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Department of Agriculture, Food  
and Rural Development



# Investigations of Animal Health Problems at Askeaton, County Limerick

## SUMMARY REPORT



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## **NOTE**

This document is based on the five-volume report on the investigations of animal health problems in the Askeaton area of Co. Limerick, carried out in the period 1995 – 1998. The five volumes are as follows:

- Main Report
- Animal Health
- Soil, Herbage, Feed and Water
- Human Health
- Environmental Quality

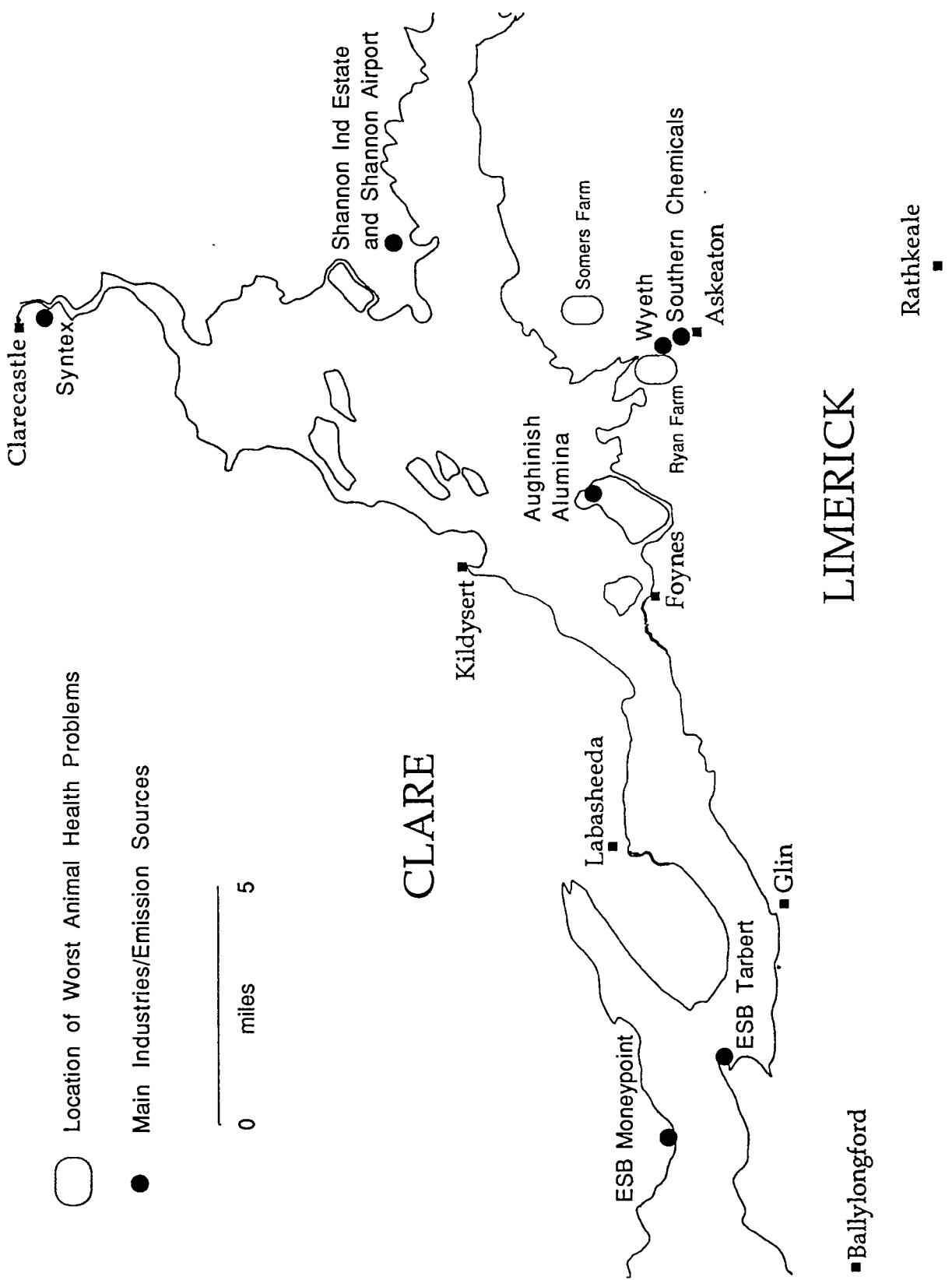
The investigations were prompted by reports of severe animal health problems on two farms in the Askeaton area, which first came to notice in the early 1990s. In February 1995, following preliminary investigations by Limerick County Council, the Environmental Protection Agency was requested by the Minister of State at the Department of Agriculture, Food and Rural Development to co-ordinate a wider study of the situation. This was considered necessary, as there were local concerns that human health was also being affected in the area and that environmental pollution was involved.

Arrangements for the undertaking of the investigative work were put in place in late February 1995, this being assigned to the Veterinary Research Laboratory of the Department of Agriculture, Food and Rural Development (animal health), Teagasc (soils, herbage and related aspects), the Mid Western Health Board (human health) and the Environmental Protection Agency (environmental quality aspects). Subsidiary studies were carried out by Coillte and the Mid Western Health Board, respectively, on tree health and the levels of metals and other substances in vegetable produce.

Field measurements and observations took place between March 1995 and December 1998. Interim reports were published in December 1995, June 1997 and August 1998.

# **PART ONE**

## **Background and Findings**



## **Introduction**

This document sets out the background to events in Askeaton, Co. Limerick, which led to a joint investigation being carried out by the Veterinary Laboratory Services (of the Department of Agriculture, Food and Rural Development), Teagasc, the Mid-Western Health Board, and the Environmental Protection Agency.

It provides a chronology of the main events between the time the investigations got underway and the conclusion of the various studies and test measurements.

It offers a synopsis of the main findings in each of the four investigating agencies' discrete reports as well as their composite main report. The composite report (183 pages) and the sectoral reports of the Environmental Protection Agency (152 pages); Veterinary Laboratory Services (317 pages); Mid-Western Health Board (372 pages) and Teagasc (138 pages) are available from EPA Publications Office, St Martin's House, Waterloo Road, Dublin 4 (Tel: 01-667 4474).

## **Background**

In the early to mid 1990s two County Limerick farmers, Liam Somers of Ballysteen, Askeaton and Justin Ryan of Toomdeely, Askeaton reported unusually high levels of animal health problems on their farms.

Generally, the problems on the Somers and Ryan farms can be summarised as including failure to thrive (ill thrift) and poor body condition in cows. These problems became progressively worse, with relatively high numbers of animal deaths occurring. Accompanying them were a decline in milk production and an increase in infertility as well as loss of calves at birth.

Mr Somers' problems were worst between 1992 and 1993, while Mr Ryan's were worst between 1994 and 1995.

Both Mr Somers and Mr Ryan and a portion of the approximately 4,000 people living in the Askeaton/Rathkeale area felt that environmental pollution was the key cause of these animal health problems, in particular emissions from alumina production at Aughinish Island located some 8 km west of the affected farms. Among the substances suspected to be involved were aluminium and fluoride. Other possibilities put forward were organic compounds such as dioxins and PCBs.

These suspicions were not based on any record of contamination in the area. Rather, research material from the scientific literature was put forward by independent advisers to the farmers as suggesting such possibilities.

To a lesser extent, suspicions were also directed at the two Electricity Supply Board power plants at Moneypoint and Tarbert (located on the Shannon Estuary about 28 km and 25 km respectively west of Askeaton). Aughinish Alumina and the two ESB plants are large in an Irish context. In 1998 they accounted for 56 per cent of sulphur dioxide emissions nationally and 23 per cent of nitrogen oxides emissions, with the Moneypoint plant being the largest source of these emissions.

Air quality monitoring systems had been in place around both the Aughinish Alumina and Electricity Supply Board plants since those operations first began in the 1980s. Some of the sites in these monitoring networks, particularly those operated by Enterprise Ireland (formerly Forbairt) on behalf of Aughinish Alumina, are located near the affected farms.

At no stage did data from these monitoring networks raise concerns about pollution levels in the area.

In view of strong feelings on the matter locally, it was considered necessary to carry out a full assessment of all external factors that could have posed a risk to animal health in the area.

Because environmental pollution was suspected by the farmers concerned to be the key causative factor, the Government asked the Environmental Protection Agency to co-ordinate a four-agency investigation team.

The decision to involve the Mid-Western Health Board was prompted by widespread local concerns that if environmental factors were found to be the cause of adverse effects on animal health then these could also have implications for human health, and also by a perception locally that there were actual health problems, such as increased cancer, in the area.

### **Scale of operation**

This joint investigation was unprecedented both in terms of the scale of financial resources allocated to it and the numbers of scientists and other personnel involved. It was also the first inter-sectorally managed environmental investigation in Ireland.

It cost approximately IR£4.19 million and it involved 33 personnel from the participating agencies, including environmental and soil scientists, veterinary and medical experts along with additional technical support staff and consultants.

### **Brief chronology of events since 1993**

**Spring/Summer 1993** Teagasc personnel sampled soil, herbage, water and animal blood from Mr Somers' farm in an effort to provide an explanation for reported animal health and performance problems. The results did not provide an indication of the causes of the animal health

problems but soil fertility and animal nutrition advice was provided.

- August 1993** Limerick County Council commissioned a survey by Dr Paul Dowding and Dr Valerie Dowding, Trinity College Dublin. They concluded that many of the reported animal health and production problems were consistent with iodine deficiency.
- January 1995** The Mid-Western Health Board began investigating the problem in Askeaton following expressions of concern by local people that human illness and minor ailments in the area might be linked with animal health problems.
- February 1995** The Veterinary Laboratory Service, Department of Agriculture, Food and Rural Development undertook pathological and toxicological investigations on carcasses of animals from the Ryan farm.
- The Minister of State at the Department of Agriculture and Food and Rural Development confirmed that the Environmental Protection Agency would co-ordinate a four-agency investigation team. The four main areas of the investigation were assigned as follows: animal health (Veterinary Laboratory Services); soils and plant status (Teagasc); public health aspects (Mid-Western Health Board); pollutant emissions and environmental quality (Environmental Protection Agency).
- The Environmental Protection Agency organised a briefing meeting for local bodies including representatives of farming organisations, concerned farmers and members of the public living in the Askeaton area, the local authorities (Limerick, Clare and Kerry County Councils), representatives of local industries including Aughinish Alumina, Wyeth Nutritionals and the Electricity Supply Board.
- March 1995** Formal investigations by four agencies began.
- The Environmental Protection Agency established a technical group comprising representatives of the four investigating agencies and the local authorities in the Askeaton area. (This group met regularly between 1995 and 1998 to review progress and consider data arising from the various scientific measurements and observations.)

<b>March 1995</b>	The Environmental Protection Agency assessed the pollution potential of industrial activities in the area and collated the existing information on air quality. This was complemented by the commencement of continuous automated measurements of sulphur dioxide levels on the Somers and Ryan farms and weekly measurements of pollutants deposition in precipitation. In addition, a range of measurements of organic compounds such as dioxins and pesticides in soil, milk and water were undertaken. The Agency continued monitoring at both locations through to the end of 1998 and is continuing to monitor on the Somers farm to date.
	Teagasc conducted a soil and botanical survey of three farms. A large number of soil, herbage, fodder, feed and water samples were also taken for chemical analysis.
<b>April 1995</b>	All four agencies addressed the local community at the invitation of the Askeaton/Ballysteen Animal Health Committee.
<b>May and August 1995</b>	The Environmental Protection Agency brought in veterinary toxicology experts from the UK and the US - Mr Chris Livesey, Head of Toxicology at the UK Ministry of Agriculture, Fisheries and Food Central Veterinary Laboratory in Weybridge and Dr Gerry Henningsen and Dr Mark Wickstrom, veterinary toxicologists attached to the Denver office of the US Environmental Protection Agency.
	They examined the animals on the Somers and Ryan farms and concluded that nutritional imbalance was the single most likely factor involved in the animal health problems being experienced in the area.
	Teagasc conducted a second botanical survey of three farms.
<b>July 1995</b>	The Environmental Protection Agency distributed an information booklet on the nature of the upcoming investigations to people in the Askeaton area.
<b>1995 and 1997</b>	The Environmental Protection Agency commissioned two studies in relation to sulphur dioxide, which at that time was judged to be the main pollutant emitted in the Askeaton area.
<b>July 1995</b>	The first study involved a review of published international research studies on the ecotoxicology of sulphur dioxide and was

undertaken by Dr Mary Brennan and Dr Paul Dowding, Trinity College Dublin.

- October 1997** The second, carried out by Dr N F Suttle, Honorary Research Fellow at the Moredun Foundation for Animal Health and Welfare in Edinburgh, was an assessment of the likely impact of the emissions of sulphur dioxide in the Askeaton area on livestock.
- Spring 1995** The Mid-Western Health Board began discussions with the Department of Epidemiology and Public Health Medicine, University College Dublin on the planning of a series of human health investigations on people living in the Askeaton area. (The university subsequently partnered the health board in a number of investigations carried out between 1995 and 1998).
- November 1995** In order to carry out a monitoring study of animal health and production on the two problem farms, the Department of Agriculture, Food and Rural Development purchased the Ryan farm outright and made arrangements to lease the Somers farm.
- November 1995** The Environmental Protection Agency began daily sampling of precipitation on the Somers and Ryan farms. (These measurements were maintained up to end 1998 on every day of the year).
- November 1995** The retrospective study of the Somers and Ryan farms and of the other self-declared problem farms began.
- December 1995** For the purposes of the monitoring study, exchanges of cows took place between the Somers farm and the State farm at Abbotstown, Co. Dublin in December 1995 and again in April 1996
- December 1995** The Environmental Protection Agency published an interim report, mainly dealing with Teagasc and Environmental Protection Agency measurements, but also summarising all available information on animal health and human health in the Askeaton area.
- Between 1995 and 1998** The Environmental Protection Agency convened regular meetings between the Veterinary Laboratory Services, Teagasc, the Mid-Western Health Board and the Askeaton/Ballysteen Animal Health Committee.
- Between 1995 and 1998, the four investigating agencies published two further interim reports summarising the outcome of all scientific measurements taken over a 36-month period. In addition, seven progress reports were prepared for an Interdepartmental

Committee that monitored the progress of the investigations on behalf of the Government.

The Environmental Protection Agency circulated both the interim and progress reports to interested parties including local authorities; industrial enterprises, Mr Somers, Mr Ryan and the Askeaton/Ballysteen Animal Health Committee.

Teagasc monitoring of herbage for sulphur, selenium and molybdenum was conducted between end 1995 and early 1998 on the Somers and Ryan farms.

<b>Early 1996</b>	From early 1996, the Mid Western Health Board began analysing data on various aspects of human health to facilitate a comparison between the notionally exposed area around Askeaton and control areas in Counties Limerick, Clare and Tipperary (NR) as well as the national situation.
<b>Between 1996 and 1998</b>	The Health Board carried out 12 studies to determine if any illnesses were occurring at unusual levels in the Askeaton area.
<b>March to December 1996</b>	The Mid-Western Health Board examined contaminant levels in vegetables grown in the Ballysteen area.
	During the same period, Coillte, on behalf of the Forest Service, began to monitor the health of trees in nearby forestry plantations. These trees continued to be monitored until the end of 1998.
<b>April 1996</b>	The Veterinary Laboratory Services team began a series of studies and investigations. This work continued until December 1998. This team's investigations included a two-year detailed monitoring study on the Somers and Ryan farms and incorporated a survey of additional "problem" farms.
	Twenty-seven farms, including the Somers and Ryan farms, from the wider Askeaton area that had reported unexplained animal health problems, volunteered for inclusion in the survey. All of these farm owners were interviewed in depth regarding their stated problems, and a detailed monitoring programme of five of the more seriously affected farms was put in place. All 27 were offered investigating agency expertise and advice on dealing with problems.
	A series of studies to measure the immune function of animals from the Somers and Ryan farms began.

<b>1997</b>	On two separate occasions during 1997 soil, herbage and fodder samples were taken from 23 of the self-declared problem farms. These samples were analysed by Teagasc for elements of environmental and nutritional importance.
<b>June 1997</b>	Environmental Protection Agency published second interim report.
<b>August 1998</b>	Environmental Protection Agency published third interim report.
<b>December 1998</b>	The Environmental Protection Agency, Teagasc, the Veterinary Laboratory Services and the Mid-Western Health Board all completed the measurement phase of their various investigations.
<b>Between January 1999 and June 2001</b>	The four investigating agencies analysed and cross-referenced the measurement data, which had been collected over a period of almost four years.

### **Main investigation findings**

It is important to note that the overall findings in relation to animal health and environmental quality do not differ from the findings already contained in the three interim reports published since 1995.

The complete findings on human health are presented in the final report for the first time.

The investigators' final report concludes that:

- Environmental pollution, toxic substances in the diet, soil composition anomalies and herbage composition anomalies are all unlikely causes of the animal health problems on the Somers and Ryan farms.
- The reasons for the severity of animal health problems on the **Somers farm** could not be specifically identified – both because of the retrospective nature of the investigations and the very limited involvement of specialist veterinary pathology services during the period when the problems were at their worst, i.e. from about 1988 to 1993. However, many of the problems reported were of a type commonly seen on farms elsewhere and there is evidence from the available historical information of the involvement of on-farm infectious, nutritional and management factors.

- The most likely causes of problems on the **Ryan farm** were infectious and nutritional in nature. Cows submitted for post-mortem in February 1995 had lesions of acute infectious diseases. An outbreak of salmonellosis was also confirmed in cows. It is likely that the combined effects of out-wintering pregnant cows on poor quality silage during the severe winter and spring of 1994 and 1995 resulted in a large proportion of cows calving down in poor condition in the spring of 1995. This would have increased their susceptibility to disease.
- While there was undoubtedly an unusually high incidence of animal disease on a small number of farms in the Askeaton area, in addition to the Somers and Ryan farms, neither the number of farms involved nor their geographical spread, suggests that this provides evidence of a phenomenon affecting the wider Askeaton area as a whole.
- Given the animal health study findings, there is little cause for concern that the problems in the Askeaton area posed a threat to human health.
- An independent human health problem arising from atmospheric emissions in the area is unlikely given that, since the mid-1980s at least, air quality measurements in the area have complied with EU standards. This assessment was borne out by the results of the human health studies reported below.
- Specific studies carried out as part of this investigation showed none or only minor differences between the human health experience in the Askeaton population and the populations in counties Clare, Limerick and Tipperary.

### **Investigating agencies' general comments**

While these investigations did not reach definitive conclusions about the causes of the animal health problems in Askeaton, it is hoped that they will provide assurances that they were not the result of some area-wide factor or factors, which might also have had negative effects on human health.

The experience gained in the investigations of these animal health problems emphasised the need for early intervention and a systematic and co-ordinated approach to any future problems of this nature. The government agencies did not become involved in a co-ordinated way until some years after the problems first manifested. The opportunity to make observations at the most critical periods i.e. 1988 to 1995 was therefore limited.

It is possible that had a protocol for the investigation of serious incidents been in existence at the time the animal health problems first came to attention, these

investigations would not have been necessary. Certainly, they would not have been so detailed or as lengthy.

The delayed investigation and intervention allowed a situation to develop which, from the point of view of the farmers and the local community, could not be addressed satisfactorily by a limited study.

### **Investigation Outcome**

As a result of specific recommendations made by the four investigating agencies, a Government protocol for investigating human health and animal health problems was put in place in 1997.

This protocol has been used on a number of occasions since then – specifically in the Silvermines, Co. Tipperary Investigation and the Leixlip area of Co. Kildare.

## **PART TWO**

### **Detailed Sectoral Findings**



## **ANIMAL HEALTH INVESTIGATIONS CARRIED OUT BY THE VETERINARY LABORATORY SERVICES, DEPARTMENT OF AGRICULTURE, FOOD AND RURAL DEVELOPMENT (DAFRD)**

The Veterinary Laboratory Services investigated the Somers farm in 1993, and again in 1994 and 1995. It investigated the Ryan farm in early 1995 (i.e. prior to the establishment of the four-agency investigation).

The retrospective survey was carried out in late 1995 and detailed animal health tests/measurements as part of the four-agency investigation began in March 1996.

Specifically, the team set out to establish

- the causes of the animal health and production problems on the Somers and Ryan farms, and ascertain if there was any evidence that they were due to environmental pollution.
- if there was any evidence of an unusually high incidence of animal health and production problems in the wider Askeaton area. If so, was there any evidence that this was due to common underlying factors. In particular, was there any evidence that environmental factors had contributed to an excess of animal disease and milk production problems in the area.

In order to establish these findings, the investigators carried out

- a **two-year monitoring study** of health and production of cattle on the Somers and Ryan farms. In the case of the Somers farm, monitoring was duplicated with Askeaton and non-Askeaton-origin cows on the Department of Agriculture, Food and Rural Development farm at Abbotstown, Co. Dublin. (Some of the Somers cattle were transferred to the Abbotstown farm, and some of its cattle were transferred to the Somers farm).
- a **retrospective epidemiological survey** of 25 self-identified ‘problem’ herds plus the Somers and Ryan herds.
- a **two-year longitudinal study** of animal health and production on five of the 25 self-identified problem farms. (One of these farms was subsequently withdrawn by the farmer from the study).
- a **contemporary investigation** of animal health on 19 of the self-identified problem herds.
- a **series of studies** to measure the immune function of animals from the Somers and Ryan farms.
- a **questionnaire survey** of animal health and production in the Askeaton area, in other areas in CO Limerick and nearby counties.
- a **study** on the effect of feeding soil from the Somers farm to laboratory rats.
- a **field study** to investigate a suggested association between liver enzyme activities in voles and environmental pollution in the Askeaton area.
- **Laboratory analyses** on tissues of cattle carcases from Askeaton farms.

### **Key Findings: 1995 to 1998 investigations**

During the **monitoring study** (April 1996 to October 1998) overall mortality levels and disease levels on the Somers, Ryan and Abbotstown farms were low. There was no recurrence of the severe animal health problems of previous years on the Somers and Ryan farms. Animal and milk production was generally satisfactory. No outbreaks of unusual or undiagnosed diseases were encountered. Occasionally reduced animal fertility on the Somers and Ryan farms was readily explainable, and there was no evidence of unusual factors. In particular,

- The health of farm 'growing stock' i.e. calves and yearlings was good throughout. Had environmental pollution been present, these younger animals would have been more likely to exhibit adverse effects of such pollution.
- Age for age, 'growing animals' in Askeaton (i.e. calves, weanlings, yearlings and two year olds) generally outperformed similar-age animals on the Abbotstown (control) farm.

The **retrospective epidemiological study** involving 25 farms concluded that reports from 14 of the farms were consistent with moderately severe or severe problems. The study did not find evidence of a common cause and the results were not considered to be indicative of a severe animal health problem in the wider Askeaton area.

- There were indications that the very limited recourse to veterinary laboratory assistance while problems were at their worst led to a low rate of diagnosis of the problems on the Somers and Ryan farms.
- Factors that contributed to the severity of the problems on the Ryan farm, included poor cow cubicle design, outwintering of pregnant cows on poor quality silage during the severe winter of 1994 and 1995 and inadequate pre-calving nutrition.
- Fourteen of the 25 self-identified problem farms appeared to have had moderately severe or severe animal health problems. The results of the survey did not provide any evidence to suggest that there was a high incidence of unusual diseases in the Askeaton area . The majority of the problems reported are common on farms elsewhere.
- The range of problems reported, as well as variations in their times of onset and duration, would tend to rule out involvement of a common underlying cause such as environmental pollution.

Animal health performance was generally good on the four farms participating in the **longitudinal study** during 1997 and 1998.

- A problem of low milk yields on one farm in 1997 could not be fully investigated owing to the sale of the dairy herd.
- Fertility performance in all four herds was acceptable.

In the **questionnaire survey of animal health**, animal mortality and production (cow fertility) indices were generally within reference ranges. Reported rates of suckler cow mortality, as well as rates of ill-thrift in cows and dry stock, were significantly higher in the Askeaton area than in the control areas. Interpretation of the survey results was complicated by significant differences between the two areas in terms of farm size and type (i.e. dairy vs. suckler).

The **immunological study** did not show any immune system deficiencies in cattle located at or originating in Askeaton.

The **rat feeding trial** showed no adverse effects in laboratory rats of consuming food mixed with soil from the Somers farm.

The **vole field studies** showed that lower liver enzyme activity in the Askeaton animals, compared to voles in other areas, was most likely due to naturally occurring variations of selenium concentrations in the herbage.

Analyses of blood and tissue samples, carried out by the Veterinary Laboratory Service, from cattle and cattle carcases from the Askeaton area, showed that the concentrations of fluoride and of a range of metals, including aluminium, were well below harmful levels.

#### **Overall conclusions: Veterinary Laboratory Services investigating team**

Whatever factors had contributed to the unusually high incidence of disease on the Somers and Ryan farms in previous years were no longer present by early 1996.

The absence of evidence of environmental pollution (based on the results of environmental monitoring in the area between 1987 and 1998), combined with the variety of syndromes reported, argues against its involvement in the animal health problems.

Contrary to previous researchers' suggestions, it is unlikely that mineral deficiencies were of more than marginal importance on these two farms.

The reasons for the severity of problems on the Somers farm are largely a matter of speculation owing to the very limited nature of contemporary investigations. The majority comprised conditions seen on farms elsewhere and there was historical evidence for the involvement of commonly-accepted on-farm contributory factors. While the most severe problems on the Ryan farm were ultimately infectious in nature – inclement weather and nutrition were also important contributory factors.

## **SOIL, HERBAGE, FEED AND WATER INVESTIGATIONS CARRIED OUT BY TEAGASC**

This field investigation was carried out to obtain evidence of previous inputs to soil, herbage (grass/fodder) and water that may have contributed to reported animal health problems on farms in the Askeaton area.

Since soil acts as a long-term reservoir, soil analysis can provide evidence of historical inputs.

Soil analysis also provides an indication of possible plant nutritional factors (mineral excesses or deficiencies), that would affect crop growth and nutrient content, thereby contributing to animal health problems.

Herbage and fodder (silage and hay) act as a short-term reservoir, thereby providing evidence of more recent inputs. Herbage and fodder analysis also provides an indicator of potential animal dietary/nutritional problems.

#### **What Teagasc set out to do**

First, Teagasc set out to establish factors that might have contributed to the animal health problems on farms in the Askeaton area. Specifically, the investigating team sought to obtain evidence of any unusual inputs to soil, herbage, water and feed (including conserved fodder).

Second, Teagasc provided support for the animal health investigations conducted by DAFRD. This included providing input to the development of project protocols and on-going management advice and support for the farms involved in the investigation.

Specific measurements/tests in relation to the Ryan, Somers and a control farm in the Askeaton area:

- A soil survey and classification/evaluation of production potential was carried out in March 1995.
- Soil sampling and chemical analysis for a range of inorganic components were carried out between 1995 and 1998.
- Herbage sampling and chemical analysis were carried out between 1995 and 1998.
- A water analysis study was carried out in March 1995.
- Samples of concentrates and mineral mixtures were analysed in spring 1995.
- Analysis of fodder on the Somers and Ryan farms was carried out in 1995.
- Two botanical surveys of pastures and hedgerows on the three farms were conducted in March and May 1995 and June 1999.

A longitudinal study of animal health and production involving analysis of soil, herbage and fodder on four farms (excluding the Somers and Ryan farms), was carried out between 1997 and 1998.

Follow-up analyses of soil, herbage and fodder were carried out in 1997 and 1998 on the farms that were the subjects of the Retrospective Study.

### **Key Findings**

The following are the key findings resulting from the Teagasc investigations carried out between March 1995 and December 1999.

- The **soil survey** results on the Ryan, Somers and control farm were typical of north County Limerick soils. There were no anomalies which could be regarded as significant in the context of the reported animal health problems.
- Levels of **minerals and trace elements in soils** (i.e. those considered necessary for healthy crop and animal production) on the Somers, Ryan, control farm and on 23 farms participating in the retrospective study were generally within expected ranges for Ireland as a whole. As such they cannot account for either the range or severity of animal health and production problems displayed in the Askeaton area. Relatively high levels of **selenium and fluoride** were found in a few small areas on the farms, but these are natural features of soils in the Askeaton area. There was no evidence to suggest contamination by pollutants such as **sulphur and aluminium oxide** emitted from local industries
- Levels of **mineral and trace elements in herbage** were average for the country as a whole, and again there was no evidence of contamination by potential pollutants from local emissions. However, almost half the farms investigated were found to have high levels of molybdenum, which under certain circumstances could have an impact on copper absorption by grazing animals. The relatively high levels of sulphur measured in

herbage samples from the Somers farm in 1994 were not borne out by the more detailed measurements made in 1995 and by the later monitoring of herbage sulphur.

- Generally, the nutritive value of the **silage** was typical for Limerick County, but low when compared to values for the country as a whole. Silage of the Askeaton quality would need added feed concentrates in order to ensure proper nutritional requirements for cattle.
- The **quality of pastures** on the Ryan and Somers farms was less than considered optimal for intensive dairy production.
- Sources for **water for livestock** on the farms, while showing bacterial contamination in some cases, did not contain harmful levels of potentially toxic substances.
- There was no evidence of contamination with potentially harmful substances of the **feeds, concentrates and mineral mixes** used on the Ryan, Somers and control farm.
- **Damage to hedges, trees and shrubs** was attributed to unfavourable weather conditions rather than atmospheric pollution. **Discoloration of grass** in some Askeaton pastures was caused by nitrogen deficiency – a not unusual phenomenon that occurs in pastures at certain times of the year.
- **PCBs concentrations** in soil samples from the three farms were at background levels.

### **Overall conclusion: Teagasc investigating team**

Teagasc found no evidence of previous chemical inputs to soil, herbage and water that could have contributed to reported animal health problems on farms in the Askeaton area during the investigators' sampling and analysis programme carried out between March 1995 and December 1999.

## **HUMAN HEALTH INVESTIGATIONS CARRIED OUT BY MID-WESTERN HEALTH BOARD**

At a public meeting held on January 10<sup>th</sup> 1995, a high level of concern was expressed about adverse human health in the Askeaton area.

Immediately after that meeting, Dr Mary O'Mahony, Acting Director of Community Care, Mid-Western Health Board contacted six GPs in the Ballysteen/Askeaton area requesting them to review patterns of illness among their patients. Specifically, they were asked to report any cases of skin rashes; eye/nose/throat irritation; respiratory problems; abnormal outcome of pregnancy (in particular miscarriages or birth of twins); change in the pattern of cancer; neurological problems.

**No GP reported any cluster of adverse health effects that might be attributable to an environmental hazard.**

In the weeks following the GP survey, Dr O'Mahony carried out a review of international research findings on the possible health effects of known pollutants. She held discussions with local industry representatives and the Senior Environmental Engineer, Limerick County Council. She also organised meetings with the Askeaton/Ballysteen Animal Health Committee and other concerned individuals.

The Health Board offered to pay for private consultations with medical specialists for anyone concerned about specific health issues. Of the approximately 4,000 people living in the Askeaton/Rathkeale area, one person took up this offer.

The formal Human Health Investigation got underway in summer 1995.

In May 1995 the Department of Epidemiology and Public Health Medicine, University College Dublin became involved in the investigation at the request of the Mid-Western Health Board.

In November 1995 Dr Kevin Kelleher was appointed Director of Public Health, Mid-Western Health Board and he subsequently hired a team comprising 17 personnel dedicated solely to examining human health in the Askeaton area.

Specifically, the investigators set out to establish if the health experience of people living in the Askeaton area was different to that of residents in a number of control areas in CO. Limerick and parts of CO. Clare and CO. Tipperary and, if so, could that difference be attributed to environmental pollution.

In order to establish these findings, the investigating team brought in a number of experts experienced in pollution investigations. These experts included Professor Tim Aldrich, Environmental Epidemiologist, South Carolina Department of Health and Environmental Control, USA; Dr Nichol Black, Consultant in Communicable Diseases Control, Newcastle, UK; Dr Patrick Wall, (then Public Health Laboratory Service, Colindale, UK; now Chief Executive, Food Safety Authority of Ireland).

First, the team carried out an international literature review of research findings on the effects of common atmospheric pollutants on human health.

Second, the team carried out 12 separate studies – on births and congenital abnormalities; sex ratio; twin rates; GPs perceptions of health problems in their practices; a health status survey; an acute health effects/diary study; cancer incidence study; Askeaton mortality study; adolescent health study; child absenteeism study; a report on sampling of horticulture produce, and an investigation into media reports of suspected cases of chloracne.

Two additional studies, a hospital admissions study and a prescribing patterns study were attempted but could not be progressed because of the impossibility of accessing the relevant data.

#### **Study 1: International scientific literature review on the effects of common atmospheric pollutants on human health**

Atmospheric pollution *per se* does not cause disease, but it can exacerbate pre-existing conditions such as chronic bronchitis, emphysema and asthma. In the last 30 years, childhood asthma has increased by about 50 per cent in the UK against a background of diminishing emissions of smoke and sulphur dioxide.

Of specific relevance to Askeaton residents is the fact that the most up to date published research suggests that people who enjoy the cleanest air may be more likely to react adversely to atmospheric pollutants at levels significantly below even stringent EU limits.

#### **Study 2: Births and Congenital Abnormalities**

Although local people had voiced concerns about the level of congenital abnormalities among new-born children and the rate of multiple miscarriages in individual women, no clusters of specific abnormalities were ever actually reported.

Due to the absence of any form of more advanced recording system, the investigating team examined more than 14,906 manual birth records dating between 1987 and 1992. In addition to those birth records, they examined special baby care unit records in Limerick, Cork and Tralee; public health nurse records; counselling nurse records; long term illness records; domiciliary care allowances and official birth notices.

All stillbirth records in Limerick, Cork and Tralee hospitals were also examined in order to ascertain whether congenital abnormalities were present.

The investigating team searched for cases of structural malformations, chromosomal abnormalities, metabolic disorders and hereditary diseases. Malformations were classified into subgroups indicating their mutagenic (e.g. Down's Syndrome) or teratogenic origin and known association with environmental exposures.

The overall study time frame covered the period 1987 to 1994.

**Result/key finding:** No clusters of specific abnormalities were found. Overall, the rate of congenital abnormality in the Askeaton area is lower than in other European registries and within the norms accepted internationally i.e. 1-2 per cent of all births.

#### **Study 3: Sex Ratio**

Normally male births exceed female births. However, environmental and occupational health research suggests that a change in sex ratio in favour of female births may be an early indicator of environmental hazards. Some researchers have suggested that because male infants and foetuses are weaker than females, unborn males may be more susceptible to the adverse effects of environmental pollution. Alterations in the usual sex ratio pattern have been associated with airborne pollution from steel foundries and incinerators.

**Result/key finding:** The ratio of male to female births is slightly higher in Askeaton than in the comparison areas. This is positive news because the male birth sex ratio is the opposite of what might be expected should the area suffer from the effects of environmental pollution.

#### **Study 4: Rate of Twin Births**

Some years ago Scottish researchers carried out a study to assess the frequency of twin births during the period 1975 to 1983 in defined geographical areas known to be most at risk from incinerator air pollution. The results showed increased frequency of human twinning and a dramatic increase in twinning among dairy cattle.

In 1994 Irish media reports alleged there had been an increase in twin births among farm animals, especially dairy cows, around the Askeaton area. Even though the local community had not expressed concerns about an increase in human twinning, the Mid-Western Health Board decided to carry out a study to establish if such a phenomenon had occurred in Askeaton during the period 1987 to 1994.

**Result/key finding:** The human twinning rate (i.e. number of twin births per thousand births) is slightly lower in Askeaton than in Limerick County and Ireland as a whole. The reverse would have been predicted in an area of environmental pollution.

#### **Study 5: Survey of GPs' perceptions of health problems in their practices**

Given that 95 per cent of patient health queries are dealt with by GPs, the investigators decided to survey them to see if they had experienced a pattern of adverse health effects among their patients – specifically effects which may result from exposure to environmental health hazards.

The first study of six GPs in the Askeaton area carried out in January 1995 showed no cluster of adverse health effects that might be attributable to an environmental hazard.

In November 1996 the Mid-Western Health Board decided to carry out a much wider study, and a detailed questionnaire was sent to an additional 50 GPs. Of those invited to participate, 34 actually took part.

This time, the Health Board's aim was to assess GPs' perceptions of patient ill health in six geographically defined Mid-West areas to see if there were significant differences between them. The participating GPs were drawn from Askeaton, Rathkeale, Killadysert, Clarecastle, Ennistymon, and Moyne/Littleton as well as towns adjacent to those areas.

The specific objective was to assess whether GPs in Askeaton and Rathkeale compared with those in other areas had noted an increase in the previous twelve months in the number of patient consultations for respiratory problems, sinus and skin irritations, cancers and serious illness.

In the case of fertility problems, unusual numbers of cases of miscarriages, and serious illnesses such as cancer, leukaemia and neurological problems, GPs were asked to extend their record searches back over a ten-year period (i.e. to 1986). Finally, they were asked to give their views on environmental hazards in their area.

**Result/key findings:** Of the 34 GPs who responded to the questionnaire, those in the putative exposed areas (Askeaton and Rathkeale) had more concerns about rates of miscarriage, serious illness and patient health than those in the control areas (Killadysert, Clarecastle, Ennistymon and Moyne/Littleton in Counties Clare, Limerick and Tipperary). They also had more health concerns about their patients. This may reflect the level of patient anxieties conveyed to them. It may also reflect GPs' concerns about their own proximity to major industry.

Unfortunately, because routine written patient records and computerised records were not available, the study could not elicit responses about putative incidences of specific environmental hazard related illnesses (i.e. skin rashes, eye/nose/throat irritation, respiratory problems, change in pattern of cancer and neurological problems), and miscarriages. This phenomenon of incomplete paper records (and almost non-existent computerised records) is not unique to GPs in the Mid-Western Health Board region: at the time the study was carried out, it was the norm in GP practices all over Ireland.

#### **Study 6: The Health Status Survey**

Because of the aforementioned lack of health information systems, the Mid-Western Health Board team decided to conduct a comprehensive 'stand alone' survey of human health in the Askeaton and Rathkeale areas and four comparison areas - Ennistymon, Killadysert, Moyne/Littleton and Clarecastle.

This survey set out to establish if there was any association between geographical patterns in human health and the reported pattern of animal ill health. It also sought to elicit information about pregnancy outcomes and potential environmental hazard related illnesses such as upper respiratory tract problems, eye and skin irritation.

A key focus was to measure low levels of illness that might not require GP visits (particularly relevant given the likely low-level effect of environmental pollution).

In the light of community concerns about miscarriage rates, the numbers of women of childbearing age (15-44) interviewed was doubled deliberately.

A team of nurses interviewed a total of 2,500 people (aged 15 and over).

**Result/key finding:** The figures for pregnancy outcomes, including miscarriages, show no statistically significant differences between Askeaton and Rathkeale and the four comparison areas (Ennistymon, Killadysert, Moyne/Littleton and Clarecastle).

**In cases where people interviewed did report specific ill health patterns, none are consistent with any known pollution source.**

### **Study 7: The Diary Study**

This study was conducted over a 13-month period. 26 families agreed to take part, but effectively only 18 families (totalling 76 individuals) remained involved. All were from the Askeaton area and all had farms that had experienced an unusually high level of animal health problems.

The ‘diary process’ required a family co-ordinator to record details of all family members’ acute health problems, and in particular to note symptoms of upper respiratory tract, eye and skin irritation. Other categories included ear/nose/throat, mental health, muscular/skeletal, gastrointestinal and fatigue.

Respiratory symptoms were the most commonly reported (19.5%); followed by ear/nose/throat (16.4%); skin (13%), and fatigue (12.6%).

**Result/key finding:** Of the 18 farm households (totalling 76 individuals) taking part in this diary study, 13 households had good health; three had moderate health and two had an excess of mild ill health.

Although five of the 76 individuals suffered frequent bouts of low-level ill health throughout the study, in the majority of cases, this did not require the intervention of a GP or any other health professional.

The possible bias involved in a self-reporting exercise in an area of heightened environmental awareness must be considered when assessing these results.

### **Study 8: Cancer Incidence**

Because people in Askeaton and Rathkeale had expressed concerns about the incidence of cancer in their area, the investigating team set out to determine if they had a greater likelihood of developing cancer than people living in the comparison areas ( i.e. Ennistymon, Killadysert, Moyne/Littleton and Clarecastle).

The study time frame covered 1994 and 1995, i.e. the first two years of operation of the National Cancer Registry. These Registry data only became available to the Mid-Western Health Board investigating team in late 1997.

**Result/key finding:** There was no evidence that cancer risk was greater in the putative exposed area compared to the control areas or indeed Ireland as a whole. On the contrary, the figures indicate lower cancer incidence than would otherwise be expected in a population of this size ( i.e. approximately 4,000 people) or indeed in the population of Ireland as a whole.

**Men have approximately 15 per cent less chance of developing cancer than other residents in the Mid-Western Health Board catchment area, and 30 per cent less risk than men in Ireland as a whole. For women, the risk is about one-third less than the average Mid-Western Health Board population and approximately three quarters less than women in Ireland as a whole.**

**Note:** Nationally, cancer death rates remain unchanged since the early 1970s and Ireland’s figures are comparable to other western European countries. That said, within Ireland, cancer incidence and death rates do show geographical variation. For example, lung cancer is commoner in the more heavily industrialised parts of the East Coast.

### **Study 9: The Askeaton Mortality Study**

This study analysed data for all cause mortality and respiratory mortality in the Mid-Western Health Board region over a six-year period (1991 to 1996 inclusive). It involved examining some 12,000 Central Statistics Office records, an extremely labour intensive task, which took almost three person years to complete.

The study set out to answer three specific questions. Did people living in the Askeaton area have a higher mortality rate than people living in the lower risk comparison areas of Ennistymon, Killadysert, Moyne/Littleton and Clarecastle? If they did suffer a higher incidence of mortality, was this increase to be found in any particular population sub-groups? Was there any association between mortality and distance from nearby pollutant sources?

**Result/key findings:** Excluding deaths from accidents and suicide, Askeaton and Rathkeale have a more favourable mortality rate generally than the comparison areas of Ennistymon, Killadysert, Moyne/Littleton and Clarecastle.

**Askeaton and Rathkeale also have more favourable mortality rates generally compared to the Mid-West Health Board region.**

Within the overall study, two sets of findings go against that favourable pattern – the rate for all-cause mortality in young people of both sexes aged 0 to 14, and the rate for respiratory mortality among men of all ages were higher in the Askeaton area than in the control areas. While the excess in both cases was statistically significant, it was numerically small.

It must be stated however that when deaths for all cause mortality and respiratory mortality are taken into account, there is no consistent pattern of increased risk associated with Askeaton compared to Ennistymon, Killadysert, Moyne/Littleton and Clarecastle, or indeed the Mid-West as a whole.

Finally, there is no evidence of increased mortality nearer to the main source of pollutants in the area – if anything mortality rates increase as distance away from Askeaton increases.

#### **Study 10: Adolescent Health**

This study carried out in mid-1997 set out to determine if the physical health experience of teenagers living in the Askeaton/Rathkeale area was worse than that of teenagers in three comparison areas in CO. Clare (Killadysert, Ennistymon and Clarecastle). Altogether, 750 pupils from nine second level schools took part by completing the US-devised child health questionnaire that measures physical and psychosocial well-being. Approximately one-third of the pupils were from Askeaton and Rathkeale.

**Result/Key findings:** The study found that the physical health of teenagers in the Askeaton/Rathkeale area was no different to that of their counterparts in Killadysert, Ennistymon and Clarecastle. The other key positive finding was that scores for mental health and self-esteem were significantly higher in Askeaton/Rathkeale teenagers than in teenagers in the comparison area.

#### **Study 11: Child absenteeism**

This study followed consultation with and recommendations from the local residents group (Askeaton/Ballysteen Animal Health Committee) and Dr Patrick Wall, Consultant Environmental Epidemiologist, Public Health Laboratory Colindale, UK. Its aim was to establish if school absenteeism in Askeaton and Rathkeale was different from that in Killadysert, Ennistymon, Clarecastle and Moyne/Littleton. The investigators examined attendance records over a ten-year period (1985 to 1995) involving 10,723 pupils in 50 primary schools.

**Result/key findings:** Askeaton, specifically, had a lower attendance in each of the ten years examined. In nine of those years, the differences were very small and may not be clinically significant i.e. an average of 0.5 days to 1.5 days per child per year.

This type of retrospective study has its limitations, and therefore care should be taken when evaluating the results. For example, it is not possible to link the absenteeism to pollution, as no measure is available. School absenteeism is only a proxy measure of ill health. It is not possible to state that these are ‘ill health

absences' let alone 'respiratory ill health absences'. No such detailed information was available – just a crude absenteeism score gleaned from each of the schools' "clarleabhar" registers.

#### **Study 12: Report on the sampling of horticulture produce**

At the request of the Environmental Protection Agency, the Mid-Western Health Board Environmental Health Department undertook sampling of horticulture produce from the Ballysteen area to establish whether vegetables grown there showed evidence of being contaminated or unfit for human consumption.

This initiative was prompted by Ballysteen market garden owners' fears that their livelihoods would be adversely affected by public perception of an environmental problem in the area.

During the period March to December 1996, samples of cabbage, spring greens, cauliflowers, turnips, leeks and potatoes were analysed for fluoride and a range of metals including aluminium, lead, cadmium, chromium and vanadium.

**Result:** Measurement of fluoride and a range of metals, including aluminium, in these vegetables showed that levels were well within safe limits for human consumption. They were not appreciably different to levels measured in vegetables sourced from control areas.

#### **Study 13: Chloracne**

In 1995 there were a number of speculative media reports about cases of **Chloracne** in the Askeaton area. This is a skin condition caused by the presence of chlorinated organic compounds in the air. It is most commonly associated with the 1976 Seveso disaster in Italy.

In spring 1995 the Mid-Western Health Board wrote to each of Ireland's consultant dermatologists asking them about patient referrals for Chloracne. All confirmed that they had never encountered a case of Chloracne in Ireland.

**Result:** Because no consultant dermatologist had encountered a case of Chloracne in Ireland, it was concluded that the media reports had no foundation.

#### **Study 14: Prescribing patterns**

Given the absence of computerised GP health information systems, the team considered the possibility of examining General Medical Services (GMS) computerised prescription records as it was felt that it might be possible to detect abnormal patterns of illness in the Askeaton area from abnormal GP prescribing patterns.

**Result:** This study method was rejected for several different reasons, among them the fact that approximately 65 per cent of people living in the Askeaton area attend GPs as private patients. Because they are not Medical Card holders, their prescriptions do not show up in GMS records. In the case of the remaining 35 per cent of the population who could qualify as GMS patients, the GMS coding system is such that it does not indicate where those patients reside. Therefore the study could not proceed.

#### **Study 15: Hospital study**

The investigating team looked at the possibility of designing a study that would produce geographically coded patterns of illness that had subsequently led to hospital admissions.

**Result:** Unfortunately, the Hospital In-Patient Enquiry (HIPE) system and the Patient Administration System (PAS) data were not accessible in the form required to carry out an analysis of geographically coded patterns of illness that had resulted in-hospital admission. Therefore the study could not proceed.

### **Overall conclusions: Mid-Western Health Board investigating team**

The results from the 12 separate studies carried out by the investigating team over a two-year period **do not support a link to any form of local environmental pollution.**

**The team did not find a significant degree of excessive ill health in the Askeaton area.**

**It would appear however that in a small number of families there is an excess of self-reported mild ill health in the Askeaton area, which does not subsequently lead to either GP visits or involvement with the health services generally.**

The clinical or practical significance of some of the study findings is questionable, despite their statistical significance. It is impossible to be certain of the validity of these statistics given the self-reported nature of much of the evidence.

The overall picture is further complicated by the fact that concern about environmental pollution in the Askeaton area may have been high enough to raise local people's fears about their health.

## **ENVIRONMENTAL QUALITY INVESTIGATIONS CARRIED OUT BY THE ENVIRONMENTAL PROTECTION AGENCY**

The Environmental Protection Agency was established under the Environment Protection Act, 1992. It became operational in August 1993.

In 1994 the Agency became aware of animal health problems on the Somers and Ryan farms. It also became aware of strong suspicions on the part of the farmers directly concerned and farming and non-farming communities in the Askeaton area that these animal health problems were caused by environmental pollutants. Emissions from the Aughinish Alumina (AAL) bauxite processing plant were a major focus of these suspicions.

Given the relatively high level of industrial development, which had occurred in the largely rural Askeaton area since the mid-1980s, it is understandable that environmental pollutants would figure strongly as the likely cause of unexplained animal health problems.

Although the scale of these industrial developments is moderate when compared to the situation in other areas of Europe, the Electricity Supply Board (ESB) power plants at Moneypoint and Tarbert and the nearer AAL plant, are large industrial undertakings in an Irish context. Combined, they generate 56 per cent of sulphur dioxide emissions nation-wide. As such, it was felt that the potential impact of these relatively large emissions necessitated full environmental impact assessment.

Smaller industrial activities in the local area include the manufacture of milk-based baby foods at Wyeth Nutritionals and polystyrene products at Southern Chemicals. The Roche pharmaceutical plant at Clarecastle is located to the north east of Askeaton, (across the Shannon estuary).

Nitrogen oxides are the other major pollutants emitted in the area, being produced by all high-temperature combustion processes.

Prior to 1993 air quality monitoring systems were in place around the AAL plant and the two ESB plants. In fact, monitoring had been in place since the mid-1980s. Some of the monitoring systems, in particular those operated by Enterprise Ireland for AAL, were located just 3 km from the Somers and Ryan farms.

In addition, in 1993, Limerick County Council (which at that time was the sole statutory pollution control authority in the Askeaton area), began measuring air and precipitation quality on the Somers farm.

Such were the strong feelings on the matter locally, it was considered necessary to carry out a full assessment of the pollution risks and the overall environmental quality position in the Askeaton area – even though none of the monitoring networks data had at any stage raised concerns about pollution levels in the area.

In February 1995, when the Government asked the Environmental Protection Agency to co-ordinate a joint investigation into the Askeaton problem, the Agency responded by convening a Technical Group to oversee the carrying out of a series of new studies.

Specifically, these studies sought to assess the possibility that environmental pollution was occurring in the area at a level that might cause or contribute to the animal health problems on the Somers and Ryan farms, and that might be responsible for reported human ailments in the Askeaton area.

The approach adopted in these studies was based on the hypothesis that if environmental pollution was a factor, this pollution would most likely be of an atmospheric nature – thereby resulting in poor air quality and/or harmful levels of pollutant deposits on farm land.

The new studies were designed to determine

- the range and extent of atmospheric emissions and pollutants from local industries and the two ESB power plants, and the level of risks associated with these emissions.
- the geographical areas where these emissions were likely to have the greatest impact.
- the short term variations of levels of airborne pollutants on the Somers and Ryan farms and at control locations.
- deposition rates of potential pollutants falling on the Somers and Ryan farms.
- the levels of a number of other potential pollutants in the Askeaton area, about which public concern had been expressed.

The bulk of the Agency's environmental measurements concentrated on the Somers and Ryan farms; the problems here were generally acknowledged to be so severe that if environmental pollution was involved, then measurements taken at those farms alone should be able to confirm that involvement.

Because the mode of sampling used by the AAL and ESB networks for monitoring sulphur dioxide levels did not allow the detection of short-term, high concentrations, the Environmental Protection Agency put in place continuous monitoring on the Somers and Ryan farms in spring 1995. Measurements of pollutant deposits in precipitation were made on daily samples, in particular for sulphate, nitrate and ammonia. Levels of metals, including aluminium, were measured in monthly samples. In addition a range of measurements of organic compounds, such as dioxins and pesticides, in soil, milk and water were made in 1995.

As well as assigning a dedicated team to carry out these benchmark assessment studies, the Agency commissioned research and advice from other outside agencies and experts.

Specifically,

- In 1995, it solicited the opinions of experts from outside Ireland who had dealt with similar cases in their own countries. The UK expert was Mr Chris Livesey, Head of Toxicology at the UK Ministry of Agriculture, Fisheries and Food Central Veterinary

Laboratory, Weybridge. He travelled to Askeaton in May and August 1995. Mr Livesey was then retained as an adviser by the Agency for the remainder of the investigation.

- In 1995 the Agency brought Dr Gerry Henningsen and Dr Mark Wickstrom, toxicologists attached to the Denver Office of the US Environmental Protection Agency to Ireland. Together with Mr Livesey, they visited the Somers and Ryan farms. The Agency continued to consult with them on occasion during the following years.
- In 1995 and 1997, the Agency commissioned two studies on sulphur dioxide, which was judged to be the main pollutant emitted in the Askeaton area. The first involved a review of the scientific literature on the ecotoxicology of sulphur dioxide and was undertaken by Dr Mary Brennan and Dr Paul Dowding, Trinity College Dublin. The second, carried out by Dr N F Suttle, Honorary Research Fellow at the Moredun Foundation for Animal Health and Welfare in Edinburgh, was an assessment of the possible impact of emissions of sulphur dioxide on livestock in the Askeaton area.

#### **Atmospheric emissions**

The main potential pollutants contained in **atmospheric emissions** in the Askeaton area are the gases sulphur dioxide and nitrogen oxides, fine particulate matter, and metals and their compounds.

Sulphur dioxide, nitrogen oxides and particulate matter are potential irritants of the respiratory system, and may aggravate conditions such as bronchitis and asthma. High levels may cause acute effects on skin and eyes. There is little scientific information about the effects of sulphur dioxide on farm livestock, although experimental work with a variety of laboratory test animals showed similar effects to those observed in man.

High concentrations of sulphur dioxide and nitrogen dioxide in air can directly damage vegetation, especially in combination with other stressors such as cold.

Deposits of sulphur and nitrogen oxides and related chemical compounds may alter the pH balance of inadequately protected soils and waters and can turn them acidic.

An increase of soil sulphur may adversely affect the uptake of certain elements into herbage.

Metal compounds are potentially toxic. That said, the metal compounds emitted in the Askeaton area, or which are found in dust blown from the waste lagoons at the Aughinish Alumina plant, also occur naturally in normal soils at relatively high levels, and would therefore not be regarded as particularly harmful.

#### **Key findings**

The following were the key findings resulting from various Environmental Protection Agency investigations carried out between 1995 and 1998.

- Tests showed that atmospheric levels of **sulphur dioxide** in the general area were within the stringent EU limits set for the protection of ecosystems and human health (i.e. the revised EU standards to be achieved by 2005). In view of the fact that the emissions of nitrogen oxides are significantly smaller than those of sulphur dioxide, and that the gases would be dispersed in a similar manner, it is considered that the levels of nitrogen dioxide in the area would also have been within permitted limits.

Results from the ESB and AAL monitoring networks suggest that these safe levels also applied in the seven years leading up to the Environmental Protection Agency's 1995 to 1998 investigations.

- Mathematical modelling of the dispersal of emissions from the ESB and AAL plants indicates that the **geographical area most likely to be affected** was located approximately 9 km from the Somers and Ryan farms i.e. in the hilly terrain near Foynes. These mathematical predictions also indicate that these emissions would not create pollution levels exceeding current stringent EU standards.
- There were no signs of precipitation in the Askeaton area being adversely affected by emissions from local or distant sources. In fact, **deposition rates of sulphur and other potentially harmful substances** in the Askeaton area are not much different to the levels found at remote and recognised unpolluted sites in CO. Clare, CO. Galway and other parts of Europe including the UK and Norway.
- Measurements made indicate that the presence of **fine particulate matter** in the air was not significant in the Askeaton area either between 1995 and 1998, or between 1987 and 1994.
- The concentrations of synthetic organic pollutants, including **PCBs, PAH and dioxins**, in various media, were at background levels.
- **pH and hydrogen ion levels** in rainfall/precipitation samples taken daily in the Askeaton area were consistent with those found in an unpolluted environment. No markedly acid or alkaline reactions were observed.
- The results from automated monitors on the Somers and Ryan farms showed that **hourly concentrations of sulphur dioxide** were well within the revised EU standards, which must be achieved by 2005. The significantly higher levels, recorded over short periods on both farms, mostly associated with winds coming from the direction of the AAL and ESB plants, were not high enough to cause acute reactions in humans.
- Tests on **milk** produced by cows in the Askeaton area showed no sign of contamination with pollutants emitted in the area. Of the 25 organochlorine and 48 organophosphorus compounds checked, no traces were found.
- There was no difference between **aluminium** levels in milk sourced from the Askeaton area and milk sourced from two Wexford farms for comparison purposes. (US-based experts who analysed the measurement data indicated that none of the aluminium concentrations found in the milk would have any health implications for consumers).

#### **Overall conclusion: Environmental Protection Agency investigating team**

All available data indicate that the levels of potential pollutants in the Askeaton area In the 1995-1998 period were below those likely to cause harm to the environment generally, to animals or to humans. Furthermore, the available information suggests that this was also the position since the mid-1980s at least.

## NOTES

# **Environmental Protection Agency**

## **Establishment**

The Environmental Protection Agency Act, 1992, was enacted on 23 April, 1992, and under this legislation the Agency was formally established on 26 July, 1993.

## **Responsibilities**

The Agency has a wide range of statutory duties and powers under the Act. The main responsibilities of the Agency include the following.

- the licensing and regulation of large/complex industrial and other processes with significant polluting potential, on the basis of integrated pollution control (IPC) and the application of best available technologies for this purpose;
- the monitoring of environmental quality, including the establishment of databases to which the public will have access, and the publication of periodic reports on the state of the environment;
- advising public authorities in respect of environmental functions and assisting local authorities in the performance of their environmental protection functions;
- the promotion of environmentally sound practices through, for example, the encouragement of the use of environmental audits, the setting of environmental quality objectives and the issuing of codes of practice on matters affecting the environment;
- the promotion and co-ordination of environmental research;
- the licensing and regulation of all significant waste disposal and recovery activities, including landfills and the preparation and periodic updating of a national hazardous waste management plan for implementation by other bodies;
- implementing a system of permitting for the control of VOC emissions resulting from the storage of significant quantities of petrol at terminals;
- implementing and enforcing the GMO Regulations for the contained use and deliberate release of GMOs into the environment;

- preparation and implementation of a national hydrometric programme for the collection, analysis and publication of information on the levels, volumes and flows of water in rivers, lakes and groundwaters; and
- generally overseeing the performance by local authorities of their statutory environmental protection functions.

## **Status**

The Agency is an independent public body. Its sponsor in Government is the Department of the Environment and Local Government. Independence is assured through the selection procedures for the Director General and Directors and the freedom, as provided in the legislation, to act on its own initiative. The assignment, under the legislation, of direct responsibility for a wide range of functions underpins this independence. Under the legislation, it is a specific offence to attempt to influence the Agency, or anyone acting on its behalf, in an improper manner.

## **Organisation**

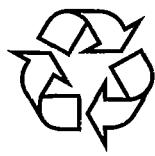
The Agency's headquarters is located in Wexford and it operates five regional inspectorates, located in Dublin, Cork, Kilkenny, Castlebar and Monaghan.

## **Management**

The Agency is managed by a full-time Executive Board consisting of a Director General and four Directors. The Executive Board is appointed by the Government following detailed procedures laid down in the Act.

## **Advisory Committee**

The Agency is assisted by an Advisory Committee of twelve members. The members are appointed by the Minister for the Environment and Local Government and are selected mainly from those nominated by organisations with an interest in environmental and developmental matters. The Committee has been given a wide range of advisory functions under the Act, both in relation to the Agency and to the Minister.



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