine pesticides in the liver tissues of birds of prey could have had adverse effects on the health of the birds and contributed to their deaths. The species involved were sparrowhawk (2) and peregrine falcon. A sparrowhawk recovered from an island off Oban in late March carried a residue of 32 mg/kg of DDE, a metabolite of DDT, in its liver. A second sparrowhawk submitted from Forfar in late March was shown to be carrying liver residues of both DDE (36 mg/kg) and of dieldrin (5.7 mg/kg). Finally residues of DDE (2.5 mg/kg), dieldrin (1.9 mg/kg), and HCB (1.2 mg/kg) were detected in the liver from a peregrine falcon that had died at a site within the boundaries of the City of Edinburgh.

57. Honeybee mortality at a site near Dundee in July was attributed to bendiocarb poisoning after the detection of a residue (0.63mg/kg) of this insecticide in a sample of bees. The source of the exposure was not identified in the ensuing field investigation. Past history of honeybee incidents involving bendiocarb would suggest that the mortality was probably an indirect effect of a control operation on either a feral bee colony or on a wasp nest.

58. A residue of demeton-S-methyl was identified in honeybees from an incident at a site in East Lothian in late October. The source of the insecticide was not established. Several incidents involving this pesticide were reported from this area in the summer of 1999 and resulted from use of a formulation in a trial on oil seed rape[2]. The timing of the incident in 2000 was not consistent with that kind of use.

SECONDARY POISONING

59. The potential for secondary poisoning of predatory birds from the use of second-generation anticoagulant rodenticides has been recognized for some time[3]. Originally in Great Britain, the barn owl was considered to have be one of the more

vulnerable species[4,5]. However data from post registration monitoring in 1999, from Scotland[2,6] and also from England[6,7], indicated that red kites were at risk and that the relatively small numbers of breeding pairs in the re-introduction programme could be vulnerable. All red kites received by the WIIS schemes are now monitored for the presence of rodenticide residues in liver tissue. In 2000, liver tissues were available from eight incidents involving red kites submitted in Scotland. Four of these resulted in mortalities that were evidently caused by secondary poisoning involving either bromadiolone or difenacoum (see paragraphs 16-17). In the other 4 cases the birds were all victims of carbofuran poisoning, however rodenticide residues were detected in the livers from 3 of these birds. Bromadiolone was present in all three cases, and in one case difenacoum was also present. The magnitude of the residues in liver tissue ranged from 0.1 to 0.14 mg/kg. The frequency (75%) for the detection of rodenticide residues in red kites in 2000 was only marginally higher than that observed (72.7%) for all birds (22) of this species examined in Scotland in the years 1998 - 2000. A similar frequency of detection has been reported for red kites in England[6], however the rodenticides detected there include brodifacoum as well as bromadiolone and difenacoum.

60. The death of a buzzard submitted in the early part of the year was attributed to secondary poisoning from a rodenticide (see paragraph 14). This, the finding of a relatively high residue of bromadiolone in a buzzard[2] at the end of 1999, and increasing concern about the possible extent of secondary poisoning, prompted measures to screen a wider sample of the buzzards submitted to the scheme. In addition to the mortality referred to above, a further 46 liver tissue samples from buzzards submitted in 2000 were subject to analysis for rodenticide residues. Rodenticides were detected in 6 of these, the chemicals identified were bromadiolone (4) and difenacoum (3), and residues ranged from 0.03 to 0.08 mg/kg. The frequency of detection of rodenticides in buzzards submitted in 2000 was 14.9% compared to an overall frequency of 16.7% for all buzzards (60) analysed for rodenticides by the WIIS scheme in Scotland. (*Outwith the scheme, a number of frozen buzzard carcases collected by the RSPB from 1998 to 2000 have been made available for analysis and data from these will be reported elsewhere*).

NON-ABUSE INCIDENTS 1995-2000

61. A simple overview of some possible problem areas of non-target animal poisoning can be obtained by scrutiny of the types of active ingredient associated with confirmed poisonings, if those incidents associated with abuse are excluded[1,2]. The outcome when this approach has been applied to incident data for Scotland for the period 1995-2000 is illustrated in Figure 4. Anticoagulant rodenticides were involved in 45% of vertebrate incidents, and were also identified in a number of other cases in 1999 and 2000 where birds of prey were victims of abuse. Incidents caused by exposure to insecticides and molluscicides each made up a further 21% of vertebrate incidents. As might be expected, honeybee mortalities were largely the result of exposure to insecticides (63%). The insecticide applications identified consisted of organophosphorus compounds (9), pyrethroids (2), and a carbamate (1).

ENFORCEMENT ACTION

62. Positive enforcement action continues to be a priority as a measure to counteract pesticide abuse. SERAD 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.

63. Charges were prepared in respect of 3 cases arising from incidents accepted for investigation during 2000. Only one case, in which a gamekeeper has been charged with breaches under the Wildlife and Countryside Act and the Control of Pesticides Regulations, will proceed to a court hearing. In one of the other cases charges were not pursued because of the death of the accused. In the other, charges were dropped because of a technical issue concerning licenses for bird traps. A prosecution arising from incidents in 1998 and 1999 was withdrawn by the Fiscal Service at a hearing in Perth Sheriff Court in December 2000.

64. There were 3 cases where it was recommended that SERAD Policy Branch should issue advisory letters. One was in relation to the poisoning of a red kite with bromadiolone near Doune and the other two involved the poisoning of buzzards with carbofuran at sites in Grampian.

65. SERAD Agricultural Staff carried out 40 field investigations during 2000. Many of these were joint operations with the police, and some also involved RSPB Investigation Officers. The police pursued three incidents, either independently or with assistance from SSPCA.

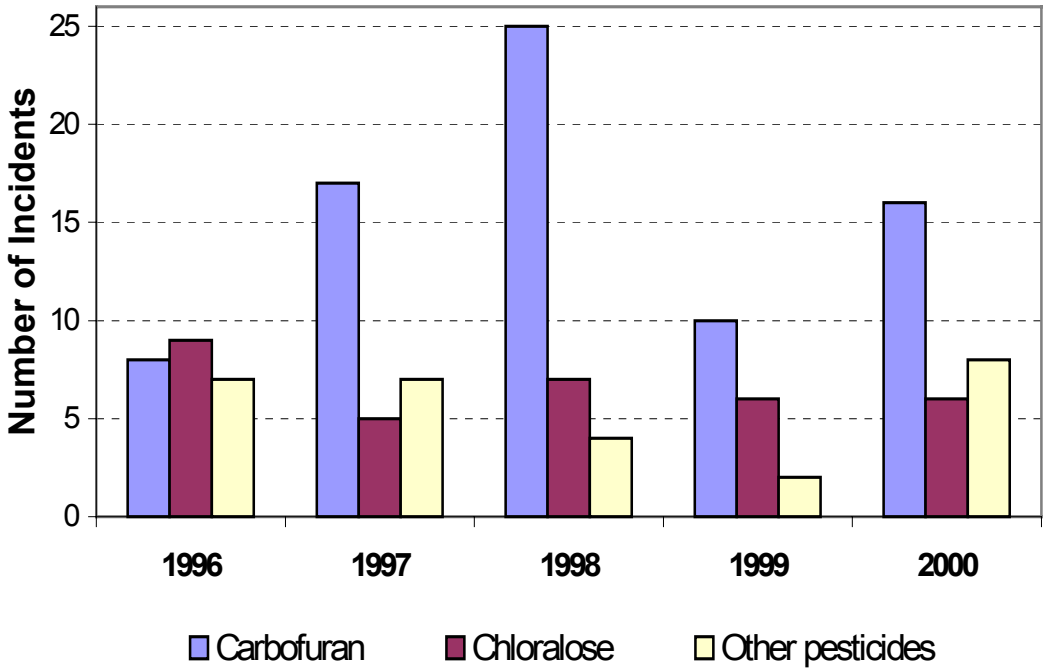

Figure 3. Pesticides Abused in Scotland

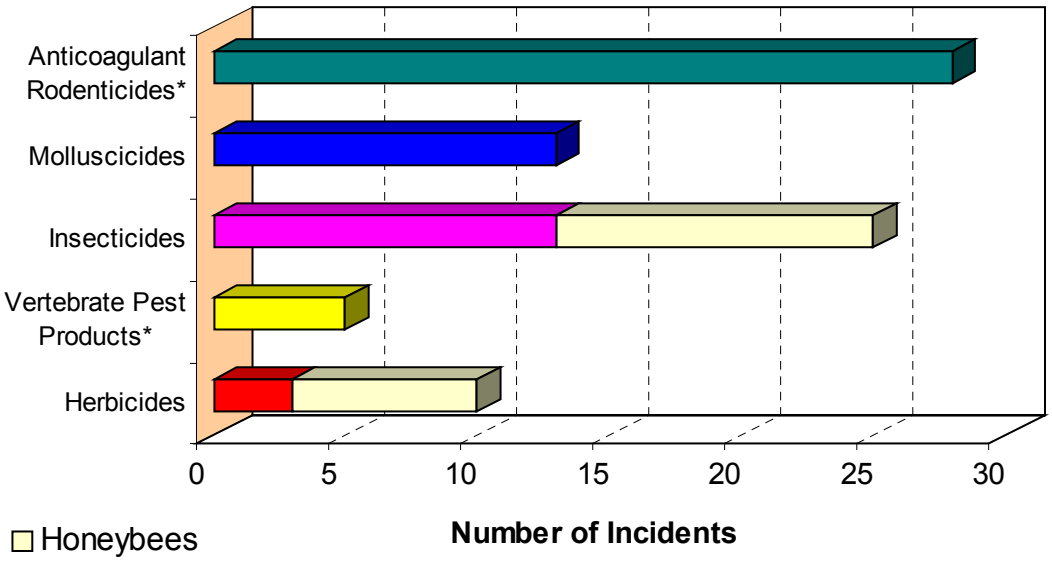

Figure 4. Pesticides Identified in Non-Abuse Incidents 1995-2000 (*Data include vertebrates and honeybees*)

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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 carcases, 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 SERAD. Agricultural Staff in the area offices of SERAD 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.

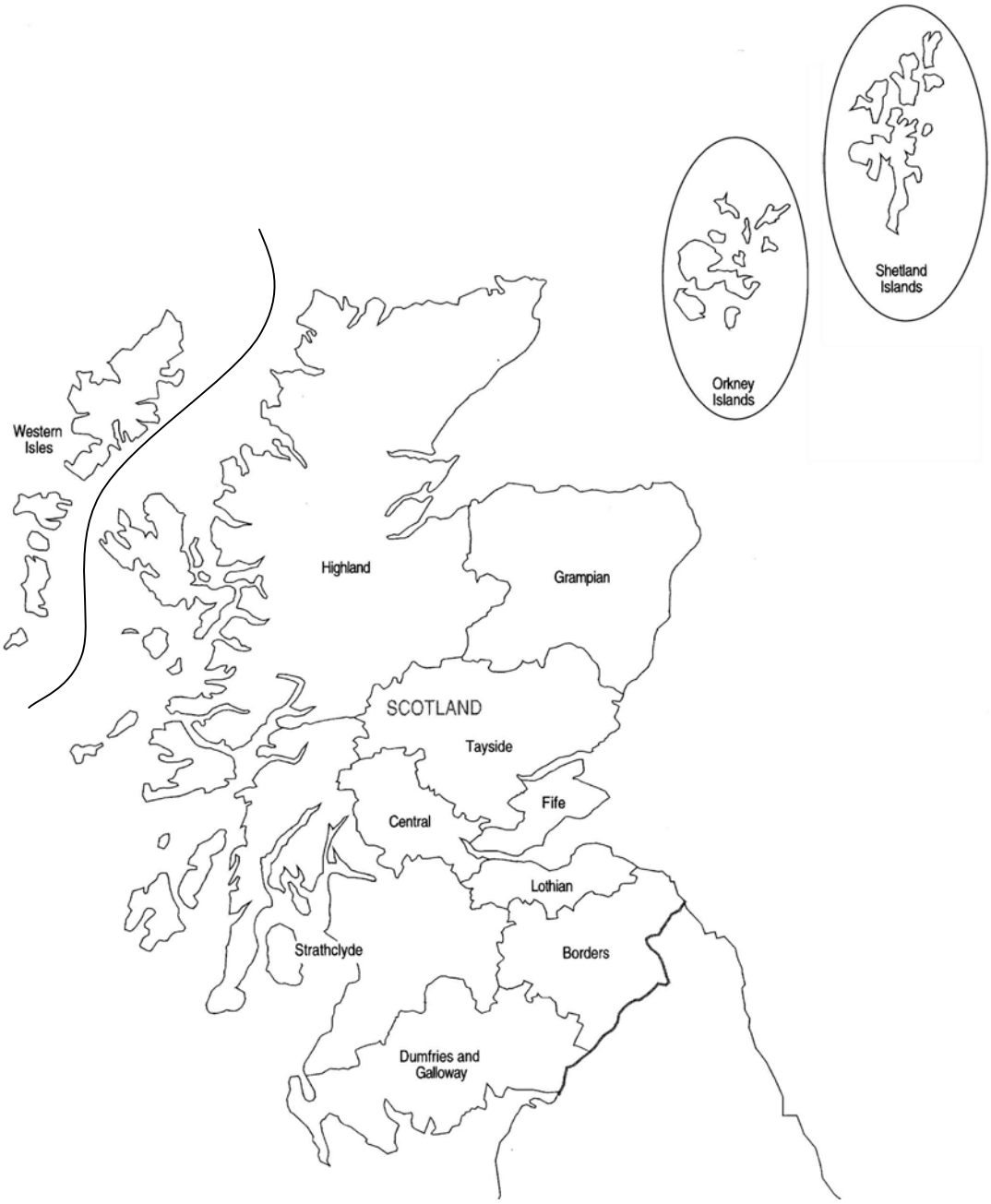
SASA makes use of analytical techniques and equipment capable of identifying low levels of pesticides considered to present a possible hazard to vertebrates or beneficial insects. Two multi-residue methods are used for carbamate, organochlorine, organophosphorus, and pyrethroid compounds, and for anticoagulant rodenticides. These are supplemented by compound specific analytical methods for chloralose, metaldehyde, paraquat, strychnine and other compounds. 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 a 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 SERAD 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 2000

Incident No.	Date	Location	Species	Pesticide	Conclusion	Enforcement Action	Comments
00004	Jan	Black Isle, Highland	Buzzard	Difenacoum	Approved Use	RAD investigation	Significant haemorrhaging
00009	Jan	Maud, Grampian	2 Buzzards	Carbofuran (and Bromadiolone)	Abuse	RAD investigation	
00010	Jan	Forfar, Tayside	Dog	Strychnine and Chloralose	Abuse	Police and RAD investigation	Chemicals recovered, improper storage
00012	Feb	Easter Ross, Highland	Red Kite	Carbofuran	Unspecified Use	Police and RAD investigation	Source not established
00014	Feb	Lanark, Strathclyde	Dog	Strychnine	Abuse	RAD investigation	Dog survived
00017	Feb	Trochray, Tayside	Buzzard	Difenacoum	Approved Use		Sub-lethal residue No haemorrhaging
00018	Feb	Sanquhar, Dumfries & Galloway	Cat	Carbofuran	Abuse	Police & RAD investigation	
00020	Feb	Milnathort, Tayside	6 Buzzards, 1 crow, and 5 Pigeon Baits	Carbofuran (and Bromadiolone)	Abuse	Police and RAD investigation	
00023	Feb	Castle Douglas, Dumfries & Galloway	2 Buzzards, a Tawny Owl and Bait	Carbofuran, (Bromadiolone and Difenacoum)	Abuse	Police, RSPB and RAD investigation	
00024	May 99	Easter Ross, Highland	Buzzard	Chloralose	Abuse	No new investigation	Related to another incident in 1999
00031	Mar	Seil Island, Strathclyde	Sparrowhawk	DDE	Unspecified Use		

00037	Mar	Edinburgh, Lothian	Peregrine Falcon	DDE, Dieldrin and HCB	Unspecified Use		

00038	Mar	West Glen Lednock, Tayside	Golden Eagle	Chloralose	Abuse	Police & RAD investigation	Press release
00040	Mar	Newmilns, Strathclyde	Cat, Dog and Baits	Carbofuran	Abuse	RAD investigation	
00043	Mar	Forfar, Tayside	Sparrowhawk	DDE and Dieldrin	Unspecified Use		
00045	Mar	Taymouth Castle, Tayside	Buzzard	Difenacoum	Approved Use		No haemorrhaging
00052	Mar	Strath Kildonan, Sutherland, Highland	Golden Eagle	Carbofuran	Abuse	Police & RAD investigation	
00053	Apr	Fala, Lothian	Buzzard	Chloralose	Abuse	Police investigation	
00054	Apr	Alford, Grampian	Dog	Coumatetralyl	Approved Use	RAD investigation	Baiting operation in farm feed store
00056	Apr	Tarbolton, Strathclyde	Several Cats	Bendiocarb	Abuse	Police & RAD investigation	
00061	May	Maybole, Strathclyde	3 Cats	Bendiocarb	Abuse	Police & RAD investigation	
00068	May	Doune, Central	Red Kite	Bromadiolone	Approved use	RAD investigation	Advisory letters issued by RAD
00074	Jun	Newtyle, Tayside	Dog	Strychnine	Abuse	RAD investigation	Related to incident 00010
00080	Jun	Perth, Tayside	Dog	Metaldehyde	Unspecified Use	RAD investigation	
B04/00	Jun	Near Ladybank, Fife	Honeybees	Paraquat	Approved Use	RAD investigation	
00081	Jun	Breasclete, Isle of Lewis	37 Gulls	Dichlorvos	Veterinary		Veterinary Medicine

					Use		

00088	May	Black Isle, Highland	Red Kite	Carbofuran (and Bromadiolone)	Abuse	RAD investigation	
00090	Jun	Edinburgh, Lothian	Cat	Carbofuran	Abuse	SSPCA and Police investigation	
00091	Jun	Muir of Ord, Highland	2 Red Kite Chicks	Difenacoum	Approved Use	RAD investigation	
B05/00	Jun	Dunfermline, Fife	Honeybees	Paraquat	Approved Use	RAD investigation	
B06/00	Jun	Nairn, Highland	Honeybees	Paraquat	Approved Use	RAD investigation	
B07/00	Jun	Nairn, Highland	Honeybees	Paraquat	Approved Use	RAD investigation	
B08/00	Jun	Nairn, Highland	Honeybees	Paraquat	Approved Use	RAD investigation	
B09/00	Jun	Nairn, Highland	Honeybees	Paraquat	Approved Use	RAD investigation	
B10/00	Jun	Dingwall, Highland	Honeybees	Paraquat	Approved Use	RAD investigation	
00098	Jun	Black Corrie Burn, Highland	Golden Eagle	Carbofuran	Abuse	RAD, Police and RSPB investigation	
B11/00	July	Dundee, Tayside	Honeybees	Bendiocarb	Unspecified Use	RAD investigation	
00106	Jul	Cumnock, Strathclyde	3 Cats	Aldicarb	Abuse	RAD investigation	
00109	Jul	Kelso, Border	12 Starlings and 1 Jackdaw	Mevinphos	Abuse	RAD investigation	Town centre location

00110	Jun	Black Isle, Highland	Red Kite Chick	Bromadiolone	Approved Use	RAD investigation	Significant haemorrhaging
00114	Aug	Cabrach Est, Highland	50-100 Egg Baits	Carbofuran	Abuse	Police and RAD investigation	Anti-abuse Campaign Hot-line call
00118	Aug	Strathmiglo, Fife	Dog	Brodifacoum	Unspecified Use		Residue identified in rat, tissues from dog not submitted
00119	Aug	Garve, Ross-shire, Highland	Red Kite	Carbofuran (and Bromadiolone)	Abuse	Police and RAD investigation	Source not established
00122	Aug	Durisdeer, Dumfries & Galloway	Rabbit Bait	Carbofuran	Abuse	Police and RAD investigation	
00123	Sep	Sauchen, Grampian	Dog	Propetamphos	Veterinary Use		Veterinary medicine
00127	Sep	Muirkirk, Strathclyde	None – chemicals	Carbofuran, Cymag and Strychnine	Abuse	Police investigation	
00128	Sep	Eastriggs, Annan, Dumfries & Galloway	Dog	Metaldehyde	Unspecified Use		
00131	Sep	Banff, Grampian	Dog	Metaldehyde	Misuse	RAD investigation	Dog owner compensated for loss
00136	Sep	Alness, Highland	Red Kite	Bromadiolone	Approved Use		
00137	Oct	Evanton, Highland	Red Kite	Carbofuran (and Bromadiolone)	Abuse		
00145	Oct	Doune, Central	Buzzard	Chloralose	Abuse	Police and RAD investigation	
B14/00	Oct	Pencaitland, Lothian	Honeybees	Demeton-S-methyl	Unspecified Use		

00147	Nov	Pitroddie Farm, Perth, Tayside	Buzzard	Chloralose	Abuse	Police and RAD investigation	
00152	Oct	Auchteran, Braemar, Grampian	Buzzard(2) & Rabbit Bait(2)	Carbofuran	Abuse	Police and RAD investigation	Advisory letter to Estate Factor recommended
00155	Feb 98	Cabrach Est, Nairn, Highland	Buzzard	Carbofuran	Abuse		
00156	Nov	Reston, Border	Buzzard	Carbofuran	Unspecified Use	Police, RAD and RSPB investigation	
00162	Dec	Laurencekirk, Grampian	Buzzard (4) & Deer Bait	Carbofuran	Abuse	Police and RAD investigation	Advisory letter to farmer recommended