# WELSH SHEEP DIP MONITORING PROGRAMME

## 1999

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April 2000

# memo

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Ein Cyf/Our ref

Oddi wrth/From Wendy Merrett

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Estyniad/Ext. Number2186

Dyddiad/Date 13 April 2000

**1999 WELSH SHEEP DIP MONITORING REPORT**

Attached is the Final Report for the 1999 Welsh Sheep Dip Monitoring programme.

The report shows that there has been a successful change in practices by most farmers in the last year, resulting in reduced environmental impacts. Thanks are due to all the EP and EAT staff who have contributed to this project over the last two years to bring about this change. Some limited action is still required in problem catchments, and to monitor the impacts of the recent ban on OP dips in 2000.

The findings will be reported to EPAC on 19th April 2000, and the report will then be available to the public on request. Area Customer Contact sections will have copies available for circulation to the public, and a summary will be placed on the web site.

~~If you have any queries with the report please contact me~~
Thanks once again to all those involved in this issue - well done!

regards

Wendy

**WENDY MERRETT**
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# EXECUTIVE SUMMARY

## Introduction

Sheep are prone to infestation by a number of ectoparasites and there is a need for effective treatment systems for economic, cosmetic and sheep welfare grounds. Treatment may take the form of full immersion by dipping, or the use of jetters and showers, to apply the dipping solution. Other alternatives include the use of pour-ons which are applied to a restricted area of the fleece or injectables. Two groups of pesticides were licensed for use during 1999: organophosphates (OPs) and synthetic pyrethroids (SPs). On December 20th 1999, the Government announced an immediate suspension of licences for OP dip compounds in response to concerns regarding potential health risks associated with spillages of concentrate from packaging.

Since 1995 there has been an increasing awareness of the environmental problems associated with the use of synthetic pyrethroid based sheep dips. Given the importance and prevalence of sheep farming within Environment Agency Wales and the Midland Region of the Environment Agency, monitoring and pollution prevention visits have been carried out since 1997.

Surveys in 1997 and 1998 showed that up to 75% of sites monitored had positive results for sheep dip and levels were environmentally significant (exceeding EQS) at 29% of sites in 1998.

Pollution prevention visits in 1998 indicated that although awareness of the risks associated with sheep dipping was increasing amongst farmers, practices had not changed sufficiently to allay concerns. Usage as indicated by farmers suggested a downward trend in the use of OP dips, and an upward trend in the use of SP dips. An increase in the number of incidents and greater impacts were also found. Biological surveys suggested that up to 1200km (9%) of rivers and streams could be affected by sheep dip in 1998.

Sewage Treatment Works receiving effluents from livestock markets and fell mongers were identified as potential point sources of sheep dip pesticides that also needed to be minimised.

In 1999, these monitoring programmes were continued with the following aims:

1) To establish whether the increase in farmer awareness in 1998 was continued in 1999 with improvements in practices;
2) To determine whether any change in practices resulted in less environmental impact;
3) To investigate what impact the introduction of the Groundwater Regulations in April 1999 had had;
4) To further investigate the occurrence of sheep dip in Sewage Treatment Works effluent and to establish if this was leading to environmental impacts which should be targeted by consent review.

## Methods

Catchments from within the intensive sheep rearing areas of upland Wales were selected for inclusion in the monitoring programme. Many of these were those where monitoring in 1998 had indicated that there may be environmental problems associated with sheep dip.

A network of 89 water quality sampling points was identified. Monthly water column samples were collected from this sampling network from June to November and analysed for pesticides used as active ingredients in sheep dip formulations. Twenty-two sites used to monitor upstream of sewage treatment works, and therefore unaffected by discharges from the works, were also included, to give 111 sites in total.

Biological surveys were undertaken in 42 sub-catchments in July/August and October/November. Many of these were resurveys of sites assessed in 1998.

A programme of targeted pollution prevention visits at 164 farms was also carried out in selected catchments. This was complimented by talks to farmers groups, attendance at agricultural shows, press releases and articles, and the distribution of guidance notes.

Final effluent monitoring was carried out at twenty-eight Sewage Treatment Works that were known to receive drainage effluents from sheep markets or fell mongers. Three control, works were also monitored. Monitoring upstream and downstream of the discharges was carried out at twenty-five of these. This programme will continue until July 2000.

## Stream chemistry

The presence of sheep dip pesticides was found to be widespread, with 67% of 111 river sites monitored giving positive (above detection level) results. Overall 57% of the 111 sites recorded positive results for the organophosphate (OP) dip diazinon, and 20% for the OP dip propetamphos. Synthetic pyrethroid (SP) dips were also found at 8% of sites for cypermethrin and 6% for flumethrin. For 1998, the incidence of positive records for OPs was 52% for diazinon and 34% for propetamphos respectively, while that for SP cypermethrin was 33%, and for 6% flumethrin.

Sixteen sites (14%) of the 111 monitored failed the Maximum Allowable Concentration (MAC) Environmental Quality Standards (EQS) for one or more sheep dip pesticides. Eight sites (7%) failed the MAC EQS for one or more of the OPs and eight (7%) failed the EQS MAC for cypermethrin. In 1998, 29% sites failed the MAC for one or more sheep dip pesticides, 12% for OPs and 20% for cypermethrin.

## Stream biology

Biological surveys were carried out in 42 sub-catchments in upland areas, with a total of 827 km covered between a network of 430 sites. The results showed that at least 66km (8%) were known or suspected of being affected by sheep dip. In addition a further 6% showed signs of biological impacts from other sources, and in another 7% the exact cause could not be determined.

In 1998, 1432 km were surveyed, and 9% was known or suspected of being impacted by sheep dip, and a further 11% due to other cause or unknown. In 1999, much of the survey work was narrowly targeted at catchments with ongoing problems related to sheep dip, or following the recording of positive results from chemical monitoring. This may be why the improvements noted above in terms of a reduction of positive results recorded from water quality monitoring have not been reflected as a reduction in biological impacts, since surveys would only be targeted in areas with poor chemical results.

Resurveys, at sites which suffered sheep dip pollution in 1998, showed that in the majority of cases recovery of the invertebrate fauna was good. Where recovery had not occurred, this was attributed to further incidents of sheep dip pollution within the catchment, or possibly longer term impacts associated with disposal of used dip to inappropriate land or soakaway, or chemicals being bound to silt in small streams and ditches. This was comparable to the results of resurveys in 1998.

## Pollution prevention activities and farm visit programme

Two hundred and eight-four properties were visited as part of the 1999 pollution prevention campaign. Of these, 164 were occupied by sheep farmers using some form of treatment, such as dipping or injection, and were inspected accordingly.

Organophosphate (OP) dips were used by 16 % of farms inspected. Synthetic pyrethroid (SP) dips were used by just 8%. This shows a major decline in percentages using these forms of treatment from 1998, when almost half (44%) used organophosphate dips, and nearly a quarter (24%) used SP dips.

The use of jetters or showers had increased from 6% to 10%, and injections and pour-ons were used at 36% of farms compared to 9% in 1998. These types of treatment give rise to minimal amounts or no residual dip for disposal if managed well. This has resulted in just over half (64%) of sites inspected no longer disposing of dip. The Groundwater Regulations are also likely to have had an influence on this. Fewer farmers disposed of their dip through landspreading, including mixed with slurry or water, (25% in 1999, compared to 79% in 1998), and off site disposal has increased from 1% to 10%. Only one site (<1%) was found to dispose of dip to soakaway (reduced from 19%).

Awareness amongst farmers on the risks of sheep dipping, and particularly the need for safe disposal was high. Considerably fewer sites overall were found to be of high risk compared to 1998 (3% cf 16% in 1998 and 26% in 1997) and well over three quarters (84%) were considered to be low risk. However, the need to keep freshly dipped sheep away from watercourses was not always recognised, and in a few cases poor practice was still apparent.

## Sewage Treatment Works monitoring

Twenty-two out of twenty-eight works recorded positive results for sheep dip chemicals in the effluent, and at 14 of these levels exceeded the MAC EQS. No MAC EQS failures were recorded in associated downstream samples. The monitoring will continue so that a full assessment can be made on 12 months data, when firm conclusions and recommendations will be made.

## Pollution Incidents

Only three substantiated and two suspected pollution incidents were recorded in 1999. Those that were confirmed were due to SP dips. Three were highlighted during biological surveys, and the remainder was reported to the Agency. In 1998, 17 incidents were recorded, eleven of which were due to SP dips. Sixteen of these were identified during biological surveys.

## Overview

The results of the survey are remarkable. There is a considerable reduction in high risk dipping practices, and contamination of watercourses with sheep dip chemicals. This is believed to be due to the success of awareness and pollution prevention campaigns by the Agency over the last three years, and the introduction of the Groundwater Regulations in April 1999. Fewer farmers are dipping sheep, with a downward trend particularly in the use of SP dips. Other forms of treatment, (injections and pour-ons), which pose less risk to the aquatic environment, are being used. More mobile operators are also being employed, and many of these have co-operated fully when they have been contacted by the Agency to discuss their dipping operations and to provide pollution prevention advice.

The number of substantiated pollution incidents due to sheep dip has also fallen. However, the percentage of watercourse surveyed suffering biological deterioration due to sheep dips has remained similar to 1998 levels. Although fewer biological surveys were undertaken, due to fewer positive results being detected in chemical monitoring, those that were carried out were still targeted at sites previously impacted or related to high chemical results in 1999.

Monitoring at sewage treatment works has shown, in the interim, that these could be a source of sheep dip chemicals. However, the environmental significance of this will not be fully assessed until the monitoring is complete in summer 2000.

It is important that this substantial progress is maintained in 2000 and beyond. A critical issue is the recent suspension of OP dips for approved use. This could lead once again to greater use of SP dips, and increased risks to the environment. It is therefore crucial that farmers continue to be vigilant in following pollution prevention guidelines throughout the whole treatment activity and comply with the Groundwater Regulations.

## Recommendations

1) The success of the pollution prevention campaigns reported here should be publicised to acknowledge the increased awareness of farmers and the environmental benefits.

2) The current ban on OPs may lead farmers to increase usage of SPs, with potentially greater environmental impacts. Therefore some river monitoring must be continued.

3) It is therefore recommended that background water quality monitoring is continued at key sites as part of the regional pesticide monitoring programme, and at additional selected sites for June - November to cover the peak dipping period.

4) In those catchments identified as having ongoing problems, pollution prevention and Groundwater Regulation enforcement activities should be continued in a prioritised way in each area.

5) Opportunities to work with other organisations should be continued.

6) Outputs arising from the National Sheep Dip strategy implementation, including the R&D on flock management, should be promoted as and when available.

# 1.0 INTRODUCTION

Sheep are prone to infestation by a number of ectoparasites and are dipped for economic, cosmetic and welfare reasons. Sheep Scab, caused by the ectoparasites *Psoroptes ovis* or *Sarcoptes scabiei*, is perhaps the most serious condition which can cause discomfort and even death. There is therefore a need for effective treatment systems on sheep welfare grounds. Treatment may take the form of full immersion by dipping, or the use of jetters and showers, to apply the dipping solution. Other alternatives include the use of pour-ons which are applied to a restricted area of the fleece or injectables.

During 1999, two groups of chemicals were licensed for sheep dipping: organophosphates (OPs), which have the active ingredients diazinon or propetamphos, and the newer synthetic pyrethroids (SPs) such as flumethrin and cypermethrin. The latter were introduced in the early 1990s, partly because of concern over the potential effects of organophosphates on the health of farmers undertaking the dipping process. Although SPs were deemed to be less damaging to human health than OP dips, they are around 100 times more toxic to some aquatic species. On December 20th 1999, the Government announced an immediate withdrawal of licences for OP dip compounds in response to concerns regarding potential health risks associated with spillages of concentrate from packaging.

Since 1995 there has been an increasing awareness of the environmental problems associated with the use of synthetic pyrethroid based sheep dips. Given the importance and prevalence of sheep farming within Environment Agency Wales and the Midland Region of the Environment Agency, monitoring and pollution prevention visits have been carried out since 1997.

The initial survey in 1997 confirmed the occurrence of sheep dip compounds at 49% of surface water sites sampled in high risk areas in Wales at levels exceeding environmental quality standards (EQSs). Biological impacts were also recorded, at 5% of river length surveyed and farm inspections revealed that dipping activities posed a high risk of pollution in 26% of cases.

The monitoring programme for 1998 was set up to establish whether the results of the 1997 survey were representative of a larger proportion of Wales and to target pollution prevention activities. Overall the results of the 1998 survey confirmed that pollution by sheep dip pesticides was widespread in upland Wales. Positive results for sheep dip chemicals were recorded at 75% of sites, and levels were environmentally significant (exceeding EQS) at 29% of sites. Biological surveys suggested that up to 1200km (9%) could be affected by sheep dip.

Pollution prevention visits in 1998 indicated that although awareness of the risks associated with sheep dipping was increasing amongst farmers, practices had not changed sufficiently to allay concerns. Usage as indicated by farmers suggested a downward trend in the use of OP dips, and an upward trend in the use of SP dips. An increase in the number of incidents and greater biological impacts were also found.

Sewage Treatment Works receiving effluents from livestock markets and fell mongers were identified as potential point sources of sheep dip pesticides that also needed to be minimised.

In 1999, these monitoring programmes were continued with the following aims:

1) To establish whether the increase in farmer awareness in 1998 was continued in 1999 with improvements in practices;
2) To determine whether any change in practices resulted in less environmental impact
3) To investigate what impact the introduction of the Groundwater Regulations in April 1999 had had;
4) To further investigate the occurrence of sheep dip in Sewage Treatment Works effluent and to establish if this was leading to environmental impacts which should be targeted by consent review.

This report summarises the monitoring and pollution prevention inspection programmes carried out in each area of Wales, including Upper Severn area of Midland Region. Further details for individual catchments can be obtained via the respective area customer contact teams.

In 1998, what was then the Welsh Office led a project to investigate contamination of Private Drinking Water supplies by sheep dip chemicals. This was reported in December 1999, and copies of the report are available from the National Assembly for Wales Office, Environment Division, Cathays Park, Cardiff.

# 2.0 SURVEY METHODOLOGY

## 2.1 Location

As in previous years, sub-catchments were selected within upland areas of Wales categorised as high risk due to sheep densities and geographical characteristics. Many of the catchments selected were those where monitoring in 1998 had indicated that there may be environmental problems associated with sheep dip.

## 2.2 Stream Chemistry

A network of 89 water quality sampling points was identified at routine General Quality Assessment (GQA) sampling points (Fig 1). In addition, 22 sites, located upstream of sewage treatment works, and therefore unaffected by the works, as described in section 2.5 below, were included in this network. Monthly water column samples were collected from these points from June/July to November. These were analysed for the organophosphate pesticides diazinon, propetamphos and chlorfenvinphos, and the synthetic pyrethroids cypermethrin and flumethrin. Chlorfenvinphos, which is no longer authorised as a sheep dip was included due to the possibility of farmers using old stocks. The limit of detection (LOD) for organophosphate pesticides was 5ng/l, and for synthetic pyrethroids the LOD was 1ng /l.

The maximum value for each determinand recorded at each site was assessed against the maximum allowable concentration (MAC) Environmental Quality Standard (EQS) for each pesticide (Table 2.1). It should be noted that these figures have recently been reviewed. The MAC EQS should not be exceeded at any time. Annual Average EQS failures were not calculated as the sampling period and frequencies did not allow 12 samples to be taken over a 12 month period.

**Table 2.1 Annual Average (AA) and Maximum Allowable Concentration (MAC) Environmental Quality Standards (EQS) for sheep dip pesticides.**

| Pesticide | Annual average EQS in ng/l | Maximum Allowable Concentration EQS in ng/l |
|---|---|---|
| Diazinon (OP) | 30 | 100 |
| Propetamphos (OP) | 30 | 100 |
| Chlorfenvinphos (OP) | 30 | 100 |
| Total OPs | 30 | 100 |
| Cypermethrin (SP) | 0.1 | 1 |
| Flumethrin (SP) | No agreed standard | No agreed standard |

## 2.3 Stream biology

Biological surveys were undertaken in 42 sub-catchments at 430 sites, representing a total length of 827 km of river. The majority of surveys were targeted using positive results recorded from chemical monitoring in 1999, or where impacts had been recorded in previous years.

The biological surveys consisted of one-minute kick samples amongst stream gravels at key locations, followed by bank-side assessment for invertebrate composition. Each site was given a score according to the standard Biological Monitoring Working Party (BMWP) methodology. The biological quality at each site was assigned a category using the methodology reported previously (EAW 1998), and the river length affected or suspected as being impacted by sheep dip recorded.

Some of the sites which had suffered severe biological impacts, due to sheep dip pollution, in 1998 were reassessed to establish if the fauna had recovered, and whether there was any indication of long term impacts.

## 2.4 Pollution prevention activities and farm visit programme

A programme of targeted farm visits was undertaken within a total of six sub-catchments. Two hundred and eighty-four properties were visited in total. At 164 of these a full inspection was carried out and recorded when it had been established that the farmers employed some sort of treatment. A common site inspection form was used to record information such as the site location details, type of dip used, structure of dipping facility, disposal method for used dip and the overall risk to watercourses from the sheep dipping operation (Appendix I).

This programme was complimented by talks to farmer's groups and training boards, attendance at agricultural shows and markets, press releases and articles and the distribution of guidance notes. Mobile dip contractors were contacted and offered advice on minimising the risks of dipping.

In consultation with the Agency, additional farm visits were carried out by ADAS on behalf of the National Assembly for Wales Office in sheep rearing catchments.

## 2.5 Sewage Treatment Works monitoring

A total of twenty-eight Sewage Treatment works were selected for monitoring on the basis that the works received effluents from markets or fellmongers (Fig 2). Three 'control' works were also selected. With the exception of three works, and the controls, monitoring of the receiving water upstream and downstream of the effluent discharge was also carried out. Samples were taken on a monthly basis, and analysed for the determinands listed above (Table 2.1). The detection levels stated above could not always be achieved in the effluent samples due to interference from other substances.

Monitoring was planned at monthly intervals for a twelve month period from July 1999. Therefore at the time of compiling this report, this programme was incomplete and this should be viewed as an interim report.

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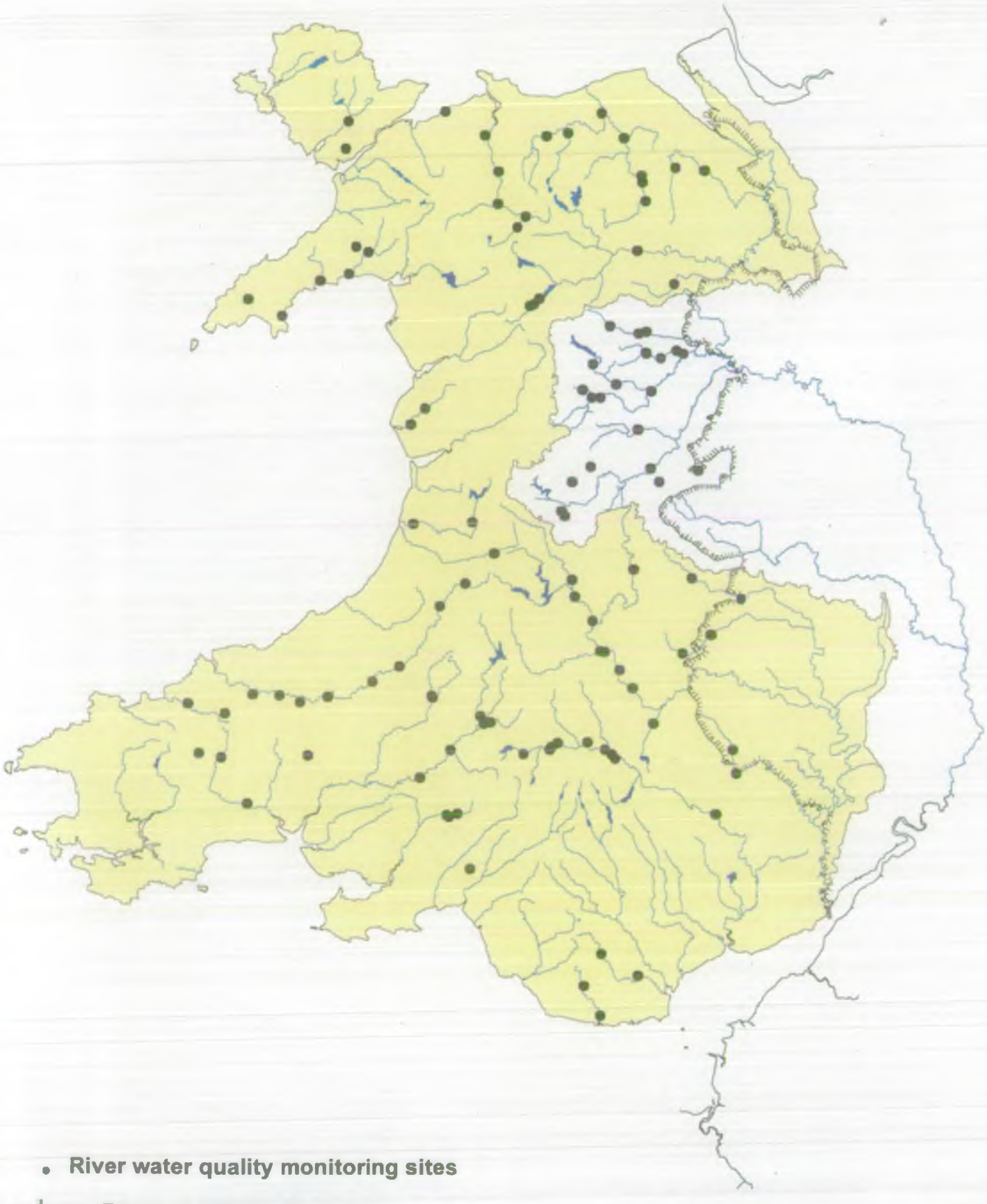
Environment Agency Wales

# Fig 1 Water quality monitoring network included in the 1999 sheep dip monitoring programme



• River water quality monitoring sites

England / Wales Boundary

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# Fig 2 Sewage Treatment Works monitoring included in the 1999 sheep dip monitoring programme

- Sewage treatment works final effluent monitoring site
- Control sewage treatment works final effluent monitoring site

England / Wales Boundary

# 3.0 RESULTS

## 3.1 Stream chemistry

### 3.1.1 Temporal nature of contamination

The proportion of samples with positive (above detection level) results by month is shown in figure 3.1, and table 3.1.1. Positive samples were recorded in all the months when sampling took place, with the greatest proportion in September. Diazinon was found most frequently, at between 9% to 25% samples in each month, and contributed the majority of positive results recorded in each month. Positive results for propetamphos were similarly found in each month, at between 2 - 6% of samples. Chlorfenvinphos was recorded on one occasion only, in July, and flumethrin recorded only in August. Cypermethrin was recorded in July, August September and November in between 1- 3% of samples per month.

### 3.1.2 Spatial nature of contamination

Sixty-seven percent of the sites monitored had positive results for one or more sheep dip pesticides (Table 3.1.2). Assessment of the distribution of positive results by area reveals that sites in all areas most frequently had positive results for diazinon compared to other chemicals. (Fig. 3.2) Overall 57% of 111 sites recorded positive results for diazinon, 20% propetamphos, 1% chlorvenfinphos, 8% cypermethrin and 6% flumethrin.

South West area had the highest proportion of sites positive for diazinon (72%) and cypermethrin (14%). Upper Severn area had the highest proportion of sites positive for propetamphos (28%), and the highest proportion of sites with positive results overall (76%). South East area had 75% of sites with positive results overall, and had the most for flumethrin (18%). Northern area was the only area with a record for chlorvenfinphos, and had the lowest number of sites with positive results overall (45%).

### 3.1.3 Assessment against EQS MAC limits

On average only six samples were taken at each site in the period June-December 1999. Therefore, as in previous surveys, assessment has been made against Maximum Allowable Concentration (MAC) Environmental Quality Standards (EQS) only.

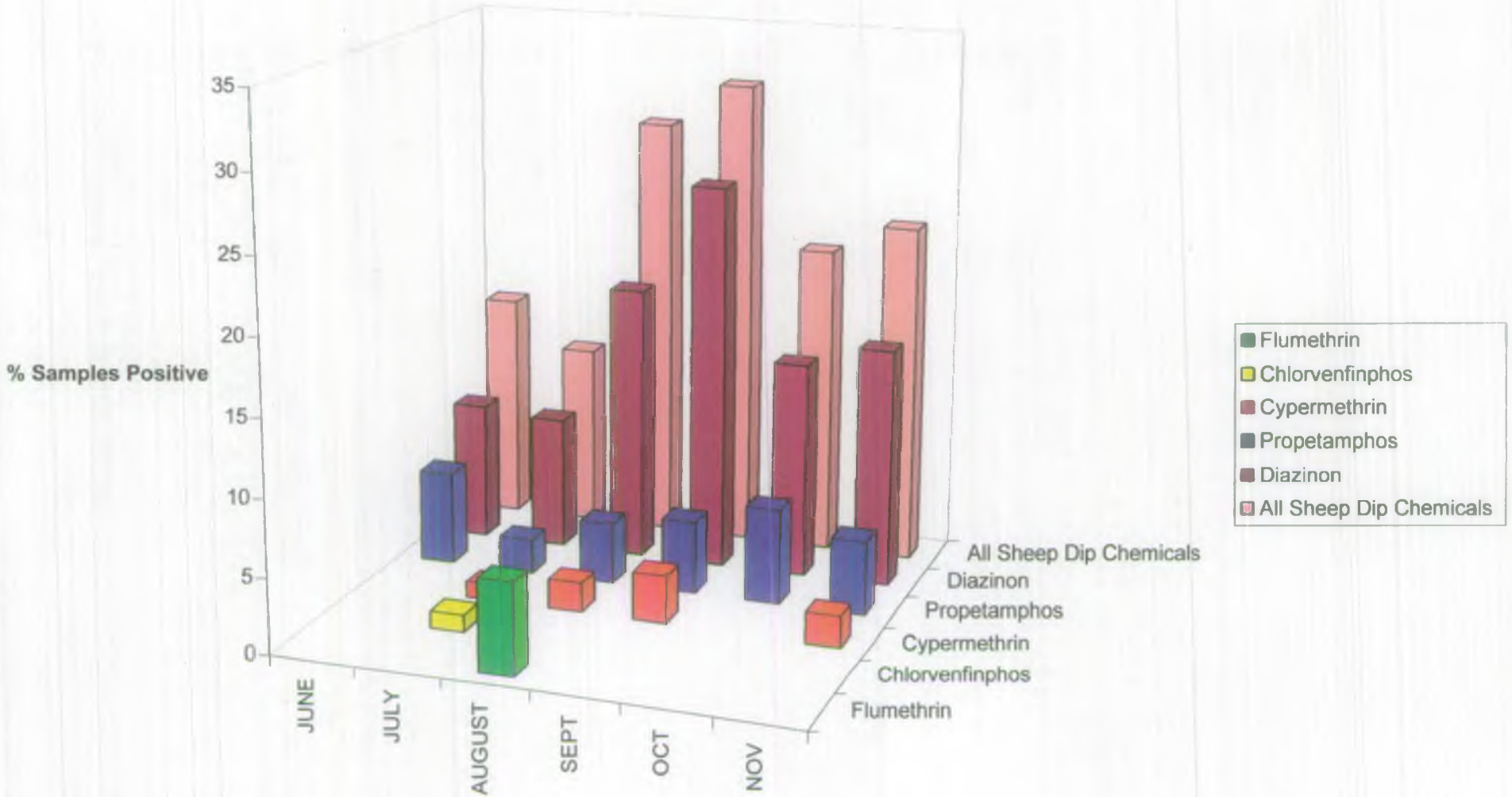
Sixteen sites (14%) of the 111 monitored failed the MAC EQS for one or more sheep dip pesticides. Eight of these (7%) failed the MAC EQS for one or more OPs, and eight (7%) were for cypermethrin.

In all cases of MAC failure except one, no immediate follow up action was taken by Environment Protection staff due to delays in data reporting and allocated resources being redirected to other activities. The exception was a failure for diazinon, reported on the Dwr Ial in North Wales, where an intensive monitoring campaign followed in October and November 1999. However, it was still not possible to locate the source of the pollution. Where biological surveys were carried out, these are reported in section 3.2

**Table 3.1.1 Number of samples with positive results, by month and area**
Including samples taken at sites upstream of STWs

| Month | Determinand | US | N | SW | SE | Total | % |
|---|---|---|---|---|---|---|---|
| **June** | Diazinon | 3 | | | | 3 | 9.1 |
| | Propetamphos | 2 | | | | 2 | 6.1 |
| | Chlorvenfinphos | | | | | 0 | 0 |
| | Cypermethrin | | | | | 0 | 0 |
| | Flumethrin | | | | | 0 | 0 |
| | Samples with one or more dets +ve | 5 | 0 | 0 | 0 | 5 | 15.1 |
| | Number of samples taken | 31 | 0 | 2 | 0 | 33 | |
| | | | | | | | |
| **July** | Diazinon | 4 | 1 | 1 | 2 | 8 | 8.7 |
| | Propetamphos | | | 1 | 1 | 2 | 2.2 |
| | Chlorvenfinphos | | 1 | | | 1 | 1.1 |
| | Cypermethrin | | | 1 | | 1 | 1.1 |
| | Flumethrin | | | | | 0 | 0 |
| | Samples with one or more dets +ve | 4 | 2 | 2 | 3 | 11 | 12.0 |
| | Number of samples taken | 23 | 31 | 14 | 24 | 92 | |
| | | | | | | | |
| **August** | Diazinon | 2 | 3 | 9 | 4 | 18 | 18.2 |
| | Propetamphos | 1 | | 1 | 2 | 4 | 4.0 |
| | Chlorvenfinphos | | | | | 0 | 0 |
| | Cypermethrin | 1 | | | 1 | 2 | 2.0 |
| | Flumethrin | | | 1 | 5 | 6 | 6.1 |
| | Samples with one or more dets +ve | 4 | 3 | 11 | 10 | 28 | 28.3 |
| | Number of samples taken | 17 | 25 | 29 | 28 | 99 | |
| | | | | | | | |
| **September** | Diazinon | 5 | 9 | 11 | 7 | 32 | 25.6 |
| | Propetamphos | 2 | 2 | 2 | | 6 | 4.8 |
| | Chlorvenfinphos | | | | | 0 | 0 |
| | Cypermethrin | 2 | 1 | 1 | | 4 | 3.2 |
| | Flumethrin | | | | | 0 | 0 |
| | Samples with one or more dets +ve | 9 | 11 | 12 | 7 | 39 | 31.2 |
| | Number of samples taken | 32 | 32 | 37 | 24 | 125 | |
| | | | | | | | |
| **October** | Diazinon | 1 | 5 | 6 | 6 | 18 | 14.2 |
| | Propetamphos | 3 | 1 | | 4 | 8 | 6.3 |
| | Chlorvenfinphos | | | | | 0 | 0 |
| | Cypermethrin | | | | | 0 | 0 |
| | Flumethrin | | | | | 0 | 0 |
| | Samples with one or more dets +ve | 4 | 6 | 6 | 10 | 26 | 20.5 |
| | Number of samples taken | 25 | 34 | 37 | 31 | 127 | |
| | | | | | | | |
| **November** | Diazinon | | 5 | 6 | 5 | 16 | 15.7 |
| | Propetamphos | 2 | 1 | | 2 | 5 | 4.9 |
| | Chlorvenfinphos | | | | | 0 | 0 |
| | Cypermethrin | | | 2 | | 2 | 2.0 |
| | Flumethrin | | | | | 0 | 0 |
| | Samples with one or more dets +ve | 2 | 6 | 8 | 7 | 23 | 22.5 |
| | Number of samples taken | 22 | 31 | 28 | 21 | 102 | |

**Fig 3.1 Samples recorded positive for Sheep Dip chemicals**



## Fig3.2 Detections of Sheep Dip Chemicals at River Monitoring Sites

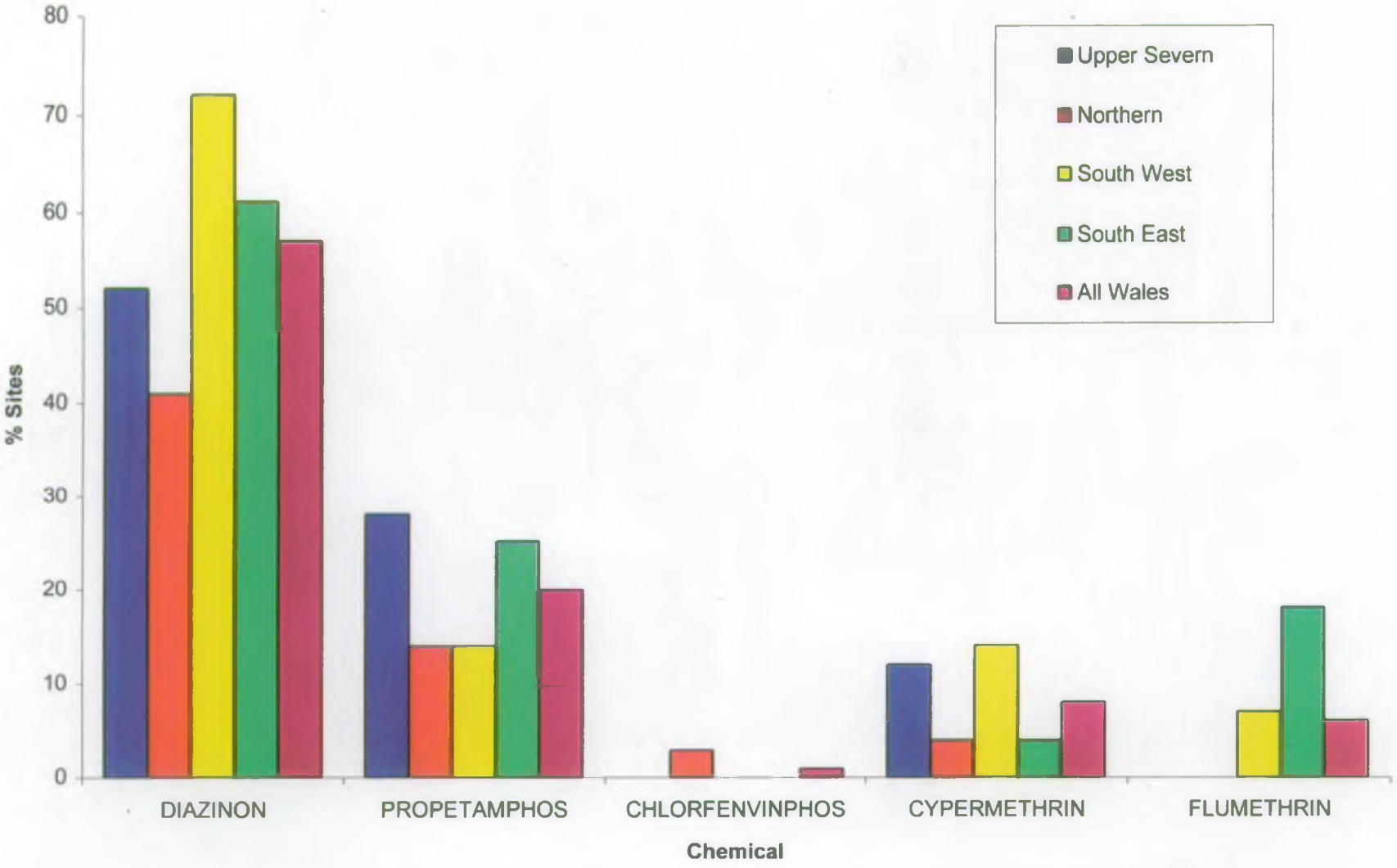


**Table 3.1.2 Number of sites where positive results were recorded in each area**

| Determinand | US | | N | | SW | | SE | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Diazinon | 13 | 52 | 12 | 41 | 21 | 72 | 17 | 61 | 63 | 57 |
| Propetamphos | 7 | 28 | 4 | 14 | 4 | 14 | 7 | 25 | 22 | 20 |
| Chlorfenvinphos | 0 | - | 1 | 3 | 0 | - | 0 | - | 1 | 1 |
| One or more OPs | 17 | 68 | 12 | 41 | 21 | 72 | 20 | 71 | 73 | 66 |
| Flumethrin | 0 | - | 0 | - | 2 | 7 | 5 | 18 | 7 | 6 |
| Cypermethrin | 3 | 12 | 1 | 3 | 4 | 14 | 1 | 4 | 9 | 8 |
| One or more SPs | 3 | 12 | 1 | 3 | 6 | 21 | 6 | 21 | 16 | 14 |
| One or more OPs and/ or SPs | 19 | 76 | 13 | 45 | 21 | 72 | 21 | 75 | 74 | 67 |
| Total number of sites sampled. | 25 | | 29 | | 29 | | 28 | | 111 | |

**Table 3.1.3 Number of sites exceeding EQS MAC in each area**

| Determinand | US | | N | | SW | | SE | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Diazinon | 1 | 4 | 2 | 7 | 1 | 3 | 2 | 7 | 6 | 5 |
| Propetamphos | 1 | 4 | 0 | - | 0 | - | 1 | 4 | 2 | 2 |
| Chlorfenvinphos | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| One or more OPs | 2 | 8 | 2 | 7 | 1 | 3 | 3 | 11 | 8 | 7 |
| Combined OP MAC | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| Cypermethrin | 3 | 12 | 0 | - | 4 | 15 | 1 | 4 | 8 | 7 |
| One or more OPs and/ or SPs | 5 | 20 | 2 | 7 | 5 | 17 | 4 | 14 | 16 | 14 |
| Total number of sites sampled. | 25 | | 29 | | 29 | | 28 | | 111 | |

Details of sites EQS MAC failures are listed in Appendix II

## 3.2 Stream biology

Biological surveys were carried out in 42 sub catchments, with the majority of the surveys carried out in Upper Severn area (23 sub catchments). A total of 827 km was surveyed, covered by a network of 430 sites. The results show that 66 km (8%) were impacted or suspected of being impacted by sheep dip. An additional 51.5 km were suffering from impacts of other pollution, and 57.9 km showed signs of pollution but the cause could not be determined.

The majority of the surveys were targeted at catchments where sheep dip impacts were recorded in 1998. Of these twenty-five catchments, seventeen had shown a full recovery, and five had partially recovered. Only two were still suffering from the impacts of sheep dip, possibly from repeated incidents, but some other sources of pollution were identified, including acidification, organic pollution from agriculture and unknown sources.

The other seventeen catchments were included in the programme for the first time on advice from EP or in response to positive chemical results. Of these, six were impacted or suspected as being impacted by sheep dips, three were impacted by other pollutants, and eight were of good biological quality.

**Table 3.2 Summary of biological surveys undertaken in 1999**

| Area | Water-course length surveyed km | Watercourse length impacted* by sheep dip km | % of water-course length surveyed impacted* by sheep dip | Length of watercourse impacted by pollution other than sheep dip km | Length of watercourse impacted by unknown pollution km |
|---|---|---|---|---|---|
| Upper Severn | 395 | 38 | 10 | 4 | 0 |
| Northern | 77 | 15 | 19 | 0 | 8.9 |
| South West | 276 | 7 | 3 | 47.5 | 36 |
| South East | 79 | 6 | 8 | 0 | 13 |
| Wales | 827 | 66 | 8 | 51.5 | 57.9 |

* or suspected as being impacted

A summary of the surveys by catchment is given below. Further details can be provided by the relevant area's Ecology (Midlands) or Environmental Appraisal Teams (Wales)

## 3.2.1 Upper Severn area biological surveys

A total of twenty three subcatchments were surveyed biologically in 1999, to monitor the incidence of sheep dip pollution. Nine of these surveys were undertaken to determine whether the invertebrate life had recovered in the watercourses affected by sheep dip pollution in 1998. The catchments surveyed were prioritised by Environment Protection staff and were a mixture of watercourses where positive chemical results had been found, of high-risk catchments surveyed previously and entirely new catchments. Positive chemical results were found in the following four subcatchments.

**Upper Tanat**
The Upper Tanat was surveyed in the summer and autumn. There was no evidence that this catchment had been affected by sheep dip. The invertebrate life indicated good quality throughout although the top of the catchment may be affected slightly by acidification.

**Upper Morda**
The Upper Morda was surveyed in the summer and autumn. This catchment has suffered from sheep dip pollutions in the past. In the summer there was evidence of another incident

in the catchment. The Trefonen tributary contained very limited life, in contrast to previous results. The source of the decline was traced to a farm at the top of the catchment and alpha-cypermethrin was found to be present downstream. One of the farmyard drains had been wrongly connected to the surface water system. Remedial action is to be undertaken by the farmer. Approximately 6 km of watercourse had been affected. The autumn survey results indicated an improvement in biological quality on the Trefonen tributary. There was no evidence of any further problems with sheep dip on the Morda catchment.

**Afon Gam**

Following a positive water sample for sheep dip pesticides, the Afon Gam was added to the survey. A total of 16 sites were sampled. The survey was conducted in a period of high flows, which may explain the low numbers of sensitive families at some sites. However there was no evidence of recent sheep dip pollution on the Gam subcatchment. A low score was found on the Cledan at the confluence with the Gam. Further investigation indicated there was no pollution and that the low score was due to the poor habitat.

**Afon Cain**

There was no indication of any decline in biological life in the Cain subcatchment. All sites contained pollution sensitive macroinvertebrates in good numbers.

**Afon Trannon**

Following the high number of sheep dip incidents previously found on the Afon Trannon, nine sites were sampled in the summer. The routine GQA site at Trefeglyws was found to have improved significantly compared to the low scores recorded in 1997 and 1998. There was no evidence of pollution caused by sheep dip this year and the majority of samples contained good numbers of sensitive life. However a silage problem was found on the Nant Cwmgernog. Silage liquor had entered the watercourse via a roadside drain. Sewage fungus was abundant and there was a decline in macroinvertebrates sensitive to organic pollution. The main Afon Trannon was also slightly affected by the problem.

**Afon Irwch**

Seven sites were sampled on the Afon Irwch in the autumn. This subcatchment is one that has not been surveyed for sheep dip before. All sites were of good biological quality and there was no evidence of any impact caused by sheep dip chemicals.

**Afon Lleiriog**

The Lleiriog was another subcatchment that had not been surveyed before. Lack of sensitive life on the Lleiriog indicated there had been a decline in biological quality on the watercourse. The source of the decline was traced to a farm near the top of the catchment. Management of the flock after dipping was thought to be the cause of the problem. Approximately 10 km of watercourse had been affected by sheep dip.

**Cynllaith**

The Cynllaith was resurveyed in the autumn following a sheep dip pollution in 1998. The watercourse appeared to have completely recovered from the previous problem and there was no evidence of any further problems with sheep dip in the catchment. All the samples were of good biological quality with plenty of sensitive life. However the small tributaries directly below the inputs were of moderate quality. This is probably due to the small and silty nature of the downstream watercourses, rather than any ongoing problems.

**Afon Llwydiarth**
Following a number of problems detected on the Llwydiarth in previous years, a limited survey was undertaken in the summer and autumn. Both surveys indicated that no further incidents had occurred. It appears that one tributary had fully recovered and the other had only partially recovered. The partial recovery is thought to be due to the sheep dip pesticide binding to sediment and being slowly released over time.

**Afon Dulas (including Afon Brochan)**
Ten sites were surveyed on the Afon Dulas in autumn. Nine of these sites were of good biological quality and there was no indication of any problems with sheep dip chemicals. However the routine GQA site on the Afon Brochan was sampled as part of the Dulas cachment survey. The fauna at this site was found to be severely limited suggesting a problem of a toxic nature. A further survey was undertaken to investigate the source of the decline. Recent high flows may have accelerated recovery through recolonisation by downstream drift and it was not possible to determine the cause of the decline, although sheep dip was suspected.

**Nant Rhyd ros lan**
This was another new catchment looked at for the first time this year. The Nant Rhyd ros lan was surveyed in the summer and autumn. There was no evidence of any problems with sheep dip chemicals although one of the tributaries contained only sparse invertebrate life due to a diesel pollution.

**Afon Rhaeadr**
Six sites were surveyed in the summer. The samples taken from this catchment showed no evidence of being affected by sheep dip, all of the samples contained good numbers of pollution sensitive life. There was a suspected problem in the summer of 1998 although the source of the problem was not pinpointed. There was no evidence that this had recurred this year.

**Upper Clun (including Folly Brook)**
Following a query regarding reduced numbers of birds on the Upper Clun, a biological survey was undertaken in the autumn. The River Clun suffered from a large sheep dip pollution in summer 1996, however there was no indication of any recent sheep dip pollution in the Upper Clun catchment. All samples contained good numbers of sensitive macroinvertebrate life. The native white clawed crayfish was also found to be present on Folly Brook.

**Afon Mule**
Ten sites were surveyed on the Afon Mule. A low biological score was recorded at the routine GQA site at Glanmule. It is thought that this decline was due to the lack of dilution of Kerry STW effluent as a result of very low flows in the watercourse. There was no indication of any sheep dip pollution in the rest of the catchment.

**Hirnant**
Six sites were sampled in this subcatchment. There was no evidence of any impact of sheep dip chemicals and the results are very similar to the survey undertaken in 1998.

**Banwy (Neuadd – Pont Twrch)**
Fifteen sites were sampled in this survey. Flows were low and some small tributaries were dry at the time of sampling but there was no indication of any impact from sheep dip chemicals in the sub catchment.

**Bechan Brook**
Following a decline in biological quality at the routine GQA site on Bechan Brook, the subcatchment was surveyed in February and then resurveyed in the summer. The decline was still present on both occasions and sheep dip chemicals were suspected, although it was not possible to pinpoint the source. The suspect tributary was again surveyed in the autumn and 3-minute kick samples were taken and analysed in the laboratory. These samples gave no indication of any recent sheep dip pollution. It was assumed that the macroinvertebrate community had recovered from the original problem.

**River Unk**
This catchment had been surveyed in 1998 and problems with sheep dip suspected, although the source of the problem was not pinpointed. The survey was repeated in November 1999. A slight decline in biological quality was found near the confluence with the River Clun. This was traced to a farm where a small organic problem was found. This is not thought to have caused the original decline on the watercourse. There was no indication of any other impact due to sheep dip chemicals in the catchment.

**Luggy Brook**
Luggy Brook was included in the sheep dip survey for the first time this year. Surveys were undertaken in the summer and the autumn. All the sites sampled were of good biological quality and had a reasonable selection of sensitive life such as stoneflies, mayflies and caddis. There was no indication of any impact of sheep dip chemicals in the catchment.

**Nant Menial, River Abel and Caebitra Brook.**
Resurveys were carried out on the above watercourses following on from surveys carried out in 1998. The invertebrate life on the these streams had totally recovered.

**Afon Garno**
The above main watercourse appeared to have recovered from the pollution problems found in 1998, however the small tributaries directly below the inputs have not completely recovered. This is probably due to the small and silty nature of the downstream watercourses, rather than any ongoing problems. However, the Afon Garno requires resurveying due to positive chemical results being recorded on this river, but to date, high flows have prevented this.

## 3.2.2 Northern area biological surveys

Seven surveys were carried out in the northern area in the following sub-catchments: Dwr Ial, Merddwr, Llafar, Twrch, Dwyfawr, Upper Alyn, Ddu (at Llanfairfechan). A total of 51 sites were sampled, covering a length of 77 km of river. An estimated 15 km of river had been impacted or were suspected to have been impacted by sheep dip pesticides, and 8.9 km were found to have been polluted but the cause was unknown. Surveys were also carried out on the Clwyd (Ruthin STW) and Cefni (Gaerwen STW). These are reported in section 3.4.

**Dwr Ial**
The Dwr Ial subcatchment was selected on the basis of poor biological scores in July and November 1998, which led to a request to assess whether the Dwr Ial had again been affected by sheep dip pesticides. It was hoped that the results could be used to target farm visits. 11.5 km of river was surveyed, and seven sites were sampled. It was concluded that the biological quality of the Dwr Ial subcatchment had greatly improved since the 1998 surveys. There was a reduction in biological quality at one site, the cause being unknown; 1.4 km of river was estimated to have been affected.

**Merddwr**
The Merddwr subcatchment was selected for resurvey in order to assess the impact or otherwise of sheep dip pesticides in 1999. A river length of 10.1 km was surveyed, and 10 sites were sampled. The biological quality of the catchment was considered to be good, and there was no evidence of sheep dip impact.

**Afon Twrch and Afon Llafar (Dee)**
These subcatchments were selected for follow-up surveys based on the results from the 1998 surveys. 16.6 km of the Llafar subcatchment, and 12.3 km of the Twrch subcatchment were surveyed. Six and seven sites respectively were sampled. The Afon Llafar catchment was found to be of good biological quality, with no evidence of sheep dip pesticide impact. The lower reaches of the Afon Twrch had been moderately impacted by sheep dip pesticides. The length of river impacted was estimated to be 5.0 km.

**Dwyfawr**
The Dwyfawr subcatchment was selected on the basis of the 1998 survey results. A total length of 10.1 km was surveyed, and eight sites were sampled. Some improvement in biological quality had occurred since 1998, particularly on the Afon Cwm Llefrith and the Afon Henwy. The biological quality of the Afon Dwyfawr was much lower than anticipated. 9 km were thought to have been moderately impacted by sheep dip pesticides. 0.6 km were impacted by an unknown cause, possibly related to a small disused mine adit close-by.

**Upper Alyn**
The Upper Alyn subcatchment was selected as it supports high density sheep farming. The survey was requested to help target pollution prevention visits by Environment Protection staff, and farm visits by ADAS. 15 km of river were surveyed, and 7 sites were sampled. 6.9 km of river length was considered to have been mildly polluted. The cause was not determined, however it was thought to be mild diffuse pollution, which is not unexpected in an intensively agricultural area.

**Ddu (Llanfairfechan)**
The Ddu catchment was selected on the basis of the 1998 survey, and followed an Environment Protection catchment initiative. 1.4 km of river were surveyed and six sites were sampled. 1 km of the Nant y Iar was severely impacted by sheep dip pesticides. This was a result of activities in 1998. The dip has since been taken out of use. The stretch of the Afon Ddu sampled was considered to be unpolluted.

### 3.2.3 South West area biological surveys

**Teifi catchment**
Results from chemical monitoring of the main river Teifi in 1999 showed six positives for pesticides. Due to these positives it was decided to extend the 1998 survey (Pont Einon to Lampeter road bridge) down to Maesycrugiau.

In October, 1999, a total of 34 sites were sampled, surveying approximately 145 km of river. No impacts were found that could be attributed to sheep dip pollution with any certainty. It is estimated that 41 km of the Teifi and its tributaries were affected by acidification, with 26 km affected by unknown pollutants.

**Cych catchment**
Due to a positive result for sheep dip on the Cych, 29 sites were sampled in October, representing 67 km of river. No impacts were found that could be attributed to sheep dip pollution. Organic pollution was found to have impacted 3.5 km of river.

**Duad catchment**
A positive for sheep dip pesticides on the Duad prompted an investigation of the river. In November, 9 sites were sampled, representing 17 km of river. It is believed that 2 km of river was moderately affected by sheep dip pesticides. No other impacts were found.

**Cothi catchment**
A previous survey was made of the Upper Cothi catchment in 1998. This survey revealed a number of problems related to sheep dip pollution.

As a result of this, and further positive results found in the 1999 chemical monitoring survey, the Cothi was re-surveyed from Pumsaint to the headwaters in June and November, 1999.
A total of 38 sites were surveyed, representing 47 km of river. Acidification was found to affect 3 km of river, and unknown pollution 10 km. Moderate sheep dip pollution affected 4 km of river, and severe sheep dip pollution affected 1 km. By the autumn survey the 1 km severely affected appeared to be recovering.

### 3.2.4 South East area biological surveys

A total of seven sub-catchments of the Wye and one of the Usk were sampled in 1999. One sub-catchment of the Wye was sampled in response to a pollution incident, the remaining seven sub-catchments were repeat surveys of those found to be affected in 1998. No new requests for sheep dip surveys were received in 1999.

**Wye catchment**

Follow-up surveys were carried out in the summer on the Upper Arrow, Bach Howey, Dyfnant, Aran, Camddwr, Monnow and Chwefri. All except the Chwefri made good recoveries, with each returning to the quality seen prior to the sheep dip impacts.

The Chwefri continued to have reduced scores, with the problem area being pinpointed to the same location as the previous summer. This was reported to EP for a follow-up visit. It was not clear what was causing the poor biological quality.

The Arrow was sampled downstream of the originally targeted area in response to a pollution incident. It was determined that a synthetic pyrethroid sheep dip had entered the river via a small tributary, causing extensive invertebrate mortalities for approximately 6km.

**Usk catchment**

A follow-up survey was carried out on the Hydfer. It was found to have recovered and returned to its previous good quality.

## 3.3 Pollution Prevention Activities and Farm Visit Programme

One hundred and sixty four site inspections were carried out in a targeted way in 1999. This was a result of 284 visits to premises, but not all of these would allow access for inspection, did not stock sheep, or were not fully recorded.

**Table 3.3 Treatment methods used in Wales**

| Treatment method | % sites visited |
|---|---|
| OP dips | 16 |
| SP dips | 8 |
| SP & OP dips | 1 |
| Injection | 14 |
| Pour on | 22 |
| Shower/Jetter | 10 |
| Not in use | 27 |
| Don't know | 1 |

OP dips were used most frequently, but a wide range of different treatment methods were used regularly; injection, pour-on and use of jetters and showers.

**Table 3.4 Disposal methods used in Wales**

| Disposal method | % sites visited |
|---|---|
| Landspread | 20 |
| Off-site disposal | 10 |
| Soakaway | 1 |
| Diluted with slurry | 2 |
| Diluted with water | 3 |
| Not reported | 64 |

In more than half the sites visited, the use of alternative treatment methods to dipping made disposal unnecessary. Landspreading was the favoured method of disposal, but off site disposal was also used regularly. Only one site was found to use soakaway, a practice which is now unacceptable.

All sites were assessed using the site inspection sheet data to identify whether the site represented either High, Medium or Low risk to surface and groundwaters. The results are given below

| Risk category | % sites visited |
|---|---|
| High | 3 |
| Medium | 10 |
| Low | 84 |
| Not reported | 5 |

As less dipping activity and onsite disposal was recorded than in 1998, the overall risks of treating sheep were low in the large majority of cases.

As well as inspections, other pollution prevention activities were carried out. This included targeting mobile dip, jetter and shower operators, stands at agricultural shows, talks and dealing with enquiries on the introduction of Groundwater regulations, and mailshots of guidance with bills.

The pollution prevention activities and inspections carried out in each area are set out below.

### 3.3.1 Upper Severn area

**Site inspections**

Seventy three properties were visited within the Afon Cain catchment in the Lower Vyrnwy, thirty five of which were occupied by sheep farmers using some form of treatment. Thirty-five farm visits were conducted, and the results of the inspections are given below. Further ongoing work is being undertaken in the Mordda and Tanat catchments, and others, which will be reported next year.

**Type of Treatment**

Pour-ons were the most commonly used treatment, followed by organophosphate based sheep dips and mobile jetter/showers. Many farmers stated they had recently changed from using synthetic pyrethroid dips to organophosphate based dips due to the ineffectiveness of the SP's. Farmers also said that due to the Groundwater Regulations they had decided this year to use alternative treatments to their dipping baths such as pour-ons, to avoid having to pay for the Authorisation to spread the dip.

The level of awareness of the environmental impacts associated with sheep dip disposal was generally good with only 3% low operator awareness.

**Table 3.5 Treatment methods used in Midlands Area**

| Treatment method | % sites visited |
|---|---|
| OP dips | 17 |
| SP dips | 3 |
| SP & OP dips | 0 |
| Injection | 17 |
| Pour on | 28 |
| Shower/Jetter | 24 |
| Don't know | 0 |
| Not in use | 11 |
| Not reported | 0 |

## Sheep Dipping Structures

The majority of dipping structures was found to be in a good state of repair. There were a few farms where baths were present with drain holes to soakaway. These were temporarily sealed and the dip was vacci tanked out and spread to land. A number of farms agreed to fill in baths which they were not intending to use in the future.

Pollution Prevention Guidelines were given to all farmers visited, and any procedures in use that were notcompliant with the guidelines were discussed. Letters requesting remedial measures or changes in practices were sent when necessary.

Farmers were informed that the use of soakaways is now unacceptable and drain holes should be permanently sealed. Management of flocks after dipping was also discussed with the need to keep freshly dipped sheep well away from watercourses.

**Table 3.6 Dipping Structures**

| | Concrete % | Brick % | Plastic % | Other (GRP) % | None % | Not reported % |
|---|---|---|---|---|---|---|
| Structure | 22 | 3 | 0 | 3 | 0 | 72 |

## Storage of sheep dip chemicals

The majority of farms only purchase what is needed. Any surplus dip would be held in a locked store.

## Disposal

Landspreading was often used for disposing of used dip and all farmers inspected who disposed to land had Groundwater Authorisation. Off-site disposal numbers have increased on last year due to more farmers contracting mobile dippers who take the dip away. As more farmers used alternative treatment methods to dipping, fewer disposal methods were reported.

**Table 3.7 Disposal methods**

| Disposal method | % sites visited |
|---|---|
| Landspread | 17 |
| Off-site disposal | 17 |
| Soakaway | 0 |
| Diluted with slurry | 0 |
| Diluted with water | 3 |
| Not reported | 63 |

**Overall Risk Assessment**

All sites were assessed using the site inspection sheet data to identify whether the site represented either High, Medium, or Low risk to surface and groundwaters. The results are given below:-

| **Risk Category** | **% Sites Visited** |
|---|---|
| High | 0% |
| Medium | 19% |
| Low | 81% |

Overall risk generally decreased from last year, and risk wasdue to poor management rather than condition and siting of facilities. OP dips are the most frequently used, however pour ons, injections and mobile dips are also popular, with 69% of treatments within these categories. This again probably reflects the introduction of the Groundwater Regulations, 1998.

**Pollution Prevention Activities**

A display trailer was taken to a Pesticides and Water Quality Seminar held with South Staffordshire Water and the National Farmers Union, which was attended by farmers from the Shropshire area.

The display trailer was also taken to a number of Agricultural Shows in Shropshire containing information highlighting the pollution risks posed by sheep dipping operations.

A talk was held for the Shropshire branch of the Institute of Agricultural Secretaries and Administrators to give information on the Groundwater Regulations and general sheep dip pollution prevention information.

A meeting was held with Montgomeryshire Wildlife Trust to discuss joint sheep dip awareness campaigns.

## 3.3.2 Northern area

### Site inspections

Due to the reduced number of catchments visited for farm inspections in Northern Area, it is not feasible to report on an individual catchment basis. Inspections were carried out in the Upper Dee catchment and on Anglesey.

Some thirty-four sites were assessed and in all cases pollution prevention advice or leaflets were provided. The level of awareness, of the environmental impact associated with sheep dip disposal, was generally medium to good, with only about 14% having low operator awareness. OP dips are the most popular type of treatment, however since the introduction of the Groundwater Regulations 1998, many farmers have opted to inject, use a pour-on or contract a mobile dipper, rather than pay for a Groundwater Authorisation for landspreading spent dip.

**Table 3.8 Treatment methods used in Northern Area**

| Treatment method | % sites visited |
|---|---|
| OP dips | 21 |
| SP dips | 15 |
| SP & OP dips | 3 |
| Injection | 12 |
| Pour on | 18 |
| Shower/Jetter | 19 |
| Not in use | 12 |

**Table 3.9 Structures**

| | Concrete % | Brick % | Plastic % | Other (GRP) % | None % | Not reported % |
|---|---|---|---|---|---|---|
| Structure | 44 | 6 | 6 | 3 | 6 | 35 |

**Table 3.10 Disposal**

| Disposal method | % sites visited |
|---|---|
| Landspread | 24 |
| Off-site disposal | 26 |
| Soakaway | 3 |
| Diluted with slurry | 6 |
| Diluted with water | 12 |
| Not reported | 29 |

All sites were assessed using the site inspection sheet data to identify whether the site represented either High, Medium or Low risk to surface and groundwaters. The results are given below

| Risk category | % sites visited |
|---|---|
| High | 0 |
| Medium | 15 |
| Low | 82 |
| Not reported | 3 |

**Pollution Prevention Activities**

In the Northern Area, nineteen mobile dipping contractors have been identified and visited. Geographical distribution of these contractors is as follows:

| Unitary authority | No of contractors |
|---|---|
| Gwynedd County Council | 6 |
| Conwy County council | 5 |
| Anglesey County Council | 1 |
| Denbighshire County Council | 6 |
| Flintshire County Council | 1 |

Of these nineteen contractors, five hire out equipment to farmers rather than actually undertaking the contract dipping.

Of particular concern is the fact that there is no requirement for a contractor to register with any Regulatory or Licensing body e.g. Trading Standards or H.S.E. and there is no certificate of competence or other proficiency/training required to operate such a unit. The Agency list was compiled after talking to known contractors who were then contacted accordingly. All those contacted demonstrated a high awareness of the risks associated with sheep dip disposal and were extremely helpful in the distribution of pollution prevention material.

Over 1500 Environment Agency mobile dipping information leaflets have been distributed via the contractors. In addition, draft guidance for field operations and draft advice notes on the safe use and disposal of sheep dip has been circulated to the contractors for comments. The draft guidance/advice sheets have also been circulated to the National Sheep Association (NSA) and the National Association of Agricultural Contractors (NAAC) for comment.

## 3.3.3 South West Area

**Rheidol catchment site inspections**

Thirty farm visits were conducted in the Rheidol catchment, however access for inspection purposes was only possible for twenty-three of them. The overall level of awareness was difficult to gauge because only 43% of sites visited were assessed for operator awareness. The results of the inspections are given below.

**Table 3.11 Treatment methods used in Rheidol catchment**

| Treatment method | % sites visited |
|---|---|
| OP dips | 27 |
| SP dips | 17 |
| SP & OP dips | 3 |
| Injection | 17 |
| Pour on | 0 |
| Shower/Jetter | 7 |
| Don't know | 3 |
| Not in use | 3 |
| Not reported | 23 |

**Table 3.12 Structures used in Rheidol catchment**

| | Concrete % | Brick % | Plastic % | Other (Steel) % | None % | Not reported % |
|---|---|---|---|---|---|---|
| Structure | 50 | 3 | 0 | 3 | 0 | 44 |

**Table 3.13 Disposal used in Rheidol catchment**

| Disposal method | % sites visited |
|---|---|
| Landspread | 40 |
| Off-site disposal | 7 |
| Soakaway | 0 |
| Diluted with slurry | 0 |
| Diluted with water | 0 |
| Not reported | 53 |

All sites were assessed using the site inspection sheet data to identify whether the site represented either High, Medium or Low risk to surface and groundwaters. The results are given below

| Risk category | % sites visited |
|---|---|
| High | 7 |
| Medium | 7 |
| Low | 73 |
| Not reported | 13 |

OP and SP dips are generally used, however injections and mobile dips are becoming more popular probably due to the introduction of the Groundwater Regulations. There are a small number of farms in the high risk category due to their proximity to surface waters and the poor state of repair of their dipping structures.

**Gwili/Tywi catchment site inspections**

Another catchment targeted for site inspections in the South West area was the Afon Duad subcatchment of the Afon Gwili, which enters the Afon Tywi at Abergwili, following detection of positive diazinon results. The Nant Gochen, which is a major tributary of the Afon Duad, was previously targeted in a Catchment Survey undertaken in 1998, when 46 farms were visited as part of a pollution prevention programme.

Sixty four farm visits were conducted in the Gwili/Tywi catchment. The overall level of awareness was difficult to gauge because only 5% of sites visited were assessed for operator awareness. Many sites report that they have moved away from sheep dipping towards injection and pour ons.

The results of the inspections are given below.

**Table 3.14 Treatment methods used in Gwili/Tywi catchment**

| Treatment method | % sites visited |
|---|---|
| OP dips | 5 |
| SP dips | 2 |
| SP & OP dips | 0 |
| Injection | 11 |
| Pour on | 30 |
| Shower/Jetter | 0 |
| Don't know | 0 |
| No longer in use or not reported | 52 |

**Table 3.15 Structures used in Gwili/Tywi catchment**

| | Concrete % | Brick % | Plastic % | Other (Steel) % | Not reported or no structures required % |
|---|---|---|---|---|---|
| Structure | 11 | 0 | 0 | 2 | 87 |

**Table 3.16 Disposal used in Gwili/Tywi catchment**

| Disposal m ethod | % sites visited |
|---|---|
| Landspread | 6 |
| Soakaway | 0 |
| Diluted with slurry | 0 |
| Diluted with water | 0 |
| Not reported/not in use or off-site disposal | 94 |

All sites were assessed using the site inspection sheet data to identify whether the site represented either High, Medium or Low risk to surface and groundwaters. The results are given below

| Risk category | % sites visited |
|---|---|
| High | 5 |
| Medium | 6 |
| Low | 89 |
| Not reported | 0 |

There were a very small number of farms in the high risk category due to their proximity to surface waters and the poor state of repair of their dipping structures. It was apparent that a large number of farms had opted to stop using sheep dips as a form of treatment probably due to the introduction of the Groundwater Regulations.

It was found that numerous sheep dips had been abandoned, some recently. The reasons for abandonment of use of the sheep dips were variously ascribed to non-possession of the Certificate of Competence for Sheep Dipping (issued by The NPC – National Proficiency Council) and also the costs entailed in application for authorisation for disposal of spent sheep dip under the Groundwater Regulations 1998.

In the catchment inspected the sheep flocks were of small to medium size and often part of a mixed farming system. It was apparent that there is marked change in practice for control of ectoparasites with abandonment of sheep dipping and increased use of injectables and pour-on products.

In addition nine farmers' union meetings were attended early in the year to explain the requirements of the Groundwater Regulations, but also incorporating pollution prevention advice.

## 3.3.4 South East Area

**Site inspections**

Seven farm inspections were conducted in the Hydfer, part of the Usk catchment, the level of awareness being generally good. This followed the occurrence of positive sampling results in 1998 and 1999. No high risk sites were found. The results of the site inspections are given below.

The Chwefru was visited as a follow up to results and visits carried out during 1998. A site was identified as a possible source of the problem, and investigations are continuing.

In addition, meetings were held with five known contractors, plus five farmers who loan out their equipment, where there was a good exchange of information. Out of five contractors visited only three were actual contractors, with a high awareness of pollution prevention issues, the others who bought the equipment for their own use, generally had a poor awareness. Two contractors visited as part of the 1998 monitoring programme were contacted by phone to discuss any changes in practice.

Operator awareness of the risks was generally good (with one exception). It is hoped to build on this initial contract further in 2000.

**Table 3.17 Treatment methods used in South-East Area**

| Treatment method | % sites visited |
|---|---|
| OP dips | 43 |
| SP dips | 14 |
| SP & OP dips | 0 |
| Injection | 14 |
| Pour on | 0 |
| Shower/Jetter | 0 |
| Not in use | 29 |

**Table 3.18 Structures**

| | Concrete % | Brick % | Plastic % | Other (GRP) % | None % | Not reported % |
|---|---|---|---|---|---|---|
| Structure | 43 | 14 | 0 | 14 | 0 | 29 |

**Table 3.19 Disposal**

| Disposal method | % sites visited |
|---|---|
| Landspread | 57 |
| Off-site disposal | 0 |
| Soakaway | 0 |
| Diluted with slurry | 0 |
| Diluted with water | 0 |
| Not reported | 43 |

All sites were assessed using the site inspection sheet data to identify whether the site represented either High, Medium or Low risk to surface and groundwaters. The results are given below

| Risk category | % sites visited |
|---|---|
| High | 0 |
| Medium | 0 |
| Low | 100 |
| Not reported | 0 |

There was a high percentage of unreported disposal methods, which may partially reflect the fact that 29% of the sites visited no longer use their sheep dipping facilities but have reverted to treatment methods such as injecting or use of neighbour's facilities. There appeared to be a general move away form using synthetic pyrethroids. Plunge dippings seemed to be used predominantly where sheep run out on common land. Closed flock systems appeared to be using jetters, showers, electroquips for fly control only treating for scab where there is a problem.

**Pollution Prevention Activities**

Talks were given to local NFU groups, FWAG (Farming & Wildlife Advisory Group) evenings, various BEAM (Balancing the Environment and Agriculture in the Marches) events, and at commercial open days.

Due to the implementation of the 1998 Groundwater Regulations the number of telephone enquiries rose substantially, and events and talks were dominated by questions on sheep dip

## 3.4 Sewage Treatment Works monitoring

The Sewage Treatment Works monitoring programme started in July 1999, and is planned to run for 12 months. A summary of the results is presented here. A more detailed interim report will be available, and a full report will be compiled in August 2000 when the monitoring programme is complete.

Twenty-two out of 28 works monitored recorded positive results for one or more sheep dip pesticides. Positive results were also recorded at two out of three controls. In the majority of cases the levels were relatively low, but fourteen works in total had levels exceeding MAC EQS in the effluent, twelve for cypermethrin, seven for diazinon and three for propetamphos. No associated failures on MAC EQS in downstream samples were recorded. Assessments will be made against Annual Average EQSs once twelve months data is available.

In some instances, sites upstream and/or downstream of sewage works recorded positive results for sheep dip chemicals, when levels were not detected in the effluent. These results are reported as part of the river monitoring.

**Biological Monitoring at STWs**

**River Clwyd/Ruthin STW**
A small stretch of the River Clwyd, into which Ruthin STW final effluent discharges was surveyed in response to positive spot sampling results in both the final effluent and the river itself. 0.7 km of river length was surveyed, and two sites were sampled. The depressed biological scores at both sites were thought to have been related to wash-out of macro-invertebrates from their habitat during high flows fairly recently preceding sampling.

**Afon Cefni/Gaerwen STW**
A small stretch of the Afon Cefni, into which Gaerwen STW final effluent discharges was surveyed in response to positive spot sampling results in both the final effluent and the river itself. 0.7 km of river was surveyed, and two sites were sampled. Both sites were considered to be unpolluted.

## 3.5 Pollution Incidents

Only three confirmed and two suspected pollution incidents were recorded in 1999. The details are given in Table 3.20

**Table 3.20 Sheep Dip related Pollution Incidents for Wales -1999**

| DATE | AREA | RIVER | IMPACT | SEVERITY | SOURCE | POLLUTANT |
|---|---|---|---|---|---|---|
| 05.02.99 | Upper Severn | Bechan Brook | Not quantified | 3 | Unknown. Detected through biological surveys. | Unknown |
| 17.06.99 | South East | River Arrow and tributary | Biological impact on 5km of tributary and river Arrow | 2 | Spillage caused by hose disconnection during demonstration of jetter. Reported by a member of the public. | Cypermethrin |
| 23.08.99 | Upper Severn | Trefonen, tributary of Morda | Biological impact for 6km | 3 | Runoff from yard drains. Detected through biological surveys | Cypermethrin |
| 03.11.99 | Upper Severn | Nant Lleriog, tributary of Tanat | Biological impact for 10km | 2 | Sheep walking through stream after dipping. Detected through biological surveys. | Synthetic pyrethroids |
| 17.11.99 | Upper Severn | Borehole, river Teme | No incident occurred | 3 | Water company report re concern over possible contamination of borehole due to proximity of dip | None |

# 4.0 CONCLUSIONS

## 4.1 Stream chemistry

Direct comparison of 1998 and 1999 data is possible due to comparable detection levels and monitoring regimes. However, external factors, such as weather and river flows may have influenced the results. The summer was drier than 1998, so any risk of runoff from saturated soils during land spreading would have been minimised. However much of the dipping activity undertaken in autumn would have been carried out in wet conditions.

The presence of sheep dip pesticides was found to be widespread, with 67% of 111 river sites monitored, including those upstream of STWs, giving positive (above detection level) results. Overall 57% of the 111 sites across Wales recorded positive results for the Organophosphate (OP) dip diazinon, and 20 % for the OP dip propetamphos. Synthetic pyrethroid (SP) dips were found at 14% of sites; 8% of sites for cypermethrin and 6% of sites for flumethrin.

These results show an overall downward trend in comparison with 1998, when 75% of sites had positive results. In particular, positive results for propetamphos have fallen from 34% of sites, and for cypermethrin from 33% of sites.

Sixteen sites (14%) of the 111 monitored failed the Maximum Allowable Concentration (MAC) Environmental Quality Standards (EQS) for one or more sheep dip pesticides in 1999. Eight (7%) failed the MAC EQS for one or more of the OPs and eight (7%) failed the EQS MAC for cypermethrin. Again these results show a marked downward trend, as 29% of sites failed MAC EQS in 1998, 12% for OPs and 20% for cypermethrin.

## 4.2 Stream biology

Extensive biological surveys were carried out in 42 sub-catchments in upland areas, with a total of 827 km covered between a network of 430 sites The results showed that at least 66km (8%) were known or suspected of being affected by sheep dip

In addition, a further 51.5km of river length surveyed in 1999 showed signs of biological impacts from other sources. Known causes included acidification and organic pollution from agricultural activities, in 6 % of river lengths affected. At a number of sites, representing 57.9 km (7%) of river length surveyed, the exact cause could not be determined. This was partly due to sites showing signs of recovery following an incident believed to have occurred some weeks or months before the survey, or impacts not extreme enough to lead to the identification of the source of the pollution.

In 1998, a more extensive survey was carried out of 1432 km, 9% of which was suspected or known to be impacted by sheep dip. In 1999, much of the survey work was narrowly targeted at catchments with ongoing problems related to sheep dip, or following the recording of positive results from chemical monitoring. This may be why the improvements noted above in terms of a reduction of positive results recorded from water quality monitoring have not been reflected as a reduction in biological impacts, since surveys would only be targeted in areas with poor chemical results.

Resurveys, at sites which suffered sheep dip pollution in 1998, showed that in the majority of cases recovery of the invertebrate fauna was good. Where recovery had not occurred, this was attributed to further incidents of sheep dip pollution within the catchment, or possibly longer term impacts associated with disposal of used dip to inappropriate land or soakaway, or chemicals being bound to silt in small streams and ditches. This was comparable to the results of resurveys in 1998.

## 4.3 Pollution prevention activities and farm visit programme

Two hundred and eighty-four properties were visited as part of the 1999 pollution prevention campaign. Of these, 164 were occupied by sheep farmers using some form of treatment, such as dipping or injection, and were inspected accordingly.

Organophosphate (OP) dips were used by 16 % of farms inspected. Synthetic pyrethroid (SP) dips were used by just 8 %. This shows a major decline in percentages using these forms of treatment from 1998, when almost half (44%) used organophosphate dips, and nearly a quarter (24%) used SP dips. This was reported as being due to the introduction of the Groundwater Regulations in 1999, and the costs of authorisations, and also a reported lack of effectiveness of SPs against scab.

The use of jetters or showers, a new innovation in 1998, has increased from 6% to 10%, and other forms of treatment have also increased, with injections and pour-ons used at 36% of farms compared to 9% in 1998. These types of treatment give rise to minimal amounts or no residual dip for disposal if managed well. This has resulted in just over half (64%) of sites inspected no longer disposing of dip. The Groundwater Regulations are also likely to have had an influence on this. Fewer farmers disposed of their dip through landspreading, including mixed with slurry or water, (25% in 1999, compared to 79% in 1998), and off site disposal has increased from 1% to 10%. Only one site (<1%) was found to dispose of dip to soakaway (reduced from 19%).

Awareness amongst farmers on the risks of sheep dipping, and particularly the need for safe disposal was high. Considerably fewer sites overall were found to be of high risk compared to 1998 (3% cf 16%) and well over three quarters (84%) were considered to be low risk. However, the need to keep freshly dipped sheep away from watercourses was not always recognised, and in a few cases poor practice was still apparent.

The use of jetters or showers, which use smaller volumes of chemicals, has increased considerably. These are often operated by mobile contractors, who in many cases will take the waste dip away, so that the farmer does not require a Groundwater Authorisation. The environmental risks of this activity, from the location of the equipment, management of sheep and disposal of spent dip are still high, and pollution prevention guidance has been targeted at these operators.

## 4.4 Sewage Treatment Works monitoring

Twenty-two out of twenty-eight works recorded positive results for sheep dip chemicals in the effluent, and at 14 of these levels exceeded the MAC EQS. No MAC EQS failures were recorded in associated downstream samples. The monitoring will continue so that a full assessment can be made on 12 months data, when firm conclusions and recommendations will be made.

## 4.5 Pollution Incidents

Only three substantiated and two suspected pollution incidents were recorded in 1999 in Wales. Those that were confirmed were due to SP dips. Three were highlighted during biological surveys, and the remainder was reported to the Agency. In 1998, seventeen incidents were recorded, eleven of which were due to SP dips. Sixteen of these were identified during biological surveys. This decrease in incidents mirrors the trend nationally, when in 1998 there were 27 reported incidents, and in 1999 there were only six, all of the latter due to SPs.

# 5.0 SUMMARY

The aims of the 1999 Welsh Sheep dip Monitoring programme were to:

1) To establish whether the increase in farmer awareness in 1998 was continued in 1999 with improvements in practices;
2) To determine whether any change in practices resulted in less environmental impact
3) To investigate what impact the introduction of the Groundwater Regulations in April 1999 had had;
4) To further investigate the occurrence of sheep dip in Sewage Treatment Works effluent and to establish if this was leading to environmental impacts to target consenting action.

The results of the survey are remarkable. There is a considerable reduction in high risk dipping practices, and contamination of watercourses with sheep dip chemicals. This is believed to be due to the success of awareness and pollution prevention campaigns by the Agency over the last three years, and the introduction of the Groundwater Regulations in April 1999. Fewer farmers are dipping sheep, with a downward trend particularly in the use of SP dips. Other forms of treatment, (injections and pour-ons), which pose less risk to the aquatic environment, are being used. More mobile operators are also being employed, and many of these have co-operated fully when they have been contacted by the Agency to discuss their dipping operations and to provide pollution prevention advice.

The number of substantiated pollution incidents due to sheep dip has also fallen. However, the percentage of watercourse surveyed suffering biological deterioration due to sheep dips has remained similar to 1998 levels. Although fewer biological surveys were undertaken, due to fewer positive results being detected in chemical monitoring, those that were carried out were still targeted at sites previously impacted or related to high chemical results in 1999.

Monitoring at sewage treatment works has shown, in the interim, that these could be a source of sheep dip chemicals. However, the environmental significance of this will not be fully assessed until the monitoring is complete in summer 2000.

It is important that this substantial progress is maintained in 2000 and beyond. A critical issue is the recent withdrawal of OP dips for approved use. This could lead once again to greater use of SP dips, and increased risks to the environment. It is therefore crucial that farmers continue to be vigilant in following pollution prevention guidelines throughout the whole treatment activity and comply with the Groundwater Regulations.

# 6.0 RECOMMENDATIONS

1) The success of the pollution prevention campaigns reported here should be publicised to acknowledge the increased awareness of farmers and the environmental benefits.

2) The current ban on OPs may lead farmers to increase usage of SPs, with potentially greater environmental impacts. Therefore some river monitoring must be continued.

3) Background water quality monitoring should be continued at key sites as part of the regional pesticide monitoring programme, and at additional selected sites for June - November to cover the peak dipping period.

4) In those catchments identified as having ongoing problems, pollution prevention and Groundwater Regulation enforcement activities should be continued in a prioritised way in each area.

5) Opportunities to work with other organisations should be continued.

6) Outputs arising from the National Sheep Dip strategy implementation, including the R&D on flock management, should be promoted as and when available.

# 7.0 APPENDICES

# POLLUTION PREVENTION VISIT - SHEEP DIPPING OPERATIONS

FILE REFERENCE _____

ASIANTAETH YR AMGYLCHEDD
ENVIRONMENT AGENCY

1. Site Details

Occupier & Site Address

Name: _____

Address: _____

_____

_____

Tel (Inc STD Code) _____

2. Owners Address

Name _____

Address: _____

_____

_____

_____

Tel: _____ Contact: _____

3.

Date of Visit: _____

Duration on Site: _____Hrs_____Mins

Inspected By: _____

Form Checked (PCO): _____ Date: _____

Follow up required yes ☐ No ☐

Re-visit date: _____/_____/_____

Letter Required: Yes ☐ No ☐

Letter Sent: _____/_____/_____

4. Catchment

NGR of Dip Site (8 Figs) _____

PROXIMITY TO W/COURSE? _____m

5. Discharge Found? Yes ☐ No ☐

Discharge Point NGR (8 Figs) _____

6. Risk to Groundwater? Yes ☐ No ☐

Abstractions at risk: _____

_____

_____

Risk Status: High ☐ Medium ☐ Low ☐

7. Risk to Surface Waters? Yes ☐ No ☐

Details: _____

_____

Risk Status : High ☐ Medium ☐ Low ☐

8. STRUCTURE OF DIP TANK

PERMANENT SITE

MATERIAL?

BRICK ☐
CONCRETE ☐
GRP ☐
PLASTIC ☐
STEEL ☐
OTHER ☐
(PLEASE SPECIFY)

Roof over dip Yes ☐ No ☐

Does structure appear to be in good state of repair? Yes ☐ No ☐

Presence of drain hole? Yes ☐ No ☐

Risk Status:

High ☐ Medium ☐ Low ☐

9. COLLECTING/DRAINOFF AREAS

Permeable Floor ☐ Impermeable Floor ☐

Draining apron diversion when not in use? Yes ☐ No ☐

Drain off Returned to Dip Yes ☐ No ☐

Capacity of Drain off Pen? (No. sheep) _____

Drain off Period _____ minutes

Risk of leakage by splashing Yes ☐ No ☐

Age of 'Permanent' Dip Tank

| | | | |
|---|---|---|---|
| 1 - 5 yrs | ☐ | 15 - 20 yrS | ☐ |
| 5 - 10yrs | ☐ | 20 - 25 yrs | ☐ |
| 10-15 yrs | ☐ | > 25 | ☐ |

10. Pesticide Usage

Type of Dip O/P ☐ S/P ☐

Product name(s) _____

Pesticide Storage

Quantity used? _____ litres

Volume stored? _____ litres

Locked Store ☐ Unlocked Store ☐

Risk Status : High ☐ Medium ☐ Low ☐

Operator awareness of pollution risk

High ☐ Medium ☐ Low ☐

# ENVIRONMENT AGENCY
# POLLUTION PREVENTION VISIT - SHEEP DIPPING OPERATIONS

ASIANTAETH YR AMGYLCHEDD
ENVIRONMENT AGENCY



11. Mobile Dips

Mobile Dip Used Yes ☐ No ☐ (If NO go to 12)

Dedicated Area? Yes ☐ No ☐

Permeable Base? Yes ☐ No ☐

Distance from watercourse? _____m

Distance from surface water drains? _____m

Could dip enter surface water drain system? Yes ☐ No ☐

Contractor Details

Name: _____

Address: _____

_____

Tel: _____

Pesticide Usage

Supplied by Contractor ☐

Type of dip O/P ☐ S/P ☐

Product Names(s) _____

_____

Risk status: High ☐ Medium ☐ Low ☐

Need to relocate to dedicated area? Yes ☐ No ☐

12. Access to Pasture

Direct from holding area Yes ☐ No ☐

Does access cross w/course Yes ☐ No ☐

Drinking water supply - from stream Yes ☐ No ☐

- from trough(s) Yes ☐ No ☐

Time held in pasture prior to release _____ hrs

13. Disposal of spent dip

Discharge to watercourse Yes ☐ No ☐

discharge to soakaway Yes ☐ No ☐

Diluted with water Yes ☐ No ☐

Diluted with slurry Yes ☐ No ☐

Drain to slurry lagoon Yes ☐ No ☐

Drain to tank Yes ☐ No ☐

Spread on land Yes ☐ No ☐

Area used for spreading _____(Ha)

Land type (e.g. soil/ slope/ geology) _____

_____

_____

Proximity to w/course _____metres

On-Farm disposal Yes ☐ No ☐

Off-Farm disposal Yes ☐ No ☐

Removed by waste contractor Yes ☐ No ☐

Removed by mobile dipping contractor Yes ☐ No ☐

Treatment prior to spreading Yes ☐ No ☐
(eg Addition of lime)

Please specify _____

_____

_____

_____

Risk status High ☐ Medium ☐ Low ☐

14. Disposal of unused dip

Returned to supplier Yes ☐ No ☐

Returned to manufacturer Yes ☐ No ☐

Stored for future use Yes ☐ No ☐

Dilute in bath & spread Yes ☐ No ☐

* onto/ * into land (delete as necessary)

Suitability of land Yes ☐ No ☐

Used by > 1 farmer Yes ☐ No ☐

Total No. sheep dipped _____

15. Comments and remedial works identified/ agreed

with timescale for completion.

_____

_____

_____

_____

_____

_____

16. Overall risk

High ☐ Medium ☐ Low ☐

Appendix II Sites with MAC EQS Failures

| Site Description | Sample Point | Grid Reference | Pesticide |
|---|---|---|---|
| Teifi at Lampeter Road Bridge | 34404 | SN58104761 | Cypermethrin |
| Ystwyth at Cwmystwyth GW | 82001 | SN79207370 | Cypermethrin |
| Tywi at Llandeilo | 31616 | SN62752200 | Diazinon |
| Amman u/s Garnant | 72896 | SN68801345 | Cypermethrin |
| Amman at Brynamman road | 30402 | SN71301380 | Cypermethrin |
| Edw at Aberedw | 50013 | SO07704697 | Cypermethrin |
| Llanwrthwl Dulas | 50826 | SN97406380 | Diazinon |
| Lugg at Monaughty | 50869 | S023746820 | Diazinon |
| Honddu | 40899 | SO04382867 | Propetamphos |
| Dwr Ial | 1453 | SJ12016075 | Diazinon |
| Conwy | 25005 | SH79846148 | Diazinon |
| Nant Alan | 31577000 | SJ13211991 | Diazinon |
| Banwy | 31795020 | SJ14301130 | Propetamphos |
| Cain | 31468030 | SJ16491889 | Cypermethrin |
| Trannon | 35303700 | SN96809030 | Cypermethrin |
| Banwy | 31798790 | SJ03160975 | Cypermethrin |