

Investigations of Animal Health Problems on a Farm near Castlecomer, Co. Kilkenny

Inter-Agency Report

August 2010

Composition of the Inter-agency Group:

Department of Agriculture, Fisheries and Food

Teagasc

Environmental Protection Agency

Health Service Executive

Kilkenny County Council



Agriculture and Food Development Authority



Kilkenny County Council



Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

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Investigations of Animal Health Problems on a Farm near Castlecomer, Co. Kilkenny

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Overview and Conclusions of the Inter-Agency Investigations

This document comprises the report of an Inter-Agency investigation into animal health problems on a farm near Castlecomer Co. Kilkenny (the Index Farm). It sets out the background to events which led to a joint investigation being carried out by the Department of Agriculture, Fisheries and Food, the Environmental Protection Agency, Teagasc, the Health Service Executive, and Kilkenny County Council, and provides a synopsis of the main findings from each of the Agency investigations.

Having considered the findings of each of the Agency contributions to this investigation, the following are the overall conclusions of the Inter-Agency Group:

- **The results of extensive environmental and animal investigations have found no evidence to indicate that environmental pollution caused ill thrift and poor growth rates in animals on the Index Farm.**
- **There was no evidence that Cadmium or Fluoride were involved with ill health of animals on the Index Farm.**
- **The problems on the Index Farm were likely to have been multifactorial in origin. The Department of Agriculture, Fisheries and Food Veterinary Laboratory Service investigations up to mid-2006 identified a number of common disease conditions which could account for much of the occurrence and severity of poor animal performance. The Epidemiological studies carried out by the Department of Agriculture-funded Centre for Veterinary Epidemiology and Risk Analysis (based in University College Dublin) also concluded that the problems were likely to be multi-factorial in nature – while at the same time finding no evidence to suggest involvement of fluoride or cadmium toxicity.**
- **Teagasc investigations concluded that while the soils on the Index Farm were difficult to farm, the nutrient status of soil and herbage was not radically different from that found on many farms in Ireland. General farm practices were not dissimilar to those found on many farms in Ireland. These factors could not be used to explain the poor thrift that was experienced by animals on the Index Farm.**
- **The Health Service Executive investigations did not identify any increase of human illness or unusual patterns of human illness in the area.**

Part One – Background To The Investigation

BACKGROUND

The farm in question is a mixed dairy and dry-stock enterprise with about 200 cattle on about 79 hectares. It is situated about one kilometre from Castlecomer Co. Kilkenny. A brick factory adjoins one field at the north-western part of the farm (Figure 1).

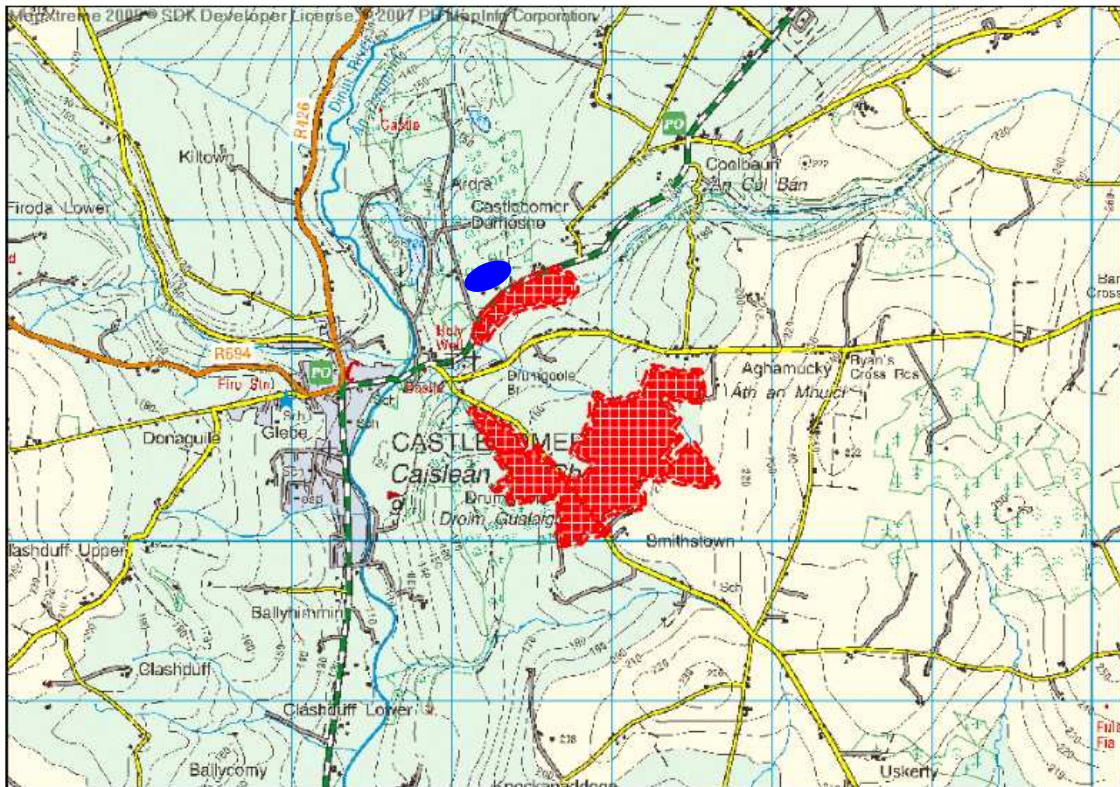


Figure 1: Index farm shown in red. Location of brick factory indicated by blue oval.

The herdowner reported that the farm has had a history of animal health problems going back to the early 1990s. These have been characterised by ill-thrift and growth retardation (stunting) in calves and growing animals, as well as periods of high calf mortality rates and poor milk production in cows.

Kilkenny Regional Veterinary Laboratory (Kilkenny RVL) first visited the farm in January 2003 following a request by the herd owner's veterinary practitioner. The local Teagasc office commenced investigations into animal nutrition, general management, and husbandry on the farm in February 2003 at the herd owner's request. Kilkenny RVL and Teagasc undertook joint and independent investigations throughout 2003. In the latter part of 2003, an over-winter feeding trial was undertaken on the farm to monitor animal weight-gain more closely. A further age-matched animal feeding trial was undertaken on the Index Farm – with a matching trial on a nearby control farm - over the winter of 2004-2005.

Staff from University College Dublin (UCD) Veterinary School (accompanied by personnel from the Department of Agriculture-funded Centre for Veterinary Epidemiology and Risk Analysis based in UCD) also visited the farm in April 2004 at the request of Kilkenny RVL.

Because of the farm's proximity to a brick factory, lines of investigation had, from the beginning, included possible animal toxicity due to environmental pollution from the factory. The Veterinary Laboratory Service toxicological investigations concentrated largely on fluoride, as this is known to be generated as part of the brick-making process - and to a lesser extent cadmium, lead, arsenic, molybdenum and zinc. The investigators were also in

communication with the EPA, which was responsible for monitoring compliance of the brick factory with emission limits set by the Integrated Pollution Control Licence.

Owing to both the severity and intractable nature of the problem, and because of the possible involvement of environmental pollution, an Inter-Agency Group was convened in June 2004 in line with the *Protocol For The Investigative Approach To Serious Animal/Human Health Problems*¹. The Inter-Agency Group (IAG) comprised the Department of Agriculture, Fisheries and Food, Teagasc, the South Eastern Health Board (HSE since 2005), the Environmental Protection Agency, and Kilkenny County Council. The IAG was chaired by the Department of Agriculture, Fisheries and Food (DAFF), and its first meeting took place on the 6th July 2004 in Kilkenny. The IAG subsequently met on a further five occasions: 12th October 2004, 30th August 2005, 15th March 2010, 20th April 2010 and July 19th 2010.

Following the initiation of the inter-agency investigation, DAFF Veterinary Laboratory Service (VLS) and Teagasc continued their on-farm involvement in relation to animal production and health matters. The focus of the EPA's role in the inter-agency investigation from July 2004 onwards was to examine emissions from the nearby brick factory to determine if environmental pollution might be contributing to the animal health problems. Their investigations – some of which were carried out in conjunction with Teagasc - included emissions monitoring and modelling, soil, herbage and water analyses, as well as ecological surveys of lichen and trees. The HSE reviewed reports produced by the group, together with relevant associated information. In addition, the HSE sought information on any increase in, or unusual patterns of, human illness in the area, and investigated concerns about human health expressed by local residents

Kilkenny County Council participated in the Interagency Group in a supporting role having regard to its statutory responsibilities for the quality of public drinking water supply in the area, and also its local knowledge of the area

DAFF VLS investigations on the farm continued throughout 2005. Bovine mortality on the Index Farm was much higher in 2005 than in previous years, providing further material for pathological examination. Pathology investigations in 2005 included active selection of representative cases for elective post mortem examinations. In the latter part of the year, DAFF funded an animal health programme for the farm - which included mastitis control, calf vaccinations, provision of calf hutches for the 2006 calving season, as well as provision of advice on enhanced biosecurity. Direct involvement of DAFF VLS staff in on-farm investigations concluded in August 2006.

A report on the findings of DAFF VLS investigations up to mid-May 2006 was completed in June 2006. However, this report was not published at the time due to objections from the herdowner. Publication of the report was subsequently withheld by DAFF pending the outcome of an appeal by the herdowner to the Information Ombudsman against its release on grounds of disputed interpretation and detail. Following confirmation of the Department's willingness to meet the herd owner and discuss the issues raised in his correspondence, the Information Ombudsman wrote to the Department on 3rd August 2007 stating that the case was regarded as closed, and so allowing publication of the report. The meeting between Department representatives, including VLS staff involved in the farm investigations, and the herdowner took place in August 2007.

In July 2006, following a meeting with the herdowner and related interests, the Minister for Agriculture, Fisheries and Food commissioned the DAFF-funded Centre for Veterinary Epidemiology and Risk Analysis (CVERA) based in UCD to conduct further epidemiological studies into the problems on the farm. The CVERA Epidemiology Report was completed in December 2009 – and was presented to an IAG meeting on 15th March 2010. An Addendum to the CVERA report was subsequently released on the DAFF website in April 2010. The CVERA summary report of its investigations is included in the present IAG report.

¹ Available on the EPA website at:

http://www.epa.ie/downloads/advice/general/EPA_protocol_investigation_animal_human_health.pdf

Part Two – Investigation Summary Reports

The following comprise the summary reports submitted by the investigating bodies identified in the respective report titles.

DEPARTMENT OF AGRICULTURE, FISHERIES AND FOOD

1 – Veterinary Laboratory Service Animal Health Investigations

This is a summary report on the investigations by the Veterinary Laboratory Service (VLS) of the Department of Agriculture, Fisheries and Food (DAFF) into animal health problems on a farm near Castlecomer, Co. Kilkenny. The report covers the period from January 2003, when veterinary staff from the Department's Regional Veterinary Laboratory (RVL) in Kilkenny first visited the farm following a request by the herd owner's veterinary practitioner, up until May 2006. The VLS on-farm investigations concluded in August 2006. The full report is available on the DAFF website at:

[http://www.agriculture.gov.ie/media/migration/publications/2010/report on Dan Brennan's Farm in Castlecomer.pdf](http://www.agriculture.gov.ie/media/migration/publications/2010/report%20on%20Dan%20Brennan's%20Farm%20in%20Castlecomer.pdf)

The affected farm is a mixed dairy/dry-stock enterprise with about 200 cattle on about 79 hectares. It was reported to have had a history of problems with high calf mortality rates, ill-thrift and growth retardation (stunting) in calves and growing animals, and poor milk production in cows. Calf mortality was reported to have been particularly high in the years 1998 to 2001 (approximately 70 calves reported to have died in that period).

As the farm is adjacent to a brick factory, and as fluorides are known components of brick-firing emissions, the possibility that fluoride toxicity might have been contributing to animal health problems had been an important component of the investigations since the start.

The VLS investigations into general animal health issues identified a number of significant disease conditions on the farm which were likely to have contributed to poor animal performance. The most important of these comprised infectious pneumonias, salmonellosis, mastitis, and bovine virus diarrhoea infection. Although clinical respiratory disease was not reported to have been a major problem in calves or growing animals, investigations in 2005 identified chronic and sub-clinical pneumonia as being a significant problem when elective post-mortem examinations were performed. Several cases of pneumonia identified in weanlings on post-mortem examination in 2005 were of a chronic nature and are likely to have originated in the calf-house. Mixing of age-groups in the calf-rearing house, as well as not isolating sick or ill-thrifty animals, were identified as factors likely to have contributed to the extent and persistence of the infectious conditions in young animals. The identification of *Salmonella* Dublin infection in the herd was also regarded as significant in the context of calfhood disease. *Salmonella* Dublin had previously been identified as a cause of abortion in 2000.

Significant factors identified as contributing to poor milk production included the high age-profile of the cows, and mastitis. Parasitism, i.e. liver fluke infestation, is also likely to have had a negative impact on milk yield at times. Poor cow condition post-calving was also considered to be a contributory factor to poor peak yields in some animals.

While low to marginal blood copper, magnesium and selenium values were recorded at times in animals of various ages, these were generally seasonal in nature and not considered to have been of primary significance in relation to the main animal health problems reported. Due to the local geology, the farm was known to be of marginal selenium status.

Animal performance was generally poor in feeding trials carried out on the farm in conjunction with Teagasc in the winters of 2003/2004 and 2004/2005. The latter trial included age-matched groups on a Control farm. According to the Teagasc report on the 2004/2005 trial, the poor performance of animals on the affected farm could not be explained by feed intake, management and housing.

A number of management changes were introduced on the farm in the latter part of 2005 in response to ongoing findings of the VLS investigations. These included:

- Milk recording which commenced in May 2005 to support a mastitis control program.
- Support for a comprehensive herd health program which commenced in September 2005.

- Provision of calf-hutches for the 2006 calving season to allow calves be segregated and reared in age and health-based groups.
- General advice and literature was provided with regard to herd health, biosecurity and disease management.

Animal health and production had improved in the first five months of 2006 – i.e. up to the date of completion of the VLS report. Calf health had been good – and this was reflected in improved growth rates. Only two calf deaths were recorded up to mid-May. Milk production and quality also improved. However, evidence of continuing disease in the most stunted animals in the group of calves born in 2006 was noted by laboratory staff who visited the farm in July 2006.

VLS investigations into fluoride toxicity comprised extensive clinical, pathological and analytical examinations on animals, carcasses, and biological samples from animals on the affected farm. Animals of all ages were examined for signs of fluorosis on visits to the farm from 2003 to 2005. These comprised examinations for skeletal deformities, lameness and dental abnormalities. Skeletal deformities suggestive of fluorosis were not observed, and lameness was not a feature of the problem. Although instances of dental abnormalities were observed – i.e. staining and pitting of teeth – these were similar in degree and frequency to those found in a contemporaneous abattoir study of normal animals from various locations. The degree of dental wear in some cows on the farm was consistent with the age profile of the herd which had been high up to 2005.

Post-mortem examinations were carried out on all farm deaths (bovine) from the start of the investigation up to early 2006. No skeletal lesions suggestive of fluoride toxicity were found as part of these gross and microscopic investigations. Elective post-mortem examinations were also carried out on four animals identified by the herdowner in 2005 as representing typical examples of the growth retardation aspect of the problems. While bones from several animals had changes consistent with their growth-retarded status, no lesions of fluorosis were seen.

Samples of blood and urine from live animals, as well as bone and teeth from post mortem examinations, were collected for fluoride analysis as part of the investigations from 2003 to 2005. Fluoride concentrations were within normal ranges. No samples had fluoride concentrations suggestive of toxicity.

In conclusion, while the results of the DAFF VLS investigations did not identify a single cause which might account for the animal health and production problems on this farm, the incidence and severity of a number of common disease conditions identified could account for much of the poor animal performance. These comprised systemic and respiratory infections in young and growing animals, mastitis, parasitism and the age profile of cows. The VLS toxicological investigations concentrated largely on fluoride - and to a lesser extent cadmium, lead, arsenic, molybdenum and zinc. Extensive clinical, pathological and toxicological investigations showed no evidence of toxicity.

2 – CVERA Epidemiological Investigations

Epidemiological studies of poor animal performance on a farm in Castlecomer, Co. Kilkenny: submitted to the Minister for Agriculture, Fisheries and Food, December 2009.

This is a summary report by the Centre for Veterinary Epidemiology (CVERA) of their contribution to the Inter-Agency investigations. The full CVERA report is available on the DAFF website at:

<http://www.agriculture.gov.ie/animalhealthwelfare/epidemiologyandriskanalysisreport/#d.en.38277>.

An Addendum to the report is at:

<http://www.agriculture.gov.ie/media/migration/animalhealthwelfare/epidemiologyreport/AddendumCastlecomerCVERAb.pdf>

Background

Production problems and stunting of cattle have been on-going on a farm in Castlecomer, Co. Kilkenny for many years. A large number of studies and investigations have been reported by a number of state agencies and other parties since 2004. The investigations by the state agencies have been coordinated by an Inter Agency Group (IAG) comprising representatives from the Department of Agriculture, Fisheries and Food (DAFF), the Environmental Protection Agency (EPA), Teagasc and the South Eastern Health Board/HSE. A number of studies have been conducted on behalf of this group, as reviewed in the *Overview* of the main CVERA report. Veterinarians from University College Dublin (UCD), including the DAFF-supported Centre for Veterinary Epidemiology (CVERA), first became involved in this investigation in early 2004, at the request of staff from the Regional Veterinary Laboratory in Kilkenny. This involvement was formalised in early 2006, when CVERA was asked by the Minister of Agriculture, Fisheries and Food to undertake epidemiological studies relevant to the

problem on the Index Farm. The current report details a series of epidemiological studies carried out and an overview of these and all other studies carried out to date.

Conclusion

A number of element deficiencies were identified in soil, herbage and cattle on the Index Farm, including calcium, copper, selenium, zinc and, to a lesser extent, Iodine. Similar concentrations were measured on other farms in the area, where problems of poor animal performance had not been reported. Observed soil conditions (low pH, high liming requirements) are known to adversely affect the availability of essential elements. The condition reported on the Index Farm is not responsive to selenium (Se) supplementation, consistent with an aetiology more complex than Se alone. A number of animal health concerns were identified on the Index Farm prior to 2007, with adverse effects on animal performance. Since 2007, however, the potential for such effects had been substantially reduced following the introduction of robust preventive measures, i.e. the DAFF-funded animal health programme that commenced in the latter part of 2005 and early 2006, and as a consequence of intensive veterinary supervision by members of the project team and the farmer's own private veterinary practitioners. There was evidence of background cadmium (Cd) exposure among cattle on the Index Farm, based on an assessment of Cd in kidney samples in 23 animals during 2003-2005 and 2009. However, these concentrations are not of toxicological significance based on current knowledge, and would not be expected to adversely affect animal health. Fluorine was present intermittently, but not at concentrations considered detrimental to animal health.

This investigation sought to address two related questions about this case: the possible cause(s) of the problem and reason(s) why this problem appears to cluster, both in time and space. It is likely that this is a multifactorial condition. A number of factors have been described that undoubtedly have some influence on the performance of cattle on the Index Farm. However, no comprehensive understanding has yet been established to fully explain the epidemiological presentation of cases, in particular the localisation of cases to the Index Farm and the temporal distribution of periods when negative performance was recorded.

Addendum to 'Epidemiological studies of poor animal performance on a farm in Castlecomer, Co. Kilkenny': submitted April 2010.

In December 2009, a report titled 'Epidemiological studies of poor animal performance on a farm in Castlecomer, Co. Kilkenny' was submitted to the Minister for Agriculture, Fisheries and Food by the Centre for Veterinary Epidemiology and Risk Analysis (CVERA), Veterinary Sciences Centre, University College Dublin. At the time of submission, a number of issues arising from the studies were still incomplete. These related to cadmium (Cd), and the two Cd patterns that were discussed in the report, including:

1. **Background Cd exposure**, which was measured throughout a number of studies in the report, with respect to whole blood Cd in cattle from *Studies 1 and 3*, and kidney Cd in cattle from *Study 5*.
2. **Acute Cd excess**, which was measured during relatively short specific time periods in *Studies 2 and 3*, in two animal study groups, located on the Index Farm (*Study 2*), or on the Index Farm and on an 'unaffected' farm in Co. Meath, 112 km from the Index Farm (*Study 3*).

In the original report, as described in the *Overview*, our conclusion was that the acute Cd excess was biologically implausible, and therefore most likely invalid.

The objectives of this addendum were:

- To further investigate the acute Cd excess:
 1. by determining, in conjunction with the testing laboratory (IAS), the validity of these measured peak Cd results.
- To further investigate the background Cd exposure:
 2. by determining Cd concentrations in herbage samples collected during April 2007 (*Study 4*) as a possible route of Cd exposure for grazing animals, and
 3. by reconstructing the air dispersion models presented in the *Overview*, Appendix 6, with the specific purpose of quantifying absolute values of potential Cd exposure on the Index Farm in both air (exposure through inhalation) and on grassland (exposure through ingestion) following dry deposition

Conclusion

In conclusion, results confirmed contamination during the original extraction process as the reason for the observed acute Cd peak. The results from further analysis of the whole blood and herbage samples, and from the modelling of the effects of Cd emissions from the nearby brick factory (Ormonde Brick), indicate that Cd does not appear to be present at concentrations that could be toxicologically significant from an animal health perspective based on current knowledge.

TEAGASC ANIMAL PRODUCTION INVESTIGATIONS

Teagasc were involved in three parts of this investigation:

1. Animal feeding/nutrition trials in 2003 to 2005.
2. Trace element analysis of materials in gutters and sediments from a quarry pool taken in October 2004.
3. Soil and Herbage investigations in April and September 2007.

1 – Animal feeding trials

Over winter feeding trial 2003-2004

An assessment of weanling performance over the winter of 2003-2004 showed:

1. Animal performance to be unacceptable - 0.32-0.42 kg ADG for 142 day period.
2. Inappetance did not appear to be a problem on the farm.
3. Forage quality was moderate.
4. Housing was reasonable.
5. Management on the farm was adequate.

Conclusion

The factors listed above did not sufficiently explain the serious nature of the ill-thrift on this farm.

Following a visit to the Index Farm in September 2004, a Teagasc expert group² concluded that the level of management and nutrition was acceptable and could not explain the severity of the depression in milk production and growth rate on the farm, as presented and observed on the day. The group suspected that external factors may have been contributing to the problem and suggested that factors including the presence of heavy metals, water quality and animal performance should be explored.

Over winter feeding trial 2004-2005

A feeding study was conducted over the winter of 2004-2005 with the objective of quantifying dry matter intake on the Index Farm, to investigate the effects of source of silage and location of housed animals (on the Index Farm or on an external farm five miles away) on animal performance.

Regardless of forage used:

1. Weanling performance was acceptable (0.66 kg ADG) on the external farm.
2. Weanling performance was poor on the Index Farm (0.38 kg ADG).
3. General observations on the housing at the Index Farm by a Teagasc expert showed the housing facilities to be adequate for weanlings.
4. Feed and water intake was normal on the Index Farm.

Conclusion

Feed intake, management and housing did not explain the ill-thrift on the Index Farm over the winter of 2004/2005.

² Teagasc Expert Group: Bill Costello (Teagasc Kilkenny), Siobhán Kavanagh (Teagasc Kildalton), Michael Cody (Teagasc Kilkenny), John Murphy (Teagasc Moorepark), Phil Rogers (Formerly Teagasc), Jim Crilly (Teagasc Moorepark). Accompanied by Donal Toolan (Regional Vet Lab, Kilkenny) and Pat Kelleher (Regional Vet Lab, Kilkenny).

2 – Trace element analysis of materials in gutters and sediments from a quarry pool taken in Oct 2004.

The aim of the study was to determine the cadmium, nickel and thallium contents of materials taken from the roof gutters of the Index Farm and from a quarry pool.

Key Findings:

1. Thallium levels in all samples were below the limit of detection by ICP.
2. Nickel levels did not indicate elevated levels.
3. The cadmium levels in the two samples of roof gutter content were 0.86 and 0.90 mg/kg, respectively. If the gutter content was representative of soils on the farm, then they were above the normal range for soil of up to 0.80 mg/kg.

Conclusion

While this was a very limited study, the findings indicated the need for further investigation of the cadmium status of the Index Farm (soil, herbage and animal).

This conclusion led to the soil and herbage survey conducted jointly with CVERA in April/September 2007.

3 - A Survey of essential elements and heavy metals in a small area encompassing the Index Farm in April and September 2007.

The aims of the study were to:

- Determine the concentrations of a number of elements including heavy metals in soils and herbage samples in a 2.5 square meter grid pattern of the Castlecomer Plateau surrounding the Index Farm.
- Relate the concentrations of the elements found, relative to their potential to impact on animal performance.
- Examine if element excess or deficiencies are potentially impacting on animal performance on the Index Farm.

Key Findings:

1. The Castlecomer soils are challenging for intensive agriculture and the soil nutrient status found was typical of that found in these types of soils. Soil pH was variable but tended to be low, with a mean pH of 5.48.
2. Calcium, copper, selenium and zinc concentrations were relatively low, although these conditions were not dissimilar to those found on other farms in Ireland.
3. Mineral status in herbage reflected those in soils; copper, selenium and zinc tended to be low. These results were not dissimilar to those found on other farms in Ireland.
4. There was no evidence of excessive fluoride in herbage.
5. There was no evidence of excessive cadmium in soils or herbage.

Overall Conclusions of the Teagasc investigations

While the soils on this farm are difficult to farm, the nutrient status of soil and herbage were not radically different than those found on many farms in Ireland. Similarly, the general husbandry was no different from that found on many farms in Ireland. These functions could not be used to explain the poor thrift that was experienced by animals on the Index Farm. While early investigations suggested that cadmium levels were a possible cause of the ill-thrift, no evidence of elevated cadmium was found in a subsequent detailed survey of the soils and herbage.

EPA INVESTIGATIONS

Summary report of the work completed by the EPA as part of the inter-agency investigation of animal health in Castlecomer, Co. Kilkenny

Background

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

Ormonde Brick Limited was established in 1968, as Irish Clay Industries, but in 1988 it was bought by the CRH Group and its name changed to Ormonde Brick Limited. The only product manufactured at the site is 'facing' brick. Production at the facility has declined from a peak in 1999/2000. The production of bricks at the Ormonde Brick facility ceased for periods in 2007 and 2008. Since the 19th of December 2008 there has been an indefinite cessation of production at the facility.

The EPA granted an Integrated Pollution Control licence to Ormonde Brick Limited in 2001. The IPC Licence set emission limit values for sulphur dioxide, particulates, oxides of nitrogen, fluorides and chlorides. The limit values were based on the requirement that emissions would not cause significant environmental pollution. These were determined using air dispersion modelling to model the maximum emissions from the facility and predict the resulting ambient air ground level concentrations. The predicted ambient ground level concentrations were then compared to National Ambient Air Quality Standards and to the German TA Luft Air Quality standards of the time to ensure that the ambient concentrations would not exceed these standards.

The EPA sought to investigate 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 Index Farm. The approach adopted was based on the hypothesis that if environmental pollution was a factor, then 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 main potential pollutant in atmospheric emissions from Ormonde Brick Limited is fluoride, as the clays used in the manufacture of bricks contain fluorides. These fluorides are released from the clays during firing above 600°C, and are emitted into the atmosphere mainly as hydrogen fluoride.

Key findings

The work completed by the Environmental Protection Agency has established that:

- Air dispersion modelling predicted that ground level concentrations of fluoride at the farmyard, and in the vicinity of the factory are within the relevant air quality standards.
- In 2006, two ambient air-monitoring stations were installed at the farmyard, and at the boundary of the Brick factory. Both fluoride and sulphur dioxide levels were found to be well within the relevant ambient air quality standards, and supported the air dispersion model.
- The EPA has monitored the emissions from this facility since 2003. Results of fluoride monitoring from Ormonde Brick Limited have indicated elevated levels of fluoride; however, they were not considered to be causing a significant environmental impact. No monitoring for fluorides has taken place since 2008, due to the closure of the factory.
- As part of the investigation, air emissions from the factory were sampled, and analyzed for a range of parameters. These included:
 - Heavy Metals
 - Dioxins
 - Polycyclic Aromatic Hydrocarbons (PAH's)
 - Polychlorinated Biphenyls (PCB's)
 - Volatile Organic Compounds (VOC's)
 - Silica
 - Condensable particulate matter.

All parameters were found to be below the relevant thresholds (Danish EPA and German TA Luft), or deemed not significant.

- A soil and grass monitoring program was conducted at the Index Farm and two neighbouring farms. The results indicated that levels of fluorides, heavy metals, and trace elements were typical for non-polluted Irish agricultural soils. Fluoride levels in grass were below the World Health Organization long term average tolerance level.
- An ecological assessment was carried out by researchers from the Aquatic Services Unit at UCC of the emissions of airborne fluorides, to determine if there were notable impacts in the vicinity of the factory. The study determined that within a radius of about 600 m, the factory had a bearing on the abundance and type of lichens present or absent. However, with increasing distance, no definite trend in lichen diversity and distribution could be related to the factory. Lichens from the main part of the Index Farm appeared to be unaffected by emissions from the factory.
- Tree surveys were carried out in 2005 and 2007 by Professor Gardiner (ex-UCD, now retired). Damage was found to some trees in the 2005 survey, which appeared to have been caused a number of years earlier, but most of the trees had subsequently recovered. Professor Gardiner could not identify the cause of the damage. The levels of fluorine in the leaves were not significant, and the levels of fluorine in damaged and undamaged trees on the farm were the same. The 2007 tree survey found damage more specific to whitethorn trees. While it was concluded that the damage was consistent with pollution damage, no agent that might cause the damage could be identified, and it was speculated that the tree damage found in the 2007 survey might have been due to a combination of meteorological factors and poor soil quality. The EPA was advised that damaged trees were not the most fluoride sensitive type, and there were no elevated levels of fluorides found in the leaves.
- Surface water and groundwater samples were taken for analysis, and while some bacteriological contamination was evident, this work found no evidence of pollution from Ormonde Brick Limited, or historical mining activities.
- Ormonde Brick Limited has made a number of significant process modifications that have led to a reduction in emissions from the plant. These process modifications included; changing from oil to natural gas in 1991, switching from two kilns to one kiln in 2001, and installing an exhaust gas recirculation system in 2005 to improve the re-absorption of fluoride gases into the dried green bricks at the heating up end of the kiln. In response to licence requirements, process optimization at the plant has resulted in a reduction in fluoride emissions of approximately 50%.
- Ormonde Brick Limited installed a continuous emissions monitoring system (CEMS) to demonstrate emission reductions using process optimization. No abnormal process events have been identified since the monitor was installed in 2004.
- The Agency reviewed the production records, and the MSDS (Material Safety Data Sheets) for the raw materials used at the factory. The fluorine content in the shale and fireclay are typical for such materials (average concentration in shale of 600 mg/kg, against a typical range of 300-800 mg/kg, and average concentration in fireclay of 300 mg/kg, against a typical range of 200-1100 mg/kg). Nothing unusual was noticed in the constituents of the raw materials used in the factory, compared to typical raw materials for brick manufacture.
- The EPA has carried out dispersion modelling of cadmium emissions from Ormonde Brick Limited. The model files used were identical to those employed in the epidemiology report, but with the addition that particulate emissions were included in the assessment, and deposition modelling (wet and dry) of particulate cadmium was carried out. Dispersion modelling of cadmium emissions indicated that ambient (airborne) cadmium concentrations and cadmium deposition to ground were within target values. Given the conservative assumptions in the model, it is considered that there is no likely significant impact associated with cadmium emissions from Ormonde Brick Limited.
- Results from grass and soil analysis for cadmium corroborate the findings of the dispersion model, as the results were within typical expected ranges for Ireland, suggesting no significant cadmium deposition.
- In 2009, an assessment of the levels of cadmium in the raw materials was completed. The assessment identified that the percentage of cadmium in the raw materials was very low, and therefore it was not a parameter that would be present in emissions to any significant extent. Furthermore, analysis of cadmium levels in the final product compared to the raw materials demonstrated that there was a negligible loss of cadmium to the atmosphere from the process. Overall this data indicated that cadmium emissions from Ormonde Brick Limited had not resulted in any significant environmental impact in the vicinity of the installation.
- In 2007, the Agency engaged a UK EA, a US EPA, an ex-UK EA air expert, and an industry expert from CERAM to conduct a peer review of the work of the operations at Ormonde Brick Limited, and the EPA's

regulation of it. The project included a visit to Ormonde Brick Limited, as well as a review of the enforcement and licence application files. Overall, the review found that the EPA had carried out an extensive amount of well focused work to characterize, monitor and minimize air emissions from the factory. The review found that Ormonde Brick had responded positively to the EPA's requirements, including the carrying out a comprehensive program of improvements to reduce fluoride emissions by optimizing kiln process conditions.

Overall Conclusion of the Environmental Protection Agency investigating team

Based on the significant amount of work commissioned and completed by the EPA, as part of the inter-agency investigation, and the findings outlined above, it is the Agency's conclusion that the environmental impact of emissions, particularly fluoride associated with Ormonde Brick Limited are not sufficient to cause significant environmental impact, or animal health problems.

HSE INVESTIGATION

HSE Summary Report of work carried out as part of the interagency investigations of animal health in Castlecomer, Co Kilkenny.

The Health Service Executive, and previously the South Eastern Health Board, has participated in the interagency group that was set up in 2004 to look at animal health in the Castlecomer area. HSE representatives from the Public Health Department and Environmental Health Service have participated in the interagency group. The HSE has reviewed reports produced by the group together with relevant associated information. In addition the HSE sought information on any increase or unusual patterns of human illness in the area and investigated concerns about human health expressed by local residents. No evidence of any increase or unusual patterns of human illness in the area was found.

In 2004 the SEHB contacted General Practitioners in the area and asked if they had noted any unusual instances or patterns of human illness in the Castlecomer area or any increase in illness. GPs were contacted again in 2005, 2006 and 2009. But there was no evidence of any increase or unusual patterns of human illness.

In 2005, 2006 and 2007 concerns were expressed by local residents of increased cancer in the Castlecomer area. In 2006 the HSE reviewed the National Cancer Registry statistics for 1994-2002 and discussed with local GPs but found no evidence of a cancer cluster in the Castlecomer area. Also, in 2006 the Health and Safety Authority undertook an investigation of recent cases and found no link between reported cancer deaths and working in the Ormonde Brick Factory, Castlecomer. Additional National Cancer Registry data (1994-2004) was reviewed by the HSE in 2007, but again there was no evidence of a cancer cluster in the Castlecomer area. A further review of the data was undertaken in 2009 for the years 1994-2006 and in 2010 for the years 1994-2007, and again there was no evidence of increased cancer levels in the Castlecomer area.

Cancer is a common disease and cause of death and people can become concerned that there appears to be a high rate of cancer. Cancer is ranked as the second most common cause of death in Ireland and is responsible for 1 in 4 deaths. Nearly 1 in 3 people in Ireland will experience cancer at some stage in their lives and over the years cancer will affect about 3 out of 4 families. A 'cancer cluster' is defined as an unusual number of cancers occurring during a specific time period among people who live or work together. For a cancer cluster to exist there must be a sufficient number of cases of the same type or body system and a plausible biological association must exist with a suspected exposure.

KILKENNY COUNTY COUNCIL

Kilkenny County Council participated in the Inter-Agency Group in a supporting role having regard to its statutory responsibilities for quality of public drinking water supply in the area and also its local knowledge. Council officials from Environment and Veterinary Services Sections attended the IAG meetings.

In relation to drinking water, the Index Farm is located in an area served by the Clogh/Castlecomer Public Water Supply. Monitoring results are satisfactory, and in particular, results for cadmium monitoring carried out by the Council from January 2002 to December 2009 were all well below the parametric value of 5.0 µg/l. as prescribed in the European Communities (Drinking Water) Regulations 2007. It is noted however that the animals on the study farm were generally not drinking from the public water supply, but from a private source located on the farmer's lands.

As part of their investigations, CVERA, the EPA and Teagasc also sampled surface and ground waters in the area and found no evidence of pollution from industrial sources.

Part Three – Conclusions of the Inter-Agency Investigation

Having considered the findings of each of the Agency contributions to this investigation, the Inter-Agency Group has reached the following conclusions:

- The results of extensive environmental and animal investigations have found no evidence to indicate that environmental pollution caused ill thrift and poor growth rates in animals on the Index Farm.
- There was no evidence that Cadmium or Fluoride were involved with ill health of animals on the Index Farm.
- The problems on the Index Farm were likely to have been multifactorial in origin. The Department of Agriculture, Fisheries and Food Veterinary Laboratory Service investigations up to mid-2006 identified a number of common disease conditions which could account for much of the occurrence and severity of poor animal performance. The Epidemiology studies carried out by the Department of Agriculture-funded Centre for Veterinary Epidemiology and Risk Analysis (based in University College Dublin) also concluded that the problems were likely to be multi-factorial in nature – while at the same time finding no evidence to suggest involvement of fluoride or cadmium toxicity.
- Teagasc investigations concluded that while the soils on the Index Farm were difficult to farm, the nutrient status of soil and herbage was not radically different from that found on many farms in Ireland. General farm practices were not dissimilar to those found on many farms in Ireland. These factors could not be used to explain the poor thrift that was experienced by animals on the Index Farm.
- The Health Service Executive investigations did not identify any increase of human illness or unusual patterns of human illness in the area.

The IAG noted that continued assistance would be available from CVERA, and that DAFF had affirmed that Laboratory assistance will continue to be available to the herd owner through his private veterinary practitioners for routine post mortem and clinical chemistry submissions.

At its meeting of 19th July 2010, the IAG reaffirmed the procedures for activation and implementation of the *'Protocol For The Investigative Approach To Serious Animal/Human Health Problems'* in the light of experiences gained by the present and previous inter-agency investigations.

Inter-Agency Group

August 2010