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CONTINUING SURVEILLANCE AND ASSESSMENT OF HUMAN HEALTH EFFECTS ASSOCIATED WITH EXPOSURE TO SHEEP DIPS

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FINAL REPORT
to
THE VETERINARY MEDICINES DIRECTORATE

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CONTINUING SURVEILLANCE AND ASSESSMENT OF HUMAN HEALTH EFFECTS ASSOCIATED WITH EXPOSURE TO SHEEP DIPS: CASES REPORTED BETWEEN 01.09.92 AND 31.12.92

FINAL REPORT

1 Aims

The aims of the survey were

- to identify cases with acute clinical effects following suspected exposure to sheep dip; particularly, but not exclusively, cases exposed during the study period (1.9.92-31.12.92).

- to undertake a risk assessment for each of the cases identified;

- to make such information available to the Veterinary Medicines Directorate and other agencies, as appropriate, with full regard for patient confidentiality.

2 Methods

The cases included in the survey were reported to the National Poisons Unit by a) physicians who contacted the National Poisons Information Service (London), asking for information on diagnosis and management of health effects associated with sheep dipping. or b) physicians and members of the public who contacted the study team directly after reading or hearing about the study.

Initial information was collected by telephone from reporting physicians by the Consultant Physician who provided 24 hour cover for the duration of the project. Patient samples were requested if the exposure had occurred less than seven days before the enquiry, and analyses of red blood cell cholinesterase and plasma pseudocholinesterase activity were carried out by the National Poisons Unit Toxicology Laboratory, using a modified Ellman method (Ellman et al., 1961). The protocol specified that repeat samples would be requested after one month from any patient whose cholinesterase activity was found to be outside normal limits (normal lower limits quoted by the NPU Toxicology Laboratory are 12 ku/l in red blood cells and 1.6 ku/l in plasma).

Additional information was obtained from reporting physicians (but not from members of the public) by sending follow-up questionnaires at suitable intervals after the enquiry. The first questionnaire asked for details about the incident reported, the patient's history of exposure to organophosphate compounds and medical history, the clinical effects reported, treatment given and outcome. It was sent with a Veterinary Medicines Directorate yellow

suspected adverse reaction reporting form. The second questionnaire asked for information about subsequent exposures and subsequent medical history.

Although the study aimed to identify cases with acute clinical effects following exposure to sheep dip, this report includes information about patients with chronic or acute effects related to an exposure occurring before the study period and patients reporting exposure, but without clinical effects. All patients who reported exposure were followed up if possible, to obtain a more detailed history of exposure and clinical effects than may be provided by telephone, because it was considered important to evaluate all cases of suspected adverse effects on human health related to exposure to sheep dip.

Each case was considered by a Steering Group including representatives of the National Poisons Unit, the Veterinary Medicines Directorate, the Department of Health and the Health and Safety Executive. The incidents were classified as either:-

confirmed	signs and symptoms typical of exposure to organophosphate pesticide and cholinesterase depression;
likely	the balance of evidence, with signs and symptoms typical of exposure to organophosphate pesticide, suggests that there is an association between exposure to sheep dip and ill health;
possible	evidence suggests that there could be an association between ill health and exposure to sheep dip, but signs and symptoms are not typical of exposure to organophosphate pesticide;
unlikely	evidence suggests that exposure to sheep dip is unlikely to have caused the reported effects, but it cannot be entirely discounted;
insufficient data	there was not enough available information to make a proper evaluation of the case;
not related	there is strong medical evidence that the clinical effects were not related to sheep dip exposure.

3 Results

3.1 Number of cases reported and followed up

Between 1.9.92 and 31.12.92, the National Poisons Unit received reports of 51 exposures or suspected exposures. These included 45 cases reported by a physician, and 6 cases reported initially by the patient or a relative of the patient.

Follow-ups were sent to the physicians who reported 33 of the cases, but not to patients or relatives. Information on seven patients was obtained without a follow-up being sent, two of these had attended the toxicology outpatient clinic at Guy's Hospital. Twenty-three of these questionnaires were returned. One month follow-up questionnaires were sent for 13 cases, 11 of these were returned. In total 29 case reports included information obtained by one or two follow-up questionnaires.

In 42 of the 45 cases reported by physicians sufficient information was obtained, either from telephone discussions with the NPU consultant physician, from written letters or follow-up questionnaire, or from clinic notes, for detailed assessment. The three cases for which insufficient information was obtained were excluded from further analysis.

3.2 Patient details

Age and Sex (Table 1). There were twice as many men as women. Ages ranged from 12-70 years, with a mean age of 38 years. 74% were aged between 30-59 years old and 31% were between 30-39 years old.

Occupation was recorded in 37 cases (88%). All but three of these patients were closely associated with farming, either working or living on a farm or small-holding. Some farmworkers only worked part-time, but one man was a contract dipper who was probably exposed for a longer period than other farmworkers. The exceptions were a businessman, who probably did not live on a farm but whose brother was a farmer, a paramedic who was helping a friend with dipping, and a woman who was married to a sheep auctioneer. Sufficient information was given about 4 of the 5 patients for whom occupation was not stated, to indicate that they were neither farmers nor living on a farm (cases 21, 22, 23, 24).

Geographical distribution See Table 2.

3.3 Exposure

Date of exposure 25 patients reported exposures occurring in the study period. Ten patients reported exposures occurring outside the study period, five in summer 1992 and five in previous years. The date of latest exposure was not given in seven cases, although there was some indication in four cases that the patients had been exposed in summer 1992.

Duration of exposure Since most patients were farmers or members of a farmer's family, they had probably been exposed on more than one occasion, but the history was not sufficiently detailed to confirm this in the majority of cases. However in 10 cases, patients were said to have been exposed to sheep dip over a number of years, over 20 years in three cases.

In six cases it seemed likely that only one episode of exposure had occurred: a) the four patients exposed to a contaminated water supply for four days; b) one man, whose

profession was recorded as "a paramedic", who had been helping a friend with dipping; and c) a man who was exposed while clearing up a spill.

Respondents seldom gave sufficient information to make it possible to determine the actual duration of exposure. Sheep dipping may take place for several hours a day over several days, depending on the size of the flock. Adequate estimation of duration of exposure would require information on the number of hours exposure per day, and, if exposure was said to have taken place over a number of weeks or months, the number of days per month and the interval between episodes. However, even if this information had been precisely documented in each case, it would still have been difficult to determine the extent of exposure without information on the extent of contact with previously dipped sheep during intervening periods. In some cases it was noted that the patient had day to day contact with dipped sheep, but in other cases, for example, wives and children who had helped farmers with dipping, no information was given and the nature of contact apart from at dipping time was unclear.

Circumstances (Table 3). Details were reported in 27 cases. In 21 cases exposure occurred while patients were working or helping on a farm or smallholding. Exposures that were not related to farming occurred when a water supply to two homes was contaminated by sheep dip (cases 21,22,23,24),and in another case, when the wife of a sheep auctioneer washed her husband's contaminated clothes.

Route of exposure Skin contamination was reported by over half the patients, inhalation of spray droplets or vapours from the dip was reported by just over one third, six patients reported accidental ingestion and five reported eye contamination (Table 4). Only eight patients reported exposure by a single route, the others reported multiple routes of exposure in various combinations.

Use of protective clothing Information on use of protective clothing (the questionnaire listed mask, gloves, bib apron, waterproof coat, waterproof leggings and Wellington boots) was obtained for 21 patients. Three patients said they had not used any protective clothing and two patients had worn only gloves. However, one patient claimed to have worn waterproof coat, waterproof leggings, bib apron, Wellington boots and gloves; eight patients reported wearing waterproof coat and/or waterproof leggings and Wellington boots, and seven reported wearing waterproof coat and/or waterproof trousers, Wellington boots and gloves.

Type of dip used The proprietary name and/or the chemical constitution was given in 34 cases. Exposure to dip containing propetamphos was reported by 21 patients (seven of whom lived or worked on the same farm), 15 patients reported exposure to diazinon, and five patients (four of whom used the same contaminated water source) reported exposure to chlorfenvinphos. Seven patients reported exposure to more than one chemical: six people were exposed to two dips, one containing diazinon and the other containing propetamphos,

and one person was exposed to a compound preparation containing chlorfenvinphos and diazinon.

3.4 Clinical effects

Frequency of symptomatic cases (Table 5) Clinical effects were reported by 30 patients (71% of the total), 10 patients were asymptomatic and in two cases the condition of the patient was not known. The 10 asymptomatic patients included the four people exposed to a contaminated water source, and six people who lived or worked on the same farm as two other people who reported clinical effects associated with exposure to dip.

Acute effects from exposures occurring in the study period were reported by 15 patients, another five patients reported acute effects associated with exposures occurring before the study period, and two patients reported acute effects but did not specify the date of exposure.

Of the patients reporting acute effects related to an acute exposure, 13 also reported chronic effects lasting several months or years, but in most cases of unspecified duration. Another six patients reported chronic effects of several months or years duration, but had no history of acute effects clearly associated with a particular exposure. The date of last exposure was not clearly stated in any of these cases: four had probably been exposed at some time in 1992, but one man was still experiencing symptoms although he had probably not been exposed since 1990.

Clinical effects (Table 6). Most patients reported several clinical effects, but there were no clinical effects reported by every patient. The number of times each clinical effect was reported was counted. The most common effects, reported by at least 33% of symptomatic patients were: increased sweating, headache, nausea, dizziness and anxiety/ irritability, blurred vision and abdominal pain. The following clinical effects were reported by between 20-33% of symptomatic patients: fatigue/tiredness/lethargy, poor short term memory, dyspnoea/tightness of the chest, numbness/tingling/paraesthesia, coughing, diarrhoea, depression, back pain or joint pain, anorexia/loss of appetite, and fever.

Some of the more commonly reported effects were as frequently reported as acute effects relating to an acute exposure, as they were reported as chronic effects, of long term duration: anxiety/irritability, poor short term memory and diarrhoea. However, the following effects were reported as acute effects related to an acute exposure at least twice as often as they were reported as chronic effects: increased sweating/hot flushes, headache, blurred vision, abdominal pain, coughing, fever, and ataxia. In contrast some clinical effects reported as chronic effects of long term duration at least twice as often as they were reported as acute effects: fatigue/tiredness/lethargy, depression, and back pain or joint pain.

There were too few cases to make a comparison of clinical status of patients exposed to different chemicals.

3.5 Measurement of plasma cholinesterase activity

Patients with acute clinical effects from exposures occurring during the study period Red blood cell cholinesterase and plasma pseudocholinesterase activity were measured in 13 of the 15 patients in this category. Samples were taken within 48 hours in one case (39), and within four days in cases 2, 3, 4, 19, 26. In cases 7, 13, 14, 15, 42, 43 and 49 the interval between exposure and taking the sample was not known exactly because either the exact date of exposure was not known or the date of sampling was not recorded. All measurements were above the lower limit of normal (above 12 ku/l in red blood cells and above 1.6 ku/l in plasma). Red blood cell cholinesterase ranged from 13.9 - 32.00 ku/l, and plasma pseudocholinesterase ranged from 2.20 - 6.91 ku/l.

Patients reporting asymptomatic exposures, or exposures occurring before the study period Red blood cell cholinesterase and plasma pseudocholinesterase activity was measured in six of the nine patients reporting acute effects from exposure before the study period or on an unknown date, four of the six patients with chronic effects from exposures occurring before the study period, all 10 of the patients exposed during the study period but without clinical effects, and two patients for whom there was inadequate information about exposure and clinical effects. All measurements were above the lower limit of normal.

Since none of the patients showed evidence of depressed cholinesterase activity, repeat measurements were not carried out.

3.6 Treatment

None of the patients was reported to have needed treatment for acute clinical effects. Four patients with chronic effects were being investigated as hospital inpatients or outpatients, in one case for a demylinating neurological disorder, in another case for asthma, and in two cases for heart disease. Two patients attended the outpatient Toxicology Clinic at Guy's Hospital, and it is possible that some others may be referred in future.

3.7 Outcome

In two cases (cases 2 and 30) follow-up information indicated that effects originally thought to have been associated with exposure to sheep dip were due to a different diagnosis. One patient (case 2) was found to have developed a subdural haematoma, and the other patient (case 30) was diagnosed as suffering over the preceding 1-2 years from general, intermittent memory loss, that was not associated with exposure to sheep dip.

4. Case assessment and discussion

Although many of the 42 patients had signs and symptoms suggestive of cholinesterase inhibition, in no case where blood samples were taken was there evidence of depressed cholinesterase activity. It is possible that reactivation and resynthesis of the plasma enzyme may have occurred in the interval between exposure and taking blood samples, when this was greater than 48 hours, or in the interval between sampling and analysis.

Since the interpretation of the analytical results was uncertain, in no case was the association between exposure to sheep dip and clinical effects confirmed. On the other hand, in many cases, although the patient's cholinesterase activity was not depressed, the history of exposure was such that an association between exposure and clinical symptoms could not be ruled out. In other cases the clinical effects described did not fit the expected pattern and there was insufficient information to rule out other causes. The difficulty of distinguishing organophosphate poisoning from other conditions is illustrated by the patient in case 2, who had clinical effects suggestive of organophosphate poisoning but was later found to have a subdural haematoma.

Cases reporting exposure without associated clinical effects It is interesting to note that exposure to water contaminated with chlorfenvinphos dip caused neither clinical effects nor depression of cholinesterase activity. It is also interesting to note that the survey found no individuals with depressed cholinesterase activity in the absence of clinical effects.

Cases reporting acute effects during study period Clinical effects were judged likely to have been associated with the use of sheep dip in cases 13, 14, 15, 19, 26. An association between clinical effects and exposure was judged unlikely in cases 3, 4, 7, 27, 28, 39, 42, 43, and 49. Follow up revealed that in case 2 clinical effects were related, not to exposure to sheep dip, but to a subdural haematoma.

Cases reporting acute effects from exposures before the study period An association between clinical effects and exposure to sheep dip was judged likely in cases 25, 32, 36, 48 and 51, possible in case 47, and unlikely in cases 5, 16, and 30.

Cases reporting chronic effects An association between clinical effects and exposure to sheep dip was judged likely in case 18, possible in case 50, unlikely in case 17 and impossible to assess because of lack of information in case 33, 40, and 45.

In total, therefore, exposure to sheep dip was thought to be likely to be related to clinical effects in 11 cases, possibly related in 2 cases, unlikely to be related in 13 cases, and unrelated in one case. In three cases the relationship was impossible to assess because of insufficient data.

References

Ellman GL, Courtney D, Andres V, Featherstone RM. (1961) A new and rapid colorimetric determination of acetylcholinesterase activity. Biochem Pharmacol 7:88-95.

Table 1. Age and sex of patients reporting exposure to sheep dip

Age	Female	Male	Total
10-19	3	2	5
20-29	-	2	2
30-39	5	8	13
40-49	2	6	8
50-59	2	8	10
60-69	-	1	1
70-79	-	1	1
not known	1	1	1
Total	13	29	42

Table 2 Geographical distribution of patients reporting exposure to sheep dip

Region	No.of cases	Counties included
England		
South-east	5	(Surrey, Kent, Hampshire)
South-west	6	(Cornwall, Devon,Somerset)
Midlands	5	(Cheshire, Derbyshire, Herefordshire)
North	7*	(Durham, Lancashire)
Wales	7	(Brecon, Glamorgan, Powys, Dyfed)
Scotland	8**	(Isle of Lewis)
Northern Ireland	1	(Co Tyrone)

* 4 cases from the North of England were from 1 incident

** 8 cases from Lewis were all from one farm

Table 3. Circumstances of exposure to sheep dip

Circumstances	No. of cases	%
dipping sheep or in close contact with dipped sheep (includes 2 people who fell into a dip)	21	48
using and/or drinking contaminated water supply	4	10
clearing up a spill	1	2
washing contaminated clothes	1	2
not known	15	38
Total	42	100

Table 4 Route of exposure to sheep dip

route of exposure	cases n (%)
skin	25 (60)
inhalation	16 (38)
oral	6 (14)
eye	5 (12)
unknown	16 (38)
Total	42 (100)

NB: some patients reported exposure by more than one route

Table 5. Date of latest exposure and frequency of acute and chronic effects

	Number of cases and type of clinical effects reported				
date of latest exposure	acute effects with or without chronic effects	chronic effects only	no clinical effects	clinical state not known	total number of cases
1.9.92-31.12.92	15	-	10	-	25
1.1.92-31.8.92	4	1	-	-	5
before 1992	3	1	-	1	5
date unknown	2	4	-	1	7
total	24	6	10	2	42

Table 6 Frequency of clinical effects

Clinical effects	number of times reported as an acute effect	number of times reported as a chronic effect	total number of times reported
increased sweating/hot flushes	14	3	17
headache	11	5	16
nausea	9	5	14
dizziness	8	5	13
anxiety / irritability	6	7	13
blurred vision	7	3	10
abdominal pain	7	3	10
fatigue/tiredness/lethargy	3	6	9
poor short-term memory	5	4	9
dyspnoea/ tightness of chest	5	3	8
numbness and tingling/paraesthesia	3	5	8
coughing	5	2	7
diarrhoea	4	3	7
depression	1	6	7
back pain/joint pain	2	5	7
anorexia / loss of appetite	4	2	6
fever	5	1	6
increased salivation	4	1	5
tremor	2	3	5
ataxia	4	-	4
muscle ache	2	1	3
vomiting	3	-	3

Clinical effects	number of times reported as an acute effect	number of times reported as a chronic effect	total number of times reported
muscle stiffness	1	1	2
short of breath/asthma	-	2	2
sore throat	2	-	2
flu	2	-	2
insomnia	-	2	2
twitch	1	-	1
bradycardia	-	1	1
atrial fibrillation	-	1	1
lightheadedness	1	-	1
heightened vision	1	-	1
mental breakdown	-	1	1
total symptomatic patients	23	19	30

Cases reporting acute effects from exposures occurring between 01.09.92 - 31.12.92										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	**Assessment**
2	M 70	Farmer	9-10.9.92: dipping for 2 days. Dip on skin and inhaled.	propetamphos	?	Acute: blurred vision, dizziness, ataxia, memory loss, headache, bradycardia. PMH: 1982, brucellosis. OUTCOME. Subdural haematoma			14.9.92 RBC 22.60 Plasma 5.90	Not related
3	F adult	Housewife (married to Case 4).	many exposures over several years. latest: 11.9.92 Dip on skin and inhaled	diazinon	?	acute: sweating, dyspnoea, headache, back-ache. Chronic: anxiety, depression	? ?	? many years	14.9.92 RBC 21.80 Plasma 3.60	Unlikely
4	M 40	Farmer (husband of Case 3)	many exposures over several years. latest: 11.9.92 Dip on skin and inhaled	diazinon	?	Acute: sweating, anxiety, headache, muscle aches, fatigue, twitch. Chronic: anxiety and depression	? ?	? many years	14.9.92 RBC 20.00 Plasma 5.40	Unlikely

Cases reporting acute effects from exposures occurring between 01.09.92 - 31.12.92										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	**Assessment**
7	M 55	Related to Cases 5,6,8,9,10)	1988: fell in dip; wore dirty clothes for 2 hours. Dips twice a year. Latest Sept 92? Dip on skin & in eyes.	propetamphos	coat, leggings, boots	Acute and chronic: sweating, salivation, numbness, blurred vision, dizziness.	1-2 weeks	2-3 months	21.9.92 RBC 21.10 Plasma 4.73	Unlikely
13	M 54	Farmer	Dipped for 40 years. 1991: dipped 5 days a month for 4 months. Latest: 20-21.9.92 at a sheep sale. Dip on skin and inhaled.	diazinon propetamphos	bib apron, coat, leggings, boots, gloves when dipping	Acute: flu-like, sore throat, headache chronic (since 1991 exposure): nausea, diarrhoea, dizziness, fever, headache, cough, dyspnoea, anxiety, memory loss, tired and listless, shoulder pain.	at once	?	undated RBC 22.70 Plasma 4.60	Likely
14	M 34	Farm-worker	23.9.92 dipped for 5 days. Dip on skin and inhaled.	diazinon propetamphos	leggings, boots	Acute: nausea, sweating, flu.	same evening	1 week	25.9.92 RBC 17.90 Plasma 4.40	Likely

Cases reporting acute effects from exposures occurring between 01.09.92 - 31.12.92										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	**Assessment**
15	M 48	Farmer	Dipped for 20 years. Oct 1992: 2 days. Dip on skin, inhaled, in mouth and eyes.	propetamphos	gloves, coat, leggings, boots	Acute: (related to 92 exposure): nausea, abdominal pain, diarrhoea, anorexia, sweating, salivation, numbness, blurred vision, cough, dyspnoea, ataxia, anxiety. Chronic: paraesthesia, gastrointestinal upset, headache, weakness.	within 1 hour	2 weeks	30.9.92 RBC 22.80 Plasma 2.20	Likely
19 and 26	M 35 M 33	Farmers brothers	29.9.92:4-6 hours dipping and handling wet sheep. Dip on skin	diazinon	trousers; gloves for some of the time.	Acute: nausea, abdominal pain, sweating, salivation, fever, cough, headache.	4-6 hours	4-5 days	2.10.92 case 19: RBC 20.60 Plasma 4.75 case 26: RBC 20.80 Plasma 3.84	Likely
27	M 19	paramedic	29.10.92,helping friend with dipping, and fell in. Dip on skin and in mouth.	?	none	Acute: sore throat				Unlikely
28	M 48	Farmer and office worker	Oct 92: dip on skin.	?	none	Acute: abdominal pain, lethargy, lightheaded	few days?			Unlikely

Cases reporting acute effects from exposures occurring between 01.09.92 - 31.12.92										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	**Assessment**
39	M 32		10.11.92 Cleared a spill. Inhaled dip.	propetamphos		Acute: nausea, abdominal pain, dizziness, headache	3 hours		10.11.92 RBC 18.60 Plasma 5.20	Unlikely
42	M 55	Farmer, related to cases 49 & 43	Aug-Sept 92	propetamphos diazinon	boots, gloves, coat	Acute: stomach upset Chronic: abdominal pain, now depressed, suicidal tendencies	1-2 days	months	2.12.92 RBC 19.30 Plasma 5.00	Unlikely
43	M 25	Farmer (related to cases 42 & 49)	Aug-Sept 92	propetamphos diazinon	boots, gloves, coat	Acute: depression, increased appetite, weight loss. Chronic: depression, "split personality".	1-2 days	months	2.12.92 RBC 20.20 Plasma 5.70	Unlikely
49	F 54	housewife (related to cases 42 & 43)	Aug-Sept 92	propetamphos diazinon	boots, gloves, coat	Acute: mental breakdown, screaming, rigid limbs, glassy eye, crying. Chronic: as above?	1-2 dys	months	2.12.92 RBC 23.10 Plasma 5.50	Unlikely

Cases reported between 01.09.92-31.12.92 with acute effects from exposures occuring before 01.09.92										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	**Assessment**
25	M 26	Farmer	11.6.92 4-6 hour dipping. Previous exposure likely. Dip on skin and inhaled.	propetamphos	gloves, coat, leggings	Acute: nausea, vomiting, sweating, headache, tiredness, muscle stiffness. Past medical history: 1986: glandular fever. 1991: depression.	2 days	6-8 weeks		likely
5	M 13	Schoolboy. related to cases 6,7 8,9,10;on same farm as cases 7,11,12	Helping with dip over several months. Latest: June 92. Dip on skin, inhaled, in eyes.	propetamphos	coat, leggings, boots	Acute: anorexia, sweating, numbness, blurred vision, dizziness, ataxia, anxiety.	1 month	5 months	21.9.92 RBC 18.14 Plasma 3.87	unlikely
16	F 33	Farmer's wife	Dipping Oct 91 & June 92. Dip on skin, inhaled, in eyes	propetamphos	coat, leggings, boots	Acute: numbness, dizziness, anxiety, memory loss. Chronic: numbness, aching limbs, neurological disorder	days	months		unlikely
30	M 64	business-man	helped brother (a farmer) shearing and handling sheep.	?	?	Acute: abdominal pain, flushing, increased sweating, blurred vision, dizziness. Chronic memory loss.		1-2 years	16.11.92 RBC 23.60	unlikely

Cases reported between 01.09.92-31.12.92 with acute effects from exposures occuring before 01.09.92										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	**Assessment**
32	M 51	Farmer	1985-91 dipped for several days at a time, once per year. Sept 1991: fell in, washed & changed clothes within minutes. · Dip on skin.	chlorfenvin-phos and diazinon	leggings, boots	Acute (1991): muscle stiffness, headaches, nausea. Chronic: tiredness, dizziness, nausea, headache, muscle stiffness. Back pain since 1984, depression since 1958.	24 hours		16.12.92 RBC 16.00 Plasma 5.10	likely
36	M 37	Farmer	May-July 92, 3hours/day for 2 days. Possible previous exposures. Dip on skin, inhaled, & swallowed some when splashed	propetamphos	gloves, leggings, boots	Acute: nausea, anorexia, sweating, salivation, numbness, blurred vision, dizziness, dyspnoea, anxiety, memory loss, tremors, headache. Chronic: anxiety, tremors.				likely
47	M 38	Farmer	1970-1990. Still in contact with dipped sheep. Dip inhaled, on skin, in eyes.	diazinon	?	Acute and chronic: back pain, joint pain, depression		18 months	20.7.93 RBC 22.8 Plasma 7.5	possible
48	F 52	Farmer	handling sheep. dip on skin & inhaled. Date unknown.	diazinon	coat, leggings, boots	Acute: flu, memory loss, irritability, diarrhoea, sweating, pyrexia, aching muscles.		days	20.1.93 RBC 18.00 Plasma 3.80	likely

Cases reported between 01.09.92-31.12.92 with acute effects from exposures occuring before 01.09.92										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	**Assessment**
51	F 41	Farmer	dipping and excessive handling. 1986-90: 1 or 2 days a year separated by 8 weeks. Dip on skin & inhaled.	propetamphos diazinon	gloves, coat, leggings, boots	Acute: tiredness, aching, headache, depression, weakness, sore throat, fever, nausea, vomiting, diarrhoea. Chronic: tiredness, pain in limbs.	1-18 days	weeks 3 years	28.1.93 RBC 23.5 Plasma 3.8	likely

Cases reported between 01.09.92-31.12.92, clinical effects absent or unknown										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	
1	F 38	Farmer's wife	16.8.90: drove van for 1 week after dip spilt inside. Dip on skin & inhaled.	diazinon	?				8.10.92 RBC 23.00 Plasma 3.69	
6	F 36	Housewife related to cases 5,7, 8,9,10,	possibly none	propetamphos		None			21.9.92 RBC 21.38 Plasma 4.02	
8	F 12	related to cases 5,6,7,9, 10	? none	propetamphos		None			21.9.92 RBC 20.40 Plasma 6.03	
9	F 12	related to cases 5,6,7,8,10	? none	propetamphos		None			21.9.92 RBC 20.50 Plasma 3.91	
10	M 44	Farmer, related to cases 5,6,7,8,9; works with 11,12	no details given. Latest dip Sept 92?	propetamphos		None			21.9.92 RBC 22.61 Plasma 4.03	

Cases reported between 01.09.92-31.12.92, exposed before 01.09.92, but still experiencing chronic effects										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	**Assess-ment**
17	F 42	Auctioneer's wife	1992 for several months: washed husband's contaminated clothes. Date of last exposure uncertain. Dip on skin & inhaled.	?	not relevant	Chronic: nausea, diarrhoea, anorexia, sweating, blurred vision, dizziness, cough, dyspnea, anxiety, tremors.		weeks	28.9.92 RBC 22.50 24.11.92 RBC 26.00 Plasma 4.50	unlikely
18	M adult	Contract dipper	1991 & 92: dipping for 6 weeks	?		Chronic: dyspnoea, asthma, headaches, insomnia, cumulative ill health.				likely
33	M 33	Farmer	1988-1992	diazinon	?	Chronic: tiredness, atrial fibrillation. No sign of heart disease, or adrenal abnormality.	few weeks	5 years		not enough data
40	M 47	Farmer	Jul 91, Oct 91, Jun 92. 4 days per year. Putting in and penning up.	propetamphos	coat, leggings, boots	Chronic: tiredness, short of breath. Dilated cardiomyopathy.			24.11.92 RBC 32.00 Plasma 4.90	not enough data
45	M 56	Joiner, farmer till 1990	2 dips a year for 13 years till 1990	?	?	Chronic: peripheral neuropathy, skin paraesthesia, pains in shins	4-5 years	>2 years	20.1.93 RBC 18.00 Plasma 4.80	not enouth data

Cases reported between 01.09.92-31.12.92, exposed before 01.09.92, but still experiencing chronic effects										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	**Assess-ment**
50	M 30	Farmer	2 dips each summer. Date of last exposure not known.	propetamphos	coat, leggings, boots	Chronic: nausea, anorexia, sweating, parasthesia, blurred vision, dizziness, anxiety, headache, insomnia, tremors, short-term memory loss, tiredness, depression.	6 months	>7 months	Dec 1992 RBC 18.3 Plasma 5.8	possible

Cases reported between 01.09.92-31.12.92, clinical effects absent or unknown										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	
11	M 52	Farmer, works with cases 7,10,12,	no details given Latest dip Sept 92?	propetamphos		None			21.9.92 RBC 21.65 Plasma 6.91	
12	M 56	Farmer works with cases 7,10,11	no details given Latest dip Sept 92?	propetamphos		None			21.9.92 RBC 18.66 Plasma 4.87	
21, 22, 24	F 38 F 15 M 40		Sept 92 for ?10 days, using & drinking contaminated water.	chlorfenvin-phos	not relevant	None			Case 21. 7.10.92 RBC 17.90 Plasma 4.20 Case 22 24.9.92 RBC 13.90 Plasma 4.56 Case 24 24.9.92 RBC 16.00 Plasma 5.83	
23	F 31		Sept 92 for ?10 days, using but not drinking contaminated water.	chlorfenvin-phos	not relevant	None			6.10.92 RBC 18.30 Plasma 4.57	

Cases reported between 01.09.92-31.12.92, clinical effects absent or unknown										
Case	**Age sex**	**Occupation**	**History of exposure**	**Dip**	**Protect-ive clothes**	**Clinical effects**	**Time exposure to effect**	**Time effects lasted**	**Cholinester-ase activity (ku/l)**	
34	M 56	Farmer	7 days dipping	?	?	?			19.1.93 RBC 18.30 Plasma 5.50	