The University of Hull

Industrial pollution control down on the farm: Integrated Pollution Prevention & Control (IPPC) and intensive pig farming.

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By
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Abstract

Multi-medium pollution control has finally transcended the boundary from its roots in traditional manufacturing industry, and has entered the realm of intensive pig farming. This research has revealed the problems that face pig farmers when confronted by the Integrated Pollution Prevention & Control (IPPC) Directive (1996/61/EC). It has developed approaches that could assist intensive pig farmers in making important choices. A parallel study of the re-licensing of landfill facilities, an industry that is a veteran of licensing, has provided an ideal comparator. The literature on both industries was extensively searched for what was previously known. This has been supported by original research, including interviews with both landfill managers and pig farmers. These interviews were preceded by tours of landfill sites and pig farms – something that is seldom performed within the data collection stage of research where interviews are used. Differences between words and actions became apparent. These were analysed and their motivating factors considered. These discrepancies, evident through this verification process, serves to caution other researchers about the distortions that can arise when interviews alone are used. Identifying these discrepancies is also important because policy is often formulated using information collected though interview-based surveys. It may be the case that policy outcome deficit can result from the difference between words and actions.

For decades farming has been moulded by society's desires in a similar vein to a nationalised industry. However, it is not a nationalised industry, but a

collection of private individuals, family businesses, and larger companies. Multi-medium pollution control has been tried before. Integrated Pollution Control (IPC) was pioneered in England and Wales in 1991. Comparing the first years of that regime with the experiences that the Environment Agency are currently having reveals that many of the lessons have not been learnt. The funding available to the regulator, and the charges levied against the regulated are negotiated through compromises whereby environmental protection may be the loser. In this study, industry structures have been examined, revealing that the landfill industry is biased towards large operating companies. Re-licensing for the landfill industry is essentially a tightening of existing emission control, with relatively few additions. Landfill operators have the ability to pass costs on. Different experiences have been found between small and large landfill operators. Many small operators will go out of business. In this context it is noted that the structure of the intensive pig farming industry is biased towards smaller operators. Existing literature demonstrates that Small- and Medium-sized Enterprises (SMEs) have difficulty implementing environmental regulation. Through this study, this knowledge has been supplemented by close examination of two industries that have hitherto been omitted from the SME – environmental regulation debate. Industry characteristics are important factors that are here explored in detail, through inter-industry comparisons based upon size and through size comparisons within each industry. Within both industries large size is not just a scaled-up version of a small business. In fact the cultures and organisational structures are different. Essentially, intensive pig farmers have limited choices. Those at the small end of the scale may be able to de-stock and temporarily escape the threshold beyond which strict environmental controls come into play. Many at this scale may decide to retire and abandon pig farming. Alternatives for these farmers include pursuing niche or more

specialised markets. Intermediate in size, Family Farming Businesses exhibit characteristics of both large and small businesses. Their future is a little more uncertain as there is a momentum to continue farming – a key characteristic which makes family businesses different. The largest businesses are better placed to implement the controls, or to challenge and to find the least cost compliance route. However, the competition from imports, and an inability to gain more for the meat they produce may force this category to increase the size of operation even further, so as to lower unit costs.

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Glossary of Terms

ACAH	Agricultural Committee on Agriculture and Horticulture
ADAS	Agricultural Development & Advisory Committee
BAT	Best Available Technique
BATNEEC	Best Available Techniques Not Exceeding Excessive Cost
BEIC	British Egg Industry Council
BOD	Biological Oxygen Demand
BPEO	Best Practicable Environmental Option
BREF	Best Available Techniques Reference Document
BSE	Bovine spongiform encephalopathy
CAP	Common Agricultural Policy
CBI	Chemical Business Industry
CCL	Climate Change Levy
CD ROM	Compact Disc Read Only Memory
CEC	Commission for the European Commission
cert. EMS	Certified Environmental; Management System
CIA	Chemical Industry's Association
COPA 1974	Control of Pollution Act 1974
CoTC	Certificate of Technical Competence
DEFRA	Department for the Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport & the Regions
DoE	Department of Environment
DTI	Department for Trade & Industry
EC	European Community
EMAS	Eco-Management & Assessment Scheme
EMSF	Environmental Management Systems for Farms
EMSR	Environmental Management System & Regulation
ENDS	The Ends (Environmental Data Services) Report
EPA 1990	Environmental Protection Act 1990
FMD	Foot & Mouth Disease
FWAG	Farming & Wildlife Advisory Group
GVNQ	General National Vocational Qualification
HMIP	Her Majesty's Inspectorate of Pollution
HWI	Hazardous Waste Inspectorate
IAPI	Industrial Air Pollution Inspectorate
IPC	Integrated Pollution Control
IPPC	Integrated Pollution Prevention & Control
ISO	International Organisation for Standardisation
ISO 14001	International Organisation for Standardisation's system standard for environmental management systems
IWM	Institute of Waste Management
LEAF	Linking Environment & Farming

Ltd	Private Limited Company
MAFF	Ministry of Agriculture, Fisheries and Food
MCL	Meat & Livestock Commission
MCPA	Methylphenoxyacetic Acid
NFU	National Farmer's Union
NIMBYism	Not In My Back Yard
NRA	National Rivers' Authority
NSCA	National Society for Clean Air
NVZ	Nitrate Vulnerable Zone
OECD	Organisation for Economic Co-operation & Development
OPRA	Operator & Pollution Risk Appraisal
PIC	Pig Improvement Company
PLC	Public Limited Company
PPC	Pollution Prevention & Control
RCEP	Royal Commission on Environmental Pollution
SCP	Site Conditioning Plan
SEPA	Scottish Environmental Protection Agency
SFI GBRs	Standard Farming Installation General Binding Rules
SI	Statutory Instrument
SME	Small- or Medium-sized Enterprise
SS	Suspended Solid
UK	United Kingdom
USA	United States of America
WAMITAB	Waste Management Industry Training & Advisory Board
WMLR	Waste Management Licensing Regulation
WWA	Welsh Water Authority
WWI	World War One
WWII	World War Two

Chapter 1.

Introduction to the research

1.1 Introduction

The main aim of this research is to investigate an approach to environmental regulation that is novel to agriculture. This new environmental regulation was developed in and for the manufacturing-industry and will be administered by the Environment Agency for the intensive pig farming sector. Similarly, this regulation is being extended to other hitherto unregulated or differently regulated industrial sectors and is being phased in over the period 2001 to 2007. It is not until the end of this period that the legislation will be applied to the intensive pig sector, although there are exceptions to this timetable in the case of new or substantially modified installations. There is, therefore, an opportunity over the six years from 2000 investigate the process with the aim of assisting intensive pig farmers to cope when they are encompassed by the legislation.

Summary aims of this chapter are:

- **To introduce the reader to the research**
- **To contextualise the research in its background**
- **To define the aims of the research**

1.2 Background to the research

The impetus for this research has been the introduction of the European Union's Integrated Pollution Prevention & Control (IPPC) Directive (91/61/EC) through its interpretation in national legislation as the Pollution Prevention & Control (England and Wales) Regulations 2000 (SI 2000/1973), as amended.[a] Pollution Prevention & Control (PPC) will be the first multi-medium pollution control legislation applied to both manufacturing-industry and the intensive pig sector. This recognises the significant pollution causing potential of agricultural emissions and signals a move towards considering intensive pig farming as just another industry. It demands a new approach to the environment on the part of intensive pig farmers in as much as farming has been exempt historically from many of manufacturing industry's environmental regulations. Some sectors of manufacturing industry, on the other hand, have been regulated through Integrated Pollution Control (IPC) since 1991. IPC was introduced as part of the Environmental Protection Act 1990 (EPA) with the Environmental Protection (Prescribed Processes and Substances) Regulations (SI 91/472), as amended,[b] detailing the processes and substances that were to be controlled

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[a] Amended by:
- Pollution Prevention and Control (England and Wales) (Amendment) Regulations 2001 (SI 2001/503); and
- Pollution Prevention and Control (England and Wales) (Amendment) Regulations 2001 (SI 2002/275).

[b] Amended by:
- Environmental Protection (Prescribed Processes and Substances) (Amendment) Regulations 1992 (SI 1992/614);
- Environmental Protection (Prescribed Processes and Substances) (Amendment) Regulations 1993 (SI 1993/1749);
- Environmental Protection (Prescribed Processes and Substances) (Amendment) (No. 2) Regulations 1993 (SI 1993/2405);
- Environmental Protection (Prescribed Processes and Substances Etc.) (Amendment) Regulations 1994 (SI 1994/1271);
- Environmental Protection (Prescribed Processes and Substances) (Amendment) Regulations 1995 (SI 1995/3247);
- Environmental Protection (Prescribed Processes and Substances Etc.) (Amendment) (Petrol Vapour Recovery) Regulations 1996 (SI 1996/2678); and
- Environmental Protection (Prescribed Processes and Substances) (Hazardous Waste Incineration) (Amendment) Regulations 1998 (SI 1998/767).

with the objective of embedding an holistic consideration of emissions to the three environmental media (air, land, and water).

The consequences of emissions from farming, and in particular those from intensive farming activities (poultry rearing, egg production, intensive pig production, and dairying) have become more significant over the past few years because of three main processes: [1] farming has revolutionised and the quantities and concentration of emissions have increased per area farmed; [2] environmental quality objectives have been set through membership of the European Union; and [3] other manufacturing industries have controlled their emissions through being the focus of historic regulation. The changes that have occurred within farming are the focus of Chapter 2, where it is the intensification of pig production that has realised increased quantities of wastes whilst the area of land available to spread that waste and be of agricultural benefit has decreased. Additionally, increased housing of animals has produced point-sources of emissions, albeit that it is the building as opposed to the traditional chimney stack, that are more concentrated than if the animals remained outside. Being a member of the European Union has made it necessary to increase the number of emissions that are regulated and controlled in order to meet environmental quality objectives. However, it is not necessarily that farming has been specifically targeted but that in the past United Kingdom agriculture has been granted specific exemptions and there is now the need to address this imbalance, for example the nitrate directive, water framework directive, and the reversal of exemptions concerning non-naturally generated agricultural waste.

1.3 Research aims

- One of the main aims of this study is to investigate the ways in which the intensive pig sector can be assisted in meeting its environmental responsibilities under the new regulations. This will be performed through a comparative study of the same Directive within the landfill industry.

- A second major aim is to assist in the development of strategies for the Environment Agency to help it implement this legislation in the agricultural sector. This is an important aspect of this study as this type of legislation is new for both sides: the regulators and the regulated.

- The third aim is to contribute to the academic community's understanding of several themes, some of which have been rarely studied. This research addresses the deficit that was noticeable during the period in which this study was performed. This research should be of interest to scholars of environmental policy, environmental regulation, environmental management, landfills, intensive pig farms, studies of industrial cultures, and agricultural history. This research also bridges the gap between both the practical level and a more theoretical overview. Specifically, the IPPC Directive is relatively new and studies have not been performed of its implementation. Further, studies of the landfill industry have tended to focus upon the technologies used to manage specific emissions to specific media. Additionally, this theme of technological solution to solve specific emission problems transcends to the intensive pig farming industry where such studies are abundant. This research is therefore informative, original, and contributes to fulfilling the information gap.

1.4 Placing this research in the context of previous work

To realise this research's aims there is the need to draw on literature from diverse areas of research. Pellini & Morris (2001) appear, thus far, to be the only ones who have published research on the IPPC Directive and the intensive pig farming industry. The focus of their paper is the possible costs of compliance. Subsequently it ignores wider concerns of environmental management, and how intensive pig farmers will manage the permit application process.

There is a need to understand environmental management within the landfill industry as this is the comparative industry from which lessons will be drawn. However, landfill-related research has tended to focus on specific or technical aspects as were needed to overcome particular identified problems with landfilling operations. For example, landfill gas analysis, leachate constituents and transport, and odour management. Research that considers the management of a whole facility is rare. Therefore, this research will contribute to the understanding of the landfill industry.

Papers published about agriculture have tended to follow specific lines of enquiry. For example, Ritson & Harvey (1997) and Kay (1998) have tended to look at the economics and workings of the Common Agricultural Policy (CAP). Whitby (1996); Lowe & Ward (1998); Winter & Gaskell (1998); Winter (2000); and Lowe *et al.* (2002) have extended this to examine the environmental implications of the Common Agricultural Policy. Additionally there has been research into the uptake by farmers of various

environmental- and conservation-related schemes, for example that produced by Whitby (1994). Other research has been related to the effects of farming practice on biodiversity, for example the study by Pain & Pienkowski (1997) on bird species and farming. More recently, there has been a move towards research into societal desires and policies aimed at the rural space, for example the works by Marsden (1995); Banks & Marsden (1997; 2000); and van der Ploeg *et al.* (2000).

More significantly for this research has been a major study of farm pollution conducted by Lowe *et al.* (1997) culminating in the book *Moralizing the environment: countryside change, farming and pollution.* Ward & Lowe (1994); and Ward *et al.* (1995; 1998) additionally published a series of papers associated with the research. Although the research was primarily focused on the dairy industry in the south-west of England, its conclusions are important. The research found that farmers use a different language and had a different perception of emissions to the Environment Agency inspectors. This is the cause of particular difficulties encountered in preventing pollution from farms. The analysis however, tended to be very specific to the Environment Agency and farmer viewpoints in examining snap-shot instances of regulatory conflict. The work did not appear that successful in integrating these examples into a broader explanation of the problems in regulating farm emissions and preventing pollution.

Research directed towards intensive pig farming tends to be very specific, either seeking technical solutions to environmental problems, or research into increasing productivity. The majority of environmental research has its origins in Western European countries and follows a more technocratic approach to solving problems from a more technologically advanced base-

line situation than is commonly found on intensive pig farms in Britain. Much of the research is concerned with atmospheric releases, in particular ammonia, from animal houses, for example, Aarnink *et al.* (1995); Anderson (1996); Aarnink *et al.* (1997); Groot Koerkamp *et al.* (1998); Hinz & Linke (1998*a*; 1998*b*); Phillips *et al.* (1998); Takai *et al.* (1998); and Wathes *et al.* (1998). Odour-related problems have also featured in works by O'Neill & Phillips (1991; 1992); and O'Neill *et al.* (1992) who have investigated emissions from animal houses, and Miner (1993) who has concentrated on the covering of slurry stores. More unusual is the work by Mejer & Krause (1986) in applying odour dispersion models to farming as opposed to their more traditional use in the sewage or landfill industries. Slurry and manure management is another popular area of research and probably reflects the pollution potential and the problems experienced in appropriate management. Williams & Thompson (1985); Berglund & Hall (1987); Klarenbeek (1990); and Svensson (1994) all discuss concerns relating to odour from spreading pig slurry, whilst Lewis & McGechan (1999); and McGechan & Lewis (2000) investigate pollution to water following the application of slurry to the land. Emissions from the process of treating pig slurry have also been investigated reflecting a technique and approach adopted in The Netherlands (Evans & Smith, 1986; Gray et al., 1991; Burton, 1992; Burton & Sneath, 1995; Burton *et al.*, 1998; Béline *et al.*, 1999). However, Imbeah (1998) considers an alternative possibility, composting natural animal waste from the pig production process. Whilst there is a wealth of research on intensive pig production, it is all very specific to quantifying or solving individual issues. The environmental management of the whole pig farm, encompassing the complete suite of emissions, is new and therefore this research is novel.

IPC has been operational since 1991 and there is a variety of research on that subject, for example, Owens (1989); Haigh & Irwin (1990); Coleman (1992); Harris (1992); O'Riordan & Bowers (1992); Turk (1992); Jordan (1993); O'Riordan (1993); Castle & Harrison (1996); Emmott & Haigh (1996); Smith (1996); Metha & Hawkins (1998); and Skea & Smith (1998). Allott (1994) was the author of an enlightening study after the first three years of the IPC regulations being in force, focusing on the problems for both Her Majesty's Inspectorate of Pollution (HMIP) and industry in making authorisations. This is a useful study as it provides information about the problems both regulator and regulated experience in dealing with a more holistic environmental pollution control regulation. Guruswamy & Tromans (1986) and Tromans (1987) focused their investigation on the Best Practicable Environmental Option (BPEO) – a central pillar in determining to which medium specific emissions are best released. Additionally Fineman (2000) has studied the regulatory interface between inspector and the regulated in the context of determining authorisations. Although there is an adequate library of literature on regulating industry emissions through the IPC regime, none covers either the intensive pig farming industry or the landfill industry; both were excluded in the regulations.

As the IPPC Directive is relatively new, published works have tended to focus on theoretical considerations of the details of the Directive and the history of its development, for example papers published by Breier (1996); Faure & Lefevere (1996); Backes & Betlem (1999); Emmott (1999); and Long & Mereu (1999). An additional area of research that adds to the understanding of firm behaviour, specifically the difficulties of regulating Small- and Medium-sized Enterprises (SMEs) has been conducted by Welford (1994);

Hillary (1995; 1999); and Hobbs (2000). By utilising these very diverse sources of information, this research will attain its aims.

1.5 Research rational

The intensive livestock sector (pigs and poultry) has no history of permitting or licensing, therefore, there is the need to gain evidence and insight from a comparative industry that has been chosen for its many similarities with agriculture. The way in which the IPPC Directive has been applied to the intensive pig farming industry has been different from that of many of the other industrial sectors in that General Binding Rules (GBRs) will be used to simplify the process for both the farmers and the Environment Agency. Following consideration of other sectors, it was decided that the landfill industry was an appropriate comparator. Landfill operators, in common with intensive pig farmers, will have to apply for permits to operate, if their facilities are above the designated threshold. Landfill operators will undergo a re-licensing process whilst the intensive pig farming industry will have to apply for a permit to operate for the first time. For the operators of landfill facilities the way in which they are constructed, operated, and closed will be in accordance with the 1999 Landfill Directive (99/31/EC). For landfill operators, the Landfill Directive constitutes the Best Available Techniques (BAT) and exerts a similar controlling influence over the facility's operations, as does the Standard Farming Installation General Binding Rule (SFI GBR) package proposed by the Environment Agency. In practise, this means that the landfill sector's and the intensive livestock (pigs) sector's adoption of the IPPC Directive has progressed along broadly similar lines. Moreover, both industries have

similar spatially diffuse emissions as opposed to point sources, and both are new sectors to the IPPC regime having no history of regulation under IPC, the previous permit based multi-media pollution control regime.

Whilst the landfill industry is not the primary focus of this research it is nonetheless an important aspect. This is because the intensive pig farming industry does not have a history of either licensing or industrial pollution control regulations and it is important to have a position from which to build as opposed to starting afresh. The landfill industry is an ideal comparator because of the history and experiences that can be turned to good advantage. It is also a worthwhile comparator because the landfill industry will have to apply for their PPC permits ahead of the intensive pig farming industry. Further, similarities can also be drawn between both industries albeit that the intensive pig farming industry is in a position where the landfill industry was when licenses were introduced under the Control of Pollution Act 1974.

1.6 Research methods

This project focuses on an original field study placed in its historical context. Interviews were carried out with representatives of both the regulated and the regulator to gain a full understanding of the issues involved. These data were then analysed in order to develop recommendations and draw conclusions. The landfill industry has been included in this study because it provides an insight into an industry that has come from a similar position to that facing the intensive pig farming industry. Additionally, landfill operators are due to apply for their PPC

permits ahead of the intensive pig farming industry and thus add to the benefits that a comparison brings. Understanding how one industry has coped will be analysed on the basis that what has worked in a similar industry may also be applicable or a suitable strategy in another.

1.7 Outline of thesis

- **Chapter 1** Introduces the work and provides the reasoning behind the decision to choose the landfill industry as a comparative example.
- **Chapter 2** Demonstrates that the demands placed upon agriculture have changed over time and in its latest phase has seen the introduction of increased regulatory control over emissions management.
- **Chapter 3** Provides a reasoned approach to the methodology adopted for the investigation
- **Chapter 4** Compares the early years following the introduction of IPC within England and Wales as administered by HMIP, with the beginnings of the authorised permitting under the IPPC Directive by the Environment Agency. Through this Chapter, it is hoped that an insight can be gained into the future for the intensive pig farming industry when they have to apply for permits in 2007, through this historic examination.
- **Chapter 5** Considers the re-licensing of landfills under the IPPC regime with the requirements of the Landfill Directive

being indicative of the Best Available Techniques. Landfill managers and those within waste management companies with special responsibility for the company's re-licensing were interviewed. A number of landfill facilities have additionally been visited to investigate how they operate and where there may be differences between language and practice. Alongside interviews conducted within the waste industry, regulator and industry representatives have been interviewed in order to gain their perspective of the re-licensing process.

- **Chapter 6** Investigates some of the concerns that the intensive pig farming industry has over the forthcoming integration into the IPPC regime. Similar themes to those adopted for the investigation with the landfill industry (Chapter 5) have been used in this Chapter to enable a comparison of actions to be made. Correspondingly, the Environment Agency and industry representatives have been interviewed.
- **Chapter 7** Discusses how the intensive pig farming industry may be able to learn from the application of the IPPC Directive to the landfill industry.
- **Chapter 8** Summarises and concludes the research culminating with specific recommendations.

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Chapter 2.

A way of life (the farm idyll) to a factory process that happens to use land; the malleability of agriculture and the beginnings of agri-environmental legislation?

2.1 Introduction

The fundaments of agriculture have undoubtedly changed since the mid 17th Century when agriculture shared a closer link with the land and the landscape. Agriculture is now dominated by chemical inputs and a drive towards intensification to achieve the greatest productivity and return the best possible financial return. This change could be considered a move from what was essentially a biological to an economic process. This Chapter charts how, since the mid 17th Century, agriculture has evolved as society's demands have changed leading inexorably to the present situation with many intensive agricultural units dominating agricultural production. Concurrently there has been cultural change within the industry to a position where agriculture's environmental impacts have increased and there is now a need for those impacts to be controlled through regulation. From the standpoint that agriculture is merely another industrial 'factory' process, environmental regulation that has a firm basis within traditional manufacturing industry will be applied to intensive pig farming.

Summary aims of this chapter are:

- **To provide an overview of the way in which agriculture has been shaped by political and societal desires within specific time periods**

- **To place the current position of agriculture in its historic context**

2. 2 1850 – 1960 Working with the countryside to working the countryside

The provision of the nation's food and achieving self-sufficiency had a special position within the country's industries throughout this period. This was achieved through the protection given to farmers from market forces and was evident with the passing of the first Corn Law in 1815. However, subsequent conflicts ensued between industrialists and the landed classes (Shoard, 1997) manifesting itself in the formation of the Anti Corn Law League in 1839. This pressure group comprised the industrialists who wished to avoid paying artificially high wages to their employees (in order that the workers could afford food) and to relieve the pressure of importing corn from countries who reciprocated by precluding the importation of British manufactured goods. The outcome of this opposition was the eventual repeal of the Corn Laws in 1868 (Carter & Stansfiled, 1994; Shoard, 1997). During this period of agricultural protection there remained historic measures to address farm pollution. Riparian owners were afforded legal redress under common law, and later the Public Health Act of 1848, and the Rivers Pollution Prevention Act 1876, although the latter was aimed primarily at the treatment and disposal of sewerage and industrial effluents. Those seeking legal recourse for pollution could also use The Salmon Fisheries Act 1861 that made it an offence to poison salmon waters and the Salmon and Freshwater Fisheries Act 1923 that extended protection to all freshwaters making it an offence to release injurious substances to fish.

The Victorians promoted 'romantic' ideals of agriculture in reaction to Britain's early industrialisation that saw declining urban conditions. Agriculture was seen as being not merely one industry among many, but a unique way of life, irreplaceable in its human and spiritual value (Trevelyan, 1942). This romantic view was a misconception as working on the land, even with horse-drawn implements, was tiresome. What it did was instil the idea that agriculture was not an outdoor industrial process but a natural part of life; consequently, the perception that farming could cause pollution was not so evident. The farming system, including pig production was based around mixed farms; most farmers would produce a variety of crops and keep different species of animals for the family's own consumption with the remainder being sold at the local market. Whilst the "best practicable means" became the formal effort to curb industrial pollution (in response to specific problems) in factory and public health legislation, this did not happen within farming.

The Liberal Government in 1906 passed the Agricultural Holdings Act that gave County Councils compulsory purchase powers, effectively making many tenants landowners. Land changed hands and a new moneyed class moved into the countryside seeking an escape from the declining conditions in the urban environment (Harvey, 1997). Desperate housing conditions, rat-infestations, brick-manufacture, brewing, dying–industries, all located in the middle of cities produced effluvia and generated wastes that made the urban environment inhospitable. Farming and the countryside were viewed symbiotically as the antithesis to the industrial urban environment. However, the rural landscape of the early years of this century (1920s and 1930s) which still generates nostalgic views is actually the result of agricultural depression (Carter & Stansfiled, 1994).

2.2.1 First World War agriculture

In 1914, Britain had no arrangements for food production as part of any defence plans (Harris, 1982). Lord Selborne, the President of the Board of Agriculture, lobbied for an interventionist agricultural policy, which was only realised by the Corn Production Act 1917. It effectively increased production through guaranteeing prices for wheat, wage levels, and prohibiting land-rent increases. In addition, the Corn Production Act 1917 gave the Government powers of compulsion over cropping and stocking of the land. After 1916, 810,000 hectares (20 percent) was added to the total arable area of Britain (Sheail, 1974; Sheail, 1976; Dewey, 1989; Chapman & Seeliger, 1991).

2.2.2 The inter war years

In reciprocation for continued support the farming industry were obliged to increase output, otherwise farm tenancies would be terminated (Whetham, 1978). The Agriculture Act of 1920 continued to support commodity prices, at a time when market prices were falling and subsequently the costs of supporting agricultural production increased. This Act was repealed in 1921 (Cooper, 1989). Unions with a predominant urban-base were opposed to the Act, as they wanted cheap food that required a free-trade regime in agriculture (Newby, 1977). During the 20 inter-war years, the United Kingdom agricultural area fell by 1,000,000 to 13,000,000 hectares with 60 percent of the area reverting to permanent pasture (Murray, 1955). At the outbreak of WWII, British agriculture supplied less than one-third of its domestic food requirements. Politics became increasingly urban-dominated; the 1918 franchise extended the vote to 78 percent of the adult population

(Moore, 1991) and Government drew upon the experiences of business and the unions when making its own policies for managing the economy (Middlemass, 1979; Booth, 1987; Tomlinson; 1990). Sugar beet was subsidised in 1925 and £1,000,000 was reserved for land drainage (Whetham, 1978). Agriculture was treated in a manner similar to manufacturing-industry with the aim of improving agriculture's contribution to the economy as a whole (Cooper, 1989). The Agriculture Credits Act 1928 provided long-term loans through the Agricultural Mortgage Corporation allowing the government to dictate loan terms and force technological and commercial modifications (Cooper, 1989). Protectionism emerged as a policy advocated by agricultural and manufacturing business that had benefited during the war and then suffered under free market conditions (Blake, 1955). These businesses were to be the beneficiaries of agriculture that became the consumer of industrial products such as fertilisers and machinery. In the 1930s fear of war focused attention again on home production (Smith, 1990). A number of marketing acts in 1931 and 1933 aimed at improving efficiency; these established the Potato Marketing Board, the Pig Marketing Board, and the Milk Marketing Board, the last of which achieved an increase in production of circa. 24 percent in England and Wales over 1933 - 1937 (Whetham, 1978). The Milk Marketing Board significantly assisted small farms in the south-west that were distanced from the market but whom, under the Board, had the same bargaining powers as larger producers (Winter, 1996). The Wheat Act 1932 introduced the concept of deficiency payments where a tax was applied on each sack of flour (up to a ceiling-level) that was milled, to bridge the gap between the actual cost and the guaranteed price of 10 shillings per hundredweight (Mowat, 1955). Imported wheat was subjected to a levy and a small subsidy was available for growing oats and barley. Inter-war agriculture was subsidised to the level of £104,000,000 in total (Murray,

1955). The Agriculture Act 1937 introduced subsidies for lime and basic slag and deficiency payments for oats and barley (Winter, 1996). In 1939 under the Emergency Powers (Defence) Act, War Agricultural Executive Committees were established (Murray, 1955). The War Agricultural Executive Committees' comprised farmers, farm workers, landowners, and land-agents. They issued compulsory orders for cropping and ploughing up grassland, rationed fertiliser and animals' feeds, allocated farm machinery, and deployed labour; they also had power to terminate farm tenancies and dispossess inefficient farmers where it was considered to be in the national interest (Harvey, 1997). Agricultural production increased dramatically under guaranteed prices: gross output rose by two-thirds between 1938 – 1939 and 1941 – 1942 (Bowers, 1985). It was during this time that pig production began to change in its position in contributing to the farm's output. Whereas in the past, pig production had been an aside to the production of arable crops, in meeting the Pig Marketing Board's drive for increased production and better efficiency there needed to be a move towards more pigs being kept on some farms. This signalled the beginnings of a movement into pig production as a more significant part of the farm's overall production. Increased quantities of cereal crops, a government policy, enabled animal nutritionists to improve the diets of farmed animals and the development of concentrated feed (Soper, 1995). This assisted farmers in increasing their pig production and in improving the quality of the carcass (Soper, 1995).

2.2.3 Second World War agriculture

This period can be summarised by the expansion of output regardless of cost to provide food in conditions of shortage and a deteriorating trade

deficit (Davey *et al.*, 1976). Farmers received fixed commodity prices at sufficiently high levels to provide an incentive for production. The 1947 Agriculture Act provided a commitment to support agriculture through a number of mechanisms:

> [1]. To provide a secure and guaranteed market for produce;
> [2]. To guarantee prices; and
> [3]. Prices were to be set at an annual review for the following year's commodities.

The price was fixed for the subsequent 18 months for wheat, barley, oats, rye, potatoes, and sugar beet. Fatstock, milk, and egg prices were fixed for between two and four years ahead. There was the desire to increase production by 20 percent for milk and 60 percent for eggs above pre WWII levels (Carter & Stansfiled, 1994) thus increasing farmer's income. The government was bound by law to consult the National Farmers' Union (NFU) as the industry's representative during the price setting process. Smith (1989) suggested that the process of the annual review effectively removed agricultural policy formulation from parliamentary and wider public scrutiny – the National Farmers' Union – Ministry of Agriculture, Fisheries & Food (MAFF) relationship flourished. The 1947 Act stated that:

> "...promoting and maintaining... a stable and efficient agricultural industry capable of producing such part of the nation's food and other agricultural produce as in the national interest it is desirable to produce in the United Kingdom, and of producing it at minimum prices consistently with proper remuneration and living conditions for farmers and workers in agriculture and an adequate return on capital invested in the industry" Bowers (1985, pp. 66).

The 1947 Agriculture Act was one driving force for the initiation of 300 farm-trials in Britain for the herbicide known as 4-chloro-2-methylphenoxyacetic acid (MCPA) (Harvey, 1997). The 1947 Agriculture Act guaranteed prices and provided an additional incentive for farmers to increase production. This was achieved by the increasing use of chemicals, and in particular with the newly trialled herbicide MCPA (Harvey, 1997).

> "The industrialisation of Britain's countryside began in 1947, the year of the great post-war Agriculture Act. Food remained under rationing. At the same time there was a desperate need to save foreign exchange. By providing farmers with a substantial degree of price security, the new Labour Government hoped to encourage expansion and give agriculture a central role in the nation's economic reconstruction" Harvey (1997, pp. 8).

At the start of WWII (1938), there were almost 226,000 mixed farms of about 20 hectares but by 1968, there were only 162,000 (Harvey, 1997). The mixed farm typically worked on the Norfolk four-course rotation system, where animal wastes were returned to the land to build up the soil's fertility. Before state intervention and guaranteed prices, a range of crops was needed on the farm to ensure security in the face of price fluctuations on any one crop. The 1947 Act that served to stabilise prices enabled the farmer to specialise in what was his most profitable crop, and to produce the highest output. Additional to this individual farmer-led process, there appears to have been political actions that promoted the specialisation trend and would subsequently realise an unfeasible return to a mixed farming regime. It has been suggested by Harvey (1997), amongst others, that the landed classes who sat on committees, the National Farmer's Union, and its influence over the Ministry of Agriculture, Fisheries & Food, sustained this position.

> "...the severe food shortages of the war years led to a totally different priorities. Each farmer was required to crop as much of his land as possible at the highest level of production. The research and development services were required to promote new technology for intensive production to meet highly ambitious targets" Carter & Stansfiled (1994, pp. xi).

2.2.4 The 1950s

According to Davey *et al.* (1976) this era saw world commodity prices fall and the continuation of a policy to support farmers become increasingly costly to the Government. After 1953, there was a move towards minimum support prices or deficiency payments. Farm structure had changed little since the post-war period and as a consequence of this, when the National Farmers' Union asked for support prices to be set, the required level was high as many farms were barely viable. Measures to increase on-farm efficiency were desired and were realised through *inter alia* fertiliser subsidies in 1952, and grants made specifically available for farmers to plough the land (Bowler, 1979). It was at this time that the Stresa Conference, held in 1958, discussed the problems of agriculture on a European level. Sicco Mansholt's said in his final conference address that,

> "...the goals of our agricultural policy, that is to say, of the need to guide agriculture in the direction of sound family farms" Fearne (1997, pp. 17).

Although Harvey (1997) says,

> "...post-war farming policy has applied a form of natural selection to the countryside, favouring the industrialists of the landscape and eliminating the custodians" (pp. 61).

This was true of pig production, according to Soper (1995) who states that producers who had previously kept small herds left the industry as specialisation and intensification began. The formation of the Pig Industry Development Authority in 1950 with the aim of improving quality and developing new and existing markets provided the drive and rewards for the changes that were being made on-farm. For example, in the past, the herd had a balance to it, but with the ability to sell greater quantities there was a tendency for farmers to increase sow numbers, specifically to increase production of bacon or pork (Soper, 1995). Furthermore, the environment in which pigs were farmed also changed from outdoors to a controlled indoor environment, especially during farrowing (Soper, 1995).

2.2.5 The 1960s

This period was one of agricultural protection in the face of growing world food surpluces, according to Davey *et al.* (1976). Technological change moved at a progressive pace where the economies-of-scale that were possible led to an increase in average farm size (Winter, 1976). Donaldson & Donaldson (1969) in what is considered a classic review of late 1960s farming, suggested that a large number of small farms constituted a threat to the balance of the industry. Their explanation was that smaller farms required a higher return per hectare to be viable and pay the farmer a "living wage" compared to a larger farm where costs could be dissipated across more hectares (Donaldson & Donaldson, 1969). A government trying to maintain farm incomes would find the restructuring of the industry around larger units a tantalising prospect. The size of sow dominated herds continued to increase during this decade according to Soper (1995) in order to comply with the developing ethos of the management of the farm being

predominated by its financial management. Additionally, the number of small pedigree herds declined as farmers concentrated on the Large White and the Swedish Landrace as breeds that could efficiently convert cereals to meat (Soper, 1995). This was undoubtedly assisted through the formation of the Pig Improvement Company (PIC) in Oxfordshire that established itself with the aim of concentrating valuable genes that could be used to improve the herd (Soper, 1995). The prevalence of indoor production in purpose built buildings continued in an attempt to optimise and control the environment in which the pigs were housed. However, Soper (1995) does suggest that this was to such a degree that the animal houses were overcrowded by today's standards. Notwithstanding this, the Brambell report on animal welfare published in 1965 advised against compulsory legislation favouring codes of practice (Brambell, 1965).

It was not until the 1960s period that the environmental consequences of agricultural policy and the repercussions realised on-farm became a considered issue. The environmental movement, according to Lowe *et al.* (1997) established an "abstract" view of pollution in the 1960s as the balance of the economy, and those in employment, shifted towards the service sector. This "abstract" view was a change in perception, from emissions being viewed as a by-product of industrial production to the same emissions being considered a polluter of the environment and according to Grove-White (1993) a moral dilemma. Since the 1950s the countryside had increasingly become the place for counter-urbanisation, retreat, and retirement, all detached from the processes of production. Agriculture was considered to threaten the rural environment from within (Lowe *et al.*, 1997). At about this time scientists had begun to record increasing levels of impurities in river

water that were believed to originate from nitrates leaching from manured land (Lowe *et al.*, 1997).

In 1948, the River Boards were established and one of their first roles was to implement the Rivers (Prevention of Pollution) Act 1951, which banned the use of a stream for the disposal of any polluting matter; by 1963 the discharge of industrial effluent was made a consentable activity with emission standards set by the River Boards. The Public Health Act of 1961 brought farm effluents under the description of "trade effluent". In 1969, the River Boards recorded 131,171 discharges from farms to rivers of which only three percent were actually consented, 22 percent were pending, and 75 percent were illegal (Gowan, 1972). One of the problems identified by Weller & Willets (1977) was that the River Boards were operating to standards set in 1912 by the Royal Commission on Sewage Disposal. These quality standards of 20 parts per million and 30 parts per million of Biological Oxygen Demand (BOD) and Suspended Solids (SS) respectively were levels that the farms realistically had little chance of complying with. The River Boards therefore had to set standards that farmers could achieve: levels of 300 parts per million for Biological Oxygen Demand and Suspended Solids, an order of magnitude higher. It is therefore interesting to see that when farmers could not comply with the standards set, the standards were changed to make the discharges fall within the legal range rather than tackle the emissions themselves. Food production took priority over pollution control.

The constituents of agricultural discharges were not compatible with Royal Commission standards and additionally the discharges were difficult to locate, as there was no single end-of-pipe, point-source, in contrast with many manufacturing-industries (Weller & Willetts, 1977). The possibility that

farm effluents could be disposed of via the sewerage network, like other industrial effluents, was investigated by the Working Party on Sewerage Disposal in 1969. They concluded that farm effluents should be returned to the land wherever possible because it would be too expensive on a national scale to divert animal wastes to sewage treatment works (Lowe *et al.*, 1997). There followed two reports in the 1970s by the Royal Commission on Environmental Pollution that suggested that valuable manure was being wasted (RCEP, 1971) and that the storage facilities on farms should be improved so that manure could be spread on the land at the most appropriate time of the year (RCEP, 1974). In 1973 the Ministry of Agriculture, Fisheries & Food, through an advisory council (Advisory Council on Agriculture and Horticulture), investigated the extent to which fertilisers and the disposal of farm waste contributed to the overall levels of pollution. Their investigation primarily focused on whether control measures were adequate, concluding that excessive restrictions aimed at improving water supplies would be at the expense of domestic agricultural production that was not intrinsically a polluting industry (ACAH, 1975). Further, the Advisory Council on Agriculture and Horticulture suggested that the "polluter-pays-principle" could not readily be applied to farming as farmers would find it impossible to transfer these costs to its customers (ACAH, 1975). Therefore, whilst the polluting potential of agricultural emissions and the management of agricultural emissions were beginning to be considered, farmers continued to have their interests given priority over the potentially damaging consequences of emissions. Additionally, in some instances (as seen above) "pollution" was avoided by moving the 'goal-posts' of what constituted pollution.

A major piece of legislation that began to shift the balance between agricultural emissions and pollution was the Control of Pollution Act 1974. The Control of Pollution Act 1974 strengthened the powers of the Water Authorities by allowing them to encompass groundwater pollution offences in relation to nitrate contamination. The Secretary of State, under this legislation, could establish Water Protection Zones prescribing allowable activities and specifying how they were to be performed; however, there was a general exemption for agriculture providing that it followed "good agricultural practice". Later the Ministry of Agriculture, Fisheries & Food established a formal *Code of Good Agricultural Practice* (MAFF, 1985). The water industry at this time was being restructured into 10 large regional organisations that were to be responsible for all aspects of the water cycle – from source to sewerage, under the Water Act 1973. It was because of this restructuring process and the fractionating of water-related control that Lowe *et al.* (1997) postulated that there was no coherent voice against agriculture's position. Additionally in 1973, Britain entered the European Economic Community (EEC) and the probability of a world shortage of food caused farm pollution to be seen as an issue peripheral to the need for technological advancement and the production of food. At this time, the Agricultural Development and Advisory Service (ADAS) had four specialists out of 5,800 staff dealing with farm waste (Lowe *et al.*, 1997), illustrating the low priority that agricultural emissions had.

2.3 The 1970s Britain joins the Common Agricultural Policy and farm pollution regulation begins in earnest

Britain joined the Europe Economic Community in 1973, primarily to ensure industrial trade on preferential bases as opposed to agricultural support *per se*. As a major food importer, Britain should (had it not been granted concessions for the first five years) have contributed significantly to the European budget (Fearne, 1997). British agricultural policy had to adapt its compliance to three main conditions of the European Economic Community (Hill, 1984; Neville-Rolfe, 1984):

[1]. Common prices, but was in practice not achieved due to monetary compensatory amounts and floating exchange rates (Fennell, 1979);
[2]. Community preference, achieved through setting annual threshold prices that imports must reach. Achieved with import levies; and
[3]. Common financing through a single budget or fund, but consequently those countries with agricultural exports are subsidised by those with imports (Hill, 1984). This benefited Denmark and The Netherlands and disadvantaged the United Kingdom (Hill, 1984).

Capital grant schemes continued, but with membership of the European Economic Community they became closely linked to overall farm development schemes to establish efficient farms and an efficient agricultural structure, for example the Modernisation of Farms Directive (1972/159/EEC), the Farm and Horticultural Development Scheme in Britain, and the Mountain and Hill Farming Directive (75/268/EEC). Sicco Mansholt's idea was to promote "sound family farms" (Fearne, 1997), in contradiction to British post-war policy instruments that were expansionist, and initiated to reduce Britain's balance of payments deficit (Bowers, 1982). European agricultural policy was based on market unity and included common pricing

which, in 1963, was set towards the higher price levels of the six members. A change in outlook was detectable from the farm lobby upon accession to Europe in 1973, as they now began to see the benefits of membership.

> "...the opinion of the farm lobby swung around to its total support of accession by 1973. The deficiency payments system had, until the mid-1960s, worked favourably for the farming population as a whole. But at a time when British farmers were being encouraged to expand production selectively (due to the rising exchequer cost of product subsidies) Community farmers appeared to enjoy more security in high guaranteed prices and open-ended market" Fearne (1997, pp. 37).

Opinion began to turn against the exceptional status for agriculture following the introduction of the Control of Pollution Act 1974 (Lowe *et al.*, 1997). The Ministry of Agriculture, Fisheries & Food replied to criticism with voluntary co-operation and suggestions that its *Code of Good Agricultural Practice* was sufficient to tackle the pollution problem. South West Water Authority conducted farm visits to assess the risks of pollution from farming with the intention of identifying problems and possible solutions. It had gained co-operation from the Agricultural Development and Advisory Service and the county National Farmers' Union to bolster its tactic of assisting farmers to improve their slurry, manure, and silage storage infrastructures through offering advice; the objective was to give farmers every opportunity to avoid legal redress. In contrast, North West Water Authority actively sought prosecution of farmers,

> "...we have prosecuted more people in recent years than most other water authorities for such incidents...we can prosecute a farmer for making a polluting discharge, but the river is already polluted and the damage done" Lowe *et al.* (1997, pp. 81).

Under the Control of Pollution Act 1974, farmers as well as others were liable to prosecution for water pollution unless emissions were authorised or attributable to an act or omission that was in accordance with good agricultural practice. The *Code of Good Agricultural Practice* actually offered legal protection to the farmers if they could demonstrate that the "pollution" had occurred, whilst they had adhered to the principles of good agricultural practice. Attributing blame for emissions to any specific farmer was difficult. The agricultural community had therefore demonstrated its ability to respond to policy whilst still preserving the freedom of farmers.

The Royal Commission on Environmental Pollution, in 1979, specifically investigated agriculture and pollution including *inter alia* pesticides, nitrogenous fertilisers, farm effluents, and the effects of urban pollution on agricultural productivity. The RCEP,

> "...were not persuaded that sufficient attention was being paid to the pollution that might be caused by agriculture...that such problems were regarded as secondary in importance and unavoidable concomitants of food supply" (1979, pp. 3).

The report concluded that the traditional mixed farming regime, where manures were returned to the land as fertilisers, was fundamentally different from the intensive farms and specifically pig and poultry production that operated on relatively small areas of land. The report stated that, "...intensive livestock units are not intrinsically agricultural in character; they are essentially industrial enterprises and should be regarded as such" RCEP (1979, pp. 128) where "...animal production is virtually a factory process for converting grass or grain into meat or eggs" RCEP (1979, pp. 127). The implication was that, "...as with other industries, the need for

pollution control, and the need to bear the costs of that control, must be accepted" RCEP (1979, pp.127).

2.4 The 1980s and the crisis of the Common Agricultural Policy

The 1980s was a decade of almost continual policy review, debate, and reform (Winter, 1996). For example, Prime Minister Thatcher secured a three-year formula to reduce the United Kingdom's budget contributions to the European coffers in May 1980 (Hill, 1984). However, the driving force behind the reforms was the costs of financing an agricultural policy that created surpluses. Evidence also mounted that the beneficiaries of the policy to support farmers were agricultural suppliers (Traill, 1982; Howarth, 1985). Additionally, assisting farmers with capital investments was creating unemployment amongst the agricultural workforce (Traill, 1982). What was actually happening differed from policy objectives. Reforms also included the five-year voluntary set-aside scheme where farmers would be paid to take land out of production. Although the objectives of this scheme were to reduce production, the same scheme was later promoted for its wildlife and farmland biodiversity benefits.

Pig production continued to intensify with an increased size of the sow dominated herd and in the development of multiple farms or units for the separation of breeding sows and finishing pigs. The later was a term that became popular during this decade reflecting the change from "fattening" to "finishing" reflecting the desire to improve carcass quality and to promote a healthy image for the consumption of pork meat products (Soper, 1995).

However, the continued trend of capital investment in the intensification process required improved efficiencies in order to repay the investment. To some degree, once specialisation or intensification had begun the need for increasing improvements in efficiency became a cycle that needed to be sustained. However, as the subsequent paragraphs highlight, environmental problems with animal waste became apparent as a consequence of intensification.

In 1983 the Department of the Environment responded to the Royal Commission on Environmental Pollution's sixth report stating that essentially the problem with agricultural emissions were with intensive pig and poultry units and that the chief problem was with the odours associated with waste (DoE, 1983). By 1988, this position had progressed to farm wastes being a major source of water pollution that needed to be regulated (DoE, 1988). The annual publishing of reports (1981 onwards) of data collected by the Ministry of Agriculture, Fisheries & Food's Farm Waste Unit on farm pollution incidents helped highlight the problem; although Payne (1986) suggests that the internalisation within an essentially agricultural department, cast doubt on the accuracy of the figures. The 1989 Water Act established Nitrate Sensitive Areas, which the Ministry of Agriculture, Fisheries & Food was given responsibility for administering. The 1989 Act removed good agricultural practice as a legal defence against a water pollution charge, but retained regard to the *Code of Good Agricultural Practice* requiring the National Rivers Authority to take into account contraventions of the Code in deciding if prosecution was required.

The River Quality Survey of 1985 found that 14 percent of the lengths of rivers had deteriorated in condition when compared to the results of the survey in 1980; although difficulties in interpreting and comparing the data were highlighted. The survey's results were widely used by those eager to promote improvements by industry and investment in sewage treatment, and to highlight the impacts of farm pollution. Although there was considerable academic analysis made of The River Quality Survey of 1985, focusing on the methods used in both the reports and the comparisons made, it did not stop the report being used to focus attention of the farming community. For example, the Confederation of British Industry (CBI) highlighted the improved quality of point sources and the impact of diffuse agricultural emissions (CBI, 1987). Further, representing their members as consumers of water, the Confederation of British Industry complained about the chemical imbalances caused by agricultural runoff (CBI, 1987).

Although the precise causes and practical solutions remained to be decided, the Torridge Report, a local river study by South West Water Authority in 1986, was widely cited in evidence to the House of Commons Environment Committee (SWWA, 1986). The Report was based upon an area where the 1985 River Quality Survey showed that 45 percent of the lengths of rivers were classified as being of lower quality than in the previous report in 1980. Agriculture was identified as a major cause of the decline (SWWA, 1986). The deterioration was in dissolved oxygen content, Biological Oxygen Demand, Suspended Solids, invertebrates, macrophytes and algae, all of which are pollution sensitive. Those organisms tolerant of 'pollution' were seen to be more abundant (SWWA, 1986).

The Environment Select Committee visited European countries and concluded that it was perfectly feasible to regulate slurry and silage liquor (House of Commons Environment Committee, 1987). Amongst the Committee's conclusions was the need for "...a far more interventionist and regulatory approach to farm pollution" House of Commons Environment Committee (1987, pp. xxx), and specific recommendations included:

[1]. The special defence for prosecution for farmers should be repealed;
[2]. A revised *Code of Good Agricultural Practice* made enforceable;
[3]. Regulation was introduced for the location, construction, and maintenance of waste storage facilities;
[4]. Grant aid should be available towards the cost of waste handling facilities;
[5]. The Agricultural Development and Advisory Service should offer free advice to the farmer;
[6]. The law be enforced and that prosecutions should be more frequent; and
[7]. Magistrates should be less lenient on those causing pollution (House of Commons Environment Committee, 1987).

The Government proposed a wholesale privatisation of the water industry in 1986, transferring all functions to the private sector (DoE/Welsh Office, 1986). Richardson *et al.* (1991) and Maloney & Richardson (1994; 1995) suggested that the issue of privatisation destabilised the previous policy community comprised of engineers and technocratic thinking. The policy community now encompassed a wider spectrum of opinions including *inter alia* environmentalists, industrialists, landowners, and anglers who voiced the opinion that the regulatory function should remain in the public arena, directly opposing the Government's wholesale sell-off. This eventually saw the creation of the regulatory function in the National Rivers Authority. Exacting standards for drinking water quality were difficult to achieve when groundwater was becoming contaminated with agricultural nitrates.

The House of Commons Environment Committee launched a report into *Pollution of Rivers and Estuaries* in 1987 (House of Commons Environment Committee, 1987). This was a landmark report that was to shape the future of agricultural regulation. The Committee called approximately 60 organisations to give evidence who subsequently laid the blame for the deteriorating river quality on agriculture. Achieving the standards for drinking water were said to cost the Welsh Water Authority £500,000 in one year and this cost was passed to consumers (WWA, 1984). This led to the question of who should pay to rectify the effects of agricultural pollution.

The Government responded in July 1988 and in December of that year replaced the Capital Grant Scheme with the Farm and Conservation Grant Scheme; this was to increase the level of grant aid available from 30 to 50 percent for investment in waste management facilities. The facilities for which grants were used had to be approved by the newly formed National Rivers Authority on the grounds of:

[1]. Minimum technical standards;
[2]. Component lifetimes;
[3]. Construction quality;
[4]. Storage capacity; and
[5]. Location (DoE, 1988).

The National Rivers Authority was to get new powers to force farmers to improve facilities under the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991 (SI 1991/324). The Agricultural Development and Advisory Service became prominent in its role in farm waste and pollution prevention. In July 1991, the Ministry for Agriculture, Fisheries & Food issued a new *Code of Good Agricultural Practice for the*

Protection of Water; fines for offences leading to pollution of controlled waters were also raised from £2,000 to £20,000 under the Environmental Protection Act 1990.

2.5 The 1990s and the reformation of the Common Agricultural Policy

John Gummer, the then Minister for Agriculture, heavily criticised Ray MacSharry's reform proposals issued in February 1991 because they favoured the small farmer and would have damaged many United Kingdom producers through the proposed modulation of payments (Winter, 1996); and by May 1992 the United Kingdom had secured major concessions. The reforms fundamentally changed the way in which agriculture was subsidised, moving from subsidies tied to the quantity of production (tonnes) to direct payments based upon the cropped land area (hectares); compensatory payments were also paid because the subsidy system had changed. In the United Kingdom this led to the Arable Area Payments Scheme (AAPS) in 1993 whereby the farmer would get an amount of money per planted hectare dependent upon the crop and provided that the there was compliance with the area to be set-aside. Beef prices were also reduced and compensation paid through the Special Beef Premium and Suckler Cow Premium, both schemes requiring a reduction in stocking densities. The Extensification Premium was made available if farmers reduced the stocking density to 1.4 compared to 2.0 Grazing Livestock Units per hectare. The first three years of the Arable Area Payments Scheme in Britain saw a 44 percent increase in the earnings for cereal farmers in 1993 reaching the highest levels

since 1986 – 1987 (Winter, 1996). The Rural White Paper published in 1995 set out the Government's intentions as,

> "...we want to see an efficient, prosperous and outward-looking agricultural industry, able to operate in increasingly open world markets" Harvey (1997, pp. 97).

One of the environmental pollution issues of agriculture was highlighted when it became necessary to implement the European Directive on the Quality of Water Intended for Human Consumption (80/778/EEC). First proposed in 1981, and to be in force by 1985, it defined a maximum permissible level of 50 mg of nitrate per litre in water, half that of the World Health Organisation's standard of 100 mg. This Directive forced the issue of who was responsible for high nitrate levels. Increased quantities of concentrated nitrogenous fertiliser were applied to increase production, exacerbated by the effects of the demise of agricultural rotation. This change in farming practice led to significant increases in nitrate in groundwater. Consequently, maximum permissible concentrations were exceeded in some areas, particularly those occupied by intensive arable farming. In the United Kingdom in 1989, it was found that 154 sources exceeded the drinking water limit and this increased to 192 by 1990 (Harvey, 1997). To comply with the limits on nitrate levels the water companies introduced expensive blending of water supplies or turned to equally expensive water treatment, a technological solution to the problem of supply. In East Anglia, one of the regions most affected, the farming lobby was so strong within the policy community that during the early 1980s the Anglian Water Authority refused to consider measures to limit farmer's fertiliser applications and pursued the water treatment option (Harvey, 1997). In 1985, a consultancy group,

contracted by the Department of the Environment, concluded that blending and the treatment of water was the most cost-effective approach, a view consistent with that of the Royal Commission on Environmental Pollution (RCEP, 1979). Latterly the consultants revised their opinion and suggested that reducing fertiliser applications in some areas might, be the cheaper option, after all (Hill *et al.*, 1989). This reversal of opinion followed ideas of prevention at source and the polluter pays principle. The Ministry of Agriculture, Fisheries & Food's 1985 *Code of Good Agricultural Practice* advised farmers on appropriate practices associated with organic and inorganic fertiliser applications but suggested little in the way of serious restrictions on their use:

> "...care should be exercised in the handling and application of solid and liquid fertilisers, particularly to avoid polluting relevant waters either directly or indirectly.
>
> Application rates of fertilisers should take account of crop requirements and the nitrates provided by any organic manure and the soil. To reduce the danger of nutrients being leached out and polluting relevant waters, fertilisers (particularly nitrogenous fertilisers) should not exceed maximum recommended rates.
>
> Nitrogenous fertilisers should only be applied at times when the crop can utilise the nitrogen. In autumn and winter application should be avoided except when there is a specific crop requirement" MAFF (1985, para. 1.5 – 1.7).

In 1989 a new European Community draft directive, (The Nitrate Directive) was issued which proposed that Member States should designate all areas where waters (taken in the UK to mean ground water) might be polluted by nitrates, and impose therein very strict limits on fertiliser use and stocking densities. To comply with this Directive, ten voluntary Nitrate Sensitive

Areas were established in 1990. In these areas, farmers who entered into an agreement to apply lower levels of nitrogen, and farm their land in particular ways would receive a payment by way of compensation for possible loses in yield. However, the site-specific schemes agreed under this process led to an intensification of agriculture outside the designated areas. Farmers were reported to have taken the payments for reducing nitrate application within the designated areas and then intensified production in those fields surrounding, using the fertilisers not applied to those fields in the Nitrate Sensitive Areas. In July 1991, the Ministry of Agriculture, Fisheries & Food revised and issued its *Code of Good Agricultural Practice for the Protection of Water*. The Nitrate Directive (91/676/EC) required designation of Nitrate Vulnerable Zones where nitrate concentrations exceeded, or were expected to exceed, 50 mg/l, or where there was evidence of nitrate-induced eutrophication. The requirement was the compulsory reduction in nitrate application rates (the rate was 210 kg/ha but further change is imminent) without providing the farmer compensation; a review of the performance of the scheme was to be carried out at four year intervals.

2.6 The mid 1990s to the present

The mid to late 1990s have seen significant changes in agricultural policy to address both overproduction and adverse environmental impacts. In addition, society has become intolerant of agricultural 'by-products' and agricultures' industrial use of the rural environment. The Agenda 2000 reforms proposed another radical change in the Common Agricultural Policy to ensure that European agriculture is competitive on both European and world markets and more environmentally aware whilst upholding farmers'

livelihoods (Chadwick, 2000). Undoubtedly, there was also an interest in controlling the Common Agricultural Policy's budget within the reform process; especially with the likely accession of a number of eastern European states. The salient features of the Agenda 2000 reform package was a reduction in commodity intervention prices, an increase in Arable Area Payments (by way of compensation), and the introduction of modulation. Modulation was the reform's mechanism for addressing the enhancement of the environment and rural landscape through allowing a percentage of payments to be diverted and matched by national funding to approved schemes such as Countryside Stewardship, Set-aside, and agricultural restructuring and farm diversification; schemes that would not increase production. Although the reforms are likely to have a limited impact upon production, they do continue the trend started in the mid 1980s.

In addition to the political desire to reduce production, society is placing increasing and more divergent demands upon the rural space; amenity, recreation, and conservation interests are challenging agricultures' traditional pre-eminence in the countryside (Lowe *et al.*, 1993). Changes to the planning system have seen the introduction of more stringent controls upon the location of new intensive livestock units. These powers and controls have also been used more frequently as the rural mix of farming, residency, and other industrial uses have superseded agriculture as the main provider of rural employment. Whilst some farmers are critical of the incoming rural population, for their lack of understanding of farming, and unwillingness to accept what farmers would see as naturally occurring emissions (others would classify them as nuisances), farmers themselves are partly to blame for the new rural population. Farmers have reduced staffing and replaced it with machinery, and they have structured their fields to be

the most economical to use. Farmers themselves have converted former agricultural buildings, such as barns, and have subsequently brought a different population into the rural environment,

> "...farmers [are] facing new challenges to their autonomy actually on the farm, over such matters as pollution incidents and access disputes" Lowe *et al.* (1993, pp. 205).

In addition to a new rural population and the new demands made of the countryside, several recent food and farming related scares (such as Bovine Spongiform Encephalopathy (BSE) in 1996, Classical Swine Fever in 2000, and Foot and Mouth Disease (FMD) 2001) have attracted major media headlines. Consequently, some consumers have begun to question the way in which our food is produced (Evans *et al.*, 2002). There are the beginnings of a backlash to the trend towards increased processing of raw food materials and concerns are increasing over safety and quality of food. The position that farmers had in the food chain has been eroded by supermarkets and the increasing use of food processors to manufacture food (Lowe *et al.*, 1993). These powerful organisations require consistent quality, supplies when they need them, and ever more set the price for the fulfilment of a contract. Concurrently raw materials can and are being sourced from a global market. However, the environmentally damaging impact of having to produce raw materials for a processing industry where the price is dictated by the supermarkets has received less attention from the consumers. In fact, the damaging effect of farm emissions on the environment is generally overlooked by society. It is true that some criticism is directed towards farmers and their impact upon the environment, but mainly in terms of: [1] nuisances caused to residents in close proximity to the farm who complain

about noise and odours (especially during slurry spreading operations); and [2] the decline of a bygone romantic ideal of an agricultural system that is no longer economically viable without heavy subsidy.

The evolving ways, in which society regards farmers and the rural environment have meant that it is now less risky for the politicians to introduce regulation to tackle agricultural pollution. For example, Nitrate Vulnerable Zone regulation will be extended to encompass 55 percent of the land area of England, the introduction of the Integrated Pollution Prevention & Control (IPPC) Directive (96/61/EC) to the intensive pig and poultry sectors, and the incorporating of non-natural agricultural wastes into mainstream waste regulation. The Government should have implemented tighter controls of nitrates, and agricultural wastes should have been included in the 1991 Waste Framework Directive (91/156/EC) according to a recent European Commission Ruling (Marcus Hodges Environmental Limited 2001). Applying 'main-stream' regulatory controls to farming activities will undoubtedly prove challenging to the Government and the Environment Agency, both of whom remain relatively inexperienced in applying these regulatory systems to farming. Similarly farmers are renowned for their inability to adhere to regulations (for example compliance with codes of good practice), and their strong lobby (National Farmers' Union and other single-issue pressure groups) that has won major concessions to the way regulation is actually applied.

2.7 Conclusion

The special status that agriculture once had with government and society has evolved. Government targets for agriculture have changed from production at any cost to feed the nation during the wars, to one of environmental guardianship and the production of wholesome, safe food at affordable prices. Wastes from production are less tolerated by Government and a new rural population. Society is making greater demands upon the use and regulation of rural space.

Pig production has changed markedly since the 1850s from a position where probably all farmers kept a pig or two for home consumption, and selling the surplus at the local market. The larger pig farms may have had a dozen sows producing meat for the local market within the confines of a mixed farming regime. Driven by the Government's desire to increase production during and between the first and second world wars, pig farmers entered into a process of intensification to meet this demand. Concurrent improvements in the quantity and quality of cereals and concentrated foods assisted in this process. Similarly, a move indoors to controlled environments has enabled increased production. These processes have required substantial investments that have fuelled the specialisation and intensification process in an attempt to lower production costs and return greater profits to repay the investments. However, as herd size has increased many breeds have disappeared as species that are more productive have been preferred. Nevertheless, the environmental consequences of intensification have become intolerable and the latter decades have seen the need for controls and constraints to be placed upon production techniques. Producing porcine in

an unsubsidised market where profits per pig can be low and prices on a world market fluctuate markedly, has not been an easy task.

For many years, farmers have been given special considerations within pollution control regulation with reference having to be made to codes of good agricultural practice in deciding if the law has been broken. However, in recent years there has been both the need and the political desire to bring agriculture alongside other traditional manufacturing industries. Therefore, the challenge is to realise this objective, whilst managing the additional responsibilities of being a member of the European Union, and overcoming the inertia within the agricultural community.

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Chapter 3.

Methodology

3.1 Introduction

Intensive pig farmers who operate farms above a threshold-based size (750 sows or 3,000 finishing pigs) will have to apply for a permit in 2006 or 2007 in order that their farming operation remains legal. They will have to produce porcine following predetermined techniques and using specific technologies agreed by the Environment Agency and the pan-European Technical Working Committee. Other industrial sectors (for example, paper- and pulp-production, and organic-chemical production) will have to apply for similar permits. What is unique about this research is that it is the first to examine, in-depth, this permitting procedure within the intensive pig farming industry. This style of environmental control is new to intensive pig farmers and has its foundation in other traditional manufacturing industries.

At the outset of this investigation, the methodology had to be selected. Social research has developed many different methodologies with which it can achieve its objectives. The objective of this research is to develop strategies to assist intensive pig farms in grappling with new regulatory controls. This Chapter focuses on the techniques that will be used to reach the research's objective.

The research process has been shaped by both aspirations and practicalities. Latterly those practicalities had to contend with Classical Swine Fever,

and Foot and Mouth Disease (FMD), both of which had a severe impact upon the farming community and ultimately affected what was feasible during the research. Nevertheless, it was working around these problems that introduced the option of a comparative study and added a new dimension to the research. Making comparison with the landfill industry, which also has to implement the Integrated Pollution Prevention & Control (IPPC) Directive (91/61/EC), has helped focus the work and led to some interesting conclusions. The added benefit to the intensive pig farming industry is the possibility of learning from another industry's experiences with permitting and licensing.

Summary aims of this chapter are:

- **To provide a rationale for the methods chosen to achieve the research's aims**

3.2 The development of a research idea

When this research was first proposed (July 1999), the intention of Government was to bring the intensive pig farming sector under the Pollution Prevention & Control (England and Wales) Regulations 2000 (SI 2000/1973), as amended, in 2002/2003. However, in 2001 the Government announced a new timetable that postponed this until 2007. This action changed the research from an examination of the active permitting process to research that would require a degree of speculation. This speculation would have to be based on the opinions of farmers, as they are the ones with responsibility for implementing the change.

Initially, assistance from a large pig farming company was offered. This company was involved in breeding sows, finishing pigs, and in managing other farms. The company's interests were dispersed throughout England and consequently would have allowed investigation into a diversity of farm set-ups, and locations. With this level of assistance it would have been possible to develop in-depth case studies and to discover how the proposed changes were dealt with centrally within the company's management and then implemented on the different farms. However, following the outbreak of Classical Swine Fever late in 2000 this support was withdrawn. The entire industry became increasingly closed to outsiders – a situation compounded with the outbreak of Foot and Mouth Disease months later during early 2001.

This difficulty necessitated both a rethink of the schedule and the approach that would be possible under the much more constrained conditions. It was realised that such a close working relationship with the intensive pig farming industry would not be possible. However, it was also felt that surveying farmers would be too cursory an investigation and therefore a balance between the two had to be reached. To address this, the idea of introducing a comparative element to the research was formed. The first idea was to seek 'best-practice' from within other industries that were to be included in the various industrial sectors of the IPPC Directive's remit. Recommendations produced from this research methodology would then be the ultimate way in which an industry could implement the Directive's requirements. However upon more careful examination this process would be both time-consuming and would gloss over the reasons as to why they were 'best-practices', and what made them work in the specific industries, if not individual companies.

Continuing the theme of a comparative study, what was required was a single industry that could be studied in-depth from where experiences with permitting could be carried forward to recommendations for the intensive pig farming industry. The more obvious choices were those industries that had gone through the IPPC Directive's precursor: Integrated Pollution Control (IPC). However, those industries may be too attuned to the permitting process; the intensive pig farming industry is new to permitting. Additionally, it was difficult to think of an industry where problems of emission management were similar: point-sources and area- or diffuse-sources.

Concurrent to designing the research and the methodology by which it was to be studied, there was a research project at Hull University on the causes and control of landfill-odour. Having gained an understanding of the landfill industry it appeared that this would be an ideal industry with which to make the comparison. The types of emissions were similar and the industry had experience of permitting or licensing – but was new to multi-media emission control regulation (it had been omitted from IPC).

3.3 Reaching research objectives

Having decided what was going to be studied, the question of how it was to be studied remained. There would be the need to gain an in-depth understanding of both industries (intensive pig farming and landfill) and therefore questionnaires might not be appropriate. In addition to gaining information, it would be advantageous to discover if there were differences between words and actions. Was there a difference between what managers

said and what actually happened at either intensive pig farms or landfill facilities? This could only be answered from combining interviews and visits. Although this approach would not equal in-depth case studies – it was be a method that was manageable, especially within the intensive pig farming industry. However, would it be possible to detect the kind of differences that were envisaged? Was it possible to make a judgement about what was right or wrong in the context of adhering to environmental regulation within such a brief period as a site visit?

To assist in answering these questions it was felt that specialist knowledge needed to be brought to the interview and visit encounter. If it were possible to come across to the interviewee as being knowledgeable about environmental management, then the quality of information might improve. This knowledge would assist with informed questioning and in separating useful from irrelevant information in answers. Additionally, it would assist in the identification of gaps between actual practice and what should be achieved through operating in compliance with respective industry regulatory requirements. This knowledge was subsequently gain by studying and gaining a National Examination Board in Occupational Safety and Health (NEBOSH) Specialist Diploma in Environmental Management, which effectively brought with it an industrial-style environmental management perspective to each encounter.

It was important to define what information was required at each stage. The following presents an initial overview of some of the information that needed to be collected during the research.

[1]. Agriculture and pollution regulation

a. Discover when and how emission control and pollution regulation became important issues within farming

[2]. IPPC Directive

a. Understand the Directive and what it requires
b. Investigate how industry has managed multi-media emission control regulation (IPC as the IPPC Directive is in its infancy)
c. Investigate IPC and the IPPC Directive from the perspective of the regulator

[3]. The landfill industry

a. Discover the development of landfill licensing
b. Investigate how the landfill industry has dealt with the licensing process and what impacts landfill licensing has had
c. Discover if there are disparities between how managers suggest landfill facilities are operated and how they actually are

[4]. The intensive pig farming industry

a. Understand intensive pig farming
b. Understand what the intensive pig farming industry is being asked to do in meeting the requirements of the IPPC Directive
c. Investigate the problems that the intensive pig farming industry may have in meeting the requirements of the IPPC Directive

Whilst stages one – two can be performed through consulting documentary data sources, stages three – four can only be the result of original research. The literature on research methodologies suggest that observation and the development of case studies could be used to gain an in-depth understanding of a situation. This would help to answer why particular practices occurred.

However, with the possibility of long-term observation and case study development sidelined (see above), a new research method was required that would yield detail across more than one level in an organisation and would be able to distinguish between rhetoric and practice. Many other researchers have turned to questionnaire surveys of the population or a

sample of the population in their quest to understand an industry. However, the response rate for these questionnaires in all industries are typically low (in the region of 10 – 15 percent), and for questionnaires to the farming industry the response rates are lower still. Further, the problem with despatching a questionnaire survey to intensive pig farmers likely to be caught by the threshold of the IPPC Directive, is that the size of the population is unknown. There appears to be significant variation in the projected numbers (450 – 1,000 of current holdings) and little information as to their identity. Additionally, a questionnaire survey would not elucidate the difference between dialogue and practice. Whilst it would have been theoretically possible to conduct a survey of landfill managers, the desire was to make the research method as similar as possible for both the landfill and intensive pig farming industries. It appeared that a process of interviewing and visits would be appropriate as it is both efficient and provides the quality of information desired.

The intensive pig farming industry and farming in general, are relatively 'closed' to outsiders. It is difficult to break into the industry, and gain acceptance. Research that has sought industry response has generally been directed towards the uptake of various environmentally related subsidised schemes, and has been performed in an official capacity with government support, for example, the Environmentally Sensitive Area scheme. Alternatively, agricultural research has traditionally been directed predominantly towards production techniques. There have been relatively few environmental management studies. One interesting exception is the study conducted by Lowe *et al.* (1997) in observing the work of the Environment Agency. The authors of that study were able to observe Environment Agency inspectors as they performed their duties. From this

process, it was possible to analyse the differences in perception of the farm-pollution issue. However, that research was based on an immediate issue as opposed to looking at future impacts of regulation and would not work in the same way for this research. However, it does highlight the issue that the regulator-regulated relationship is an important one. Therefore, it would be advantageous to this research to expand the scope of subjects interviewed to include the regulator and other employees who are responsible for implementing the IPPC Directive.

3.4 Precursory investigations and honing of research methodology

Having narrowed the research methodology techniques to interviews and visits it was important to practice these and discover what particular sub-techniques would be most appropriate. Many researchers have used the interview process and a good proportion of those have used a tape-recorder to capture every detail of the interactive process. Through personal contacts, access was gained to two local farmers who kept pigs. These served as pilot interviews from which different styles of data capture were explored, mistakes made, and lessons learnt without compromising the core data that were needed for the research.

A small tape-recorder was used in both of the test interviews. However, it was found that when the tape-recorder was switched off the flow of information improved. A similar phenomenon was found when the notebook was closed and the writing of notes ceased. Overall, as soon as it appeared that the interview had switched to a general conversation about

pig farming the farmer took the opportunity to talk about the difficulties faced and information flowed far more easily. However, this process required management to avoid the farmer unloading his problems and omitting essential information that was required in the research. Attributing the information to the individual farmers was also tested. Part way through the interview process it was explained that the information that they provided would be used in a non-attributable format, and that anything they said would be used in a confidential manner and not repeated to other farmers later in the research process. Whilst it was not possible to affirm that information would not have been forthcoming without either not attributing the information to the farmer, or stating that everything said remains confidential, it appeared a pragmatic approach to take. Therefore, following the pilot interviews it was decided that all information was to be in a non-attributable form, and that this and issues of confidentiality would be discussed at the outset of the interview process. The writing of copious notes was avoided, with preference for aide memoirs, and the interviews were written immediately after the interviews. The beginning of the interview would be used to capture basic information related to the farm and a general conversation about pig farming would be engaged; later the primary issues would be addressed. Therefore, this technique would enable the interviewee to become relaxed whilst enabling consideration to be extended to what the farmer chose to talk about during those first moments. Additionally, at some stage during the interview process the notebook would be deliberately closed in a ploy to ease the flow of information or to improve the quality of information. Following the interview a visit of the farm was arranged thereby allowing observation of differences between what was said by the farmer and what was actually present on the farm.

A similar approach was used in gaining information from the landfill industry to enable the same flow of information. Therefore, it emerged that documentary data sources could be used to provide background information and a process of interviews combined with site visits could be used in the research.

3.5 Literary critique of proposed techniques

3.5.1 Documentary data sources

There is an extensive literature concerned with the problems of utilising different documentary data sources. For example Scott's (1990) two-way typology of authorship and access referring to the document's origin: be it personal, official-private, or official-state. Additional considerations have to be given to accessibility to others, falling in the categories of closed, restricted, open-archival, or open-published. Jupp (1996) presents four key questions in evaluating documentary data:

[1]. Authenticity – original and genuine;
[2]. Credibility – accuracy;
[3]. Representational – represents all documents of its type; and
[4]. Meaning – what it intends to say.

Macdonald & Tipton (1996) stress that nothing can be taken for granted and point towards Denzin & Lincoln's (1994) triangulation framework to ensure that all information is checked from more than one perspective. Finnegan (1996) suggests that, thought should be given as to how documents have come in to existence. It is then clear that, when using documentary sources, the utmost care and consideration has to be given to the information

contained in them. Several authors of published works, *inter alia* Lowe *et al.* (1997) and Williams & Bough (2001) when using readily available statistics from the Environment Agency on pollution incidents, have mistakenly taken the figures at face value without in-depth evaluation of the information presented. For example the subtle, but important changes in categorisation of different pollution incidents made between HMIP and the Environment Agency, and by the Environment Agency over the years evaluated. All of these concepts, problems, and ideas will be borne in mind when documentary sources are used in this study.

3.5.2 Interviewing

Interviewing is an important method of gaining primary information often adopted by researchers in the field. Jones (1985) says,

> "In order to understand other person's constructions of reality, we would do well to ask them...and to ask them in such a way that they can tell us in their own terms (rather than imposed rigidly and a priori by ourselves) and in a depth which addresses the rich context that is the substance of their meaning" (pp. 46).

Interviews were conducted to gain information from a variety of people. These included the Environment Agency, the National Farmers' Union (NFU), farmers, and those within the landfill industry. Respective authors have classified interview types and some use a classification system related to the degree of structure given to the interview, see for example, Patton (1980); Minichiello *et al.* (1990); Patton (1990); Fontana & Frey (1994); and Fielding (1996). They fall within two broad categories: [1] formal interviews with a structure and set questions; and [2] informal interviews, without definite structure and more conversational in style. However, Patton (1990)

states that the groups are not mutually exclusive and that more than one approach may be used. Structured interviews include questionnaires and it has to be considered that any deviation away from a definite structure makes analysis more complex but the richness of the data collected increases as the interviewee can give their own answers reflecting their own thinking. Further variation in the degree of structure is given by Patton (1980; 1990) who considers the structured open-ended interview where the structure allows for some comparison between interviews whilst preserving the interviewees' freedom to reflect their own thinking. The informal conversation interview has no structure with the questions emerging from the immediate context of the conversation asked in the natural course of the discussion with no predetermination of the questions or topics (Patton, 1980; 1990). Due to the lack of structure, the interviewee can talk about anything and challenge the researcher's views. Data comparison and analysis is however, difficult and probing questions need to be crosschecked to validate that the answers given are corroborated (Mikkelsen, 1995). It therefore appears that a balance has to be struck between analytical comparability and allowing the interviewee freedom to explain their position. Where an understanding of the interviewee's worlds is desired it would appear that too much structure could prohibit the conversation and information collection leading to an omission of reason for causality.

Gaining interview subjects is at times a difficult task, especially where farmer's time is at a premium (National Farmers' Union, personal communication). A method in this study has been called "snowballing" where,

> "...a small group of informants who are asked to put the researcher in touch with their friends who are subsequently interviewed, then asking them about their friends and interviewing them until a chain of informants has been selected" May (1993, pp. 55).

Although this undoubtedly helps, one concern is that the selection of new interviewees by existing ones may be biased, since friends may have a similar view or opinion and therefore particular perspectives may be omitted. This technique is the only practicable one to use with farmers because access in this particular community proved difficult. It has been found that there is a considerable difference in the opinions expressed by the farmers at their farms in the interview process. Part of this is due to the very different physical characteristics of the land on which they farm. This influences their perspective on legislation and the environmental compliance of their business. Snowballing has the advantage that the researcher is introduced as a "friend" and the information flow appears is freer. In two of the instances where this technique was used, the farmer that made the introduction remained with the researcher and managed to facilitate the conversation, thus improving still further the quality of the information. In one particular instance, the farmer was keen to introduce the researcher to another farmer who he though was particularly "bad", probably to highlight his position as a 'good farmer'.

Robson (1993) suggests that consideration has to be given to how the interview process itself is conducted and that the interview is a social encounter with 'rules' and expectations. Whyte (1984) says,

> "Go easy on that 'who', 'what', 'why', 'when', 'where', stuff...you ask those questions, and people will clam up on you. If people accept you, you can

> just hang around, and you'll learn the answers in the long run without ever having to ask the questions" (pp. 69).

Mikkelsen (1995) suggests that the "why" question can put the interviewee on the defensive. The art of interviewing is to conduct a conversation in such a way that the person is able to express freely their opinions and feelings whilst still meeting the research requirements. Probing is defined as "...encouraging the respondent to give an answer, or to clarify or amplify an answer" May (1993, pp. 98). However, a change in the emphasis of a question, or a similar question posed in a different way, could provoke further thought on the subject and could be used to enable the interviewer to make links to other answers. May (1993), stresses the importance of the interviewer's role and therefore the type of material being collected. May (1993) asks of the interviewer's role is it one of impartial scientist or friend? Therefore, to go to interview an industrialist or the regulator in the position of gaining information as the 'student' or to go onto the farm in the position of a 'consultant' could yield different results due to the positionality or reflexivity of the interviewer and interviewee. Denzin & Lincoln (1994) state,

> "Thus the interview produces situated understandings grounded in specific interactional episodes. This method is influenced by the personal characteristics of the interviewer, including race, class, ethnicity and gender" (pp. 353).

Consideration has to be given as to how the information gained in the interview is recorded and returned to the laboratory. Patton (1990); Seidman (1991); and others state that, "...there are important advantages to tape recording open-ended interviews" Patton (1990, pp. 181). However, in pilot studies, it was found that the effect of the tape recorder inhibited the

flow of data, and that valuable information was lost as the interviewees became tense and uncomfortable. It was also difficult to tour a farm or an industrial facility and use a tape recorder as sound quality was degraded by background noise. Concern for the functioning of the tape recorder was such that it detracted from the interview process. A more traditional method of writing aides-mémoire was considered the best option for this research, these could be made without introducing difficulties into the interview process. It was found however, on one farm visit, that making too many notes was analogous to using the tape recorder, so caution was exercised in making notes too.

Denzin & Lincoln (1994) suggest some points to consider on the analysis of the interview data that include:

[1]. Validity of interview responses;
[2]. Possible biases;
[3]. Accuracy of interviewees' memories;
[4]. Response tendencies;
[5]. Dishonesty;
[6]. Self-deception; and
[7]. Social desirability.

Fielding (1996) suggests that these and similar issues can be overcome through careful design, planning, and training. The more difficult aspect being the differences between what people do and what they say they do.

> "...probably the most fundamental operation in the analysis of qualitative data is that of discovering significant classes of things, persons, events and the properties which characterise them" Marshall & Rossman (1999, pp. 152).

3.6 The final choice of techniques to be used

Considering the literary critique of the interview process and the types of interview that can be conducted, it appeared that the research's aim could best be met through a semi-structured interview process. This technique would allow freedom for the interviewee to talk about what they consider important, whilst the structured nature would allow similar themes to be covered upon successive interviews with other interviewees. The semi-structured approach would also address the burden-unloading phenomenon that was encountered in the two pilot interviews conducted with the farmers. The structure of the interviews came from first obtaining literature from the Environment Agency on the permitting process and using the main aspects of these documents to formulate the structure. They were also used to discover what operators intend to do in meeting each specific requirement.

The responses from the interview process were in the form of aides-mémoire taken during the interview process. Although they were not a verbatim account of the interview, they served to capture the 'flavour' of the interview, detailing the way in which operators will respond and what particular difficulties they believe they will face in meeting those requirements.

Notes were also be made following the visit focusing on how the facilities operate. Further comments were added reflecting both the differences between what the managers said and what actually happened on their installation. These were supplemented by further analysing the regulatory compliance gap.

Landfill operators were sought from the Environment Agency's Public Register of Waste Management Licences. Whilst it may be ideal to first apply some categorisation to the entries on the register in order to select a representative sample, this was not possible. The Register could be categorised along many different themes, size of operation, for example was not included. Additionally, the landfill industry is witnessing many changes of ownership of individual landfill facilities; categories applied during the research process may change. There are no 'registers' of intensive pig farmers. Therefore, it would appear more pragmatic to concentrate on selecting subjects based on diversity, and selecting those that would add to the research at each stage. Whilst "snowballing" was a useful technique to gain interviewees within intensive pig farming, the bias that this might produce was partially overcome by using other techniques in gaining additional subjects. For example, some large pig farming companies can be found on the internet, and some companies have given evidence to parliamentary select committee enquiries.

3.7 Conducting the research

3.7.1 Deciding the questions to ask

Across industrial sectors, the procedure that the operator of an installation needs to go through in order to gain a permit to operate the installation is similar. This ensures that the requirements of the IPPC Directive can be delivered coherently across divergent industrial sectors. Nevertheless, there are specific requirements that each industrial sector needs to address in its

application for a permit. These differences are contained within the Environment Agency's technical guidance and include the techniques and technologies that are expected to be used to achieve specific emission limits. Essentially this research is based upon a discovery of what the landfill industry and the intensive pig farming industry are doing in response to having to operate at the required standards. Therefore, the questions put to the respective interviewees of the two different industries followed a similar pattern: [1] using the broad cross-industrial sector themes of the Directive; and [2] honing in on the specific requirements of the individual industrial sector. This was achieved by making use of the Environment Agency's guidance on IPPC, and its guidance to the landfill industry and the intensive pig farming industry in making their respective applications for permits. Additionally, background or basic data were collected where applicable to aid in the analysis of the other information obtained during the interviews and site visits.

3.7.2 How the interviewees were found

As mentioned above, there was a marked difference in the ease with which interviewees were found – a register of licensees for one industry but no publicly available register for the other. Consequently, different techniques had to be used to find people who could and were willing to contribute to the research. Table 3.1 provides an overview of the techniques used and in some specific cases what interview resulted from the use of that technique. The relative proportion of interviews that resulted from cold-calling within the landfill industry or those associated with it demonstrates the relative ease alluded to above. By comparison, personal contacts and snowballing proved the best methods to use to gain interviews from those associated with the

intensive pig farming industry. If cold-calling was relied upon alone it would have been more difficult to secure the necessary number of interviews.

Technique	*Interviewee*	
	Farm related	*Landfill related*
Personal contacts / friends of friends	Alpha Farms Delta Farms Lima Farms Golf Farm Contact ❽	Landfill Alpha Landfill Bravo Landfill Mike Contact ① Contact ② Contact ⑦
Snowballing	Bravo Farms India Farms Juliet Farms Kilo Farms	Landfill Charlie Landfill Delta Landfill November Contact ⑧
Cold-calling	Hotel Farm Contact ❶ Contact ❷	Landfill Echo Landfill Foxtrot Landfill Golf Landfill Hotel Landfill India Landfill Juliet Landfill Kilo Landfill Lima Contact ③ Contact ④ Contact ⑥

Table 3.1 Techniques used to gain interviews and site visits during the research (Author's work).

Additionally, attendance at trade fairs produced some interesting inputs to the research. Under the public gaze, a number of people were willing to be seen to be helpful, open and forthcoming, but later within a different environment these same people withdrew their participation. In some ways these opportunities were missed and it was difficult to know how far to push the point that an individual had agreed to assist and then had changed their

mind. Farmers constitute a close-knit community and there may have been repercussions later from bullying these people too much. Table 3.2 and Table 3.3 provide a summary of some of the useful points that arose from attending trade fairs and conferences.

Event	*Comments*
Smithfield Show 2001	Collected general information on housing and waste application equipment.
East of England Show 2002	Hoping to meet pig producers who were farming in this area of the country. However, the show was dominated by high horse-power tractors, large combine harvesters etc., for arable farmers.
Pig & Poultry Fair 2002	Potentially an ideal opportunity to gain information and to seek assistance. Three of the large pig producing companies (JSR, ACMC, and PIC) were approached. Although offers of assistance were made it never materialised . Interesting conversation with Franz-Josef Sextro of Weltec Bio Power GmbH, a bio-gas generating firm selling technology to turn farm waste into energy. Colette Blackwell (head of Pigs Branch) from DEFRA gave an interesting presentation on the changes the Department believed the intensive pig farming industry needed to make. Assistance from the University farm at Oxford – sought to gain some specific information in line with some research they were conducting. This offer was never met at a later date. The National Pig Association had a stand and a member gave a presentation. Was only able to gain a little further information as to where the stumbling block with the regulations, including the Environment Agency's SFI GBR package, were. No other assistance was forthcoming although requests were made.
Royal Show 2002	Simon Johnston from Carrier Pollution Control a company selling equipment for the separation of slurry.
Muck 2002	Gained further information on manure and slurry application equipment including band spreaders and injectors. Saw working demonstrations of the above equipment. Enquired about the practicalities of using the equipment.
Great Yorkshire Show 2002	Was hoping that local (Yorkshire) pig producers would be present or at least would gain an insight into who might be worth contacting. Livestock was however biased towards cattle.
Grasslands 2002	Provided an opportunity to talk to farmers about the problems of waste management and the forthcoming changes to Nitrate Vulnerable Zone regulations. This was done within a non-threatening environment, thus adding to the understanding of some of the problems that the farmers with quantities of waste to manage were facing.

Table 3.2 Trade fairs and conferences attended during the research period and a synopsis of their contribution to the research (Author's work).

Conference event	*Comments*
Perry Foundation 2002	Proved useful as two interviews were arranged as a direct result - Echo Farms and Contact ❼.
Environmental Management Forum 2002	Attended presentations by White Young Green environmental consultants, the Environment Agency, and xxx who contributed to the latest thinking on environmental management systems, and their interaction with regulation, and in particular compliance monitoring.
Environmental Policy and the costs of compliance 2001	Had a discussion with Joe Morris who presented a paper title "*The compliance costs of the IPPC Directive on an intensive pig production unit: a UK case study*". This was useful in that it alluded to the difficulties encountered in trying to put a monetary value to many unknown factors relating to IPPC. Steve Sorrell presented a paper on "*The meaning of BATNEEC: interpreting excessive costs in UK industrial pollution control regulation*", which provided an insight into the problems of implementing this idea into pollution control practice. David Hitchens' paper on "The impact of BAT on the competitiveness of European industry: synthesis report", and the subsequent discussion was useful in that it gave an insight into the Technical Committee's workings, who are intrinsically linked to the burdens inflicted on respective industries.
Institute of Waste Management 2001	IPPC and the waste industry was the focus of a couple of presentations. In addition how the industry might modernise and generate extra incomes from their business featured regularly.

Table 3.3 Conferences attended during the research and a synopsis of the contribution that they made.

3.7.3 How support from the waste management industry was sought

Acces to the management and personnel at two landfill facilities (Landfill Alpha and Landfill Bravo) was gained whilst working on a Hull University research project investigating the cause and control of landfill-related odour . It was therefore relatively easy to ask these people to assist in the research as a relationship had already been formed. The regular

collection of meteorological data, and the production of odour maps at both landfill facilities had at the same time provided a unique insight into the 'real' way in which these two, and possibly many other, landfill facilities were run. This was important as it transcended the barrier between what a manager might say about how their facility was run, and what actually happened. It was also important in establishing the notion that whatever the management's plans were, it was often left to the operatives, the smallest cogs in the machine, to implement them effectively. From the managers of both these landfill facilities, and Contact ①, who was Landfill Facility Alpha's Environmental Compliance Advisor, it was possible to discover who they believed the other large landfill operators were – those most likely to be subject to the controls of IPPC.

Additionally, internet searches were performed to find other possibilities and to capture some general information about the waste management companies whose facilities' might be visited. Reviewing House of Commons Select Committee reports and checking the lists of who had submitted information to the Committee provided other candidates to approach. These two approaches tended to provided information of large and 'quirky' operations however. The Environment Agency's Public Register of landfill licences however proved invaluable in providing information of smaller independent operators who were hitherto 'invisible'.

Cold-calling was a technique that worked relatively well for finding interviewees from the landfill industry (see Table 3.1). The larger landfill operators proved forthcoming in turning offers of assistance into interviews and facility visits, with most positively embracing the "open-gate" policy initiated to dispel the bad publicity the industry is trying to detach itself

from. Only one landfill operator in the Yorkshire area failed to turn an offer of assistance into a facility visit and interview. The company did however provide some background information about its operations and what it believed would be the likely impacts of the IPPC Directive upon their operations.

It proved more difficult to secure help from the smaller, independent landfill operators, who remain outside the threshold of the IPPC Directive's controls. Nevertheless, these operators will still have to undergo a re-licensing procedure. Although the Public Register provided location and contact details, the only method of engaging these prospective interviewees was through cold-calling. Whilst this had been successful with the large operators, it was not so with the smaller independent ones (Landfill Facility Juliet and Kilo being two notable exceptions). Many of those contacted were unable to assist because they said that they did not have the time.

Additionally the *Ends Report* (which provides details of current environmentally-related news and reports) contained information on landfill operators and facilities. From the journal, three interviewees were selected and their cooperation gained (Landfill Facility Hotel; Landfill Facility Indigo; and Contact ④.

3.7.4 Gaining the cooperation of the regulator

Senior managers at the Environment Agency were unwilling to support the research through allowing the desired level of observation of their inspectors. Nevertheless, personal contacts with employees of the Environment Agency through the committee supervising the research at the

University secured several meetings with Contacts ⑦ and ⑧. It was again at the local level, from the Willerby office in the East Riding of Yorkshire, that cooperation ceased. People became unavailable, failed to return telephone calls, emails or did not responded to letters. One lead inspector at the Willerby office who had been "roped-in" by his manager into providing assistance through an interview saw the process as inconvenient and a "bloody nuisance", and wanted to be away from the interview before it had started. Additionally, a period of work-experience was undertaken with the Environment Agency on a project investigating and reporting deficiencies in waste management guidance resulting from the regulatory changes; this was supervised from their Warrington office.

There is something important to take away from this type of situation. For anyone seeking cooperation from the Environment Agency there has to be clearly tangible benefits for it. Securing a token financial contribution to the research from the Environment Agency may also increase and maintain their interest and cooperation in the research to protect their investment.

3.7.5 Interviewing intensive pig farmers and the farming community

As already alluded the farming community was considerably harder to break into. Although the literature suggested that cold-calling was likely to be relatively unsuccessful it was tried nonetheless. Table 3.1 adds some weight to this view in revealing the difficulty of finding interviewees through cold-calling. Part of the problem with this technique may well be the fact that it is difficult to obtain a list or register of intensive pig farmers in the first place. The starting point of these interviews was Alpha Farms, who had connections with the University; followed by Charlie Farm, with a University

connection. The farm owner of Charlie Farm then introduced Delta Farms. This was the "snowball" technique working well. This approach proved successful, as each was able to introduce a further contact or make suggestions as to who within the industry was worth contacting. The support received by one farmer often facilitated that of another.

In addition to the techniques outlined above, further resources were sought to broaden the scope of information entering the enquiry. The local (Yorkshire) National Farmer's Union, was contacted and asked if there were any farmers in the area who might assist through an interview. Nevertheless, after initially appearing interested and expressing an interest in seeing the results of the research nothing further came of it. Internet searches produced a few large pig-farming companies and some additional information was found through pig feed supplier's websites.

Farmers Weekly, a farming journal, also pinpointed potential sites, for example Foxtrot Farms. Every week an article is written covering the management of that farm. It was therefore surprising that IPPC, its likely impacts, and possible management strategies had not been covered in these articles. Contact was made with the manager of Foxtrot Farm in the hope that a link could be established. Information for this research could be collected and in return the data and some analysis could be put together as a package for forthcoming articles for the magazine. However, although the idea was well received the particular problem at Foxtrot Farm was that it had closed its doors to all but essential visits following Foot and Mouth problems. Whilst the manager was willing and able to give a telephone interview it was not possible to visit the farm.

The National Pig Association web site includes a forum where farmers and anyone else with an interest in pig farming can contribute to the discussions. The Association was approached and a request was made to ask farmers to make contact if they felt they could assist in the research. Despite saying they would, they never actually did this, and were very off-hand when asked why not. Ultimately, a direct request to farmers was made through the web-site's forum page, but no one made contact.

Attendance at trade shows (for example the Royal Show, the Smithfield Show, the Pig and Poultry Show, the East of England Show and the Great Yorkshire Show (see Table 3.2)) was another avenue used to seek additional contacts, and to meet farmers face-to-face within their milieu. Among those contacted were the Environment Department's head of pigs, other researchers, academics running research farms, and other pig farming and ancillary industry companies. All these contacts produced mixed results. The Environment Department sent some information, one of the farming companies made contact and an interview and visit was arranged.

To summarise, finding interview subjects was much more difficult than first envisaged. It was not easy to discover who the 400 or so farmers who are likely to be affected were. Many people changed their mind after showing initial interest. At one stage, payments were considered as an incentive but funds were not available to cover this.

3.7.6 A typical interview with a landfill related interviewee

Compared to the difficulties with pig farmers, landfill facilities were easier to find. This was probably because their business relied upon drivers

finding their way to the facility to deposit waste. Even following waste-filled trucks proved successful. Interviews begun with a general introduction, clarifying the nature of the research and what it hoped to achieve. Many within the landfill industry were interested in the idea that their experiences with licensing could be used to assist the intensive pig farming industry. Some basic information about the landfill facility being visited was then collected in a standardised form. Some definitional issues emerged. For example, information about the size of landfill may have related to the total void space once the landfill was completed up to restoration level, the licensed capacity, or the remaining void space. These types of definitional problems were subsequently standardised.

Questions were then asked about responses to each of the varying requirements of the IPPC Directive's permitting and the re-licensing of landfills. This questioning, although semi-structured and undertaken whilst making minimal notes so as not to impair the quality of information, was conducted with the aid of a prompt card to ensure that all necessary aspects were covered during each interview. The interview was followed by a tour around the landfill facility, with the interviewee explaining the ways in which their the particular facility operated and the salient features that could be seen.

These tours provided the opportunity to see different landfill facilities and to audit what the interviewee had said about their facility. Where possible clarification over discrepancies between what was stated and what was seen was sought. Also differences between what managers said during the interviews and others who conducted the tour (Landfill Facility Charlie) emerged which was interesting in it self. These types of differences were also

apparent at Landfill Facility Alpha were the University research project was being conducted. Following the interview and tour a suitable place to park further down the road on the journey home was found. Here the interview was written up more fully and notes made upon the observations during the facility tour. This was necessary to capture as much information as possible without having to rely upon longer-term memory.

5.7.7 A typical interview with an intensive pig farmer

Finding some of the farms proved more difficult than any of the landfill facilities. They may be hidden away, off roads lacking signposts, and unlike landfill facilities, infrequently visited. Frequent and repeated telephone calls were often needed. Time delays were unavoidable. It was clear that in the light of Foot and Mouth farmers did not want visitors wandering freely around their farms. The interviews themselves were conducted in a variety of situations. For example at Alpha Farms it was in an office, at Bravo Farms it ran concurrent with the farm tour, as it did it at Hotel Farm. At India 2 Farm the interview was conducted in the manager's kitchen. The interviews at Foxtrot and Lima farms however were conducted via the telephone and email because both farms were closed to non-essential visitors. In general interviews were relaxed and less formalised that those with the landfill industry. However, interruptions were common. Farmers had to deal with other matters as they arose. Whilst owners of small farms were willing to talk, they were always pushed for time and keeping their full attention for the hour was rarely possible.

As with the landfill industry the tours were again interesting, giving an opportunity to cross-check interviewees' answers. For example, Contact

❽ trailed across the very muddy farmyard before getting into a rather dilapidated 4x4 for a tour of the farm. In contrast at Bravo Farm, showers, overall and boots were obligatory and disease control measures were also evident at Golf Farm. The tour at India 2 Farms consisted of trekking through building after building, being shown pig after pig within highly pungent and odorous housing. The manager at Hotel Farm assisted a sow having difficulty giving birth, however the dead piglet was casually discarded on a pile of rubbish. Waste storage facilities varied greatly as did the ability of the farmers to describe the activities that took place on their farms. Many answers just could not be used, lacking context and relevance. Ultimately, touring pig farms became repetitive; a sequence of shed after shed of pigs, (literally thousands on some farms), all within standard environments. However, despite this homogeneity, there was evident variation in the technical ability to implement some of the SFI GBRs with respect to animal housing.

5.7.8 Post interview process

Immediately after leaving the site the interview was written up using the aides-memoires that had been recorded at the time. Additional comments, notes and interpretations were appended, particularly compliance with the regulations. For example, at Hotel Farm there were hoses without triggers, ponded areas in the animal housings and quantities of animal waste lying around (see Section 6.8 for a further discussion of these transgressions).

5.7.9 An analysis between the interview subjects

Chapter 5 and Chapter 6 aggregate the interviews that were conducted, in an attempt to make a more general and rounded response to the question of how the respective industries were either acting or thinking of reacting to the requirements of the IPPC Directive through their respective licensing processes. Quotes and specific instances have been used to try and bring the work alive and to add to the analysis. This aggregation does, however, gloss over some of the differences encountered among interview subjects, differences beyond those due to size and more concerned with personal issues.

Managers of the larger landfill companies tend to answer with more vigour. Thus from Table 5.5, Table 5.6, and Table 5.7 differences were apparent between the different size classes. This was noticeable regardless of the specific answer given. The smaller the operator then more answers contained the phrases "...don't know"; "...cant"; or "...wont". The larger operators, although agreeing in sentiment were able to expand upon those previous statements. Answers were more complete with for example "...don't know - the Government hasn't made up its mind yet as to which way its going to jump". This may have been because an increase in size of operation had enabled a demarcation of responsibilities resulting in the managers having had more time to devote to forward-planning as opposed to being constrained by the day-to-day running of the business. On the other hand, as was evident within some company's operations, there was a central team of experts who would advise on decisions with the managers at each landfill facility left to implement them.

Age also appeared to influence responses, especially when linked to personal background and formal qualifications. Older managers were resistant to change. Having seen re-licensing under the Environmental Protection Act 1990, following the first licenses introduced under the Control of Pollution Act 1974, the current re-licensing process appeared to them as yet another attempt at regulation; another way of trying to put them out of business. It was all very personal to them. The regulations and the actions of both Environment Agency and Government had specifically been aimed at them. By Contrast younger managers, having entered the industry under higher operating standards (for example the need to gain a CoTC from WAMITAB) presented a different attitude when responding to these types of questions. They focused upon facts, accepting the changes and different operating requirements, and looked for ways to work with them and to turn the situation to their economic advantage.

As with the landfill industry, size maters. For example, the answers from Alpha and India Farms were more informed, supported by comments about how the rules would not work, or why a particular aspect could not be done. This contrasted with the smaller operators, (for example those interviewed from Juliet Farm and Kilo Farm) who tended to respond with the "can't "and "wont".

However, unlike the landfill industry – where the younger managers accepted the re-licensing process, and in so doing turning compliance costs into economic advantage, pig farmers steadfastly resisted change to their way of life. On balance, this reflects the greater age of pig farmers compared to those interviewed at the landfill industries.

Farmers believed they could "get away with it". In effect, and in contrast to their initial protestations about regulatory burden, low levels of inspections and poor detection of wrongdoings enabled them to "get away with it". Contrasted with landfill managers who knew they could not get away with anything. Such central sites, visited by many and easily inspected, could not hide away and avoid detection. They were obliged to work with the Environment Agency where issues or problems arose.

3.8 Concluding remarks

It has been difficult to break into farming circles and to gain access to interviewees. Greater success was achieved where it was possible to obtain a recommendation from one farmer to seek the opinion of another, or where one farmer contacted another to arrange an interview. Farmer contact was additionally an important source of information on the large players in the pig industry and those likely to be encompassed by the IPPC Directive. The research came at a particularly difficult time for the farming industry and substantial rescheduling was necessitated by the outbreak of Foot and Mouth Disease during 2001. In part, this was circumvented by bringing forward interviews and visits within the landfill industry. The landfill industry, overall, was easier to access. The Environment Agency maintains a register of licensed facilities. From this register, it was possible to select a sample for interview. However, notwithstanding this easier access there were several instances where smaller operators were unwilling to be interviewed or where a facility visit could not be arranged. Larger operators adopted a very different approach, many practicing an "open-gate policy" and welcomed visits from members of the public. Additionally, working on a research project at the University of Hull concerning landfill-related odour provided a

unique insight into landfilling operations. Information could be gleaned in a non-confrontational manner, covering the whole range of employees at a facility over a protracted period with regular visits to a single facility. This enabled great account to be taken of the differences between what management said and what operatives practised on a daily basis.

In order to discover more of the issues involved, the regulator was interviewed, as were members of trade associations, (for example the National Farmers' Union, and the Waste Services Association). This was assisted by *a priori* knowledge of various regulatory requirements and an understanding of environmental management matters. Through this knowledge, it was possible to avoid being misled by what the farm or landfill manager said. This knowledge that was brought to the research, in part gained whilst studying for an industry recognised diploma in environmental management systems was especially useful for the farm visits as it was known how such systems operated in other industries and the problem areas for implementation on the farm could be fully recognised, encompassing both infrastructure and cultural differences.

The results of the research and specifically the outcomes of the interview and visit approach fully justify the decision not to tape-record the interviews, to use minimal note taking during the interview, and not to attribute the source of the information. What was encountered through the pilot interviews was born out during the interview process: as soon as the notebook was closed, the quantity and quality of information improved. Indeed several farmers begun to talk about their pollution incidents and why they had occurred, acknowledged gaps between practice and theory.

The research cannot claim to be fully representative of the two respective industries studied in a statistical sense. To a certain degree subjects have been self-selected (for example snowballing). However, it has tried to encompass a range of different sizes and types of operations in order to reflect diversity. The research has been difficult at times because crucial guidance from both the regulator and Government concerning the details of the implementation of the IPPC Directive has not been available.

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Chapter 4.

IPPC: nothing is new in the world of multi-media pollution control implementation – a comparison of IPC and IPPC

4.1 Introduction

This chapter provides an historic background to pollution control regulation within England and Wales. Integrated Pollution Control (IPC) came into force in 1991, and three years later a major investigation was published by Allot (1994) of the problems and successes. Questionnaires were sent to all the operators of authorised processes; these totalled 328 authorised by April 1st 1993. The response rate was 44 percent and represented 86 individual companies' processes on 120 sites. It was an important study, as the IPC regime marked a substantial revolutionary step in the United Kingdom's pollution control regime – somewhat uncharacteristic of the normal piecemeal evolution. From this investigation, it is possible to understand something of the way in which the regulated and the regulator act when embarking upon such a revolutionary step. In the context of the current evolution of pollution control regulation: the Integrated Pollution Prevention & Control (IPPC) Directive (96/61/EC), has the regulator (Environment Agency) learned anything from its predecessor Her Majesty's Inspectorate of Pollution (HMIP), and will industry respond differently?

Summary aims of this chapter are:

- **To detail the development of multi-media pollution within the United Kingdom**
- **To compare the early years of IPC and IPPC driven pollution control regulation**

4.2 The beginnings of pollution control in England and Wales - media specific pollution control

The control of industrial emissions has generally developed in a piecemeal fashion with legislation being passed on an emission-by-emission basis. Concern tends to be over health-related issues rather than environmental damage *per se*. The consequence of this has been medium specific emission control. For example, the Alkali, etc., Works Regulation Act 1863 (now repealed), was one of the first attempts to control emissions from industrial activities. Later the Control of Pollution Act 1974 was passed designating 60 industrial processes considered to give rise to particularly noxious or offensive emissions to the atmosphere; processes were regulated by the Industrial Air Pollution Inspectorate (IAPI) up until 1987. The Industrial Air Pollution Inspectorate produced a series of Best Practicable Means Notes (BPM) prescribing abatement technology and presumptive limits achievable if Best Practicable Means were applied. However, the process operator could claim that existing technology was, to him, the "Best Practicable Means" on the grounds of cost implications of making any changes. Therefore, for many operators, the status quo remained, despite attempts at controlling emissions. Discharges to controlled water had to be authorised by the relevant Regional Water Authority through the granting of discharge consents; limits were set depending upon the desired quality of the receiving water. For example,

specific parameters would be tighter for a salmon river compared with a river flowing through an industrial estate. Following privatisation in 1989, the Regional Water Authorities became the National Rivers Authority (NRA) who assumed the responsibility for river water quality and abstraction permits.

Until the early 1970s there were few controls on waste management, except those relating to the common law of nuisance and public health, for example the Public Health Act 1936. The Town and Country Planning Act 1947 allowed the rejection of a planning application for a landfill facility if the development could lead to unacceptable levels of water pollution. In 1972, The Deposit of Poisonous Waste Act 1972 was passed in response to indiscriminate dumping of toxic wastes and it attempted statutory control of industrial waste disposal. The Control of Pollution Act 1974 was the first attempt at comprehensive pollution legislation. Part I of the Control of Pollution Act 1974 introduced licensing for facilities that accepted "controlled waste"; as defined by section 30(1) in the Act as household, commercial and industrial waste.

4.3 The integration of pollution control in England and Wales: Integrated Pollution Control (IPC)

In 1976 an influential report by the Royal Commission on Environmental Pollution (RCEP), *Air pollution control: an integrated approach*, drew attention to certain flaws in traditional pollution control regulation (RCEP, 1976). The report highlighted the experience of the Industrial Air Pollution Inspectorate in dealing with pollution in the single medium of the atmosphere. The

Industrial Air Pollution Inspectorate found that manufacturers would design their processes in order that the waste products were in the form that was cheapest to dispose of, as opposed to designing processes that produced less waste (RCEP, 1976). The Royal Commission on Environmental Pollution proposed a more comprehensive approach to the control of industrial emissions. They suggested that a unified inspectorate was required and that it should seek to optimise the distribution of emissions across all the media using the Best Practicable Environmental Option (BPEO) (RCEP, 1976). The problem was that "Best Practicable Means" was a concept neither defined in court nor adequately explained by those required to implement it (Jordan, 1993). Although under Section 7 of the Alkali etc., Works Regulations Act 1906 it stated that the owner,

> "...shall use the best practicable means for preventing the escape of noxious or offensive gases by the flue or any apparatus used in any process carried out in the works, and for preventing the discharge whether directly or indirectly of such gases into the atmosphere, and for rendering such gases where discharged harmless and inoffensive".

"Practicable" was interpreted in relation to local conditions and circumstances, the state of technology and the costs of control. Standards for Best Practicable Means were set in consultation with industry and published by the regulator (Alkali Inspectorate) in Annual Reports as *"Notes on Best Practicable Means"*. They were used by industry as a defence and by the inspectorate as a weapon. Jordan (1993) considers that the Inspectorate saw itself as being in partnership with industry and only prosecuted the most flagrant and persistent breaches of the law.

The Government, after being indecisive for a decade, created a unified pollution inspectorate, HMIP in 1987. Several reasons have been suggested as to why there was a delay. O'Riordan & Weale (1989) suggest that the Thatcherite aversion to institutional reform, the low priority of pollution issues, and internal government disputes were all contributing factors. HMIP was formed by amalgamating the Industrial Air Pollution Inspectorate; the Radiochemical Inspectorate (RCI); the Hazardous Waste Inspectorate (HWI); and the water pollution functions of the Department of the Environment (NSCA, 1999).

The Government introduced a consultation document in 1988 on integrated pollution control with the intention of creating a more effective framework. However, this did not necessarily include a substantial enlargement of the number of processes that HMIP would control or the setting of more stringent pollution control standards (DoE, 1988). Jordan (1993) suggested that the stimulus for the integration of the fragmented elements of pollution control were wide-ranging, although the need to implement European Directives was a significant driving force. For example, the Air Framework Directive (84/360/EEC) placing control on emissions from industrial plant, and the Large Combustion Plants Directive (88/609/EEC) (Jordan, 1993). Other stimuli related to the Government's ideology on regulation, and the privatisation of the water and energy utilities.

4.3.1 Integrated Pollution Control: the Environmental Protection Act 1990

In December 1989, the Environmental Protection Bill was introduced in the Commons. IPC was introduced by the Secretary of State for the Environment, Chris Patten who stated that,

> "The United Kingdom's existing pollution control system has developed piecemeal over many years. Releases to air, water and land are subject to three distinct sets of controls, with no account taken of the effect of one on the other. IPC changes all that. For the first time, a single authority will control emissions to land, water and air within a single framework. Conditions will be set in the authorisations given to each industrial process which will ensure the greatest protection to the environment as a whole" Hansard (1990, Column 34).

IPC came into effect on April 1st 1991 under the Environmental Protection Act 1990 to control certain processes that the Government (the Secretary of State) deemed to be the most polluting subsequently known as "prescribed processes". According to the Department of the Environment, the aim of IPC was,

> "...to prevent or minimise the release of prescribed substances and to render harmless any such substances which are released; to develop an approach to pollution control that considers discharges from industrial processes to all media in the context of the effect on the environment as a whole" Ball & Bell (1995, pp. 293).

It is unclear by whom or how these processes were selected but approximately 105, covering 5,000 different plants were encompassed by IPC. Every operator was required to obtain an authorisation to continue the operation of that process. All "new" prescribed processes had to obtain an IPC authorisation before being allowed to operate and "existing" processes operators were given a date when they had to apply for a permit. The Government amended the Regulations in 1994 and again in 1995 bringing eight new processes under the control of IPC and demoting a number of others from IPC to Local Authority Air Pollution Control (LAAPC) (processes primarily concerning atmospheric emissions) through the

alteration of threshold levels (Ball & Bell, 1995). To operate a prescribed process or to release prescribed substances without an authorisation was an offence punishable with a summary fine of up to £20,000 or, on indictment, an unlimited fine, and/or a maximum of two years imprisonment (Environmental Protection Act, Section 23(1)). The significant change that IPC brought about was the use of calculations to find the best medium into which a process's emission were to be discharged. This was a reversal of the historic situation where the operator designed the process around which media was the cheapest to discharge into without consideration of the environment. To gain an authorisation, operators of processes had to complete an application form and provide clear justification for their chosen method of production and a statement as to how their proposed process would meet the required objectives.

4.3.2 Integrated Pollution Control in practice

Allot (1994) conducted an investigation of authorised processes (Table 4.1) after three years of the IPC regime. HMIP had great difficulties in raising awareness of the new permitting regime and consequently several applicants missed their deadline, probably hindered by the Regulations not being completed until March 1991, just one month before it began (Allot, 1994).

Sector	*Processes authorised*
Gasification	17
Carbonisation	8
Combustion	175
Petroleum	31
Inorganic Chemical	19
Organic Chemical	41
Incineration	15
Other	21

Table 4.1 The number of successful process authorisations up until April 1st 1993 by sector under the IPC regime and examined in Allot's (1994) study.

In 1989, it was policy that HMIP should remain at "arms-length" from the industries that they regulated when dealing with pre-application discussions. This was a reverse of the previous "cosy" working relationship between industry and the regulator (Allot, 1994). Accordingly, the first wave of IPC applications received in April 1991 omitted important information that the inspector required in order to determine the application. This necessitated dialogue with industry to begin again to obtain the relevant information. The consequence was an increase in inspector workload that necessitated an increase in the application fee (Allot, 1994). By 1992, pre-application discussions were officially back on the agenda and in the following year new terms such as "customers" and "regulatory service" were being used by HMIP (Allot, 1994).

The initial applications from all 88 large combustion plants were rejected as no justification of the BPEO was given; 86 applicants were issued Schedule 1 notices requiring that 98 aspects of the application be addressed and returned within 28 days (Allot, 1994). In 1992, an inspector was reported to have said,

> "...one condition of IPC is that we must check the applicant's competence. If he can't fill in a form properly and supply accurate information on his process, can he still be viewed as competent?" Allot (1994, pp. 25).

The incomplete nature of the applications was perhaps understandable when industry representatives suggested that between 100 and 500 man-hours were needed to complete each component of an IPC application at an estimated cost of £15,000 (Allot, 1994); IPC applications contained a number of components depending upon the complexity of the process being operated. Problems with industry's understanding of its emissions and the lack of in-house expertise were cited as the reason behind the "bonanza for environmental consultants", who were charging up to £500,000 with an average of £10,000 to complete the application (Allot, 1994).

Whilst the regulator (HMIP) criticised industry for its inadequacies, Gouldson & Murphy (1998) turned attention towards HMIP. They cite a submission made in 1995 to the then Environment Secretary, John Gummer, that only 60 percent of the checks on regulated processes had been performed (Gouldson & Murphy, 1998). One of the reasons for this was that the regulatory functions of the IPC regime were under-funded. Inspectors were experienced employees, typically having ten years or more of experience (Gouldson & Murphy, 1998). Nevertheless, whilst they were expensive in policing the Regulations their experience was considered invaluable.

> "I understand the process I regulate. I can see how BATNEEC and BPEO apply in those situations because I've worked in the area for years, although not on this side of the fence. These terms are so flexible, it is down to us to

> apply them. We have to understand our areas in sufficient depth to do that" Gouldson & Murphy (1998, pp. 78).

However, HMIP could not distance itself from hesitation over its relationship with industry. The same inspector background that made them ideal regulators ("poacher turned game-keeper") was also the cause of concern that they would be too sympathetic to industry, especially where they were required to negotiate BPEO and emission limits (Gouldson & Murphy, 1998).

HMIP was responsible for implementing the IPC regime between 1991 and 1996 when further integration of regulatory functions led to the formation of the Environment Agency. The Environment Agency amalgamated HMIP, the Waste Regulation Authorities, and the National Rivers Authority. Many employees were made redundant during this process including HMIP's technical guidance branch that was responsible for many of the technical aspects of the IPC regime (Allot, 1994). The Environment Agency was also under immense pressure to shed a further 500 of its 9,400 staff over a three-year period from 1997 to remain in budget (Allot, 1994). In an attempt to control its costs, the Environment Agency had to employ less experienced staff, candidates with no industrial background (Allot, 1994). Later there emerged concerns that inspections and four yearly reviews were less than thorough in order to clear the backlog of work that had built-up because of reduced staff numbers (ENDS, 1998*a*). In 1998, it was reported that problems were again evident in the Environment Agency, this time over restructuring. Area managers proposed that licensing and policing should be carried out by separate teams. The inspectors feared that,

> "...it would divorce them from industry and result in a "tickbox" approach to inspection and enforcement by staff without expertise in regulation of complex processes" ENDS (1998*b*, pp. 6).

Yet again, this position appears to have been the result of funding problems within the Environment Agency, and a consequence of having to regulate with less experienced employees.

4.3.3 Testing issues: BPEO and BATNEEC

The Royal Commission on Environmental Pollution's 12th report considered the meaning of the BPEO and defined it as,

> "...for a given set of objectives, the opinion that provides the most benefit or least damage to the environment as a whole, at acceptable cost, in the long term as wells as in the short term" RCEP (1988, pp. 38).

The BPEO approach was intended to be holistic in its consideration of the three environmental media (air, land, and water). The ideas and recognition of the problem were stated in two important views: [1] that of the "Bruntland Report" *Our Common Future* in 1987; and [2] a recommendation from the Organisation for Economic Cooperation and Development (OECD) in 1991. The reports suggested that existing pollution control regimes were fragmented, narrow, and that integration was required (RCEP, 1988). The Royal Commission's idea was that BPEO was to be a technical exercise where a unified inspectorate would be able to trade off emissions to the various media and hence define the BPEO (RCEP, 1988). A pilot study reported by O'Riordan (1993) claimed that it required HMIP 200 man-hours to produce such a calculation. Meeting the principal of Best Available Techniques Not Exceeding Excessive Costs (BATNEEC), applicants would have to

demonstrate how their process was the BATNEEC in order to obtain authorisation for it (Skea & Smith, 1998). The closest definition of BATNEEC comes from the Department of the Environment: operators should apply Best Available Techniques (BAT) unless they can prove that the costs incurred would be excessive, both in relation to the nature of the industry sector and the degree of environmental protection that would be achieved (DoE, 1991).

Initially, HMIP sought to judge an operator's application against centrally assigned criteria for a particular industrial sector; the alternative was to judge each application on merit relating to the individual circumstances of each (DoE, 1993). BATNEEC standards were, after all, published by HMIP for individual sectors as the "Chief Inspector's Guidance Notes'". These documents contained the limits and standards to which a process was supposed to operate. However, the actual implementation of IPC saw a reversion to the traditional British practice of a close relationship between regulator and the regulated (Skea & Smith, 1998). In many instances, there were no quantitative data available to inspectors (Skea & Smith, 1998) and consequently HMIP began to emphasise that standards in Guidance Notes were not prescriptive (HMIP, 1993). Inferior quality applications were made by operators, with less than a quarter providing their own BATNEEC assessments, and even fewer determining BPEO (Table 4.2) (Allot, 1994; Smith, 1996).

Issue	*Not considered*	*Considered briefly*	*Full consideration*
BATNEEC	51.5	18.0	30.5
BPEO	76.5	8.8	14.6

Table 4.2 The percentage of IPC authorisation applications categorised by Allot as to how well the applicant had considered BATNEEC & BPEO in their respective authorisations applications (Allot, 1994). These figures refer to the first three years of the IPC regime.

It was clear that industry was having difficulties in adapting to the need to justify their choice of process. Jordan (1993) suggests that in part this may have been because the BATNEEC determination process was not transparent. HMIP refused to reveal the rational for such conditions; in particular, no indication was given of how a balance had been achieved between costs and benefits to derive specific emission limits or how these may have been compromised for companies or sectors facing economic difficulties (Jordan, 1993). Mehta & Hawkins (1998) examined the cost implications of IPC on two categories of company size: small (1 – 399 employees) and big (500 + employees) companies. They found that big companies were able to exert influence in the bargaining process of BATNEEC, but the fear of bad publicity necessitated high levels of investment to ensure compliance (Mehta & Hawkins, 1998). Small companies however, feared the costs of prosecution and experienced proportionally higher costs in complying with the Regulations (Mehta & Hawkins, 1998). Over time, BATNEEC and BPEO discussions in applications did improve. The chemical sector's applications tended to be of a higher quality, particularly where new processes were discussed (Allot, 1994). This was probably because new processes were not tied to existing plant and manufacturers were able to look at alternative production methods.

4.3.4 Charging scheme – does the polluter pay and how much does he pay?

The Environmental Protection Act 1990 placed a statutory duty upon HMIP to recover the costs of IPC from those legislated under the Regulations. Initially the Department of the Environment proposed that this should be at 75 percent of the costs. However, this cost recovery level had increased to 100 percent by 1990 reflecting more fully the "polluter-pays" principal (DoE, 1989). Table 4.3 collates information on the charging schemes for the IPC regime covering the period 1991/1992 – 2002/2003. In the majority of cases, there has been a small increase (four percent) in the level of "application fee per component" year-on-year, 1998/1999 and 2001/2002 seeing more significant increases (14 percent). Notably there was a substantial increase (203 percent) in the charges made to process operators between 1991/1992 and 1992/1993. Poor quality applications and the subsequent increase in time that HMIP officers had to dedicate towards IPC were said to account for this increase (Allot, 1994). The charging schemes were component-based, some processes that are more complex had more than one component, and therefore application fees could run into tens of thousands of pounds. Additionally, annual "subsistence fees" had to be added to the total costs incurred by the operator under IPC. These examples of fees levied against the operators under the official charging schemes were on top of any capital expenditure that would have been required to upgrade plant to the BATNEEC emission standard. It is not surprising that those who were regulated under IPC complained. It is quoted in *The Ends Report* that,

> "Businesses have complained since the inception of IPC that the charging scheme in inequitable and does not reflect inspectors' workload, that the charges are excessive, and that the scheme gives firms no incentive to improve their environmental performance" ENDS (1997*a*, pp. 37).

Whilst part of the grievance may be an objection to having to pay any charge for 'normal' business activities, there is a valid point contained within the complaint. The charging schemes do not reflect any improvements made by industry in reducing their emissions. There are no incentives for employing emission-reducing technologies, and whilst the polluter does pay, there may have been more environmentally advantageous ways in which those charges could have been based, for example upon the quantity of emissions weighted towards those less desirable, or charges off-set against improvements in emissions management.

	Application fee per component	*Application fee (plants under existing HMIP control)*	*Major variation*	*Subsistence*
1991/1992[1]	£1,800	£1,200	£600	£500
1992/1993[2]	£3,650	£2,450	£1,200	£1,500
1993/1994[3]	£3,750	£2,500	£1,250	£1,540
1994/1995[4]	£3,860	£2,570	£1,290	£1,730
1995/1996[5]	£3,860	£2,570	£1,290	£1,805
1996/1997[6]	£3,860	£2,570	£1,290	£1,805
1997/1998[7]	£3,860	n/a	£1,290	£1,755
1998/1999[8]	£4,420	n/a	£1,480	£2,000
1999/2000[9]	£4,597	n/a	£1,539	£2,080
2000/2001[10]	£4,767	n/a	£,1596	£2,157
2001/2002[11]	£5,394	n/a	£1,806	£2,452
2002/2003[12]	£5,453	n/a	£1,826	£2,479

Table 4.3 Fees charged by the regulator (HMIP and the Environment Agency) in successive years for each component of the authorisation application, for each major or substantial variation, and made annually as a subsistence fee under the IPC regime.

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[1] Allot (1994).
[2] Allot (1994).
[3] ENDS (1993*a*).
[4] ENDS (1994*a*).
[5] ENDS (1995*a*).
[6] ENDS (1996*a*).
[7] ENDS (1998*c*).
[8] ENDS (1998*c*).
[9] ENDS (1999*a*).
[10] ENDS (2000*a*).
[11] Croner (2001).
[12] Environment Agency (2002).

4.3.5 When things go wrong - actions by the regulator

The Environment Agency's enforcement record was questioned when, in 1997, the *Sunday Times* revealed that ICI's Runcorn plant had reported 472 breeches of its authorisations since 1995; the *Sunday Times* dubbed the plant as "Britain's most poisonous plant" (ENDS, 1997*b*). It was reported that an IPC inspector visited the site approximately once a week but no formal inspection by either HMIP or the Environment Agency had been recorded (ENDS, 1997*b*). Control of the IPC regime falls within two areas of responsibility:

[1]. The regulator
   a. Has the power to suspend a licence when it is believed that the process is being operated in contravention to the authorisation; or
   b. When there is the belief that there is an imminent risk of pollution occurring.
   c. Has to inspect the process on a scheduled and unscheduled basis to ensure by way of audit that compliance with permit conditions is occurring.

[2]. The operator
   a. Has to supply the regulator emission-monitoring data; and
   b. Has to have such data available in the event of an inspection.

However, in examining the first three years of IPC, Allot (1994) concluded that the absence on the Public Registers of emissions reported by industry, and the exclusion of information on inspections carried out by HMIP, make it difficult to form a true opinion of successes or failures. Inspection programmes, dictated by the risks that HMIP believed the process represented, ranging from 10 per annum for high risk processes down to one for those of a lower risk, may not have been realised (Allot, 1994). Staff numbers and other resource problems within HMIP, including the unexpected number of application discussions with process operators, may

have hindered the environmental protection that policing the IPC regime should have brought. Furthermore, HMIP should have audited operators own monitoring data which was supplied to demonstrate that a process was being operated in compliance to emission limits. However, arrangements for this appear not to have been rigorous and Allot (1994) suggests that industry was effectively monitoring itself unchecked resulting in the data being omitted from the public registers. Moreover, it appears that when the regulator (HMIP or the Environment Agency) decided to prosecute an operator, the average fine appears relatively low (Table 4.4). Fines and costs awarded against a non-compliant operator present a risk to the operator that may be compared to the costs of compliance. Low levels of fines and cost awards do not necessarily represent an effective deterrent to polluting the environment.

Year	*No. of prosecutions*	*Total fines*	*Total costs*	*Average fine per case*
1992/3	14	£101,000	£64,101	£7,214
1993/4	13	£94,801	£75,252	£7,292
1994/5	15	£136,500	£104,223	£9,100
1995/6	15	£358,500	£420,592	£23,900
1996/7	13	£161,000	£125,221	£12,384

Table 4.4 The number of prosecutions, the level of fines and costs, and the average level of fine per case as imposed by the judiciary under IPC, air pollution, and radioactive substance legislation up until March 1997 (ENDS, 1997*c*).

4.3.6 Summary of the early years of the implementation of Integrated Pollution Control

When IPC was established, the regulator, HMIP, was a relatively new organisation; it was under-funded and under-staffed. Up until April 1st 1993, more than half of the operators who had to comply with the

Regulations considered the authorisation process burdensome and the level of fees too high (see Table 4.3) (Allot, 1994). Despite the intentions of IPC to move the focus of pollution control from end-of-pipe technologies, applications during the first three years primarily took this approach to achieving the higher emission standards required by the regulator (Allot, 1994). The first applications also failed to discuss BATNEEC and BPEO (Table 4.2), with many operators suggesting that their current processes were to the BATNEEC standard and that any change would be at an excessive cost. The increase in fees (Table 4.3) in the second year of IPC was of particular concern for industry. It was reported that HMIP incurred a deficit of £2,000,000 (1991/1992) and £4,500,000 (1992/1993) during the first two years of IPC (Allot, 1994). Inadequate applications from the large combustion plant sector, necessitating additional labour on behalf of HMIP, contributed to this. Inevitably, fees had to increase to redress the balance, although it was surprising that in most years the increase was only modest. Other charging approaches had been proposed, for example, set-prices, or hourly rates (Allot, 1994). However, with HMIP's intention to charge £1,000 per inspector day (Allot, 1994) the latter option was not necessarily cheaper; industry appeared reluctant to accept to the "polluter-pays-principal".

Although the Public Registers were supposed to instil a degree of transparency to the regulatory process, the omission of promised information did little to dispel the perception of a cosy relationship between the regulators and regulated. Moreover, some commentators feel that standards less than BATNEEC have been tolerated, especially within the large combustion plant and incinerator sectors, and that improvement programmes intended to upgrade these plants have been given a 'light-touch' by HMIP under pressure from the Government (Allot, 1994).

Notwithstanding the criticisms made of IPC it has gone some way towards the improvement in permissible emission limits, more consideration extended towards the environment, industry monitoring their emissions, and addressing the "polluter-pays-principal".

4.4 Europe's Integrated Pollution Prevention & Control Directive

4.4.1 IPPC development at the European level

Following an investigation conducted by The Organisation for Economic Cooperation and Development (1988) the Directorate-General XI of the Commission specifically asked the Institute for European Environmental Policy to examine policy development on the integration of pollution control. The Commission's concern was that some Directives were based upon tackling pollution in a single medium and would ultimately hinder the development of multi-media approaches in those Member States that wished to pursue that policy (Emmott, 1999). In response to this, the Commission finally adopted a recommendation on IPPC in 1991 (Emmott, 1999) the Directive on September 24th 1996, and entered into force on October 30th 1996.

4.4.2 Summary of the Integrated Pollution Prevention & Control Directive

The purpose of the directive is to achieve through a system of permitting,

> "...integrated prevention and control of pollution arising from the activities listed in Annex I. It lays down measures designed to prevent or, where that is not practicable, to reduce emissions in the air, water and land from the

> above mentioned activities, including measures concerning waste, in order to achieve a high level of protection of the environment taken as a whole" CEC (1996, Article 1).

The Directive applies to six categories of industry based upon threshold limits:

[1]. Energy;
[2]. Production and processing of metals;
[3]. Minerals;
[4]. Chemicals;
[5]. Waste management; and
[6]. Other activities.

The "other activities" group includes paper- and pulp-production, textile-treatment, tanning, food-production, and the intensive rearing of poultry and pigs (CEC, 1996). The Directive's requirements had to be transposed into national legislation by October 30th 1999 (CEC, 1996). All "new installations" have to be permitted as of that date, whereas "existing installations" had to gain their permits by the date contained within nationally determined timetables: 2007 is the latest date by which this process must be completed (CEC, 1996). The Directive requires the use of Best Available Techniques (BAT) in controlling emissions (CEC, 1996). This, on first impressions, appears more onerous than IPC's BATNEEC. However, "available" is defined as "...economically and technically viable conditions, taking into consideration the costs and advantages" CEC (1996, Article 2(11)). This places the Directive's BAT much closer to, if indeed not the same as, IPC's BATNEEC.

Installations are required to gain a permit before operating and the operator must inform the regulator of any changes made (CEC, 1996). The permits

are periodically reviewed in order that BAT can be updated as technology changes (CEC, 1996). The permit contains,

> "...details of the arrangements made for air, water and land, and such measures as are necessary for compliance with the Directive's provisions on general operator obligations and environmental quality standards. Emission limit values or equivalent parameters must be defined for pollutants likely to be emitted in significant quantities, in particular for certain priority pollutants listed in the Directive, and if necessary a permit must prescribe requirements for the protection of soil and groundwater and management of waste. In all cases, permits must contain conditions to minimise long-distance and transboundary pollution and to ensure a high level of protection for the environment as a whole. Permits must also contain monitoring requirements ands an obligation to provide data to the competent authority for compliance checking, and measures relating to non-normal operations" Emmott (1999, pp. 36).

The emission limits are based on the BAT but with consideration given to geographical location and local environmental conditions, factors that will vary, as will the economic conditions for BAT, between Member States (Emmott, 1999). However, meeting the requirements of all other European Community environmental quality standards will dictates stricter BAT conditions (CEC, 1996).

4.5 National IPPC: from the Integrated Pollution Prevention & Control Directive to the Pollution Prevention & Control Regulations

4.5.1 Problems in getting the legislation on the statute books

After a protracted period of debate in both the House of Lords and the House of Commons, the requirements of the IPPC Directive were finally transposed into national legislation (ENDS, 1999*b*; 1999*c*; 1999*d*). At the heart

of this was an extensive consultation period with industry (Table 4.5); the Pollution Prevention & Control Act 1999 received royal assent on July 27th 1999. The Secretary of State then had the necessary powers to make regulations in order to establish the new regime. The Pollution Prevention & Control (England and Wales) Regulations 2000 (SI 2000/1973), as amended, came into force on the August 1st 2000 with permits being issued after September 1st 2000.

Consultation	*Title*	*Period of consultation*
First	*UK implementation of EC Directive 96/61 on Integrated Pollution Prevention & Control: consultation paper.*	July 15th 1997 – October 31st 1997
Second	*UK implementation of EC Directive 96/61 on Integrated Pollution Prevention & Control: second consultation paper.*	January 6th 1998 – February 13th 1998
Third	*Third consultation paper on the implementation of the Integrated Pollution Prevention & Control (IPPC) Directive*	December 1998 – February 28th 1999
Fourth	*Fourth consultation paper on the implementation of the IPPC Directive*	August 18th 1999 – October 8th 1999
Fifth	*Final consultation on revised version of draft Pollution Prevention and Control Regulations 2000*	April 26th 2000 – May 19th 2000

Table 4.5 National consultation papers issued for consultation on how the IPPC Directive should be implemented in England and Wales (Author's compilation).

However, lengthy debates, redrafts of both the Bill and Act, and problems within the Environment Agency meant that the Commission's deadline for transposing the Directive into national law was missed. The Environment Agency was unable to agree upon a charging scheme with both Government and industry and the novel aspects of IPPC created difficulties during the consultation stages (ENDS, 1999*b*; 1999*c*; 1999*d*). The Environment Agency partially-blamed the late production of European-wide Best Available

Techniques Reference Documents (BREF Document) that set common standards for techniques to be used in the abatement of emissions (ENDS, 1999*b*; 1999*c*; 1999*d*). Consequently, the national implementation timetable was out of synchronisation with the compilation of the 30 industrial sectors that would require appropriate documentation. In January 2001, it was reported in *The Ends Report* that the United Kingdom Government was to be taken to the European Court of Justice for failing to implement the Directive on time, particularly in Northern Ireland (ENDS, 2001*a*). Proceedings were also initiated against Finland, Greece, and Spain, while Belgium, Germany, and Luxembourg were given two months to satisfy the Commission of their implementation plans (ENDS, 2001*a*).

The Directive covers more industries and has greater scope in emission control than the current IPC regime,

> "...our best estimate is that it will apply to some 6,000 installations, compared to the 2,000 or so to which the IPC already applies. The extra installations covered by the directive include 10 per cent of those currently regulated by local authorities. Therefore, they are already subject to some degree of regulation. It also includes around 1,000 landfill sites, on which we had a debate recently, and a similar number of larger intensive pig and poultry farms, plus around 500 food and drink factories which are not already covered" Hansard (1998, Column 780),

This will require a considerable degree of change and new responsibilities for the Local Authorities in their controls on industrial processes. Figure 4.1 shows diagrammatically these changes and the new pollution control regimes that will be created.

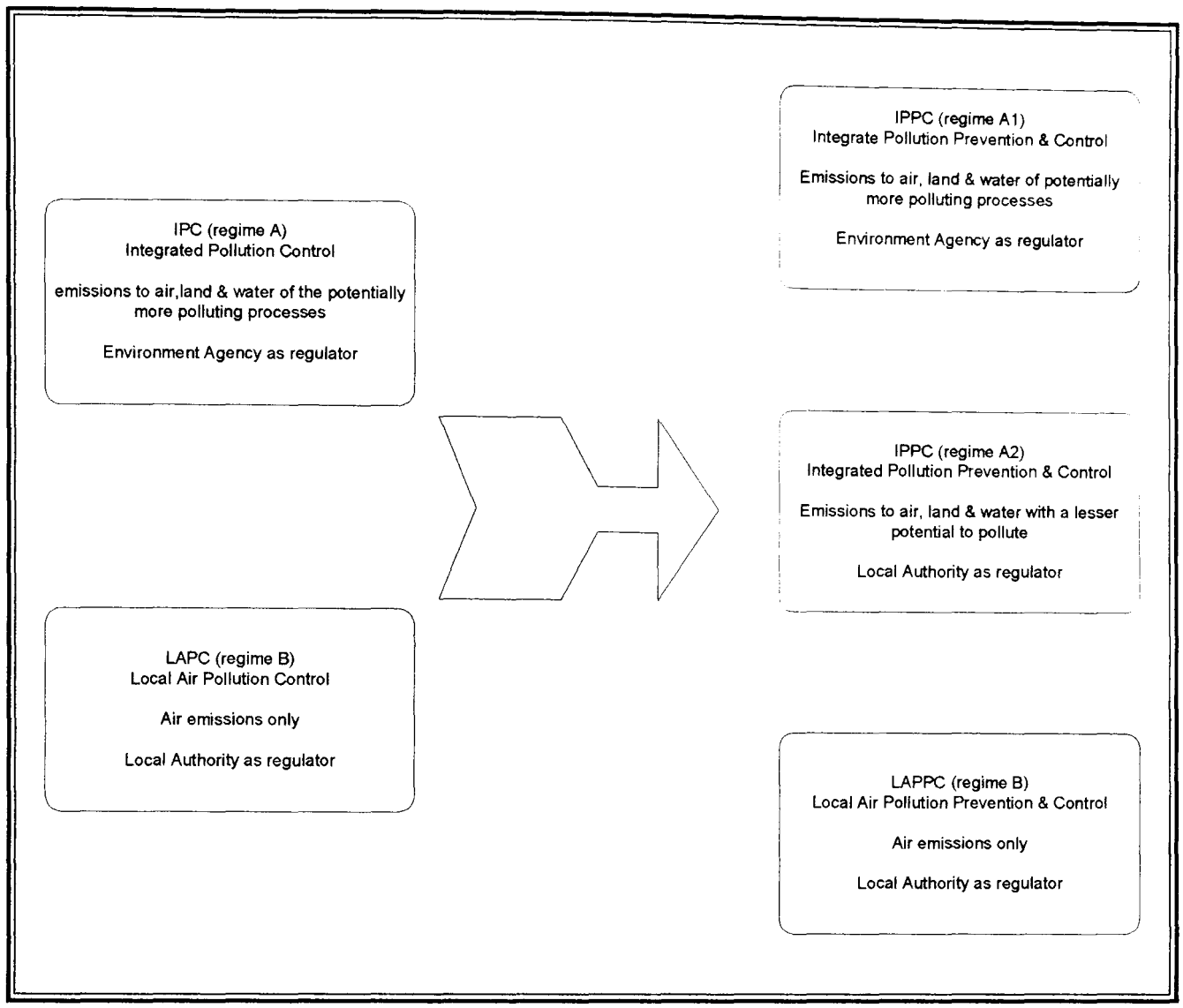

Figure 4.1 The implementation of the IPPC Directive: how it will change the England & Wales' pollution control regimes (Author's work).

4.5.2 Managing the Environment Agency's resources and the development of "smarter regulation"

During the consultation stages on the implementation of the IPPC Directive, it became apparent that the Environment Agency is at a difficult juncture. It has to regulate, and latterly is expected to offer a service to industry – although in performing these functions there has been regular criticism from both government and industry (ENDS, 1999*e*). Industry has been particularly concerned with the inconsistency in decision making (particularly apparent where an organisation has numerous facilities

dispersed throughout a number of the Environment Agency's regions), and the fees associated with regulation; the latter factor has resulted in amended charging schemes (Table 4.6) (ENDS, 1999*e*). In addition, management has been the subject of regular grievances expressed by its employees; these have concerned the status of "technical experts" and their remuneration within the organisation (ENDS, 1999*f*). The latest manifestation has been the re-grading of new inspectors that has seen a salary decrease from approximately £40,000 to £22,000 (ENDS, 1999*f*). This may influence the calibre of candidates coming forward, and may lead to shortages of sufficiently experienced staff to perform the regulatory function of PPC.

Type of charge	*IPC*	*IPPC (September 1999)*	*IPPC (December 2000)*	*IPPC - low impact installations (December 2000)*
Application	£5,074	£6,089	£5,525	£2,895
Substantial variation	n/a	£3,781	£3,542	n/a
Standard variation	£1,699	£1,699	£1,762	£300
Surrender		£1,827	£1,658	£300
Subsistence	£2,307	£2,768	£2,512	£379

Table 4.6 A comparison between the fees charged for IPC and those proposed for IPPC (ENDS, 1999*g*; 2000*b*).

In February 2002, Environment Agency figures showed that only 72 PPC permits had been issued (29 percent) from 247 applications (ENDS, 2002*a*). This may be explained by the high number of applications that had inadequately determined BAT for the process. The delays at this early stage of the PPC permitting schedule may become more severe in early 2003 when hundreds more applications are likely and even worse in 2004/2005 when the food and drink sector, which has no experience of IPC, is predicted to make

1,100 applications. The Environment Agency estimates that 1,300 extra staff are required over the next four years to manage the PPC workload; this would require either more funding from the Treasury (which is unpopular with the Government) or an increase in PPC Charges (unpopular with industry) (ENDS, 2001*b*). It has to be remembered that the level of fees under the charging scheme have already been reduced (see above and Table 4.6) to appease industry, but ultimately may affect the permitting process.

Managing both its budget and workload with the available employees, the Environment Agency has had to re-think how it regulates industry. The result has been "smarter regulation", "risk-based", and simplified permitting regimes for activities deemed to be at a lower risk of causing pollution (ENDS, 2001*b*). However, the Secretary of State may have to ask Parliament to amend legislation to make this possible.

It would appear that the Environment Agency is going to place greater emphasis than it has in the past on the presence of a certified environmental management system (cert. EMS) in smartening or risk-basing its efforts (ENDS, 2000*c*). In 1997, the presence of a cert. EMS was reflected to a lesser degree under the Operator and Pollution Risk Appraisal (OPRA) scoring system (ENDS, 2000*c*). The Environment Agency believes that cert. EMSs benefit both regulator and regulated in avoiding duplication of work (ENDS, 2000*c*). Additionally the Department of Environment, Transport and the Regions (DETR) believes that cert. EMS are an integral part of BAT (ENDS, 2000*d*) although the Scottish Environment Protection Agency (SEPA) remains to be convinced (ENDS, 2000*d*). The Environment Agency wishes to extend a "lighter regulatory touch" (ENDS, 2000*e*) towards companies that have a mature, well-established, cert. EMS. Their rationale is that such

companies are better at managing their environmental impacts and so pose less risk of causing environmental pollution (ENDS, 2000*e*). However, recent articles in *The Ends Report* detailing a number of examples where firms with cert. EMSs (the International Organisation for Standardisation (ISO) 14001 and the Eco-Management and Audit Scheme (EMAS)) have caused pollution, adds 'fuel' to the debate on this point (ENDS, 2000*e*).

The benefits also now appear less clear; while Martyn Cheesbrough of the Environment Agency remains a proponent of the role of cert. EMS, others within the organisation are more sceptical (ENDS, 2000*f*). The Environment Agency's "Environmental Management Systems & Regulation" (EMSR) project (ENDS, 2000*f*) has shown mixed results. Although the Environment Agency prefers EMAS to ISO 14001 because of a verified public statement, its focus on individual sites (ENDS, 2000*f*) and emphasis on legislative compliance (ENDS, 2001*c*), industry has favoured ISO 14001. Recent concerns expressed by the Environment Agency on poor certification by verifiers, particularly on compliance with legislation and on continuous improvement (ENDS, 2001*c*), have eroded the beliefs that the Environment Agency once had in cert. EMS. This has led to a greater degree of regulatory effort being required for firms on the EMSR project (ENDS, 2000*f*). It now appears that 'robust' cert. EMSs may only influence Operator and Pollution Risk Appraisal scoring, with a possible reduction in fees (ENDS, 2002*b*).

4.5.3 The first industrial sectors to be authorised and gain Pollution Prevention & Control permits

The IPPC Directive has been more challenging than the slight modification of the IPC system that some within industry thought it would be. For

example, the IPPC Directive has introduced new controls on site contamination, energy efficiency, and noise, whilst the emphasis has been changed from processes to installations. This challenge has perhaps been most evident for the food and drink sectors that have no prior experience of IPC or Local Air Pollution Control (ENDS, 1999*h*). In an attempt to avoid a repetition of the mass rejection of applications under IPC, the Environment Agency has initiated trials with industry (ENDS, 1999*h*). These trial have included Birds Eye Walls' Hull factory where collecting data and drawing it together in the required format proved tough (ENDS, 1999*h*). Whilst industry is ready to express concern over the costs associated with multi-media pollution control regulation – these trials have shown that the food and drink sector has the potential to make substantial savings through managing water use and effluent disposal whilst processing foods to the same safety standards (ENDS, 1999*h*).

The PPC regime appears to be more time consuming and onerous than the IPC regime. TXU Europe Power reported that the application took 170 hours (similar to an IPC application) but with an additional 200 hours required for a site report (ENDS, 2000*g*). Mercia Waste Management's energy-from-waste incinerator is reported to have taken four months, nearly double what would have been required under IPC (ENDS, 2000*g*). However, some of the problems were because appropriate guidance was not available from the Environment Agency, who in turn were waiting on Government and the IPPC Bureau (ENDS, 2001*d*). From a survey of the first 40 application, BAT justifications appeared inadequate – which might have been excused in the paper- and pulp-production sector as they have not been regulated under IPC, but other applicants appeared to be testing the regulator (ENDS, 2001e). From the same survey, it appeared that many

companies were treating the application process as a public-relations-exercise and making their applications too lengthy, the longest being 1,700 pages (ENDS, 2001e).

The steel- and cement-production sectors were not expected to be given the concessions that applicants from the paper- and pulp-production sectors (February 2001) received from the Environment Agency. The paper- and pulp-production sector were given three years to submit improvement programmes bringing their plant to BAT standards and to submit additional information omitted from their applications (ENDS, 2001*f*). Applications from the steel- and cement-production sector were expected to be on-time, in full, with the plant being up to the BAT standard (ENDS, 2001*g*). However, the industry may have used its prior experience with the IPC regime in deciding to omit BAT determinations with the consequence that the Environment Agency has shown some leniency during negotiations on costly improvements (ENDS, 2001*g*).

4.6 Have the lessons been learnt along the journey from Integrated Pollution Control to the issuing of the first Pollution Prevention & Control permits?

This chapter has compared the introduction of permitting under the IPC and PPC regimes. 10 years have separated these two pollution control regimes. During this period both industry and the regulator have amassed experience of multi-media pollution control and in administrating BAT and BPEO. Therefore, it is surprising that the problems encountered at the

instigation of IPC have reoccurred at the commencement of PPC, the appearance is that the regulator has been unable to learn from experience.

The unavailability of guidance, central to the functioning of both pollution control regimes, was the cause of uncertainties on both sides of the regulatory experience. The Pollution Prevention & Control Act 1999 finally received Royal Accent too close to the time when the regulations had to be in place to issue permits thus avoiding infraction proceeding by the European Commission. Additionally, if the decisions on the adoption of techniques and technologies are going to be made from a central European committee, then this has to keep pace with the need and the communication of those decisions. Perhaps time-scales that are more realistic should be adopted so that guidance can be produced at the time that it is required. It would appear that the United Kingdom is more suited to the gradual evolution of pollution control as opposed to revolution. This may become more apparent as more European-wide environmental controls require transposition into national legislation. Other examples include the Landfill Directive (99/31/EC), and Council Regulation 2037/2000 (effective from January 1st 2002) concerning ozone-depleting substances, that led to problems of capacity for the safe and appropriate disposal of fridges (CEC, 2000).

The unwillingness of government to fund adequately the regulatory functions of both pollution control regimes appears to have resulted in similar outcomes. Insufficient, suitably experienced staff and problems with recruitment and retention appear to be common problems to IPC and PPC. These have slowed the authorisation process and have hindered process inspection targets forcing the Environment Agency to make compromises on environmental protection. Attracting experienced staff from industry may be

more difficult than it once was; newly appointed inspectors now start on a salary of approximately £20,000 that may only appeal to new graduates. Additionally, further up the Environment Agency's hierarchy, experienced staff may be tempted by more lucrative salaries within industry and consultancies where demand is out-stripping current supply.

The solutions as to how the Environment Agency should be financed are not easy. Its counterpart, the Scottish Environmental Protection Agency (SEPA), is funded in a different way and is required to recover less of the costs from the regulated. This produces a stark difference when comparing the costs of PPC in England and Wales with Scotland. This comparison may have led to amendments to the Environment Agency's proposed PPC Charging Scheme. Under the conditions of constrained Government funding, and the political influence of business, the Environment Agency will have to continue to strike a balance between function and available resources. It remains to be seen how effective current policies of "smarter regulation" and "risk-basing" are in terms of delivering the service that industry demands and delivering environmental protection that society desires.

The quality of applications has been less than was required under both IPC and PPC. However, it is difficult to discover the real reasons for this. One argument is that applicants have been unsure of the application process and have subsequently determined BAT and BPEO insufficiently. Conversely, an accurate determination may lead to expensive upgrades of capital (plant) – something that many applicants may have deliberately sought to avoid. Application trials and permit discussions have entered onto the Environment Agency's agenda. This has marked an about-turn from HMIP's initial stance with industry. However, the Environment Agency is keen to avoid becoming

'unpaid consultants' to industry in striking this balance. Additionally, not having BREF Documents to refer to for BAT standards may have hindered industry in making decisions.

Many applicants within the paper- and pulp-production sector have been permitted, in spite of information being omitted during the application procedure. Sectors of industry new to PPC (with no prior experience of IPC) are at a disadvantage during the application process. It is understandable that information may be omitted. In the past, however, the regulator (HMIP) has reacted to this by issuing Schedule 1 Notices requiring further information in advance of issuing a permit. The Environment Agency in administering PPC appears to have struck a closer relationship with industry. Accepting the application, and permitting the process, may be preferred in order to avoid delaying the permitting of industrial sectors that are further down the Environment Agency's timetable.

During the consultation stages on the implementation of the IPPC Directive industry was concerned that the Directive's BAT was a more progressive standard than IPC's BATNEEC, which includes a balance between environmental protection and what is actually affordable to the industry. Allowing process operators up to three years in which to upgrade plant to the BAT standard appears to allay these concerns. However, it must be difficult for the Environment Agency to appease all parties in balancing environmental protection, asking industry to make potentially expensive changes, and in achieving consistency in these decisions.

In 1997, just a year after the formation of the Environment Agency, HMIP's idea that firms having a cert. EMSs in place would benefit from reduced charges, fewer inspections, and being required to submit monitoring data less frequently was not developed further (ENDS, 1997*d*). Inspections frequencies were already at a low level, averaging two per process (ENDS, 1997*d*), and the presence of a cert. EMS, was not a guarantee of appropriate environmental management. Now under PPC, the

> "requirement is for companies to implement an environmental management system compatible with the international standard ISO14001 or the European equivalent EMAS" ENDS (2003, pp. 9).

Whether this is an attempt to manage the Environment Agency's resources through targeting its efforts towards operators posing greater risk to the environment, or is an effort to make firms manage their environmental impact better, is difficult to uncover. Requiring firms to implement cert. EMS via conditions contained within improvement plans, is a relatively expensive aspect of PPC. Whilst some firms are able to derive competitive advantages as the reward for implementation, others will not. Moreover, as more firms adopt certification then the competitive advantage may be eroded. Additionally, cert. EMSs are not particularly easy for small- and medium-sized enterprises to implement, although efforts are being made to assist them. However, the incentives do not appear strong, or tangible enough to persuade businesses to follow this route and the Environment Agency may find that process operators will contest such conditions in the future.

4.7 Placing the landfill and intensive pig farming industries in the context of IPC and IPPC

The landfill industry has a history of multi-medium pollution control regulation since landfill licences were introduced in 1974 under the Control of Pollution Act 1974. The intensive pig farming industry, on the other hand does not have such a history in its experiences of regulation. Controls on the activities of farming have been primarily based around media specific regulations introduced to combat specific issues or problems as they were encountered. However, although it has been suggested above that landfill licensing has provided the industry with experiences of integrated regulation, it has not been as coherent as found within the IPPC Directive. Landfill licensing was more akin to a suite of individual regulations, each implemented to solve specific problems as they occurred, and administered by one body as opposed to an interlinked and coherent licensing regime that PPC and the Environment Agency promises.

Although an ideal candidate for inclusion within IPC because of the pollution causing potential, landfill facilities never were. Subsequently it has not been possible to include them in discussions of experiences encountered during the first three years of IPC, as has been possible with other industries. It also means that the concepts of BEOP and BAT / BATNEEC, which are included in the IPPC Directive, are new to the landfill industry. However, unlike many of IPC's scheduled processes where individual companies were responsible for determining their own BATNEEC this has function has been performed centrally by national government, which should make the application of PPC to the landfill industry a little easier.

4.8 Conclusion

An analysis of documentary data sources reveals that the problems experienced by both regulator and regulated during the first three years of the IPC regime appear to be reoccurring during the early stages of permitting under the PPC regime. This is disappointing in some respects because the Environment Agency has over five years experience in regulating industry under IPC that preceded PPC. However, not all of the problems lie at the feet of the Environment Agency. The PPC application procedure, which determines the level of BAT, has potentially expensive repercussions for the applicant. It is not surprising that perhaps a 'game' is being played between the Environment Agency and process operator. Notwithstanding this, the points below highlight those reoccurring problem areas that appear to be affecting PPC.

- Guidance, which is central to the pollution control regime, has not been available – both from Government and Europe.
- Industries new to the multi-media approach to pollution control have struggled with the application process.
- The Environment Agency appears not to have enough resources available to regulate industry – both during the application process and in policing PPC.
- The Environment Agency is having to resort to new approaches of risk-basing and smarter regulation that may compromise environmental protection in order to manage its resources and implement PPC.
- Information that should be on the Environment Agency's Public Registers has been omitted.

This is not an encouraging sign for the intensive pig farming industry where "new" or "substantially modified installations" have to gain a permit now and "existing installations" by 2007. In this particular example, both the Environment Agency and the intensive pig farming industry have no prior experience of permitting under a multi-media pollution control regime.

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Chapter 5.

The Integrated Pollution Prevention & Control Directive & the re-licensing of landfill facilities

5.1 Introduction

The United Kingdom landfill industry accepts 120 million tonnes of waste per annum, it being the disposal option for 90 percent of household, 85 percent of commercial, 63 percent of construction and demolition, and 73 percent of other industrial waste (Williams, 1998). In England and Wales there are 1,300 landfill facilities, and 11 incinerators licensed to accept municipal waste, whilst only two can deal with special waste (Environment Agency, personal communication). The modern landfill facility has developed from merely a place to 'dump' waste with little or no preparation, to a facility specifically designed, engineered, and managed for the treatment and disposal of waste (Williams, 1998). The industry has developed into a highly regulated sector with a mix of small independently owned facilities and those owned and operated by large multinational total waste management companies. This Chapter explores the development of regulation within the landfill industry as a backdrop to the re-licensing process that the industry is undergoing as part of the changes introduced under both the Landfill Directive (99/31/EC) and the Integrated Pollution Prevention & Control (IPPC) Directive (96/61/EC). The industry's response to this process has been assessed through a number of interviews with landfill managers, those within the waste industry with responsibility for making the

new licensing regime work, and the regulator. These interviews have encompassed a diverse range of facility size, location, and ownership.

Summary aims of this chapter are:

- **To provide an understanding of the ethos of the landfill industry**
- **To explore the experiences of the landfill industry and the regulator during the various phases of landfill facility licensing**
- **To establish how the landfill industry is responding to the current re-licensing process**

5.2 General characteristics of the landfill industry

The only official records providing an in-depth view of the waste management industry are contained on the Environment Agency's official Public Register. This Register contains details of active-landfills, transfer-stations, incinerators, and landfills that are being monitored before a Certificate of Completion is issued. Anecdotal evidence suggests that the landfill industry is dominated by large waste management companies who operate large landfill facilities, and accept significant volumes of the total waste landfilled in the United Kingdom. Additionally, the structure of the industry is dynamic: there has been an increasing trend towards amalgamations within recent years. For example UK Waste Management Ltd. was recently taken over by Biffa Waste Service Ltd. (part of the Severn Trent PLC. group), and Wastewise Waste Management Service Ltd. by the Waste Recycling Group Ltd. Using the available information on the Environment Agency's Register, Table 5.1 illustrates the diversity of landfill facility operators. Entries include small landfill operators, those involved in a

diverse range of waste management activities, and companies who own and operate landfill facilities as a subsidiary to their main business activity.

Company	*Main activities*	*Entries on register*
3C Waste Ltd.	Waste management	8
A & J Bull Southern Ltd.	Unknown	17
Alfred McAlpine Construction Ltd.	Construction	6
Anglian Water Services Ltd.	Water supply/treatment	5
Anti Waste Ltd.	Unknown	12
Biffa Waste Services Ltd.	Waste management	40
Blue Circle Industries Plc.	Cement manufacture	14
British Steel	Steel manufacture	9
British Sugar	Sugar processing	7
British Waterways	Canal management	37
Caird Environmental Ltd.	Waste management	12
Cleanaway Ltd.	Waste management	20
Cory Environmental	Waste management	8
Cumbria Country Council	County Council	11
Devon County Council	County Council	8
Durham County Council	County Council	19
Durham County Waste Management Co. Ltd.	Waste management	12
Hanson Quarry Products Europe Ltd.	Aggregates	23
Lafarge Aggregates Ltd.	Aggregates	38
Shanks Waste Services Ltd.	Waste management	10
UK Waste Management Ltd.	Waste management	17
Viridor Waste	Waste management	32
Waste Recycling Group Ltd.	Waste management	15

Table 5.1 Selected information from the Environment Agency's Register of licensed waste management activities. The number of entries does not necessarily reflect the total volume of waste landfilled per annum per company and therefore the dominance of the company in the waste management industry (Author's compilation from Environment Agency's Register).

5.3 Historical overview of the regulation of the landfill industry

A modern landfill facility is the culmination of an evolutionary process with practices partly dictated by increasing regulation through time. This began in earnest in the early 1970s and has taken decades of a "circular-process" that includes: problem identification; research; and ensuing legislation. However, progress has not always been smooth, as solving one problem has, on many occasions, caused other problems years later. The following historical overview of the challenges the landfill industry faced, and the industry's response to the pressures, sets the scene for the next generation of landfill licences issued under the Pollution Prevention & Control (England and Wales) Regulations 2000 (SI 2000/1973), as amended, examined later in this chapter.

5.3.1 The Control of Pollution Act 1974: 1st generation landfill licences

In the 1960s and early 1970s landfills were considered 'waste dumps' and their operation, both legal and illegal, undoubtedly caused pollution in various forms necessitating expensive remedial action by local and national government. Prior to the Control of Pollution Act 1974 (COPA), there were relatively few controls on the disposal of waste. Therefore, the first licensing regime (Control of Pollution Act 1974) for landfill facilities marked a departure from previous legislation and introduced the concept that an activity required licensing. The Control of Pollution Act 1974 provided a framework for a comprehensive set of environmental legislation, *inter alia* making it an offence to deposit or treat waste at a facility or disposal site unless that facility had a waste disposal licence. Along with the passing of the Control of Pollution Act 1974, the 1970s, "...witnessed the most intensive

programme of landfill research ever conducted in Britain sponsored by [Government]" ENDS (1985*a*, pp. 13). That research concluded that the unsaturated-zone around and beneath a landfill facility offered a highly effective barrier to pollution of groundwater by landfill leachate. Landfill activities generally followed the principles of "attenuation" or "dilute and disperse", the latter term disliked by the industry.

The findings of the research were undoubtedly helpful to the Government of the day as the research supported the status quo. It was not until the implementation of the European Groundwater Directive 1980 (80/68/EEC) that "dilute and disperse" practices were questioned. The implementation of this Directive probably caused a degree of internal friction in Government as the National Rivers Authority (NRA) insisted that landfills were to be "contained" in order that the Directive's requirements could be met, which conflicted with other Government research and established practice. Without the driving force of the Groundwater Directive, it is difficult to see when the practice of "dilute and disperse" would have been terminated. It is also this European influence that is set to prevent the United Kingdom's long-standing practice of co-disposal (see Case-Study One).

Case study One

Co-disposal

Co-disposal of hazardous and non-hazardous liquid wastes into or with municipal waste has been United Kingdom practice for a number of years. The principals are to harness the various biological, chemical, and physical processes in a household waste landfill to attenuate and degrade the hazardous constituents of industrial waste: a process that the Government maintained was acceptable, whilst opponents argued that it is nothing more than a cheap disposal option for the more hazardous waste streams. However, Aspinwall & Co. reported in 1988 that there had been no proposals for a major co-disposal facility over the previous year (ENDS, 1989*a*). Doug Benjafield (Director of technical services, Cleanaway Limited) said,

"...it's highly unlikely that there will be any new co-disposal facilities in Britain. Geologically suitable sites are in short supply, and the mineral extraction companies don't want to get involved in hazardous waste management" ENDS (1989*a*, pp. 14).

This comment was made whilst Cleanaway submitted a planning application for a £2.5 million pre-treatment complex at its Pitsea co-disposal facility – the largest in the United Kingdom. This co-disposal facility, in 1989, accepted:

- 90,000 tonnes of municipal waste;
- 200,000 tonnes of mixed commercial waste;
- 15,000 tonnes of solid industrial waste; and
- 125,000 tonnes of liquid waste including:
- Agrochemical and paint sludges;
- Inceptor wastes;
- Oily residues;
- Brewery and food processing effluents; and
- Metal plating sludges (ENDS, 1989*a*).

Where new practices were suggested in order that standards are raised the landfill industry resisted that change, suggesting that "...an ultra-cautious approach to landfill of hazardous waste and other types of waste is unjustified" ENDS (1985*a*, pp. 13), and adding unnecessary extra costs (ENDS, 1985*b*). Although Rod Aspinwall, an environmental consultant, stated that, in reality, operating a landfill facility to the higher standards would only increase costs by about 10 percent (ENDS, 1985*b*). Nevertheless,

it appears that the landfill industry has sought the cheapest options in rectifying problems. However, at times, guidance has been weak and research has not been sufficiently forward looking, for example, the problems concerning landfill gas (Case Study Two). The culmination of this interactive process between industry actions and industry guidance has been the need to issue or tighten controls contained within guidance on the ways in which a landfill facility has to be operated.

Case Study Two

Landfill gas controls

An explosion resulting from the migration of landfill gas at Loscoe, Derbyshire, in 1986 highlighted the dangers of landfill gas and the necessity to introduce controls. Her Majesty's Inspectorate of Pollution (HMIP) produced a survey finding that between 500 and 1,300 landfills gave cause for concern and would require remedial work estimated at £600 million (ENDS, 1988*a*). To save Treasury funds it was made the responsibility of the operator to address the issue. Subsequently the Department of the Environment (DoE) produced guidance on landfill gas control and monitoring measures, and amended licences conditions requiring the landfill gas be flared.

No standards for flares were set, so understandably the industry took the cheapest option. It was not until 1989 that HMIP produced recommendations for flare specifications as,

> "...curbs on [methane] emissions of this gas would make one of the sharpest possible contributions to a reduction in the overall global warming potential of total UK greenhouse gas emissions" ENDS (1991, pp. 20).

However, it would take until 1999 for the Environment Agency to implement those specifications.

Government advice and licence amendments followed problem identification – this was how control was exercised over the landfill industry. Gas control was expensive and this may have been the driving force behind the development of energy production from landfill gas to offset those costs. Although initially reliant upon proximity to a customer for direct use of the gas this later changed to generating electricity on the facility to be fed into the National Grid, the economics of which were improved by the Electricity Act 1989.

Whilst the commercial concerns of running landfills tend to push waste management businesses towards the cheapest option, Case Study Three tells the story of a landfill operator who was going beyond what was common practice at the time (ENDS, 1985*c*). However, it is difficult to decide if those practices were adopted in response to the environmentally damaging

consequences of landfilling waste, or if in part there were commercial advantages to adopting those practices. Biffa Waste Services Ltd. stated that whilst landfilling practice,

> "...has progressively raised the standards...during the past decade...no company...has attempted to turn these benefits of environmentally sound landfill explicitly to its commercial advantage" ENDS (1984*a*, pp. 12).

In addition market surveys commissioned by Biffa Waste Services Ltd., concluded that whilst most companies wanted their waste removed at the lowest cost, the producers of toxic waste were looking toward reputable disposal contractors (ENDS, 1984*a*). However, it is difficult to conclude either whether these waste producers were prepared to pay a higher price for this privilege or what affect this would have on the waste producer's competitiveness.

Case Study Three

Landfill operators lead the way

Cory's Mucking and East Tilbury landfills in the early 1980s promoted best practice and suggested that others should follow. Cory Waste Management Ltd. were monitoring: incoming wastes; leachate and water quality; surface waters outside the facility; groundwater beneath the site; water quality and microbial activity within the waste; air quality for metals and organics on and off-site; vegetation; and medicals for facility personnel (ENDS, 1985*c*).

In 1984, the Little Packington Landfill, near Birmingham, was one of the first landfill facilities to introduce a "cell tipping technique" (ENDS, 1984*b*). This technique required:

- The construction of a "cell" with either sand, gravel, or inert rubble under a clay liner; incoming waste to be spread by a compactor in layers of no more than one metre thick – as opposed to two metres that was common in the 1970s; and
- That when tipping ceased, the cell was sealed with a one metre layer of clay (ENDS, 1984*b*).

Environmental advantages aside, this method allowed waste density to be increased from 0.6 to 1.1 tonnes per cubic metre (ENDS, 1984*b*).

Cleanaway Ltd. launched an environmental policy in July 1989, and included an annual, fully financed, environmental improvement plan (ENDS, 1989*b*). Cleanaway Ltd. appointed a full-time environmental advisor, and formed an audit panel comprising external specialists whose function was to review the policy and improvement plan and report directly to the board (ENDS, 1989*b*).

In 1989 Shanks and McEwen PLC. announced that it intended to have the accredited BS5750 standard environmental management system in place at its transfer and disposal operations by the end of 1990 (ENDS, 1989*b*).

Whilst all these actions brought potential environmental benefits, the landfill operator probably benefited most. All selectively promoted their respective company's operations over others, and promoted the landfilling of waste as being more benign that others believed.

In subsequent years, the government was to use the waste producer to drive forward standards in the waste disposal industry. Under the "Duty of Care" proposal, implemented under Section 34 of the Environmental Protection Act 1990 (EPA), the waste producer had new responsibilities:

> [1]. Waste had to be stored correctly;
> [2]. Waste had to de disposed of via a registered waste disposal operator;
> [3]. Waste had to go to an appropriately licensed disposal facility to be disposed of in accordance with the facility's licence; and
> [4]. The waste producer had to maintain an auditable paper-trail on the process of waste disposal, and was encouraged to check periodically that the above conditions were being met.

The Duty of Care proposal was pivotal in changing the relationship between waste producer and waste disposer, and as such was criticised by the Confederation of British Industry (CBI) and the Chemical Industry Association (CIA) who wished the emphasis to remain on the landfill operator.

As stated above, the primary influence over the way in which a landfill has operated has been guidance from government (Waste Management Papers (Table 5.2)), in addition to conditions inserted into landfill licences. However, criticism was levied at these first generation licences by the Hazardous Waste Inspectorate (the regulator) who was of the opinion that they were,

> "...unhelpful documents which do not provide sufficient guidance to the operators...often comprise a set of standard conditions apparently imposed, it seems, with little consideration of the proposed operation" ENDS (1988*b*, pp. 10).

HMIP moreover, rallied its disapproval of landfill licences, advocating that,

> "Blind adherence to the model conditions...has contributed in part to many of the poor disposal licences we have seen. Licensing is a complex task that needs careful consideration and not the regurgitation of conditions which may, or may not, be relevant to the operation in question" ENDS (1988*c*, pp. 10 – 11).

HMIP sought:

> [1]. Clear, unambiguous and enforceable licence conditions;
> [2]. Clear definitions of waste types;
> [3]. On-site chemists and laboratories at special waste facilities;
> [4]. Risk-based inspection frequencies; and
> [5]. The review of licences every five-years (ENDS, 1988*c*).

The five-year review period, sought by HMIP, is interesting as it circumvents the static nature of landfill operation that appears to have to be punctuated by catastrophic events (pollution incidents) before there is a change in standards. The five-year review period provided an opportunity to raise standards of operation in the light of new knowledge. This is a marked departure from the observations in Case Study Two where it was a catastrophic event that drove a change in landfill practice.

No.	Year published	Waste Management Paper title
1	1976	*A review of the options: guidance on the options available for waste treatment and disposal.*
2	1976	*Waste disposal surveys.*
3	1976	*Guidelines for the preparation of a waste disposal plan.*
5	1976	*Relationship between waste disposal authorities and private industry.*
7	1976	*Mineral oil wastes.*
9	1976	*Halogenated hydrocarbon solvent wastes from the cleaning processes.*
10	1976	*Local authority waste disposal statistics 1974/75.*
11	1976	*Metal finishing wastes.*
12	1977	*Mercury bearing wastes.*
13	1977	*Tarry and distillation wastes and other chemical based wastes.*
14	1977	*Solvent wastes (excluding halogenated hydrocarbons).*
15	1978	*Halogenated organic wastes.*
17	1978	*Wastes from tanning, leather dressing and fellmongering.*
19	1978	*Wastes from the manufacture of pharmaceuticals, toiletries and cosmetics.*
22	1978	*Local authority waste disposal statistics 1974/75 to 1977/78.*
18	1979	*Asbestos waste.*
16	1980	*Wood preserving wastes.*
20	1980	*Arsenic bearing waste.*
21	1980	*Pesticide wastes.*
23	1981	*Special Wastes.*
25	1983	*Clinical wastes.*
24	1984	*Cadmium bearing wastes.*
8	1986	*Heat treatment of cyanide waste.*
26	1986	*Landfilling wastes.*
27	1989	*Control of landfill gas.*
28	1991	*Recycling.*
26A	1993	*Landfill completion.*
4	1994	*Licensing of waste management facilities.*
4A	1995	*Licensing of metal recycling sites.*
6	1995	*Polychlorinated biphenyls.*
26B	1995	*Landfill design, construction and operational practice.*

Table 5.2 Waste management guidance issued in the form of Waste Management Papers (Author's work).

As landfilling became a licensable activity there was the need to police those licences – hence the need for inspection, and verification that licence conditions were being met. However, there is a lack of information

concerning inspections so it is not possible to gain an insight into this aspect of landfill regulation during this period. What is reported is that licence conditions varied between licensing authorities (ENDS, 1988*c*). This was unacceptable to the landfill industry that sought equal standards in the licences, in order that all operators were working with the same regulatory burden.

5.3.2 Waste Management Licensing Regulations 1994: 2nd generation landfill licences

Notwithstanding the criticisms levied at the first generation of waste management licences, they served a purpose in trying to raise standards. A number of years passed before the fundamentals of the regime were overhauled; in fact, it was twenty years later when reform was realised. Although change was proposed under the Environmental Protection Act 1990 it was not until April 1994 that a new regime came into force: the Waste Management Licensing Regulations 1994 (WMLR) (SI 1994/1056), as amended.[1] The Waste Management Licensing Regulations 1994 (WMLR) (SI 1994/1056), as amended, were announced and considered as,

> "...probably the most complex item of waste legislation ever passed is now on the statute books, accompanied by a circular which, at 199 pages, is also of record length" ENDS (1994, pp. 15).

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[1] Amended by:
- Waste Management Licensing (Amendment, etc) Regulations 1995 (SI 1995/288);
- Waste Management Licensing (Amendment No. 2) Regulations 1995 (SI 1995/1950);
- Waste Management Regulations 1996 (SI 1996/634);
- Waste Management Licensing (Amendment) Regulations 1996 (SI 1996/1279);
- Waste Management (Miscellaneous Provisions) Regulations 1997 (SI 1997/351);
- Waste Management Licensing (Amendment) Regulations 1997 (SI 1997/2203); and
- Waste Management Licensing (Amendment) Regulations 1998 (SI 1998/606).

Landfill operators became uncomfortable with the way they had to operate their facilities only after the introduction of the Waste Management Licensing Regulations 1994 (WMLR) (SI 1994/1056), as amended. These Regulations implemented two significant changes:

[1]. The requirement that the facility was managed by a "fit and proper person":
   a. To demonstrate financial provision to cover foreseen and unforeseen costs during the aftercare period until the licence was surrendered; and
   b. That the operator of the landfill was competent, demonstrated through gaining a "Certificate of Technical Competence" (CoTC).

[2]. That a "Certificate of Completion" was issued by the regulator before the licence could be surrendered.

The "Certificate of Completion" was only issued after the regulator was satisfied that the landfill posed no environmental harm and met tight emission limits for leachate and landfill gas. These parameters were monitored during a period when waste acceptance had ceased and the facility restored – a period which could last a number of decades. The reason for these changes was to make the costs of remediating a polluting landfill the responsibility of the operator. Prior to this, a number of polluting landfills had to be remediated at the Government's expense when the operator surrendered the licence and 'walked away'. The introduction of these provisions led to the suggestion,

> "...that many landfill operators will opt to return their licences before next April [1993] rather than incur the post-closure and other costs posed by the licensing regime" ENDS (1992, pp. 15).

The National Association of Waste Disposal Contractors believed that no more than 20 percent of the landfill facilities licensed prior to 1994 would

continue to operate, but that these landfills would then accept 80 percent of the waste produced (ENDS, 1993).

However, in reality the conditions contained within the Waste Management Licensing Regulations 1994 (WMLR) (SI 1994/1056), as amended, were enforced for new licences whilst landfills licensed under the Control of Pollution Act 1974 were automatically upgraded without the "fit and proper person" requirement having being met; some operators saw this as creating an 'uneven playing-field' (ENDS, 1993). Relatively few CoTCs have been issued, demonstrating the reluctance of some within the industry to engage in training. This is despite the fact that concessions were granted to the waste industry. For example, the requirement was postponed until 1999 under the "deemed competence" provision for any manager that had managed a facility within the past 12 months (7,000 applied); and any manager aged 55 or over on the April 1st 1993 who had managed a facility for the past five years did not have to hold a CoTC until April 1st 2003 when it was considered they should have retired. The numbers of CoTCs issued by the Waste Management Industry Training & Advisory Board (WAMITAB) is given in Figure 5.1 & Figure 5.2, and appear relatively few when the Environment Agency's database implies that there were 3036 operational landfills in 2001 whilst there were only 1308 qualified landfill managers. One interpretation, also supported from the interviews conducted with the landfill industry (see below), is that the larger landfill operators may have only one qualified manager overseeing more than one facility.

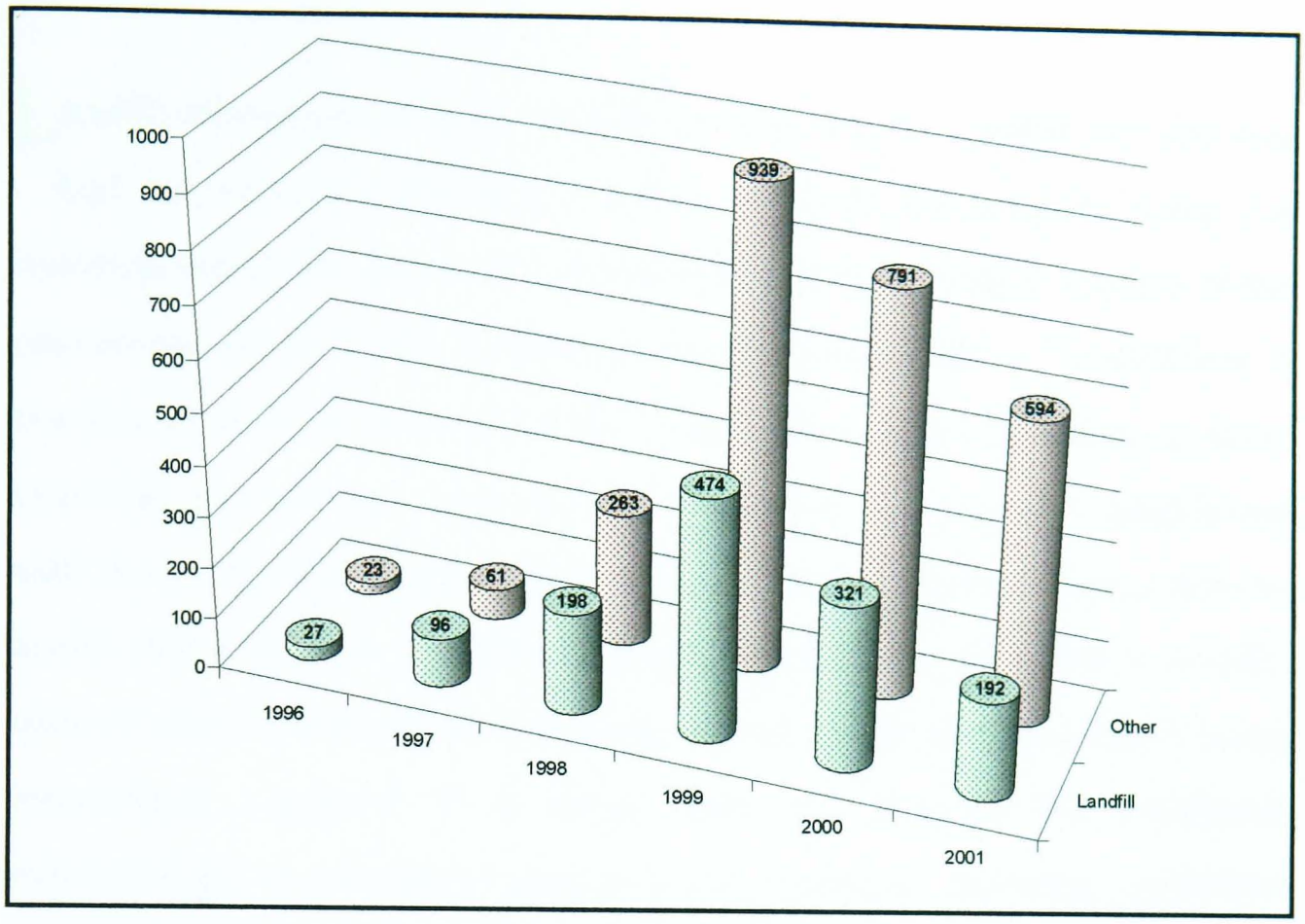
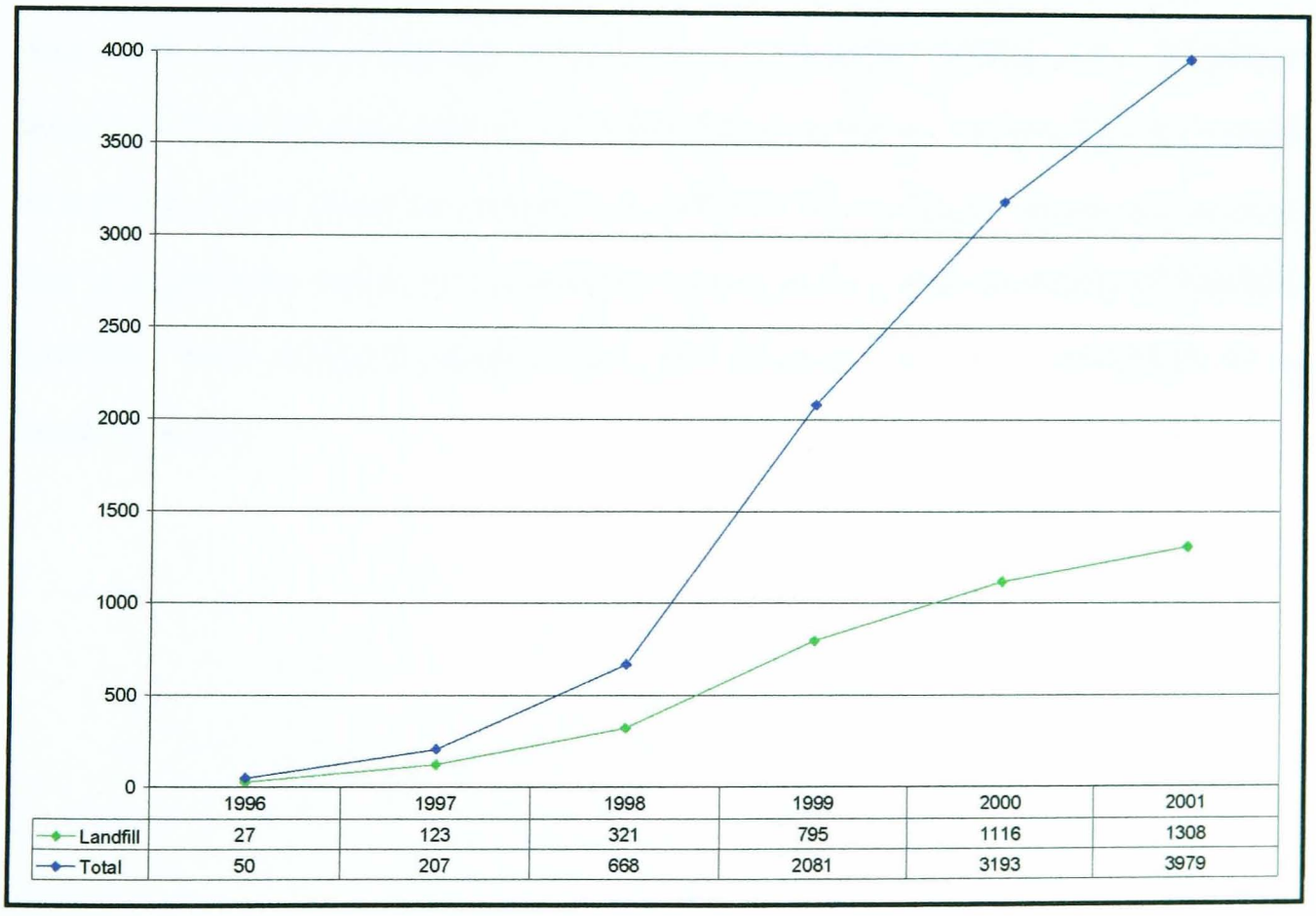


Figure 5.1 The number of CoTC issued by WAMITAB by award type (1996 – 2001) (Data supplied by WAMITAB).



	1996	1997	1998	1999	2000	2001
Landfill	27	123	321	795	1116	1308
Total	50	207	668	2081	3193	3979

Figure 5.2 The cumulative number of CoTC issued by WAMITAB, comparing those issued for landfills against the total awards issued (Data supplied by WAMITAB).

Landfill-related odour is an interesting issue that the landfill industry has had to manage (Case Study Four). It affects the amenity value for residents within the area local to the landfill and is the subject of many of the oppositions raised to the opening of new landfill facilities. The problem is possibly more acute as landfill facilities are now located in less than optimal locations, and society is perhaps less tolerant of the nuisance - heightened with the publication of epidemiological evidence linking landfill emissions to health effects (Elliot *et al.*, 2001). The perception is therefore, that if landfill-related odour is detected harm is being caused. Odour is an area that is being increasingly regulated. It is being dealt with through the traditional methodology of producing guidance for operators, inserting conditions within landfill licences, and addressed by technical fixes from the industry, for example, odour control systems and flaring of landfill gas. It is difficult to discern the cause for the apparent increase in landfill "NIMBYism". Whether residents have become sensitised to landfill operations, or whether the levels of landfill odour have increased, it is difficult to conclude. However, it now has a significant input to the planning-permission and licensing of landfill facilities with implicit commercial consequences for the operation of a landfill facility.

Case Study Four

Landfill Odour

Numerous odour complaints were made against the Trecatti (Merthyr Tydfil, South Wales) landfill owned and operated by Biffa Waste Service Ltd. The source was found to have been mixing 16,000 tonnes of calcium sulphate filter cake (landfilled during 1994 to 1995), with municipal waste despite the fact that there was clear guidance that this practice should not occur (ENDS, 1998*a*). As the municipal waste underwent biological decomposition it reacted with the filter cake and released hydrogen sulphide (ENDS, 1998*a*). The Waste Regulation Authority sought to ban "all sulphur bearing wastes" which was appealed by Biffa Waste Services Ltd. (ENDS, 1998*a*). However, Biffa Waste Services Ltd. eventually voluntarily ceased landfilling the filter cake (ENDS, 1998*a*).

Notwithstanding the ending of that particular disposal route, the waste producer found another landfill prepared to accept the waste stream: 3C's Nant-y-Gwyddon landfill (ENDS, 1998*a*).

3C accepted and deposited 30,000 tonnes of the filter cake during March 1995 to February 1997, approximately eight percent of all waste (ENDS, 1998*a*). The Environment Agency modified the landfill's licence prohibiting the landfilling of wastes containing more than 10 percent calcium sulphate in an attempt to abate odour complaints (ENDS, 1998*a*). Several months later after landfilling the waste, odour problems became apparent and complaints were received from local residents (ENDS, 1998*a*). The landfill facility was blockaded by protesters on the June 4th 1997 who unwittingly exacerbated the situation as engineers were prevented from attending to the facility's gas and leachate management system, and consequently when the flares went out they could not be reignited (ENDS, 1998*a*). The Environment Agency issued another licence modification requiring that the tipping area be covered with a gas impermeable material, and that gas be collected and burnt in high temperature flares, estimated to cost £1.6 million (ENDS, 1998*a*). Additionally, continual monitoring of hydrogen sulphide and hydrogen dioxide, both on- and off-site, was required in order that no gas-associated odour was to be detected beyond the facility cartilage (ENDS, 1998*a*). On the July 25th a High Court injunction was issued and required the maintenance of gas and leachate management systems, and the installation of a whole site gas collection system; the company was also ordered not to "cause or permit" collected gas to be vented to atmosphere (ENDS, 1997). It was not until August 4th 1997 that the Environment Agency stated that the conditions had been met (ENDS, 1997).

The regulation of the landfill industry has followed government guidance and ever tightening regulations, with guidance tending to be aimed at solving specific problems as they have arisen. details the chronological publication of a series of *Waste Management Papers*. It clearly illustrates when problems became apparent within the industry because official intervention was required with the aim of rectification. The regulatory process appears reactionary – punctuated by pollution incidents – before further guidance or amendments to licence conditions were issued. Figure 5.3 illustrates the process that has dominated the regulation of landfill operation.

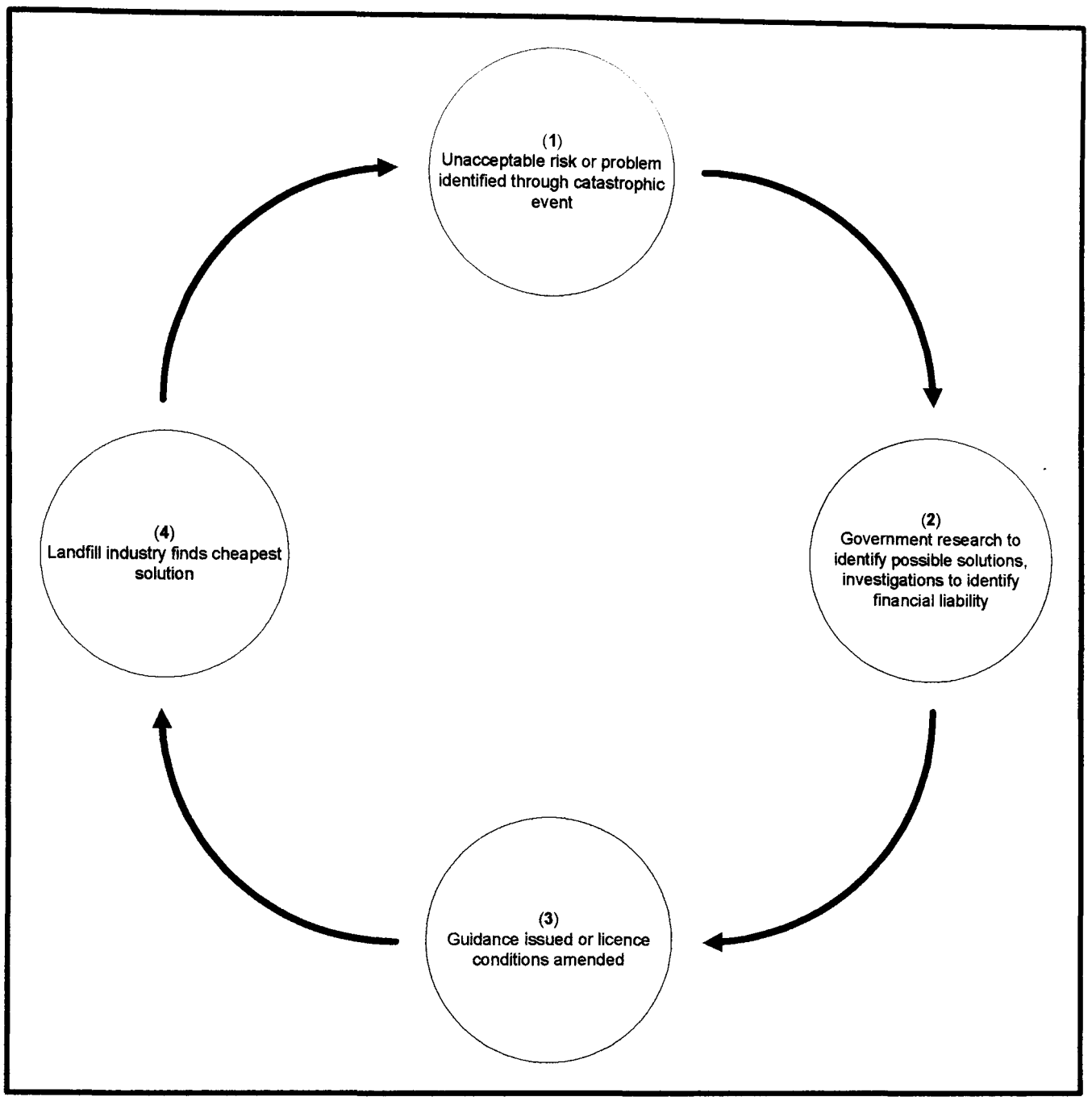


Figure 5.3 Summary diagram of the interactive process of the landfill regulation cycle (Author's work).

5.4 The next generation of landfill licences: the re-licensing of landfills

The Government has two important pieces of legislation to implement in respect of landfill facilities: [1] the Landfill Directive; and [2] the IPPC Directive. The Landfill Directive dictates the standards to which a landfill

facility is designed and operated whilst the IPPC Directive's primary concern is with the management and operation of an installation with the aim of operating with an acceptable environmental level. Additionally, the Landfill Directive is the impetus for the increasingly challenging reduction in the amounts of biodegradable household waste that can be landfilled. In meeting its obligations, the Government has chosen to re-licence all landfills that wish to continue to operate after July 2002. Landfill operators who do not wish to operate their landfills to the new standards will have to cease accepting waste. A risk-based approach has been taken by the Environment Agency for the re-licensing process. This process began in June 2003 and will conclude with the landfills that pose the lowest risk to the environment by 2007. This timetable was chosen by the Government within the bounds of the IPPC Directive to achieve the longest possible implementation period (DEFRA, 2000).

All landfills will have to meet the requirements of the Landfill Directive.

Landfill facilities that accept more than 10 tonnes of waste per day or with a total capacity greater than 25,000 tonnes will have to meet the additional requirements of the IPPC Directive. The whole process is somewhat complicated by the fact that some landfills will be regulated under different eras of licensing according to when individual cells ceased accepting waste, and how connected they are to other parts of the facility. It is a position that remains unclear as many of the decisions are have yet to be made (March 2002).

The IPPC Directive *inter alia* dictates the way processes are operated, specifically with regard to emissions that are released into the environment. This is achieved with regard to European-wide guidance (Best

Available Techniques Reference (BREF) Documents) detailing the "Best Available Techniques" for a particular industrial sector. However, for the landfill sector, a BREF Document has not been produced and landfills still have to operate in accordance with the Landfill Directive.

The Landfill Directive was agreed in Europe on April 26th 1999 and the final text published in Europe's Official Journal in July 1999 (CEC, 1999); it had to be transposed into national legislation by July 16th 2001. However, the Government has failed to comply and, in August 2001, it stated that further consultation with stakeholders was necessary to implement the Directive "effectively and efficiently" (DEFRA, 2001). Confusion therefore prevails, all material cites 2001, and the Environment Agency, landfill operators, and waste producers are trying to infer the content of the final guidance and how the Directive will be implemented.

Many of the Landfill Directive's regulatory requirements are similar to those already in operation in England and Wales under the Waste Management Licensing Regulations 1994 (WMLR) (SI 1994/1056), as amended. The key changes to current practices are:

[1]. The separation of landfills into three types:
   a. hazardous;
   b. non-hazardous; and
   c. inert;
[2]. The requirement to treat most wastes prior to disposal to landfill;
[3]. A ban on the disposal of certain wastes to landfill, for example liquid waste, certain hazardous wastes, and tyres (see); and
[4]. Higher standards of engineering controls.

At the time of writing, landfill operators have had to complete a Site Conditioning Plan (SCP) that had to be submitted to the Environment Agency by July 2002. The Site Conditioning Plan informed the Environment Agency of the operator's intention in respect of continuation and class of operation after July 2002.

> "...the Environment Agency will prioritise their detailed consideration of the plans so that those sites which either seek closure, or which at the high level sift, appear unable to meet the requirements of the directive are considered first followed by the rest in a rolling programme based upon the risk they pose" DEFRA (2000, para. 2.7).

The main impact in the United Kingdom of the site classification procedure will be upon those facilities currently operating as co-disposal facilities; a practice that has been common in the United Kingdom for many years (Case Study One). The Landfill Directive specifically seeks to end co-disposal (by July 2004) and the prohibition of specific other wastes from landfill (Table 5.3). The options for co-disposal facilities are outlined in Table 5.4. Option 2 is more favourable towards the practise of co-disposal, allowing it to continue in the United Kingdom for as long as possible; additionally, Option 2 would permit the legal acceptance of non-hazardous liquid waste. From July 2002 the "interim classified" sites had to comply with the waste acceptance criteria and procedures laid out in the Landfill Directive for all "hazardous" wastes. Additionally they had to cease accepting banned wastes after July 2002.

	New sites	*Existing Hazardous sites*	*Existing Non-hazardous sites*
Liquid waste	July 2001	July 2002	July 2002 – 2007[1]
Explosive	July 2001	July 2002	July 2002[2]
Corrosive	July 2002	July 2002	July 2002[b]
Oxidising	July 2002	July 2002	July 2002[b]
Highly flammable	July 2002	July 2002	July 2002[b]
Flammable	July 2002	July 2002	July 2002[b]
Infectious hospital or clinical waste	July 2001	July 2002	July 2002[b]
Whole used tyres[3]	July 2003	July 2003	July 2003[4]
Shredded tyres[5]	July 2004 (Hazardous) July 2006 (Non-hazardous & Inert)	July 2004[6]	July 2006[d]
Any other waste not fulfilling acceptance criteria	July 2001	July 2002	July 2002 – 2007[a]
End of Co-disposal	July 2001	July 2004	July 2002

Table 5.3 Waste banned from landfills. The only mechanism for banning certain wastes from existing landfills is with the issuing of the new permit: a rolling process decided for individual facilities on the basis of risks, and to be achieved before the Landfill Directive's deadline of 2007 (CEC, 1999; DEFRA, 2000; DEFRA, 2001).

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[1] For an individual site the ban will be effective when the site receives a PPC permit.
[2] These substances are hazardous waste, any site taking these wastes in July 2002 will be classified as a hazardous waste site, the bans apply to hazardous waste sites in July 2002 and therefore these substances cannot be landfilled at any site beyond July 2002.
[3] Excludes tyres used as engineering material and bicycle tyres and tyres with outside diameter above 1,400mm.
[4] For an individual site the ban will come into effect when the site receives a PPC permit but no sooner than July 2003 (whole tyres) and 2006 (shredded tyres).
[5] Excludes tyres used as engineering material and bicycle tyres and tyres with outside diameter above 1,400mm.
[6] A hazardous waste site can only accept hazardous waste after July 2004; tyres are not hazardous waste.

Current operation	*Option 1*	*Option 2*	*Option 3*
Hazardous (co-disposal)	Cease to accept hazardous waste after July 2002 and reclassify as non-hazardous	Seek interim classification as hazardous until July 15th 2004 with re-classification as non-hazardous after that date	Cease to accept non-hazardous waste after July 2002 and reclassify as hazardous

Table 5.4 Options for the re-classification of current co-disposal facilities. These facilities are likely to experience significant challenges due to the ending of co-disposal, and the operators' wish to retain the status quo for as long as possible. The 2004 date is tentative and it may not be until 2006 when the Environment Agency finally issues permits (Author's compiled summary).

For current inert or non-hazardous waste facilities, the implications of facility classification are not so onerous. Landfills classifying as "non-hazardous" are able to accept municipal, inert, and hazardous waste stabilised through solidification or vitrification as long as they are not disposed of in the same cell as other wastes. Landfills classifying as "inert" waste facilities can accept only a limited range of waste, for example, waste glass, concrete, bricks, tiles, and ceramics; this is similar to current legislation in the United Kingdom. Whilst the above considers the re-classification of a whole facility,

> "It is the Government's initial view that, provided the two (or more) landfills could be properly regarded as completely separate landfills, with complete engineered separation between the landfills and, as far as is possible, separate management of the sites, along with separate landfill permits for each site, this could be permissible" DEFRA (2000, para. 4.23).

In the Department for Environment, Food and Rural Affairs' (DEFRA) second consultation document, published in August 2001, clarification was

sought on the banning from landfill of certain wastes. The Government explained thus,

> "...the Directive requires some of these bans to be implemented 'as soon as possible' and no later than 2009. 2009 is not, therefore, a target date but is an absolute cut off and the real requirement is 'as soon as possible'" DEFRA (2000, para. 10.2).

If the Government upholds this view, the United Kingdom landfill industry is likely to suggest that the Government is over-enforcing or "gold-plating" the Landfill Directive's requirements because other Member States are working to the 2009 date.

The problems caused by the Landfill Directive are not only affecting the landfill sector but also their customers. Producers of certain categories of waste will face significantly higher disposal costs as landfill becomes prohibitive as a disposal option. The greatest impact is likely to be on the producers and disposers of corrosive wastes, liquid wastes, and waste tyres. A report by the Babtie Group (2000) indicated that approximately 540,000 tonnes of liquid waste and 290,000 tonnes of waste containing a banned hazardous substance would require alternative treatment. Additionally 50 – 60,000 tonnes of liquid waste will have to be solidified (Babtie Group, 2000). Currently there are not enough incinerators to handle this volume of waste (Babtie Group, 2000), and more will have to be constructed.

5.5 The re-licensing process: how the landfill industry is responding: issues examined through interviews with landfill operators

The work above has relied upon theoretical arguments and documentary research in gaining an understanding of the landfill industry, and how regulation shapes the industry's operations. The following section is the result of interviewing a number of landfill managers and employees within landfill companies. Interviews have been conducted in order to gain an understanding of the issues and problems that re-licensing poses from an industry perspective. These interviews were essential in order to understand the culture of the landfill industry.

A range of landfill managers from different sizes of landfill facilities accepting different wastes were interviewed (Table 5.5 - Table 5.11). Furthermore, within the larger operating companies, staff with responsibility for overseeing the implementation of PPC and the re-licensing of the company's landfills were interviewed (Table 5.12). Supplementing the opinions of the waste industry, employees of the Environment Agency were also interviewed in an attempt to appreciate their standpoint (Table 5.12).

Facility	*Co.*	*County*	*Licence type*	*Employees*
Alpha	*I*	Lincolnshire	Co-disposal	11
Bravo	*I*	Cheshire	Co-disposal	17
Charlie	*I*	Lancashire	Co-disposal	9
Delta	*II*	Yorkshire	Non-hazardous	2
Echo	*III*	Yorkshire	Co-disposal	3
Foxtrot	*III*	Lincolnshire	Co-disposal	4
Golf	*III*	Lincolnshire	Co-disposal	4
Hotel	*IV*	Essex	Co-disposal	21
India	*V*	Hertfordshire	Co-disposal	14
Juliet	*VI*	Yorkshire	Inert	1
Kilo	*VII*	Yorkshire	Inert	1
Lima	*IX*	Lincolnshire	Non-hazardous	2
Mike	*VIII*	Somerset	Non-hazardous	4
November	*VIII*	Somerset	Hazardous	4

Table 5.5 General information on the landfill facilities from which interviewees were selected and visits were made (Author's work).

Facility	*Co.*	*Age of interviewee*	*CoTC - YES / NO*	*Background*
Alpha	*I*	35 – 40	YES	Engineering
Bravo	*I*	35 – 40	YES	Engineering
Charlie	*I*	35 – 40	YES	Waste
Delta	*II*	50 – 55	NO	Waste
Echo	*III*	45 – 50	YES	Construction
Foxtrot	*III*	45 – 50	NO	Waste
Golf	*III*	35 – 40	YES	Waste
Hotel	*IV*	50 – 55	YES	Waste
India	*V*	35 – 40	YES	Waste
Juliet	*VI*	50 – 55	NO	Aggregates
Kilo	*VII*	50 – 55	NO	Construction
Lima	*IX*	45 – 50	NO	Waste
Mike	*VIII*	45 – 50	YES	Waste
November	*VIII*	50 – 55	YES	Waste

Table 5.6 Information on those who were interviewed during this research and the landfill facility that they were from (Author's work).

Facility	*Co.*	*Type of company*	*Operating area*	*No. of licences held*	*Ultimate ownership*	*Typology of business*
Alpha	*I*	TWMC[1]	National	57	PLC.	Large
Bravo	*I*	TWMC	National	57	PLC.	Large
Charlie	*I*	TWMC	National	57	PLC.	Large
Delta	*II*	LO[2]	Local	2	Ltd.	Small
Echo	*III*	TWMC	National	18	Ltd.	Medium
Foxtrot	*III*	TWMC	National	18	Ltd.	Medium
Golf	*III*	TWMC	National	18	Ltd.	Medium
Hotel	*IV*	TWMC	National	20	Ltd.	Large
India	*V*	TWMC	National	20	PLC.	Large
Juliet	*VI*	LO	Local	1	Ltd.	Small
Kilo	*VII*	LO	Local	5	Ltd.	Small
Lima	*IX*	LO	Regional	17	Ltd.	Medium
Mike	*VIII*	TWMC	Regional	5	Ltd.	Medium
November	*VIII*	TWMC	Regional	5	Ltd.	Medium

Table 5.7 General information on the landfill facilities from which interviewees were selected and visits made including a classification of typology of the business (Author's work).

[1] Total Waste Management Company.
[2] Landfill Operator

Facility	*Co.*	*Waste landfilled*							
		MW[1]	IW[2]	SW[3]	SLW[4]	NSLW[5]	C&DW[6]	DW[7]	GEW[8]
Alpha	*I*	✓	✓						
Bravo	*I*	✓		✓	✓	✓			
Charlie	*I*	✓		✓					
Delta	*II*	✓							
Echo	*III*	✓							
Foxtrot	*III*	✓							
Golf	*III*	✓							
Hotel	*IV*	✓		✓	✓	✓			
India	*V*	✓		✓	✓	✓			
Juliet	*VI*		✓				✓	✓	
Kilo	*VII*		✓				✓	✓	
Lima	*IX*	✓							
Mike	*VIII*	✓							✓
November	*VIII*	✓		✓	✓	✓			

Table 5.8 Information on the waste types accepted and landfilled, according the facility's license type, at the landfill facilities from which interviewees were selected and visits made (Author's work).

[1] Municipal Waste
[2] Inert Waste
[3] Special Waste
[4] Special Liquid Waste
[5] Non-Special Liquid Waste
[6] Construction & Demolition Waste
[7] Dredging Waste
[8] Gulley Emptying Waste

Facility	*Co.*	*Landfill gas management techniques*		*Electric generation*
		Flared	Passive Vent	
Alpha	*I*	✓		NO
Bravo	*I*	✓	✓	YES
Charlie	*I*	✓		YES
Delta	*II*	✓	✓	NO
Echo	*III*	✓	✓	NO
Foxtrot	*III*	✓		NO
Golf	*III*	✓		NO
Hotel	*IV*	✓	✓	YES
India	*V*			YES
Juliet	*VI*	Inert Waste Landfill		NO
Kilo	*VII*	Inert Waste Landfill		NO
Lima	*IX*			NO
Mike	*VIII*		✓	NO
November	*VIII*	✓		NO

Table 5.9 Information on how landfill gas is managed at the landfill facilities visited and included in this research (Author's work).

Facility	*Co.*	*Leachate management*			
		Re-circulated Flushing Bioreactor	*Treated on-site and discharged to sewer*	*Treated off-site at sewage treatment plant*	*Attenuation Dilute & Disperse*
Alpha	*I*	✓			
Bravo	*I*		✓	✓	
Charlie	*I*			✓	
Delta	*II*			✓	✓
Echo	*III*		✓	✓	
Foxtrot	*III*		✓	✓	✓
Golf	*III*		✓	✓	
Hotel	*IV*		✓		✓
India	*V*	Informed that has no leachate ?			
Juliet	*VI*	Inert Waste Landfill			
Kilo	*VII*	Inert Waste Landfill			
Lima	*IX*			✓	
Mike	*VIII*			✓	
November	*VIII*		✓	✓	

Table 5.10 Information on how the leachate is managed at the landfill facilities visited and included in this research (Author's work). The idea behind a flushing bioreactor is that the leachate is continual re-circulated to enable a faster breakdowns and ultimate stabilisation of the waste for restoration. The leachate would then be taken off-site for treatment and disposal. A facility based upon the principles of attenuation utilises the surrounding soil's properties to scrub effectively the leachate of contaminants as it passes through with the aim that the leachate would be of acceptable standards to not cause pollution – this is an old practice that is no longer acceptable.

Facility	*Co.*	*System for environmental management*	
		YES / NO	If "YES" is it ISO 14001 / EMAS / Neither
Alpha	*I*	YES	ISO 14001
Bravo	*I*	YES	ISO 14001
Charlie	*I*	YES	ISO 14001
Delta	*II*	NO	
Echo	*III*	NO	
Foxtrot	*III*	NO	
Golf	*III*	NO	
Hotel	*IV*	YES	Neither
India	*V*	YES	Neither
Juliet	*VI*	NO	
Kilo	*VII*	NO	
Lima	*IX*	NO	
Mike	*VIII*	YES	Neither
November	*VIII*	YES	Neither

Table 5.11 Information on the presence of a system used to manage the landfill facility's environmental impact (Author's work).

Contact number	*Employed by*	*Details of responsibilities*
①	Company *I*	Landfill Alpha Environmental Compliance Advisor
②	Company *I*	Company Regional Environmental Manager
③	Company *V*	Company Technical Waste Manager – responsible for IPPC implementation
④	Company *IV*	Company Technical Waste Specialist
⑤		Special Waste Consultant
⑥	Company *IV*	Company Head of Technical Waste
⑦	Environment Agency	IPPC Regional Manager
⑧	Environment Agency	(Regional) Waste Regulation Manager
⑨	Environment Agency	(Local) Environmental Protection Officer

Table 5.12 Details of other selected interviewees (Author's work).

Guidance to the operator in making an application for a permit to operate a landfill facility under the Pollution Prevention & Control (England and Wales) Regulations 2000 (SI 2000/1973), as amended, was obtained from the Environment Agency. This document "*Guidance for the landfill sector: technical requirements of the Landfill Directive and Integrated Pollution Prevention & Control (IPPC)*", has been used to provide a structured approach to the chapter in examining the ways in which landfill operators are responding to the requirements of the Regulations.

5.6 Management

The sphere of management techniques has two important aspects: [1] competence of the operator; and [2] the system of management. Contained within *Guidance for the landfill sector: technical requirements of the Landfill Directive and Integrated Pollution Prevention & Control (IPPC)*, the following requirements and guidance are offered by the Environment Agency,

> "It is a requirement that the management of the landfill site is controlled by a person who is a "Fit and Proper Person". This includes a component whereby the management of the specified waste management activity that is or is to be carried out is in the hands of a technically competent person.
>
> In addition to this requirement, an effective system of management is a key technique for ensuring that all appropriate pollution prevention and control techniques are delivered reliably and on an integrated basis. The Regulators strongly support the operation of environmental management systems (EMSs). An Operator with such a system will find it easier to complete not only this section but also the technical/regulatory requirements in the following sections.
>
> The Regulators recommend that the [International Organisation for Standardisation] ISO 14001 standard is used as the basis for an environmental management system" Environment Agency (2001, pp.15).

5.6.1 Competence of the operator

Historically there has been resistance by some within the landfill industry towards the requirement that management become 'qualified' through the CoTC system (Figure 5.1 & Figure 5.2). The Environmental Services Association said,

> "Why should experts employed in the waste management industry be forced to complete a needless and time consuming paper chase? ...Other sectors such as the chemical industry have not had such a bureaucratic system imposed" ENDS (1998*b*, pp. 11).

Although exceptions have been granted in the past, re-licensing will require a significant increase in the number of CoTC qualified managers. Additionally, provisions to circumvent this requirement within the Waste Management Licensing Regulations 1994 (WMLR) (SI 1994/1056), as amended, will be unacceptable under the new licensing regime. There is also the requirement that the training be ongoing as opposed to training in order to gain a qualification. These requirements will also be extended to additional categories of staff employed at a landfill facility.

There are clear cost and time implications for a manager having to be put through the CoTC system. WAMITAB suggested that an individual CoTC,

> "...would take about 5 days of assessment spread over 6 – 18 months typically for each candidate to gain the VQ [Vocational Qualification] and CoTC...Each day of assessment might cost between £350 - £400" WAMITAB, (undated).

Therefore, costs would be in the region of £1,750 - £2,000 for an individual manager to gain a CoTC, and even the larger waste management companies with in-house training and assessment, expected the costs to be in the region of £1,500 (Contact ①). It is interesting to note that several of the larger waste management companies have minimised past requirements for CoTC management through having a single, qualified manager, overseeing more than one facility. The Environment Agency has responded to this with a degree of scepticism over the apparent workloads individual managers have had (Contact ⑧) which will be more closely monitored under the new licensing regime.

All the managers interviewed, except the manager of Landfill Juliet, had a relevant CoTC for the facility that was being managed. The manger of Landfill Juliet came under the deemed competency clause of the regulations and was considering closing the facility before re-licensing started. The manager at Landfill Alpha suggested that if one of their facilities did not have a suitably qualified manager then the company would explore the possibility that an individual manager could oversee more than one facility. In fact, this situation did occur during a transition period when the current manager was promoted and was employed at another of the company's landfills. Through working the system in this way, the company could chose when it needed to engage in training and train a number of managers together thus reducing costs. Further, these companies had then progressed to develop their own in-house training facilities (accredited by WAMITAB) to assist in training the company's landfill managers. These larger landfill-operating companies additionally benefited from having qualified managers able to assist those seeking qualification within the company. Overall, these

companies appeared to accept the requirement, and were equally able to manage its implementation. These same companies suggested that they were unconcerned with either the subtle change in the regulations removing the deemed competence clause, or with the requirements to engage in the training of more than managerial employees. This view was different from the managers of Landfill Juliet and Kilo who saw training rather negatively and as having a "...significant impact upon the commercial viability of a smaller site". The manger at Landfill Kilo expressed an opinion that it was "...like teaching your grandmother to suck eggs", and this remark was further qualified as like "...going back to school to be taught how to run a site that I have been running for years now without a hint of trouble". However, it was not possible to corroborate this statement, and there may have been a difference between "concern" as viewed by the manager and the Environment Agency. There are clearly differing views about the impacts of the need and the feasibility to engage in training; these tended to vary with the size of operation. Larger landfill operators may have responded to the question more positively as they believed that it demonstrated a cultural shift, and a more positive attitude, away from the negative 'cowboy' image that landfill operators once had.

5.6.2 Environmental Management Systems

The regulator has toyed with the idea of using the presence of a certified environmental management systems (cert. EMS) in the past as an indicator of the possible environmental risks posed by the management of a firm (see Chapter 4). The view expressed in the document, *"Guidance for the landfill sector: technical requirements of the Landfill Directive and Integrated Pollution Prevention & Control (IPPC)"*, appears to be pushing the operator

towards implementing a cert. EMS certified to the Eco-Management and Audit Scheme (EMAS) standard. Although the ISO standard of 14001 is acknowledged, the Environment Agency remains of the opinion that the EMAS standard is preferable.

Landfill Alpha, Landfill Bravo, Landfill Charlie, Landfill Hotel, and Landfill India all had an ISO 14001 cert. EMS; and the operating company of Landfill Hotel and Landfill India were aiming to accredit all its facilities to that standard. Considering it takes time and money to introduce such a system, why, were these companies introducing cert. EMSs? An underlying reason, discovered during the interviews, relates to the introduction of the Environmental Protection (Duty of Care) Regulations 1991 (SI 1991/2839). Landfill operators of facilities certified to the ISO 14001 standard used it as a marketing tool, it "looked good" to the customer and "...the customer was able to say that their waste was going to a responsible landfill operator who managed a well run site". There appear supply-chain pressures that the company supplying waste disposal services should, if the waste producing company has a cert. EMS, have one too. Additionally, the waste management companies have sought publicity, promoted, and marketed the achievement of certification. Cert. EMSs appear another mechanism by which some landfill operators were trying to distance themselves from landfill's bad image, from other 'cowboy' operators, and to seek competitive advantage.

Whilst the Environment Agency's reasoning is that such systems assist the better management of the environmental impact of a landfill facility, it was difficult to verify this benefit during the interview process. Overall, the landfill managers omitted to cover this aspect. The exception was the manager at Landfill India who specifically suggested that, "...the system

helped with the paperwork needed in running my landfill site". However, Landfill Mike, and Landfill November (operated by the same company) both had their own system in place to manage the facility, which included its environmental impact. These systems appeared to be geared towards assuring data was collected and recorded in accordance with licence conditions. These management systems did not encompass the wider remit of the ISO 14001 or EMAS certified system standards. It is evident that the presence of an environmental management system, certified or otherwise, does not necessarily indicate that a landfill facility is being operated in accordance with licence conditions, or that its environmental impacts are being adequately managed.

The other facilities did not have an environmental management system, but still appeared organised, systematic, and methodical. When asked if they intended to implement an ISO 14001 or EMAS cert. EMS, they said that there were no plans as yet to do so. They reasoned that they had an organised management style and were capable of meeting the re-licensing requirements without having to put together a cert. EMS. What was interesting to note, was that although the Environment Agency suggests that there is a regulatory incentive to adopting a cert. EMS, none of the managers made any specific reference to an advantage being obtained in that way.

5.7 Emissions management

In the operating of a landfill facility, there is the potential to release a range of polluting emissions to both air and water. For example, waste placement gives rise to odours, leachate is produced as the waste undergoes biological

decomposition, and methane and carbon dioxide can be released into the atmosphere, *etc.* These comprise both point-sources and diffuse-sources, the former being easier to control and the focus of tightening regulations under the Landfill Directive. The other significant BAT requirement is that landfill gas should be used to generate energy where it is economically possible to do so (Environment Agency, 2001).

New landfill facilities and new cells at existing landfill facilities have to be engineered to higher standards; specifically the liners must achieve reduced rates of permeability than at present. Whilst operators have experience of meeting new engineering specifications, this movement towards lower permeability will add to operational costs and increase the level of capital investment required to enter into the landfill business. This will undoubtedly deter some entrepreneurs.

The managers interviewed suggested that the more stringent construction conditions would indeed increase engineering costs, and that this cost would inevitably have to be passed to the customer. Unusually the manager of Landfill Hotel said that at his landfill there were no cells and therefore no liner! This was because the location had been used to accept waste since the late 1800s and had progressively become the present facility still working on the now out-dated concept of a dilute and disperse landfill. The manager explained that, "...leachate drains naturally over a five year period to an outlet at the lower side of the site" and that,

> "...recently we have installed a small treatment facility, but most of the leachate cleaned itself within the waste, and all that is needed is a top-up process before discharging to a very handy creek that entered the

> estuary...[and they] intended not to engineer cells and if the Environment Agency were bloody minded on this then they would fight them".

It appeared that the facility had a limited lifespan and would cease taking special liquid waste, but would possibly continue to take non-special liquids for as long as it could. This is an interesting remark as it signifies the intention of a well-resourced waste management company to think about challenging the actions of the regulator. Notwithstanding this, the operating company had invested heavily in technology to meet regulatory requirements but crucially important to them was that this investment would give the company an advantage in being able to accept waste that other facilities could not.

There are new requirements contained within the re-licensing procedure that are wider in scope and necessitate risk-assessments to be made, for example, to "Provide an assessment of the risks posed by the landfill leachate" Environment Agency (2001, pp. 30). This requirement when considered in its environmental context is quiet broad. However, whilst the larger landfill operators are likely to be able to engage consultants to complete this information for their respective applications, it may prove more challenging for the smaller operator who may lack the knowledge and resources to perform this wider assessment.

The Landfill Directive specifically seeks the use of landfill gas for energy production wherever possible,

> "Landfill gas shall be collected from all landfills receiving biodegradable waste and the landfill gas must be treated and used. If the gas collected cannot be used to produce energy, it must be flared" Environment Agency (2001, pp. 34).

This is a change from current practice where the operator instigates when, and if, energy production should be a part of the landfilling operation. It marks a significant departure away from flares and passive venting. However, Contact ③ suggested that as,

> "...liquid wastes were being banned, gas production would take longer, affecting the economics of energy generation to a stage where it would not be economical to generate energy for a much longer period and flaring would increase above current levels... [and as a company they were] reliant upon their consultants to put together a good argument for the continuation of flaring where they did not consider it economically feasible to generate energy".

Landfill Alpha, Landfill Bravo, Landfill Hotel, and Landfill India were generating electricity because they believed it was economically viable. However, although the primary stand-by flare at Landfill Bravo would meet the guidelines for temperature and retention times, some smaller flares would possibly require upgrading. This area of flare design and specification is particularly unclear as the Environment Agency has yet to produce the necessary Technical Guidance Notes. A similar position applies for the permissible emissions from landfill gas engines. Whilst it is the Environment Agency's intention that energy should be produced from landfill gas, the proviso that it should be economically viable may allow many operators to claim exception. However, there appears to be a genuine concern within the industry as the manager of Landfill India and Contact ③ both concurred on the view that,

> "...the requirements to reduce the quantity of biodegradable waste landfilled would impact upon the economics of energy production, we will have to take a long-term view as to whether, in many cases, it will be

economical to produce electricity, or if we will continue to flare the gas produced".

Whilst it is relatively easy to manage and regulate point-sources of emissions (for example using gas collection systems, flares, tighter emission standards for flares, and covers for leachate treatment plants), diffuse-sources are more difficult both for the operator to control and for the Environment Agency to regulate. The control, management, and regulation of landfill-odour is one such example. Figure 5.4 illustrates the diversity of potential odour sources on a landfill facility. Indeed, odour has been the remit of the Local Authority under common law and statutory nuisance, the skill-base to regulate odour is probably absent from the Environment Agency.

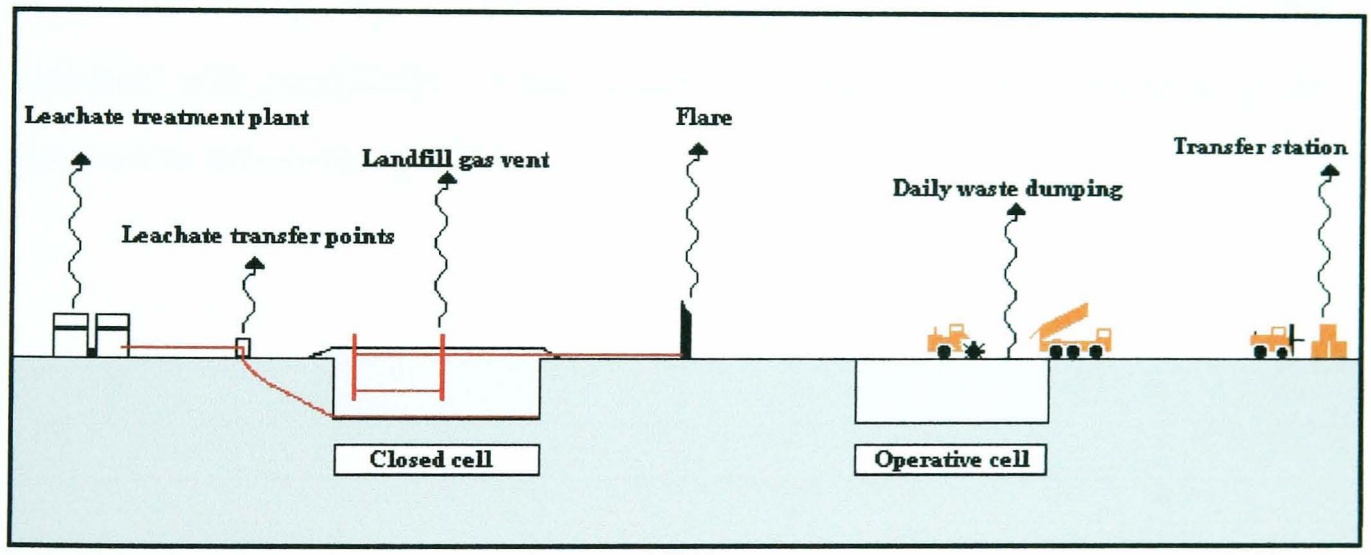

Figure 5.4 A diagram of the sources of potentially detectable odour at a typical landfill facility (Author's work).

Odorous emissions are a natural aspect of the landfilling of waste but the problem is one of receptor and source location. If the population were not there to detect the odour, it would not be a problem and there would be no need for control. An in-depth study at Landfill Alpha, part of a University of Hull research project on the causes and controls of landfill-related odour, has provided a unique insight into the difficulties involved in understanding and controlling this particular emission.

Whilst the mechanisms of odour detection appear to be relatively well researched and understood, the subjective nature of offensiveness proves more difficult. This process is individual and based upon many historical experiences building an individual's own tolerance and perception. Further, this process is subject to a number of physical controls such as age, adaptation, and habituation to the odour source (see Köster (1994) for a full discussion). This would account for why operatives at a landfill facility report not being able to detect the odour. Figure 5.5 tries to show the number, and complexity of the stages involved from the formation of an odorant to action being taken.

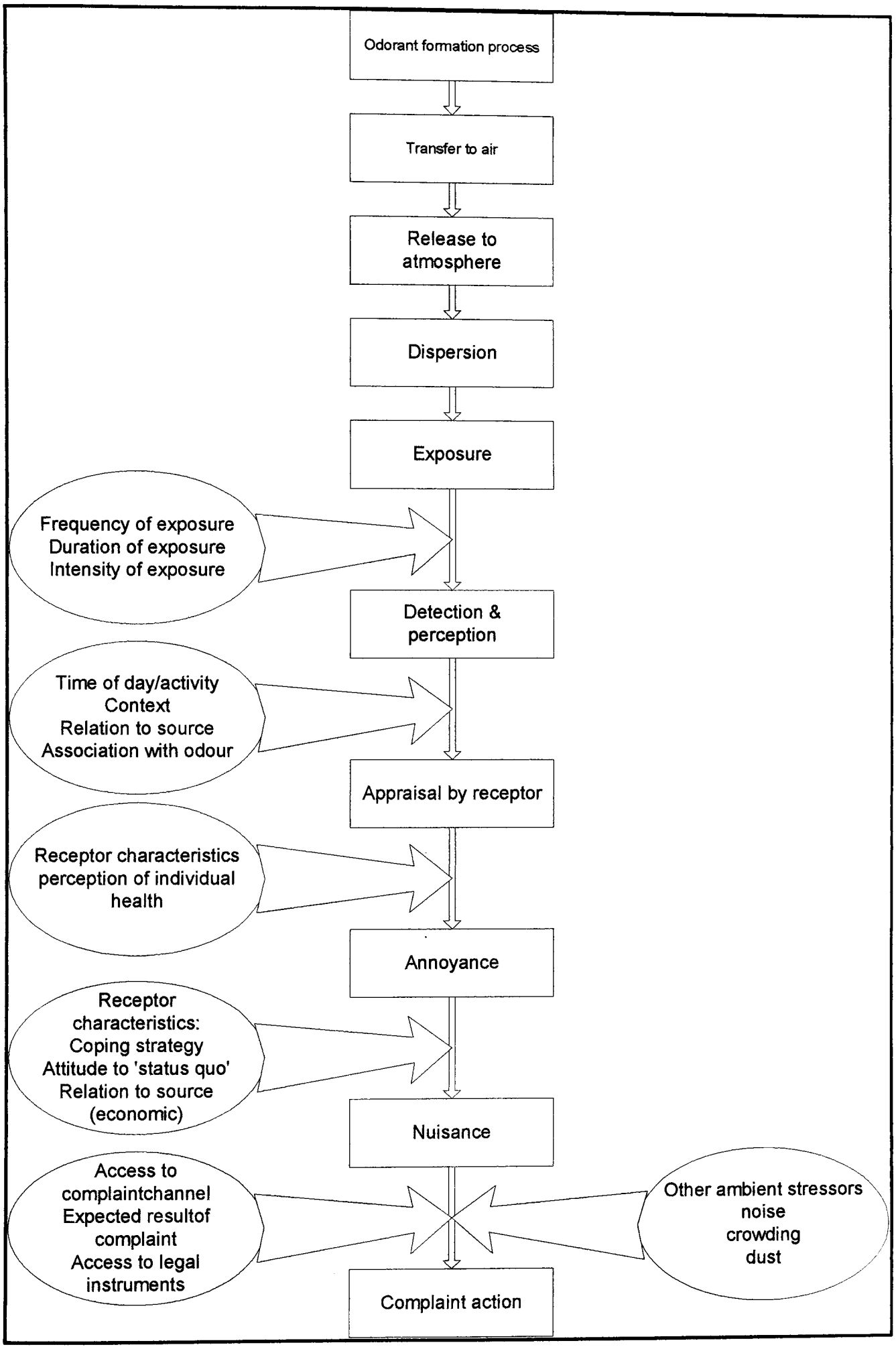

Figure 5.5 The pathway of odour from release to complaint action (Author's work).

There is limited knowledge of the chemical characteristics of odorous material, the driving force behind their transportation off-site, and any readily field operational measurement techniques. Electronic noses appear unable to detect individual constituents of a potential odour to a level that is comparable to that detected by the nose; an instrument costing about £60,000 was tested at the University but was found not to produce reproducible results (Hynds, personal communication). Without the technical ability to define odour levels and remove the subjectiveness for both complainee and investigator, odour units are used as an alternative. An odour sample is collected through, for example, a Tedlar bag within an airtight vessel The surrounding airspace is evacuated and the odorous air is drawn into the bag. The sample is then analysed by subjecting the odorous air to an olfactory panel of eight people. Personnel are selected if they can detect a standard concentration of n-butanol. An odour unit value is then assigned where one odour unit is equal to the number of dilutions with odourless air required to bring the sample to a concentration where only half the panel are still able to detect an odour.

The industry has embarked upon a number of approaches in order to show it is managing its odorous releases during both the planning and the operational phases of the facility's life. Odour models, based upon odour units, are submitted with planning applications to demonstrate that a nearby population will not be subjected to unreasonable levels of odour. However, this technique is expensive and the models used to predict dispersion are simplified, often not accounting for the physical properties of airflow and terrain interaction, and relying upon the concept of odour units rather than the physical properties of substance dispersion. For many pollutants there are air quality standards expressed in terms of the maximum permitted,

mean, worst hour, or 98 percentile concentrations (Simms *et al.*, 2001). These are difficult to transpose directly to odour problems in the field. Accepted odour criteria include, "that odour should not be detectable at a plant boundary", or conditions stipulating odour unit values for a certain period (Simms *et al.*, 2001). For example, a level of 5 or 10 odour units which can be exceeded for no more than two percent of the time (175 hours of the year in some cases)) (Simms *et al.*, 2001).

Setting an environmental exposure criterion with a view to avoiding odour nuisance is not only a scientific but also a political process (OdourNet UK Ltd., 2000). The obligation to avoid nuisance is met increasingly through using quantitative exposure limits, a practice that has been recognised in planning enquiries as a suitable approach to avoid nuisance. This quasi-scientific process has considerable implications for landfill operators. It is believed that an extension to Landfill Bravo was refused at the planning stage due to the alleged number of odour complaints and apparent inability to manage the facility's odour releases. The implication resulting from this decision was that the site will have to cease accepting waste in approximately two years compared with the proposed decade.

Whilst facilities are in operation, a number of odour control techniques are deployed:

[1]. The use of an odour control system;
[2]. Increasing gas extraction; and
[3]. The adoption of best waste management practice.

Odour control systems produce a fine mist of proprietary chemical mixed with either air or water; there are two types of product available: those that

claim to neutralise the odour or those that mask the odour. Odour control systems are placed around the facility boundary such that odorous material flows through the system before it reaches the receptor. Such a system was in operation at Landfill Alpha. A number of proprietary chemicals were tested in the system and it was found that none completely abated landfill-related odours being detected by the human nose, although some performed better than others did. It is worth noting that some within the industry have suggested that,

> "...whilst misting systems may reduce the impact of waste generated odours, they are ineffective against the majority of odour problems derived from LFG" Karnik & Parry (in press).

In practice, control systems rarely work and end up being used only because the Environment Agency "...likes to see them in use", as was suggested by the managers at Landfill Alpha, and Landfill Bravo. Nevertheless, whilst some managers suggest that they are doing all that is possible to minimise the impact of landfill-odour there does appear a gap between management theory and worker practice. Best waste management practice suggests that odorous material should be covered as soon as it placed in the active cell. In spite of this, the practice was not followed at Landfill Alpha on repeated occasions.

The larger waste management companies appear to be more proactive and engage in open dialogue with residents (Landfill Alpha; Landfill Bravo; Landfill Charlie; and Landfill India) in an attempt to appease them and work around concerns. For example, the manager at Landfill Alpha meets regularly with the residents of a nearby village who have formed an action group, and has invited them to visit the facility. In contrast, the smaller

independent operators appear to be less concerned about their relations with nearby residents being primarily concerned with the landfilling operation and viewing odours as a natural by-product of the process. Landfill Delta in the past had had its licence suspended by the Environment Agency because of odour-related complaints received from residents in the nearby village. The facility's odour control system, although operational, was observed to drift across the duel-carriageway adjacent to the facility boundary and was probably a visual reminder to the residents of its ineffectiveness.

5.8 Monitoring

Requirements for monitoring are detailed, with the operator having the specific responsibility of informing the Environment Agency of any "significant adverse environmental effects" (Environment Agency, 2001) without clear indication of what this means, a fact that can be exploited by the more astute landfill operator. Whilst many of the requirements are similar to those contained within the Waste Management Licensing Regulations 1994 (WMLR) (SI 1994/1056), as amended, some aspects may be new. For example, operators of inert waste facilities will have to adopt appropriate monitoring techniques.

The collection of meteorological data may be one area that the regulator might choose to address through the production of guidance. Whilst data were being collected at the facilities visited, its accuracy and representativeness was questionable because of inappropriate positioning, and the poor quality of instrumentation. Other areas that require monitoring, including noise and vibration, dust and particulates, and odour, will require

the industry to learn additional skills if they are to perform these functions themselves as opposed to engaging consultancy services. Whilst the larger waste management companies may be able to address these areas, the smaller operators will find it more difficult on grounds of cost. For example the manager at Landfill Kilo (although an inert waste facility) carried out all the monitoring himself in addition to managing the facility. The lack of time and skills in this situation will either compromise the quality of monitoring or force operators out of business.

If the industry moves towards self-monitoring, and with the frequency of inspections within the waste sector being low compared to Environment Agency targets (ENDS, 1997), there is a real risk of pollution occurring from the smaller landfill operators who appear less able to monitor their emissions effectively. This situation is exacerbated by the Environment Agency moving away from verifying operators' results by performing its own periodic monitoring.

5.9 Discrepancies between what the interviewee said and what was observed at the landfill facility

This section discusses the differences between what the managers at the landfill facilities say and what was actually observed during tours of the sites. The combination of interviews and tours goes beyond the un-ventiable results of simple questionnaires.

At Facility Alpha there was a real difference between the ways in which the manager said the Facility operated and the way in which it did. For

example, best practice as contained within the waste management papers (Table 5.2) suggests that particularly odorous waste should be deposited and then covered immediately to prevent malodour becoming a nuisance. The manager at this particular facility was very proactive in trying to control odour and its nuisance potential. This was probably because he realised that odour nuisance could be used by the Environment Agency as grounds to interrupt or close the facility, and would be a factor at the planning application stage if or when an extension might be required. Whilst genuinely working towards this aim (and in particular engaging the University), operatives at the Facility did not always follow best practice, especially if odorous waste arrived during tea- or dinner-breaks. This is an interesting example of how there can be differences between the intentions of management, the actions of others, and the attaination of a different overall result. It does emphasise that the smallest 'cogs' of an organisation play an important part in achieving the overall objective. This situation could have been different if there had been better supervision.

This example also serves to illustrate the problems of only collecting data from an individual who is part of the management, more accessible and often a named contact. The manager acts as a gateway to junior employees or those working at the 'coal-face' and may deny contact. This adds to the difficulty to discovering a true representation of what is actually happening within any firm. In these circumstances, observation, even participant observation are useful tools. Discrepancies between what is said and what is done, when noted or 'captured' in this way can enrich our understanding of the effectiveness (or ineffectiveness) of policy.

Other discrepancies were observed at both Facility Alpha and Facility Bravo. Anecdotal evidence from operatives pointed to the acceptance of wastes that should have been rejected because they did not meet the facility's licence conditions. Additionally, whilst observing at Facility Alpha, the Environmental Compliance Advisor (Contact ①), whose function it was to periodically examine the waste before accepting it for placement, refused a load as it contained material that he believed could not be accepted. His actions subsequently created conflict as the operatives wanted to accept the waste thus earning their bonuses, and the manager did not want to create trouble with the client. In the end, it was refused and had to be collected following the Environment Agency's procedure.

A pond at Facility Alpha that was used to balance water levels was actually contaminated, although it should have contained only surface runoff. The intention was to pump it out slowly, diluting the contaminants with the aim that it would not be noticed. In general, across all the facilities visited, there were instances of waste that had been accepted that probably should not have been. Further, practices of solidifying liquid wastes in order that they could be accepted were observed. This practice falls within a 'grey-area' under current licensing regulations and is likely to be prohibited under regulations contained within the re-licensing process. This practice was never mentioned in the interviews, nor fully explained during the tours. Gas collection and flaring systems did not appear to be functioning as well as indicated during the interviews. Further, a number of the flares observed were almost certainly not of sufficient standard when comparing what was observed with what was required under the licensing regulations. Bunds were a commonly observed contravention, containing liquids or objects when they should have been empty and clear.

Some of the differences were caused because there appeared to be a divergence in motivation between management and operatives. Whilst this would be expected, the lack of supervision transferred this difference in outlook into bad practice. At the heart of supervision is the supervisor or foreman. Where he or she sits in the relationship between management and operatives is important. Too often the foreman does not exert enough control because they wish to fit-in and be "one of the lads". This phenomena is unlikely to be found within the small landfill operators who have too few staff, but it is more likely in the medium to large operations – those that should have systems and controls in place to prevent such instances.

There also appears to be a culture that 'small' infringements don't matter, because they would go unnoticed, would be covered up by additional waste, would be diluted to nothing, and with minimal chances of discovery. Where examined in depth, it seemed that this attitude pervades the whole organisation. Operatives were eager to place the waste and earn their bonus, and management did not want to create a problem for customers. This phenomena was present across the range of facilities visited. The smaller the operation the more they thought they could get away with, and the least they wished to upset a customer by refusing a load. Where larger operations refuse to accept waste, rejection was based upon careful consideration rather than as an automatic reaction.

5.10 Composites and future scenarios

This section draws together the specific answers collected from each of the individual facilities visited and from those who were interviewed and compiles these (Table 5.13 & Table 5.14) to form composites of each of the three size types identified: 'Small Independent', 'Medium Company', and 'Large Total Waste Management Company'.

	Small Independent	*Medium Co.*	*Large Total Waste Management Co.*
Age of interviewee	▪ 52	▪ 38	▪ 40
CoTC held	▪ No	▪ Some	▪ All
Background	▪ Wastes ▪ Aggregates ▪ Construction	▪ Waste Industry	▪ Waste Industry ▪ Engineering
Type of company	▪ Local Operator	▪ National Operator ▪ Regional Operator	▪ National Operator
Facilities encountered	▪ 3 (21%)	▪ 6 (43%)	▪ 5 (36%)
Licenses held	▪ 8	▪ 40	▪ 97
Wastes accepted (typically)	▪ Inert	▪ Municipal	▪ Municipal ▪ Special ▪ Liquid
Complexity	▪ Simple	▪ Medium	▪ Medium ▪ Complex
Full-time labour	▪ 2	▪ 4	▪ 11
Part-time labour	▪ 3	▪ 2	▪ 3
Dedicated Admin	▪ No	▪ Some Do	▪ Yes
Admin Staff	▪ N/A	▪ 1	▪ Many
Organisational Structure	▪ None	▪ Semi-formalised	▪ Formalised
Management style	▪ Reactionary	▪ Planned	▪ Planned
Landfill gas management (typical)	▪ N/A	▪ Flare	▪ Flare
Energy generation	▪ N/A	▪ No	▪ YES
Leachate management	▪ N/A	▪ Treated on-site and disposed of to sewer ▪ Treated off-site	▪ Flushing bioreactor ▪ Treated on-site and disposed of to sewer ▪ Treated off-site

Table 5.13 Assimilation of some key facts discovered during the interview process categorised the facilities visited into "Small Independent", "Medium Company" and "Large Total Waste Management Company" landfill facilities (Author's work).

	Small Independent	*Medium Co.*	*Large Total Waste Management Co.*
Income sources	▪ Waste placement	▪ Waste placement	▪ Waste placement ▪ Energy generation ▪ Composting ▪ Sorting of waste
Market	▪ Smaller waste disposal contractors	▪ Local authorities ▪ Businesses	▪ Local authorities ▪ Blue-chip companies
Interactions with the Environment Agency	▪ Reaction to things going wrong	▪ Reaction to things going wrong ▪ Regular inspections	▪ Proactive ▪ Reaction to things going wrong ▪ Regular inspections
Experiences of regulations	▪ Hindrance to normal business activity	▪ Need to be applied equally to neighbouring facilities and businesses too	▪ Unclear interpretations and decisions ▪ Differences between regions of the Environment Agency ▪ Need for equality
Incentives for compliance	▪ None	▪ To continue in operation and accepting waste	▪ To continue in operation and accepting waste
Future scenario	▪ Possible closure where investments outweigh the period over which return needed before retirement	▪ Continuation for some as is at present ▪ Some will close where investments not considered economical ▪ Some will be bought or chose to sell their facility to larger operators who will make the investment	▪ Continuation of business following investments and re-licensing ▪ Seek alternative income sources as ways of meeting criteria of IPPC

Table 5.14 Assimilation of some key facts discovered during the interview process categorised the facilities visited into "Small Independent", "Medium Company" and "Large Total Waste Management Company" landfill facilities (continued) (Author's work).

5.10.1 Larger landfill facilities – Large Total Waste Management Companies

The larger landfills are likely to be managed by total waste management companies who operate on a national basis (Table 5.7). Although individual sites will vary in size, the company's interests, control, and management goes further than an individual facility, or facilities visited during this research. As Table 5.8 illustrates this class of landfill operator is likely to manage the more technical landfill facilities: those that accept waste which is more difficult to manage, and those that are facing more stringent controls. Larger landfill facilities generally appear tidier, giving the impression of a site that was proactively managed. Boundary fences and neighbouring land are unlikely to be strewn with litter, and haul roads will have been swept or cleaned. These facilities have an abundance of signs, compound areas for vehicles, and machinery which will be well maintained. Additionally, offices will be clean and tidy, often with a dedicated reception area that is permanently staffed. These larger landfill facilities are busy, with waste arriving almost constantly throughout the facility's operating hours. One of the reasons behind these appearances is the landfill operator's relationship with customers. At this size of operation the customers are likely to be more prestigious or of a higher profile. There is the need to be seen to be doing things right. Prestigious companies (PLCs) or multinationals cannot afford to have their reputation tarnished by being associated with a waste disposer who is polluting the environment (although prosecutions do occur and the facilities are still used). Producer responsibility and the Duty of Care Regulations have played a part in this.

Significant to the Large Total Waste Management Company classification was the overall size of the operating company to which the individual facility belonged. These operating companies normally have a central core of experts who will make the overall decisions about optimising responses to environmental regulations. For example, facilities Alpha, Bravo, and Charlie all belonged to Company *I*, whose Regional Environmental Manager was interviewed (Contact ②). These central cores of experts compile a management package for each individual facility or a package that can be implemented across a number of similar facilities. At this level, the site manger has a given modus operands, with limits on how the facility has to be operated. In effect, the manager looks after day-to-day issues, and the central core of the operating company work on the strategy for the longer term. This is significantly different from the other categories of landfill facilities, where the facility's manager is more, involved in strategic planning.

Although no precise data on the age of those interviewed from this category was collected, those that were interviewed seemed younger, and perhaps more importantly, were forward looking (as opposed to hankering after the "good old days"). Therefore, managers of larger landfill facilities are likely to be younger, possibly in their late 30s to early 40s and more willing to accept regulatory changes.

The majority of the managers are likely to hold a CoTC qualification for the facility that they are responsible for. One of the reasons for this is that the company will have already trained many of their managers, or have only employed qualified managers from the start. A number of these operating companies have become accredited training centres, and are able to train

their own employees in-house. The cost advantage that this brings comes with the addition of being able to train their employees at a time to suite themselves. Whereas removing a manager from a small landfill operator is likely to cause operating difficulties, the larger companies will have a qualified manager overseeing more than one landfill facility whilst individuals are trained. The larger landfill operators are more likely to engage in the training because there is a culture of regulatory compliance. Even so, these larger operators have been able to find loop-holes in previous licensing regulations and have one CoTC qualified person designated as the manager of more than one facility. In response, the Environment Agency has clamped down upon operators who they see as bending the rules in this way. The Environment Agency is too of the opinion that incidents have occurred because of inadequate supervision and the proximity of management in control (Contact ⑧).

The presence of certified EMSs is limited. Only Company *I*, representing Facilities Alpha, Bravo, and Charlie had an ISO14001 standard management system in place (Table 5.11). Two other facilities that were visited claimed to have a 'system' for managing their environmental impact, although it was probably more akin to an operations management system. Therefore, whilst larger landfill facilities are likely to have a system for managing their environmental impact, it may be tailored more towards the management of the installation, rather than being designed to the ISO 14001 system standard. Systems are central to the effective functioning of larger facilities, for this is the primary means by which the central core can control local level activities. The system of management has two aims within this class of business: [1] to assist in managing the installation and its environmental impact; [2] promoting and publicising the installations

greenness; in effect to say that it is operating with responsibility towards the environment for its customers and to sell itself in a competitive market.

Large Total Waste Management companies overtly appear willing to control the landfill's emissions. However, this dose not necessarily translate into better emissions management. Rather, it seems that emissions are generally managed to the letter of the law. The central core of experts will have found the limits of acceptability, fulfilling these at lowest cost. The final system may have been developed through numerous meetings with the Environment Agency. Additionally, and characteristically of Large Total Waste Management Company landfilling operations the costs and the way emissions are managed are often offset against an income stream derived from that same process. For example, landfill gas is managed whilst generating electricity and earning income. The systems of management normally ensure that monitoring data is collected with the correct degree of regularity. The person collecting the data is likely to hold a relevant CoTC qualification and his job is to perform environmental compliance functions. However, one area of emission control that still presents a problem is area- or diffuse-source emissions. Whereas technology can be deployed to control point-sources, the science of diffuse sources is still poorly understood. Control of these is difficult, and results in nuisance and contentious interactions with the regulator and planning authorities.

Large Total Waste Management Company landfilling operations are better equipped to manage the re-licensing process – from making the initial applications, discussing the requirements with the regulator and arguing their case where decisions remain unclear, financing and implementing the changes, and to operating under the new licensing regime. The central core

of the operating company will find the best economic way of meeting these requirements and produce a management package for each individual installation. In the process there is likely to have been a good deal of consultation with the Environment Agency, so the understanding of what is required is good. What is of concern is equality in the system. They do not wish to be the first ones regulated under the new regulations and to be operating at higher standards that their smaller competitors. It is their national coverage that highlights inequalities and differences in the operating standards required between different regions of the Environment Agency and its control. This class will continue in business, as their investments are such that they are effectively obligated to do so.

The costs of compliance can be off-set through the provision of income streams (for example as has happened with managing landfill gas and generating electricity). In a similar vein, pre-treatment may promote composting at the landfill. Additionally, mechanisms such as the Duty of Care Regulations promote responsible disposal and customers subscribing to the ISO14001 EMS system standard are likely to retain continuity in the chain and will seek responsible waste disposers. Therefore, there remains a means by which the operator can be rewarded and can recover some, if not all, of the costs involved in waste disposal. Further, one aim of the re-licensing process (from the European Landfill Directive) is to make all the costs of waste disposal chargeable at the landfill gate. In this way – by passing costs to the waste producer – producer responsibility is promoted.

5.10.2 Small Independent landfilling operations

Typically, these smallest sized landfill facilities contain the least technical facilities and represented 21 percent of those facilities visited (Table 5.5 – Table 5.11). Landfills within this group are independently owned and operated and serve a local area. Their customers are likely to be private waste disposal contractors, such as a company with a skip lorry serving private individuals (removing building waste etc.). Perhaps atypically these facilities may as in the example of Facility Kilo, be part of a small company (Company *VII*). Table 5.7, shows that these facilities typically accept "Inert Wastes", "Construction & Demolition Waste", and "Dredging Wastes". These classifications of licensed wastes would be the simplest to gain licenses for. The licenses were easy to obtain principally because the wastes are not considered to generate leachate and therefore pose little risk to the environment. Concurrent with this thinking is a general lack of site monitoring. Very little is required in the way of lining the site. There is no gas collection infrastructure and no leachate collection or treatment facilities. The only real control required is to know that the wastes being accepted truly meet the requirements of the license. Facility Delta is somewhat different for this class in that it accepts "Municipal Waste", which requires more capital expenditure and more intense management of the facility.

Smaller sites tend to appear less well kept and give the impression of minimal management. A bare minimum of staff means that only core-activities take place. Managers are typically older and nearing an age where early retirement is an option (Table 5.6). Requirements to train and gain a relevant CoTC will add to these pressures, especially where previously under the Waste Management Licensing Regulations 1994, many of these

operators were exempted. It is with this in mind that many of these types of operators may use this re-licensing pressure to cease accepting waste and close their business. What implications this will have on operators 'walking away' from sites and negating their after-care remains to be seen. Changes included in the re-licensing process will require additional monitoring and controls that have thus far not been required from inert waste landfill facilities. This is likely to add to the pressures to close within this sector. Further, the re-licensing process may encourage the recovery or recycling of the very waste that is the business of these landfill operators. Many inert waste landfills have been developed from old sand or gravel pits. Others may actually be landraises, where for example a farmer, is landscaping for a future golf course, and is earning an income from those depositing waste.

Without the backing of a well-resourced company, with experts available to make strategic decisions, the manager / owner is likely to be making day-to-day decisions in addition to those that are strategic: a situation that leads to compromise in both time-scales, and is self perpetuating as tomorrow is never planned – and tomorrow's planning becomes today's 'fire-fight'. Knowledge about the re-licensing process and what exactly is entailed is poor. To many mangers or owners of Small Independent landfill facilities, the terminology of re-licensing is equated with closure and of overregulation and the 'killing' of their business. Interviewees would typically draw upon experiences giving the impression that the industry is past its heyday; now declining from overregulation.

Most of these sites are simple facilities, few accept municipal waste that requires monitoring – where they do the monitoring is likely to be performed by the manager in addition to his other duties. Flares would be of

simple design, not yet upgraded – because of prohibitive expense. It may be possible that some of these facilities still retain passive vents and are releasing landfill-gas emissions to the atmosphere. The culture towards emissions management is typically one where emissions are thought of as by-products of the business activity, often viewed as benign, and where controls need to be simple and cheap. There are often conflicts between the business operator and neighbours concerning the right to place restrictions upon a business activity.

Interactions with the Environment Agency are limited to occasional inspections or in reaction to a complaint received. As they are of a low risk to the environment, the Environment Agency is unlikely to afford these sites a high priority, concentrating their regulatory effort elsewhere. It is likely that many within this typology of landfilling operation will close under the re-licensing process. Changes to the ways in which these simpler facilities will have to operate will require a degree of expenditure across a number of areas (for example, in training and gaining qualifications, monitoring, and the installation of infrastructure). Considering that the managers / owners are generally older than those of the other two classes there is less incentive to finance these changes. Additionally, there is a great deal of reluctance and an attitude against regulation and control on business activities. External to the business there appears too little concern that these businesses may fold and leave the industry.

5.10.3 Medium-sized landfill facility operators – Medium Companies

The Medium-sized Company typology is harder to define as there appears more heterogeneity within this category. Many such facilities contain elements of both "Large Total Waste Management Company" and "Small Independent". This class accounted for 43 percent of the facilities visited. A landfill facility within this category is likely to accept municipal waste and serve a regional area. There are likely to be several sites owned and operated by the company. The manager at these facilities is typically in the 45 – 50 year old range and has spent the best part of his career within the waste industry – possibly moving through various jobs to become a manager. Many, but not all, will hold a CoTC relevant to the site being operated. These facilities were probably once owned and operated by the Local Council or the Waste Disposal Authority before there was a separation of control between collection and disposal. Many such facilities were taken into private control through management by-outs. Additionally, this sector has probably experienced a fair degree of transition as many of these operating companies have had their facilities 'cherry-picked' and have been taken-over by larger companies. Waste placement is the dominant aspect of the business but there may be some diversification to meet the needs of their customers.

Medium Company landfill facilities can share similarities with their larger counterparts. Although they don't have a central core of experts it became evident that managers from a number of their facilities met informally to discus their approach to implementing particular regulations. their future is more difficult to predict with any degree of confidence. This is because of the diversity of the sector, encompassing different types of

landfill, accepting different wastes, at different stages in their life-cycle, under a diversity of ownership, and dealing with a range of customers. Some of this uncertainty is also based upon experience of what has begun to occur with some of them. Many would have been included within this category had it not been for the fact that they have already been taken over by larger companies. For example, UK Waste is now owned by Biffa Waste Service, which in turn is part of Severn Trent PLC. Amalgamation such as this is a distinctive trend within the industry and this transient nature hinders longstanding comparisons. This observation, combined with data captured from field-research, suggests that the future of this class could proceed along two divergent paths. The better landfills, or those that the larger operators consider attractive are likely to be taken over or bought out. At the other end, the smallest of this category are likely to continue accepting waste to restore the facility to the planned contour levels and then close. Problems of technological investment and higher or more stringent operating standards, adding to costs within a competing market, point to this outcome. A further complication comes from uncertainly over how far customers are prepared to transport their waste for disposal and what level of cost this adds. The Babtie Group (2002) estimates a shortfall of disposal space for waste that is more difficult or technical. Medium-sized operators may perform well in this aspect of waste disposal if they are prepared to invest and offer a service to local customers.

5.11 Discussion

Through interviewing a selection of landfill facility managers (Table 5.5 – Table 5.11) and other staff (Table 5.12), a picture has been formed as to the

impact that the re-licensing process under the IPPC Directive may have. The interviews have encompassed both small independent landfill operators and landfills operated by national/international waste management companies. Additionally, a diverse range of landfill facilities including inert, co-disposal, municipal, and those licensed to accept special waste have been examined. Visits were arranged in order to see if there were disparities between the declarations of the facility managers and how it actually operated.

The changes to the way in which landfills have to operate after the re-licensing process were examined using Environment Agency guidance. However, during both the interviews and visits it became apparent that landfill operators were waiting for crucial decisions to be made by the regulator and that they were unsure of their actions and plans for the future. The entire re-licensing process appears to have got into a state of disarray with operators unable to inform customers if they will be able to accept their waste in the future. Operators were disparaging of this as it was affecting their decision-making processes and affecting planned investments.

Additionally the larger operators (Contacts ③, ④, and ⑥), with nationally dispersed facilities, were critical of the Environment Agency's plan to re-licence facilities based upon risk alone, as opposed to setting firm dates when certain categories of facility are to be licensed. They believe that waste could be "...travelling the length and breadth of England" because of this (Contact ⑥). The smaller operators also shared concerns of risk-based timetabling. They believed that their facilities would feature more prominently in the risk-based timetable, would have to undergo re-licensing in advance of larger competitors, and would subsequently loose business. The problem with the Environment Agency's approach is that until the re-licensing

process has been completed it is likely that landfills across the country will be operating to different standards. This will include conditions on what wastes can be accepted. Two-tiered regulation was something that the Environment Agency intended to avoid, nevertheless it appears to be a reality.

The policing of waste management licensing by the Environment Agency also received criticism. This was more apparent from operators that controlled more than one landfill facility, as it was easier for them to make comparisons and find discrepancies. The criticism was two-fold: [1] that the operator could not understand how the Environment Agency had derived the facility's Operator and Pollution Risk Appraisal score; and [2] that geographical differences were emerging in inspections between facilities operated by the same company for no apparent reason. These operators believed that this situation made it more difficult for them to implement centralised planning and develop a model-plan of what was required to manage a landfill facility. In addition to this, the majority of landfill operators who were interviewed mentioned examples of 'neighbouring' landfills that were not regulated with the same degree of severity. Whilst it would appear desirable to make the regulatory system and the policing of licences equitable between all operators, criticism levied by the larger operators concerning inconsistencies between their respective facilities may in part be the result of different local environmental conditions.

A visit during February 2002 to view the Environment Agency's Public Register at Phoenix House, Leeds, found five applications for landfill facilities. The applications varied considerably in their respective page-counts, but common to four was the use of consultants in preparing the

application. The important role of consultancy services was acknowledged by Contact ③ who had worked with the Environment Agency on developing the permit application supporting-document. Contact ③ stated that previous versions of the application form were,

> "...about three times as thick as the latest version and although amendments were made...five extra staff would be required to do the work, and we would have to use consultants as the company doesn't have the expertise in some areas where we have to consider wider environmental impacts of site operations".

This may affect the ability of the smaller landfill operators to both complete the application and to continue operating. What is not clear is if the regulator will assist applicants who are genuinely having trouble. Although this 'good-will' was observed during an application discussion with a paper-producer, the regulator's 'policy' on this has changed over time. Initially HMIP had a close relationship with industry when administering Integrated Pollution Control (IPC) applications, but later distanced itself in response to commentator's suggestions that it was in a "cosy relationship with industry". Subsequently that stance changed when applications were not to the required standard (see Chapter 4).

The re-licensing of landfills would appear to foster the already apparent trend of divergence within the industry. In broad terms, this has seen changing practices, attitudes, and cultures in the larger operations and stagnation from their smaller counterparts. These larger companies have been able to deal with the tightening of regulations and, from the interviews and visits conducted during this research it appears that they will be able to deal with the tighter requirements of both the IPPC and Landfill Directives.

Part of their coping strategy has been to centralise skills and specialisations to produce company templates and guidance, which individual facility managers have to implement. These centralised departments have the right calibre of staff and the resources to question and exert influence on Environment Agency strategy. The culmination of this closer working arrangement is technical guidance favouring the positions of larger waste management companies. Application preparation and training are two other areas where centralising has realised economies-of-scale. These larger waste management companies have also engaged in public relation exercises through adopting cert. EMS and openly inviting local residents and other members of the public to visit their facilities. Although this goes some way to dispel the bad reputation of the industry, these same operators still appear to cause pollution attracting Environment Agency action and prosecutions (see for example *The Ends Report*).

Independently operated landfills are very different. Lacking manpower, and resources, it is often the owner-manager who has to perform a variety of duties on a day-to-day basis. These include monitoring, to running the office, and the operation of the landfill business. There is a different culture evident at these facilities, emissions often seen as natural by-products of the industry with only some needing to be controlled. Regulation is seen as a burden to business and the re-licensing process adds to and complicates the existing and "adequate" licence conditions. The operators of these landfill facilities are unable to employ consultants to assist in the application process and ultimately may have to cease accepting waste and begin the route to closure.

5.12 Conclusion

The re-licensing of landfill facilities under both IPPC and Landfill Directives builds upon and tightens control on many of the areas already regulated under the Waste Management Licensing Regulations 1994 (WMLR) (SI 1994/1056), as amended. For this reason alone, many within the industry will be able to manage the re-licensing process. In addition, many of the costs associated with meeting the requirements will be passed to the waste producer. Currently there is not enough capacity to incinerate waste (which is the only viable alternative) and it will take time before more incinerators are constructed. However, in the current 'climate' it appears that there is increasing opposition to the construction of new incinerators and several have failed to receive planning applications, for example the proposed facility in Kingston-upon-Hull.

Disparities between small independently owned and operated facilities and those operated by the larger waste management companies will continue to increase. Many of the smaller operators may decide that increased capital costs and regulatory burden will hasten their exit from the industry. Controls on who is allowed to manage a facility will also move towards the elimination of unsuitable operators. Although the Environment Agency has to consider sustainability and contemplate the consequences of the regulatory regime on the industry, there is still a desire to see higher standards and the exclusion of the 'cowboy' element from waste management. At the European level, there is increasing pressure to increase incineration, re-cycling, and landfill gate-fees, whilst reducing the permissible levels of biodegradable waste that can be landfilled.

This Chapter has shown that the smaller independently owned and operated facilities are finding the re-licensing process more difficult than the larger waste management companies. Economies-of-scale, centralisation of technical expertise, tiered management, devolved responsibilities, and the use of consultants is some of the underlying reasons. However, size is not always an indicator of higher standards of operation and low environmental impact. It also does not guarantee that the facility will be operated in total compliance with licence conditions.

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Chapter 6.

The industrialisation of pig farming: licensing intensive pig units under IPPC

6.1 Introduction

The environmental impact of agriculture has been the focus of environmental concern for a relatively short period since "production at all cost" was the main political aim until about the 1980s. It was not until the 1990s that the environmental impacts of intensive livestock farming began to be a serious topic of concern, including problems related to soil contamination, complaints concerning farm-related odour, and the possibility that agriculture's emissions were having a significant impact upon the government's aim of meeting European Directives on environmental quality. The timing of the modernisation of intensive pig production, balancing environmental impacts, production, and animal welfare, to develop a sustainable and profitable industry, is right.

Control has always been focused on manure and slurry management; particularly with regard to restrictions on the quantities of nitrogen applied to land so that the United Kingdom could meet the requirements of the Nitrates Directive (91/676/EC). The Integrated Pollution Prevention & Control (IPPC) Directive (96/61/EC) goes beyond this and begins to consider the total impact of an intensive pig farm (Table 6.1), including feed, animal housing, waste management, and management of the farm. It also introduces the concept of the need to gain a permit to operate an intensive pig farm, as opposed to there being a natural often inherited right, to operate a farm.

Summary aims of this chapter are:

- To introduce the reader to the process of intensive pig farming
- To introduce the reader to the intensive pig farming industry
- To characterise and examine the culture of the intensive pig farming industry

Media	*Emission*	*Source of emission*
Air	Ammonia (NH_3)	Animal housing, storage of manure, land spreading of manure.
	Methane (CH_4)	Animal housing, manure treatment.
	Nitrous oxide (N_2O)	Animal housing, storage of manure, land spreading of manure.
	Nitrous oxides (NO_x)	Heaters in buildings, small combustion installations.
	Carbon dioxide (CO_2)	Animal housing, energy used for heating & transport on farm, burning of waste.
	Odour (H_2S)	Animal housing, storage of manure, land spreading of manure.
	Dust	Milling & grinding of feed, feed storage, solid manure storage & application.
	Dark smoke	Burning of waste.
Soil & Groundwater	Nitrogenous compounds	Land spreading & manure storage.
	Phosphorous	Land spreading & manure storage.
	Potassium (K) & Sodium (Na)	Land spreading & manure storage.
	Heavy metals	Land spreading & manure storage.
	Antibiotics	Land spreading & manure storage.
Surface water	Nitrates	Land spreading & manure storage.
	Phosphorous (P)	Land spreading & manure storage.
	Biological Oxygen Demand (BOD)	Dirty yard water.
Other	Noise	Animal housing & farm operations.
	Bioaerosols	Dust from feed.

Table 6.1 A summary of emissions from intensive pig production that are a cause of concern for the Government and the Environment Agency (European Commission, 2001).

6.2 Characterisation of the intensive pig farming industry

The structure of the United Kingdom pig farming industry has altered significantly since the 1950s, particularly over the past decade. The Ministry of Agriculture, Fisheries & Food's (MAFF) Agricultural Census probably under-records the degree of change as the Census does not reveal ultimate ownership or management. Taking information from the Census, it is possible to gain a general impression of the trends within the pig farming industry. Over the period 1981 – 2000, there has been a decrease in the number of pigs in all farm size categories of 28 percent and a 62 percent decrease in the number of farms keeping pigs (Table 6.2). This has effectively seen almost a doubling (90 percent) of the average number of pigs on the farms. However, there have been other changes within the intensive pig farming industry that are more interesting and not as easily discernable from a cursory interrogation of the statistics. Figure 6.1 shows that whilst the total number of farms has fallen (based upon the index of 1981), smaller farms, those in the "1 – 199 pigs" category, have fallen by more than the overall trend. also shows that the larger sizes of pig farms ("200 – 499 pigs" and "500 + pigs") have increased in number, going against the overall downward trend in the number of farms. Significantly, the "500 + pigs" category has seen the largest increase in number. Figure 6.2 also supports this in that it can be seen that the balance of the total number of pigs on all sizes of pig farms has significantly changed over the 1981 – 2000 period. In 1981 nearly two-thirds of the total number of pigs were kept on smaller farms ("1 – 199 pigs) compared to 13 percent being on the largest farm size category ("500 + pigs"). This situation reversed by 2000 when the figures were 26 percent and 39 percent respectively.

Year	*Total number of holdings (farms)*	*Total number of pigs*	*Average number of pigs per holding (farm)*
1981	14,431	698,398	48
1986	11,270	698,989	62
1996	6,656	612,274	92
1997	6,702	644,897	96
1998	6,781	621,391	92
1999	6,049	571,115	94
2000	5,448	500,185	92

Table 6.2 The total number of holdings that keep pigs, the total number of pigs, and the average number of pigs per holding as recorded in the Agricultural Census of England & Wales 1981 – 2000 (MAFF, 1981; 1986; 1996; 1997; 1998; 1999; 2000).

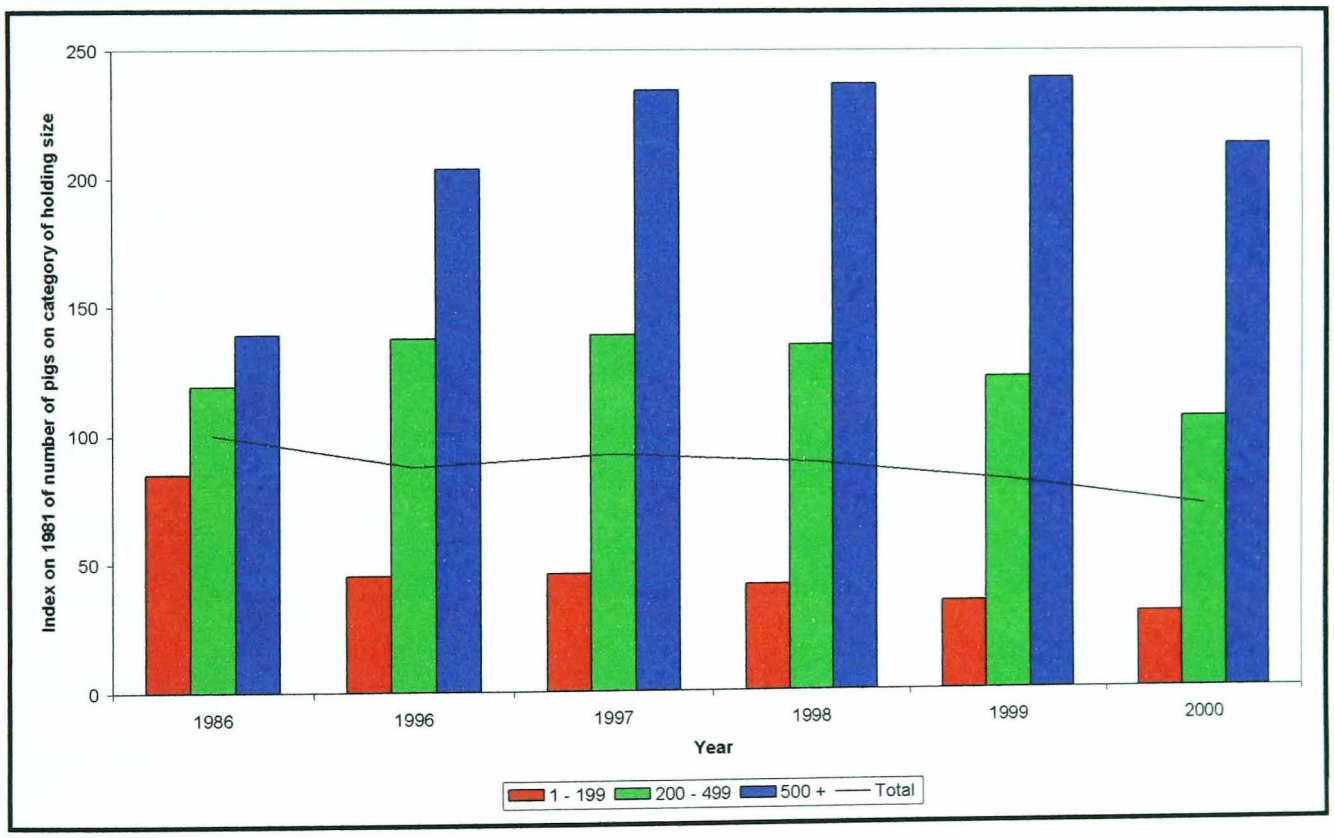


Figure 6.1 The number of holdings (farms) by the size of the holding (number of pigs) 1981 – 2000 indexed upon 1981 (MAFF, 1981; 1986; 1996; 1997; 1998; 1999; 2000).

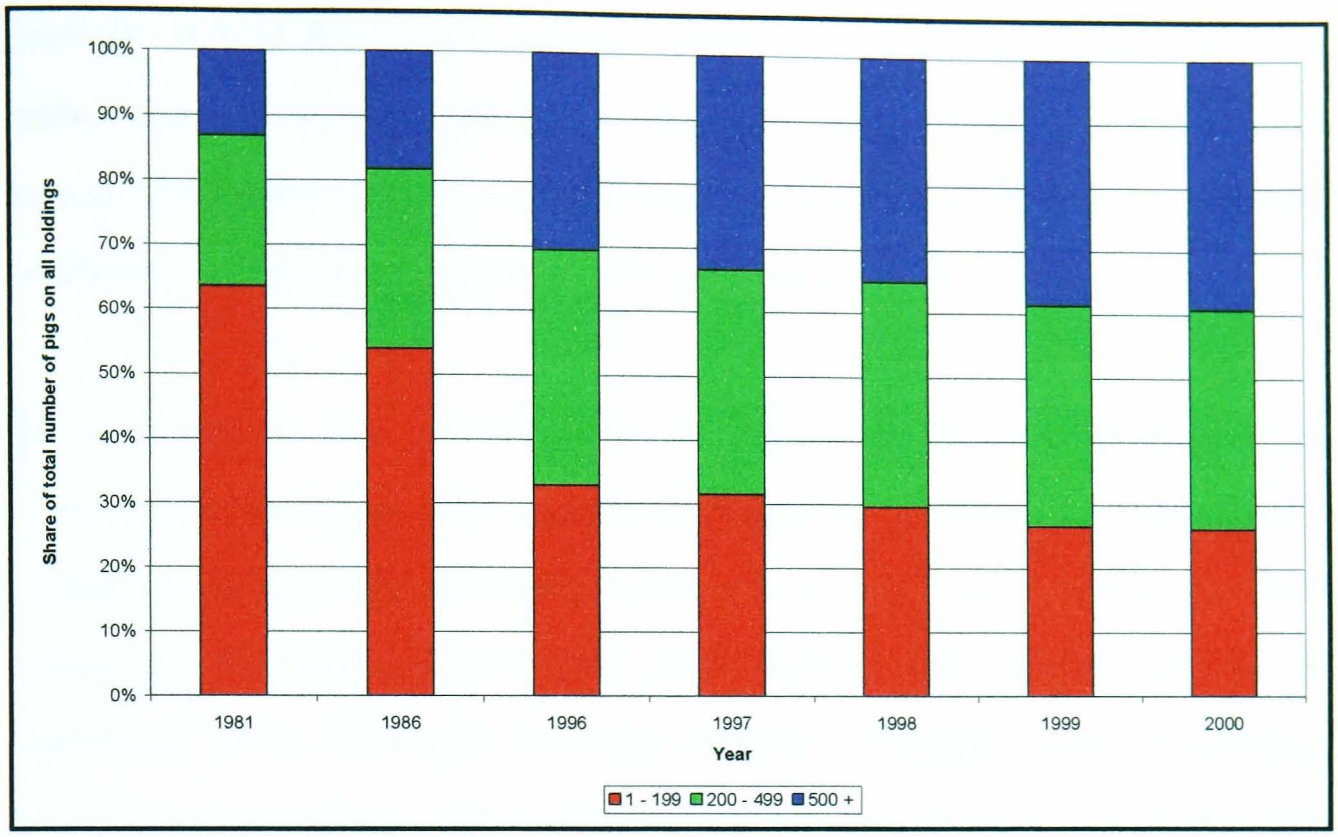


Figure 6.2 The percentage share of the total number of pigs on all holdings (farms) that three size categories of holdings (MAFF, 1981; 1986; 1996; 1997; 1998; 1999; 2000).

In the early 1950s, pig farming was often a secondary enterprise of a mixed farming system. Home-grown cereals were milled for feed, straw was available for bedding and manure was returned to the land for the next season's crops. Herds were small and only a few specialist pig producers existed. Over the intervening years, the pig industry has intensified, and pig farming has become a primary farming operation. The intensification and specialisation resulted from farmers' desire to increase income, and latterly the need to produce porcine competitively at lowest cost.

> "A few years ago an average pig unit was 100 sows. Currently in the UK this figure is nearer 500 sows and herds of 1000 and 2000 sows are not uncommon" Varley (1995, pp. 464).

Many intensive pig farms now purchase specific feed rations from specialist feed-merchants, house their pigs in dedicated buildings with fully or

partially slatted floors, and animal wastes are treated as a waste product rather than an intrinsic part of a farming system. However, change has begun, and animal wastes are again being used on farms instead of inorganic fertilisers, and are being applied during spring to growing crops.

In addition to the specialisation that the pig farming industry has undergone, there has been a gradual geographic movement of the location of pig farms towards the eastern counties of England, for example, East Riding of Yorkshire, North East Lincolnshire, and Norfolk (Carter & Stansfield, 1994). Although the drier climatic conditions assist in meeting housing requirements, and waste can be utilised or disposed of through proximity to arable land, the main reason for this shift has been the logistics of transport into the export market. The proportion of the European herd in England and Wales has decreased significantly since 1973 when it peaked at about 13.5 percent. This decrease was particularly noticeable when Spain, Greece, and Portugal joined the European Union and the trend has continued (Figure 6.3). In 1998, the largest producers were Germany (23 percent), Spain (16 percent), France (12 percent), The Netherlands (12 percent), Denmark (nine percent), and the United Kingdom (seven percent). Although the United Kingdom is about 70 percent self-sufficient in porcine there is an imbalance between production and consumption for specific cuts of meat. For example, the United Kingdom is close to 100 percent self-sufficient in fresh pork, whilst producing only about 50 percent of its own bacon (Figure 6.4). This imbalance in demand and production necessitates the import of pig-meat. However, the differing standards of production and ultimately the cost of the finished product are of cause for concern amongst domestic producers.

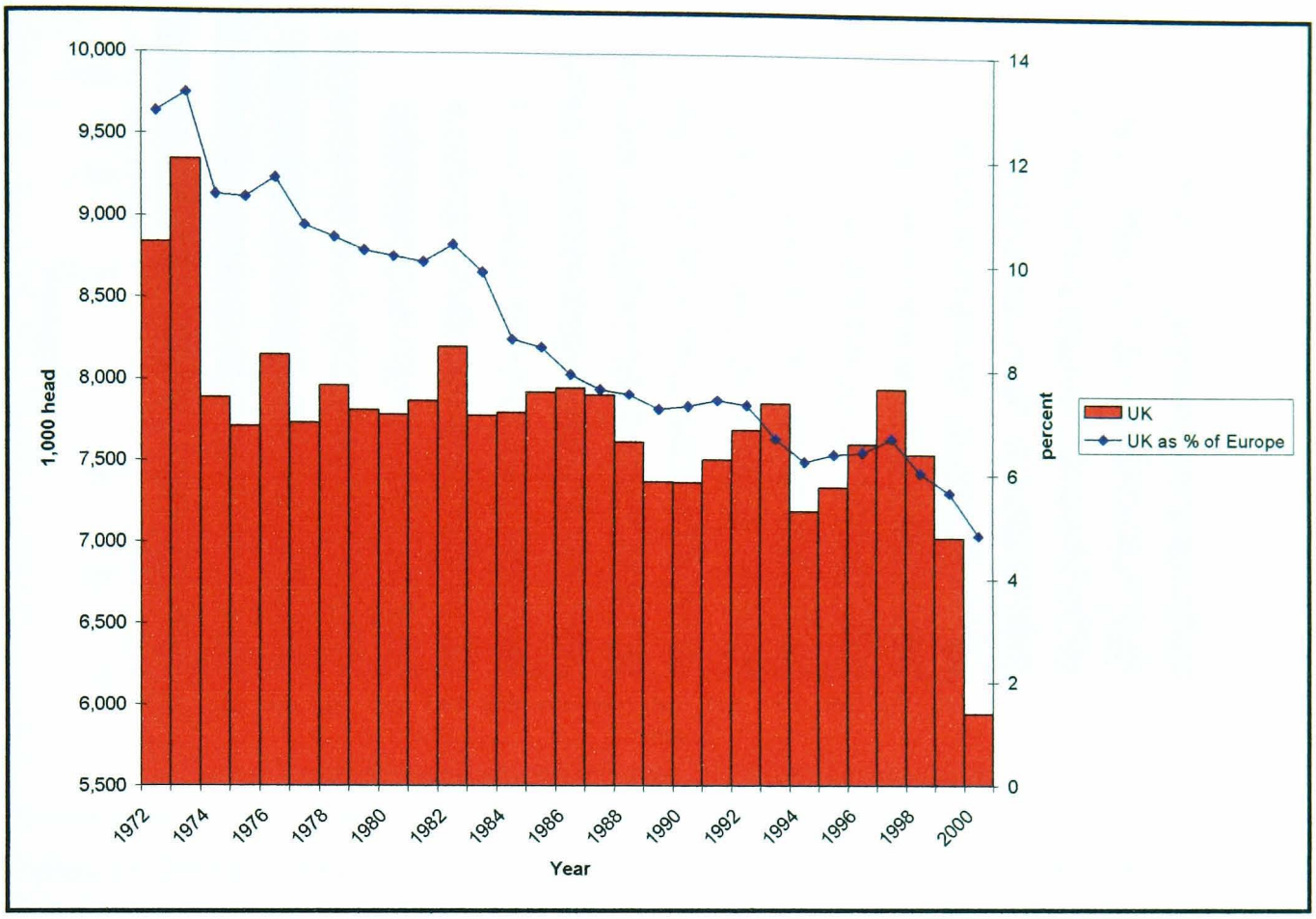


Figure 6.3 The United Kingdom pig herd size as a percentage of the total European pig herd size 1972 – 2000 (Data supplied by the European Commission).

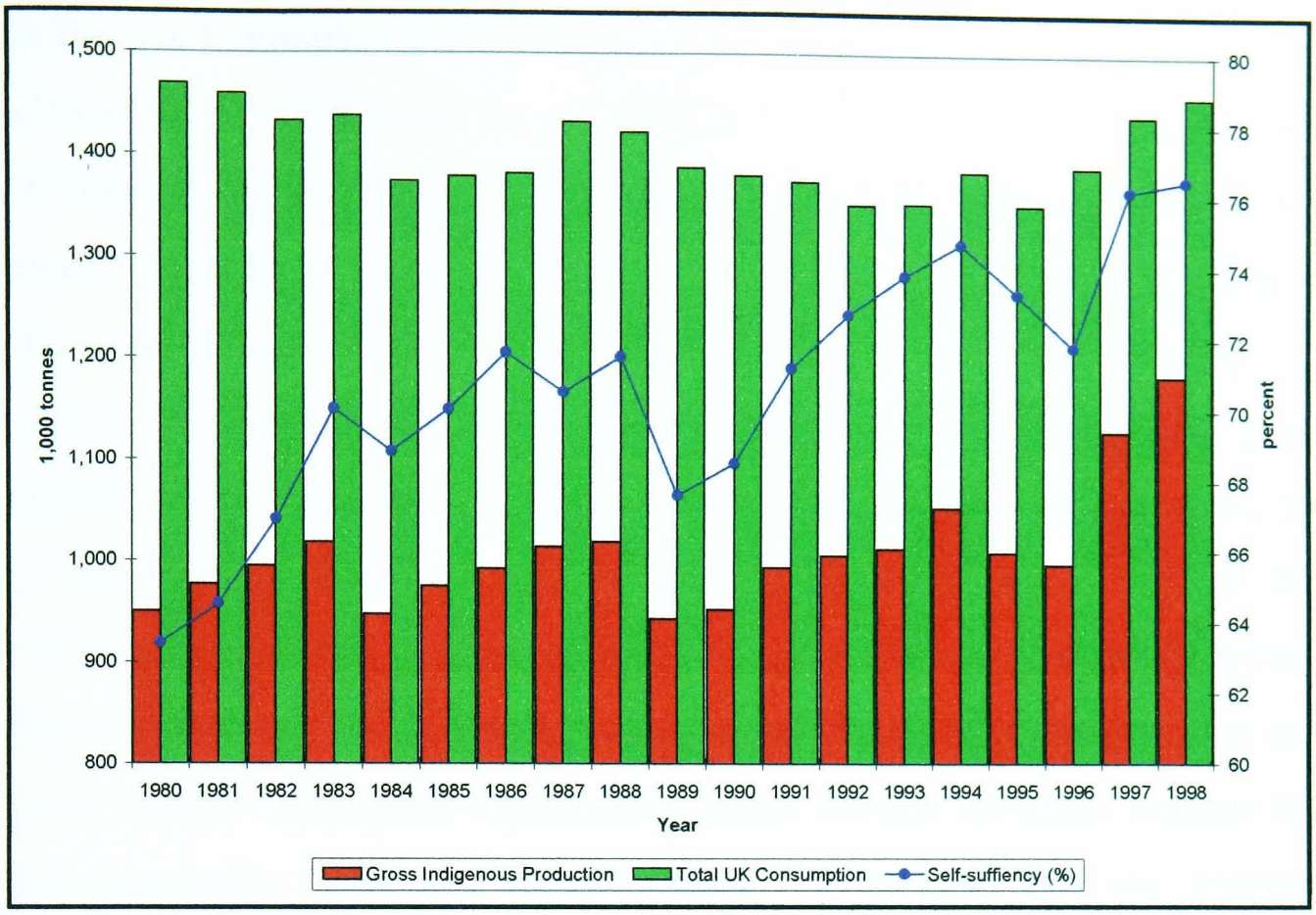


Figure 6.4 United Kingdom gross domestic production, consumption, and self-sufficiency in pig-meat for the period 1980 – 1998. Note the cyclical nature of increased production subsequently followed by falls in production (Data supplied by the Meat & Livestock Commission).

6.2.2 United Kingdom pig production in the European context

The problem that United Kingdom producers face in exporting porcine is that other European Member States are not necessarily under the same pressures or constraints when they farm pigs. Moreover, United Kingdom producers face competition from North America where it is possible to farm on a larger-scale, with lower production costs, on farms away from centres of population. By contrast, United Kingdom pig farming has grown 'hand-in-hand' with the development of the rural space, and latterly faces competition from alternative land uses all within a relatively densely populated island.

In Europe, Denmark has certain advantages in having a more dispersed and a lower density of pigs per hectare (European Commission, 2001). Moreover, in Denmark, pig production is generally combined with larger proportions of arable farming and consequently it is easier to manage animal wastes (European Commission, 2001). A similar situation exists in the areas of concentrated pig production in Germany (European Commission, 2001). The spatial density of pig farms in Spain as a whole is very low, although there is a concentration of intensive pig farming and other agricultural activity in Cataluña (European Commission, 2001). However, there remain many areas where manure can be applied to the land without causing nitrate pollution of water supplies (European Commission, 2001). Further, in Spain, manure is not necessarily considered as a nuisance – something that the farmer inevitably has to get rid of – but is viewed more positively as a product that can be used to improve soil structure to counteract desertification (European Commission, 2001).

Within the European pig farming industry there has been the trend towards vertical integration of the porcine supply chain. The supply of feed, pig production, slaughter, and processing has been brought together under the control of a single operator encompassing the farm-to-table chain. This allows the operator to add the profits at each stage of the chain and receive a much larger income compared to farming (primary production) alone, especially as processing appears to command higher profit margins than primary production (see House of Commons Agriculture Select Committee, 1999*a*; 1999*b*). This trend has perhaps been most marked in Denmark under the guidance of the Federation of Danish Pig Producers and Slaughterhouses (Danske Slagterier) (European Commission, 2001).

The environmental problems associated with the concentration of intensive pig production have led some Member States to investigate ways in which assistance can be given to intensive pig farmers to leave the industry. This approach has been adopted for example in The Netherlands and the Flemish Region of Belgium (European Commission, 2001). State-aided support varies between Member States, for example, the Finnish agricultural-environmental support programme assisted farmers by up to 55 percent if they reduce the environmental impact of farming activities (European Commission, 2001). In Italy a regional support programme was initiated to push farmers to invest in better manure management, for example, equipment designed to separate pig slurry into solids and liquids and assistance for the construction of tanks approved for the storage of pig slurry (European Commission, 2001). However, in the United Kingdom there has been limited support for the intensive pig farming industry. The Pig Industry Restructuring Scheme is a relatively new initiative to assist in the restructuring of the farming industry and is not specifically designed to reduce the environmental impacts of intensive pig production. In addition, limited assistance is being offered to farmers in the form of grants, up to a ceiling of 40 percent of the costs, towards the construction of slurry stores for farms that are within designated Nitrate Vulnerable Zones.

6.2.3 Economic difficulties facing United Kingdom intensive pig producers

The Administration Select Committee enquired into the implementation of the IPPC Directive to the intensive pig farming industry (House of Commons Administration Select Committee, 2000). From that report, it was evident that the intensive pig farming industry was experiencing economic hardship and that adopting the Directive would add to this (House of

Commons Administration Select Committee, 2000). Consequently, with the prospect of strong lobbying from farming representatives it would be difficult politically to implement the Directive immediately. However, that report also suggested that farmers are, in part, to blame for some of the economic volatility in the market for porcine (House of Commons Administration Select Committee, 2000). Farmers tend to react to market signals for an increase in porcine production. However, there is a time-lag between the signals for increased demand and the ability of the pig farming industry to meet that demand. Consequently, farmers tend to overproduce, ultimately leading to depressed prices. This is a cyclical phenomenon of the United Kingdom pig industry reflected in the size of the United Kingdom herd (Figure 6.5). Professor Revell is quoted as suggesting that,

> "...pig producers and the industry itself have learnt little, and the sector is essentially reactive to market signals rather than forward looking, despite the plethora of available market information and intelligence" House of Commons Agriculture Select Committee (1999*a*, para. 8).

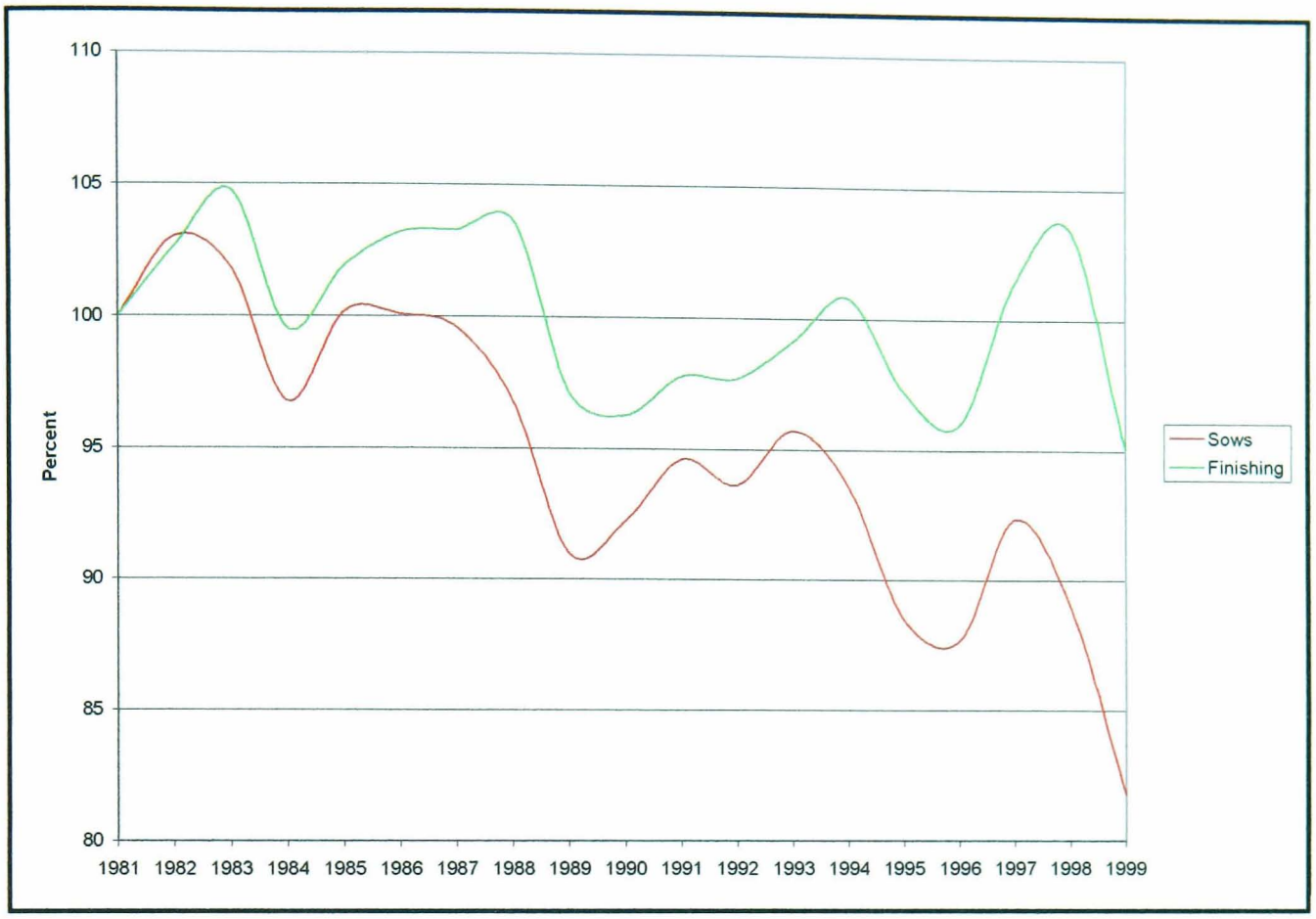


Figure 6.5 Sow and finishing pig numbers in England & Wales 1981 – 1999 indexed upon 1981. The strong cyclical nature of pig numbers is evident. The divergence between sow and finishing pig number indices is the result of a 2 percent increase in sow productivity over the period (Data supplied by the Department for the Environment, Food & Rural Affairs).

The Committee heard that the current problems in the pig industry resulted from the culmination and coincidence of a number of domestic and external factors.

[1]. An excess of supply

a. European production increased coinciding with recession in the Far-East, and sales of pig-meat fell as beef consumption recovered after the Bovine Spongiform Encephalopathy (BSE) crisis (House of Commons Agriculture Select Committee, 1999*b*).

[2]. Increased production costs over competitors

a. European Directive (91/630/EC) set minimum standards to protect the welfare of pigs (CEC, 1991). This was interpreted nationally as the Welfare of Livestock Regulations 1994 (SI 1994/2126), effective January 1999. This Directive banned the use of sow-stalls and sow-tethers for dry-sow

accommodation. However, tethers will not be outlawed in other Member States until the end of 2006, and stalls will remain permissible. British farmers therefore faced £500 per sow in capital costs (modification to buildings) (National Farmers' Union, cited in: House of Commons Agriculture Select Committee, 1999*b*), and £2.86 (Garth Veterinary Group, cited in: House of Commons Agriculture Select Committee, 1999*b*) – £ 3.00 (National Farmers' Union cited in: House of Commons Agriculture Select Committee, 1999*b*) per pig produced in complying with United Kingdom legislation over European competitors.

b. Measures to protect the public health following Bovine Spongiform Encephalopathy had a knock-on-effect on the pig farming industry that effectively increased production costs. It was no longer permissible to feed pigs food that contained mammalian meat and bone meal. This is estimated to have added £1.06 per pig in feed costs (House of Commons Agriculture Select Committee, 1999*b*). Additionally a charge of £1.50 per pig for the disposal of the offal was made by the processor that was subtracted from the price received per pig when the animal went to slaughter (House of Commons Agriculture Select Committee, 1999*b*).

This combination of these factors is estimated to have caused a combined loss of some 30,000 jobs in the pig industry and its associated industries between 1998 and 1999 (House of Commons Agriculture Select Committee, 1999*b*). Individual farmers reported losing about £18 for each pig that they sold, with prices having declined for 16 months reaching a low of 60 pence per kilogram deadweight in October 1999 (Figure 6.6) – half the price of the previous year (House of Commons Agriculture Select Committee, 1999*b*).

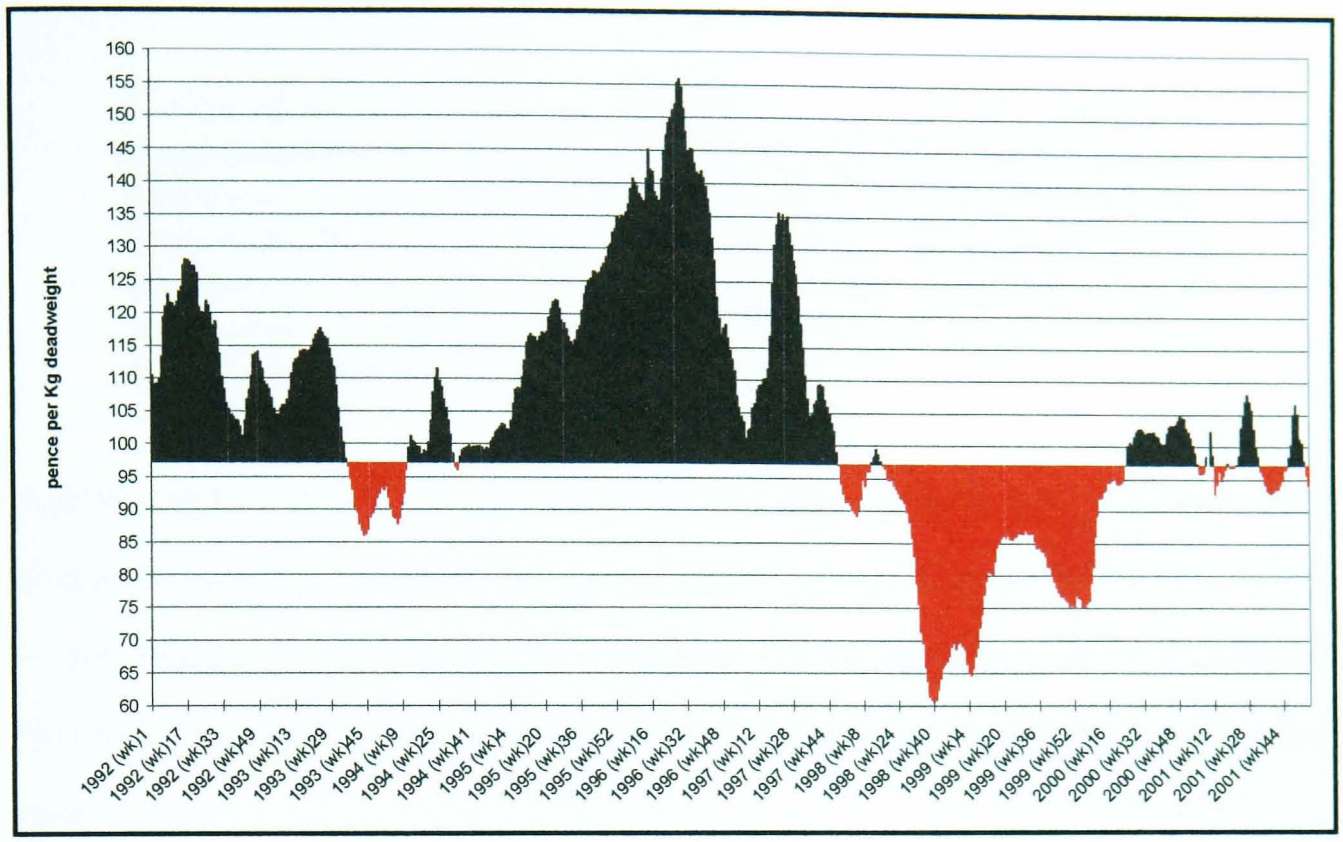


Figure 6.6 The GB adjusted euro-spec average pig price (pence per kg deadweight), up until the week ending 19 January 2002 (Data supplied by the Department for Environment, Food & Rural Affairs). The dissecting line set at the price of 97.25 pence represents a suggested figure from where most pig farmers could make a profit (House of Commons Agriculture Select Committee, 1999*b*).

Whilst farmers have faced lower farm-gate prices, there is the suggestion that this has not been reflected in the retail price of pig-meat, especially for products on sale at supermarkets. Supermarket chains account for 70 percent of pork, and 80 percent of bacon retail sales, and their buying-power has the potential to exert significant influence on primary producers (House of Commons Agriculture Select Committee, 1999*b*). Figure 6.7 highlights price differences in the supply chain from farm-gate to supermarket; farmers could be forgiven for thinking that the supermarkets and processors are making exorbitant profits at their expense. However, the supermarkets retort,

> "...that prices of the products sold and farm-gate prices could not be equated, because farm-gate prices were for whole pig carcasses, whereas the product mix of many multiple retailers was biased towards a selection of the more expensive cuts...a surplus of less desirable cuts has to be sent for processing or, more frequently, exported. It is these surplus cuts that are being sold at distress prices" House of Commons Agriculture Select Committee (1999*b*, para. 33).

Additionally, representatives of abattoirs and processors state that only about 40 percent of a carcass actually goes to the supermarket (House of Commons Agriculture Select Committee, 1999*b*). However, the Agricultural Select Committee's report on the United Kingdom pig industry concludes that,

> "The onus is upon downstream processors, manufacturers and retailers to ensure that their profit margins are not at the producer's expense, thereby undermining the long-term viability of the UK industry. We remain unconvinced that the majority of the industry after the farm gate – abattoirs, processors, manufacturers and retailers – either understands this or is ready to act on it" House of Commons Agriculture Select Committee (1999*b*, para. 67).

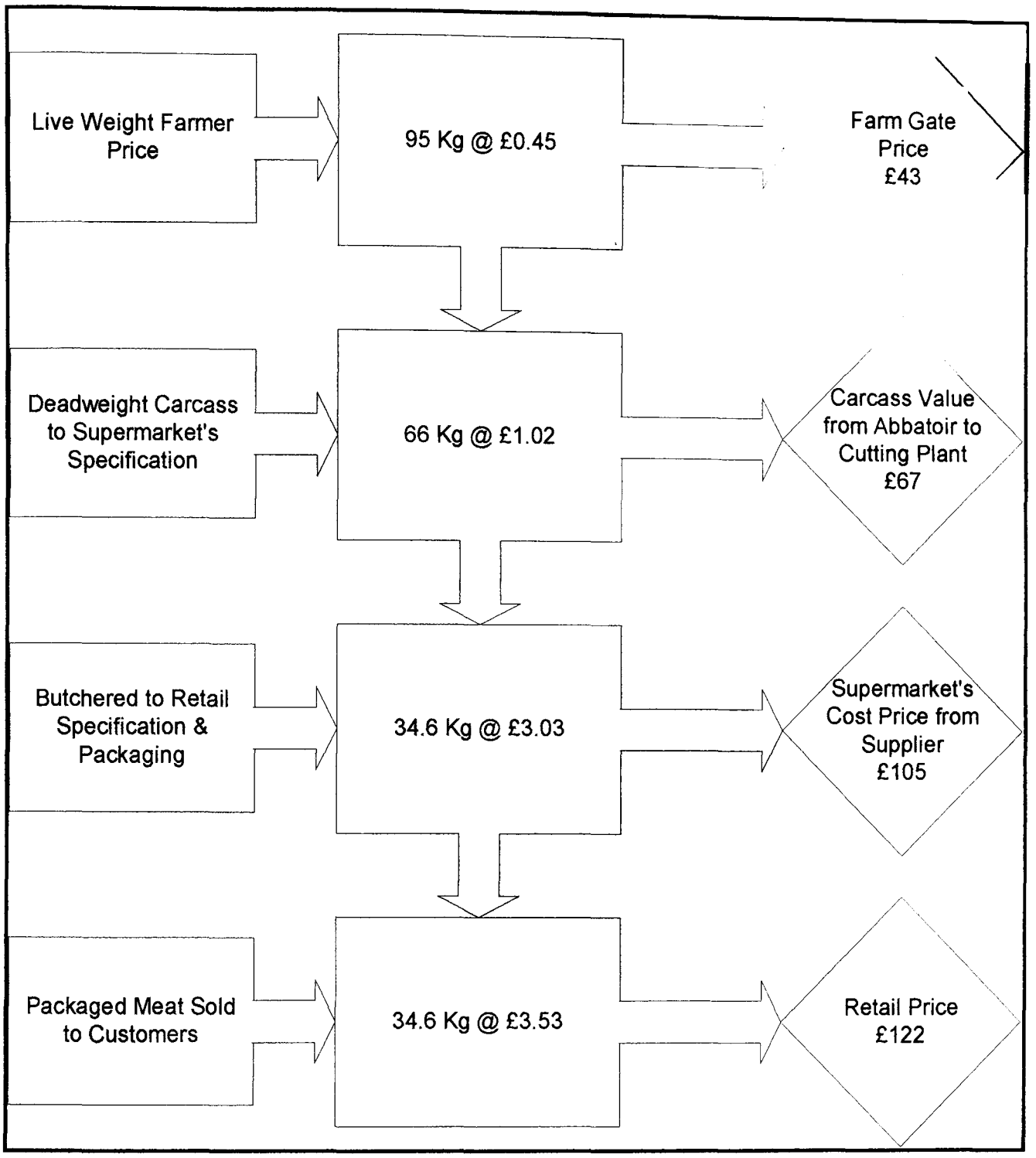


Figure 6.7 From farm to table: who makes the money? (Sainsbury's supermarket evidence cited in: House of Commons Agriculture Select Committee, 1999*a*).

6.3 The intensive pig farming industry and IPPC

The IPPC Directive has to be implemented across Europe through national legislation to any pig farms ("installations") where there are 2,000 places for production pigs (over 30 kg) or 750 places for sows (CEC, 1996). The actual number of farms in England and Wales that will have to apply for a permit is unknown. The Environment Agency suggests between 440 and 520, the Meat & Livestock Commission 1,000, while The Department for Environment, Food and Rural Affairs (DEFRA) put the numbers at 400 (House of Commons Administration Select Committee, 2000). It would appear that a higher percentage of pig farms in England and Wales (58 percent) could be affected compared to other European Member States (38 percent) (House of Commons Administration Select Committee, 2000). Some of the problems concerning the quantification of exact numbers relates to the interpretation of IPPC terminology and the exact definition of an "installation". How the farm will operate (the technologies and techniques) in order to gain a permit to operate and subsequently operate on a day-to-day basis have been, in part, decided on a European basis by the IPPC Technical Committee based in Seville. The Committees' decision has been published as a Best Available Techniques Reference (BREF) Document.

6.3.1 Why is IPPC being extended to the pig industry?

Notwithstanding the Royal Commission on Environmental Pollution's opinion that intensive agriculture is more akin to an industrial process than farming (RCEP, 1979) – it is difficult to understand why the IPPC Directive specifically includes intensive pig farming whilst excluding other farming sectors. Additionally, the British Egg Industry Council (BEIC) stated that they failed to understand the reason why cattle farming (beef and

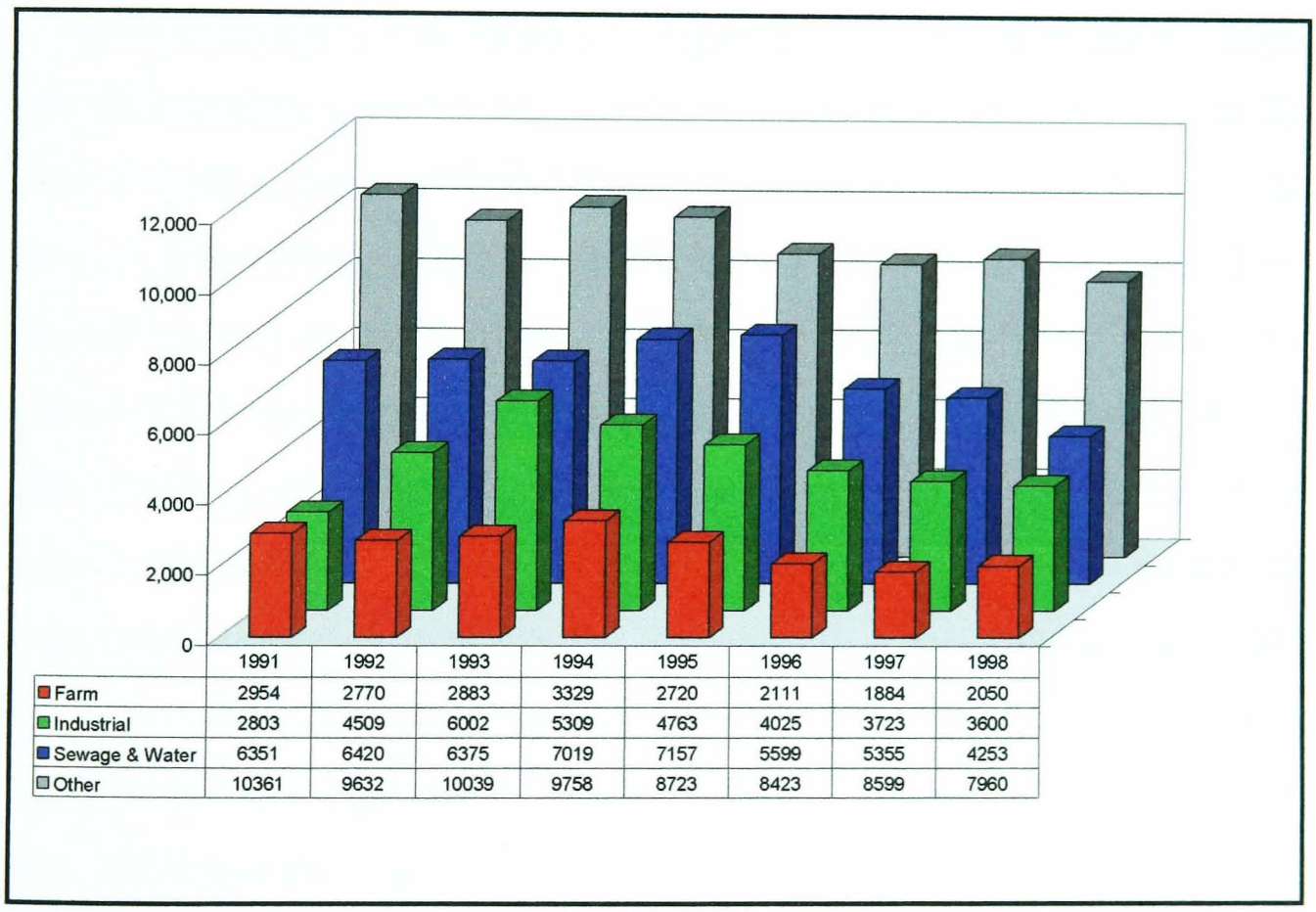
dairying) was excluded when it accounts for 55 percent of the United Kingdom's ammonia emissions (House of Commons Administration Select Committee, 2000),

> "...that IPPC has essentially missed the target; the target being a reduction in ammonia. As far as the poultry industry is concerned, we reckon we are only responsible for 19 per cent of the total ammonia emission. We believe at the end of the day it was horse trading in Brussels which had cattle removed from IPPC. They were included in some of the earlier drafts" House of Commons Administration Select Committee (2000, question. 52).

Although government was compelled to reduce ammonia emissions under the United Nations Economic Commission for Europe's Convention on Long-range Transboundary Air Pollution 1979 and to meet nitrate levels in drinking-water supplies (Nitrate Directive), these could have been addressed by other policy instruments without the need for licensing and the associated level of charges. It is estimated that the IPPC Directive will deliver a four percent reduction in total ammonia emissions and reduce nitrogen deposition to below the critical-load on 20,000 hectares (House of Commons Administration Select Committee, 2000). However, this is to be achieved by focusing on selected farmers as opposed to the whole pig farming industry. Outdoor pig producers, and intensive pig farmers who keep a few less pigs than the Directive's threshold will be excluded, although both contribute to ammonia emissions and nitrogen deposition. Further, the National Farmers' Union (NFU) believes that 80 percent of sows and 50 percent of finishing pigs will remain outside the controls of the Directive (House of Commons Administration Select Committee, 2000). The National Farmers' Union also opposed the inclusion of farming within the Directive,

> "...on the grounds that it was an inappropriate system of regulation for small agricultural businesses, some of which are one or two man enterprises" Memorandum submitted by the National Farmers' Union of England and Wales to: House of Commons Administration Select Committee (2000).

The need, however, to control agricultural activity is evident as agricultural activities still appear to be the cause of some 11 percent of all pollution incidents or nearly 20 percent of the pollution incidents recorded from other traditional industrial sectors (including Industrial and Sewage & Water categories) averaged over the 1991 – 1998 period (Figure 6.8). Any additional means of control may be seen by some as a positive benefit.



	1991	1992	1993	1994	1995	1996	1997	1998
Farm	2954	2770	2883	3329	2720	2111	1884	2050
Industrial	2803	4509	6002	5309	4763	4025	3723	3600
Sewage & Water	6351	6420	6375	7019	7157	5599	5355	4253
Other	10361	9632	10039	9758	8723	8423	8599	7960

Figure 6.8 Substantiated pollution incidents of the more major type by originating source. The figures are indicative, as a direct comparison over 1991 – 1994 is not strictly possible. The former data has been provided by the National Rivers Authority and the latter is provided by the Environment Agency; subtle differences are evident between the two authors recording of statistics (NRA, 1992; 1993; 1994; 1995; Environment Agency, 1996; 1997; 1998; 1999).

6.3.2 The implementation of IPPC

Whilst it appears that the Government's initial intention was to require that "existing installations" (intensive pig farms) gained a permit by 2004, the requirement was eventually postponed until 2007, the latest permissible date contained within the IPPC Directive. The reason for this postponement may have been lobbying from farming representatives, or because the Environment Agency would not have been able to permit intensive pig farms so rapidly (House of Commons Administration Select Committee, 2000).

Following the familiar route of consultation with industry, the Environment Agency engaged in developing a regulatory package (applications forms and technical guidance) for the intensive pig farming sector. However, at the time of writing (January 2004) this task is incomplete and therefore, for any new or substantially modified installations that would require immediate permitting, the requirements are not clear. Additionally those within the industry that may be caught by the IPPC Directive's threshold are unable to plan the necessary investments given the uncertainty. There are calls from within the industry for the Environment Agency and Government to complete the process (National Pig Association, personal communication). However, some of the problems and delays in producing relevant guidance are because the European-wide BREF Document is currently in draft form. The Environment Agency will have to interpret the finalised BREF Document and decide what degree of technology and techniques (BAT) are appropriate for adoption in England and Wales.

The charging scheme proposed by the Environment Agency (Table 6.3) was criticised by farmers, the National Farmers' Union, and the Meat & Livestock (House of Commons Administration Select Committee, 2000). The Environment Agency's proposed charges would result in costs of about £18,000 to £20,000 per unit of 1,000 sows (House of Commons Administration Select Committee, 2000). The Meat & Livestock Commission suggested that it was unacceptable for the Environment Agency to cost time and materials at £1,215 per day (or £164.19 per hour), and to levy a registration fee of £6,089 per component upon intensive pig farmers (House of Commons Administration Select Committee, 2000). The Meat & Livestock Commission also suggested that five hours would be a more realistic period to determine an application as opposed to the Environment Agency's suggestion of five inspector days (House of Commons Administration Select Committee, 2000). One reason put forward by the Environment Agency in justification of the high fees was that the Government required them to recover all their costs from the polluter (Environment Agency cited in: House of Commons Administration Select Committee, 2000). Therefore, in addition to the application determination, a proportion of technical back-up and research and development costs had to be included (House of Commons Administration Select Committee, 2000). Comparing the Environment Agency's proposed charges to those of the Scottish Environmental Protection Environment Agency (SEPA) and other European Union Member States (Table 6.3) it is evident that producers in England and Wales would have their competitiveness eroded.

Country	*Permit application*	*Annual subsistence*	*Comments*
Ireland	£2,500/£7,000	No Data	Existing charging scheme under IPC. Small farms less than 4,000 pigs.
Denmark	No Data	£1,000	Inspections carried out by local authorities, full cost recovery.
Holland	No Data	No Data	No charges made for the cost of administration, subsidised.
Italy	n/a	n/a	Possibly nothing.
England & Wales	£18,269	£8,304	Interim charging scheme until 31 March 2001 (based upon 10,000 production pigs and 3,750 sows).
Scotland	£7,894	£2,764	

Table 6.3 A comparison of the charges proposed for an IPPC permit and annual subsistence fees in selected European Member States (National Farmers' Union evidence in: House of Commons Administration Select Committee, 2000; Environment Agency, 2001).

A significant concession to the intensive pig farming industry was the decision by the Environment Agency that, Standard Farming Installation, General Binding Rules (SFI GBRs) were permissible for the industry. General Binding Rules, says the Commission, can be developed, and adopted for an industrial sector where the techniques of production are homogeneous. The significance of this to intensive pig farmers is that their permit applications should be cheaper and simplified compared to individually determined permits (compare Table 4.1 with Table 6.4). However, developing the SFI GBR package has tested the relationship between the regulator and regulated in 'thrashing out' an acceptable, understandable, application procedure. Subsequent information from the Environment Agency has seen reduced charges under the SFI GBR scheme and for those applicants that wish to pursue a fully determined application (Environment Agency, 2002). Table 6.4 sets out these new charges.

	Small farming activity		*Large farming activity*	
	Standard	*Non-standard*	*Standard*	*Non-standard*
Application	£2,950	£5,900	£2,950	£6,900
Standard variation	£300	£1,650	£300	£1,850
Substantial variation	n/a	£5,350	n/a	£6,200
Partial transfer	£300	£300	£300	£300
Whole transfer	£300	£300	£300	£300
Partial surrender	£300	£875	£300	£875
Whole surrender	£300	£875	£300	£875
Subsistence	£1,975	£2,975	£2,475	£3,975

Table 6.4 A detailed breakdown of the fees that is likely to be made to operators under the PPC permitting regime. The classification of a small farming activity is where there are up to 7,500 sow places or 20,000 places for finishing pigs. The large farming activity classification is for farms above that level (Environment Agency, 2002).

6.4 How the regulations work at the farm level

In due course the Environment Agency will send information to farmers who they believe will fall within the threshold of the IPPC Directive to the effect that the operator of the installation is required to complete and submit an application to continue the legal operation of that installation. The Environment Agency's website and the National Farmer's Union will be used to try to ensure that all those who need to make an application are aware of that fact and where to gain further information and assistance. Additionally there is a duty upon those intensive pig farmers who make substantial modifications to their installations to apply for a permit as soon as the modifications are made. Details of what constitutes a substantial modification have to be sought from the Environment Agency. Immediately the deadline for the permit application has passed, those farmers who continue to operate will be doing so illegally and can be prosecuted. In

becoming aware of this requirement the farmer has an important decision to make: to seek avoidance and de-stock to a level below the threshold or to maintain stock numbers and apply for a permit.

The intensive pig farmer can follow two paths when applying for a permit:

[1] Use the Environment Agency's 'standard' SFI GBR application pack; or [2] request that the permit is individually determined. The former option is favoured by the Environment Agency as it takes less time to administer and consequently it should be cheaper for the farmer. The primary requirement of the SFI GBR is that the farm or installation is operated in accordance with the techniques contained within the rules, and that the appropriate technologies are adopted. These have been selected by the Environment Agency as being most appropriate for intensive pig farms within their remit area. However, because these Rules may 'force' the uptake of particular technologies on some farms, it may be cheaper overall for those farmers to opt for an individually determined permit if they can demonstrate or argue that the techniques and technologies in place on their farm are adequate and still within the limit guidelines. Paying more for the permit may produce savings in capital expenditure.

Applying for a permit is essentially an information providing process for the farmer. The Environment Agency must be informed of the farm's present condition, how it is run, what are the inputs, how animals are housed, and how wastes are managed. Some sections of the application form require information on how conditions are going to be met. Through this process the gap between current and required standards will become apparent, and the cost implications of making improvements will become apparent. Upon completion of the application form it has to be returned to

the Environment Agency with the appropriate fee. The Environment Agency is then expected to either grant or refuse the application within a period of four months. Alternatively, the Environment Agency can return all or part of the application to the farmer requesting further information in order that the application can be determined.

At the permit application stage the Environment Agency has a choice if it believes that an installation will fall short of the required standards (SFI GBRs or other). These are: [1] to allow the continuation of operation but require that it be brought up to standard via an agreed improvement plan; or [2] to force its closure and only permit the continuation of business once the necessary standards are achieved. The ramifications for the farmer of not having an installation operating to the required standards are not precisely clear. Neither is it possible to second-guess which of the above options the Environment Agency is likely to follow as there is no comparable a priori knowledge from which to take precedence. Operators of other industrial installations who have entered into the IPPC Directive's controls have been given up to four years to bring their installation's operation up to the required standards. Specifically the problem in regulating the intensive pig farming industry is that the date of the sector's inception into the permitting regime coincides with the date by which the Directive has to be fully transposed into national legislation. Intensive pig farmers will therefore have to operate at the required standard from the outset in order to maintain the continuity of date (2007). Farmers may be forced to pre-empt the 2007 deadline by making infrastructural and methodological changes now.

In addition to the information provision stage of the application there will have to be a process of verification, to verify what the farmers have said is correct. How this audit will be conducted, and in what form, is at present unknown. There may be one or several inspections from either one or several inspectors depending upon the complexity of the installation's operation, and the experience of individual inspectors from the Environment Agency. However, as has occurred within other industrial sectors it is feasible, that the audit process will be compressed into an individual visit utilising a general "tick-box" methodology which can be performed by less experienced inspectors.

Gaining a permit to continue the legal operation of the intensive pig farm is not the end of the matter; the Directive intends to drive forward an ever increasing continuation of environmental protection. This will be achieved through periodic review at both the national level and within the European Technical Committee (thus ensuring harmonisation) of the techniques and technologies that are in place. Any novel or innovative approaches that may lead to improved environmental protection are intended to be considered and put forward for adoption. Furthermore, there are annual subsistence fees to be paid to the Environment Agency, and the added costs to the farmer of having to operate in a more constrained method (for example, record keeping, staff training and development, and regular and recordable checks and audits to be performed on farm). Additionally, it is likely that the farm will be subjected to more inspections from the Environment Agency that any are currently receiving.

6.5 The licensing of large pig farms: interviews conducted with farmers, farming organisations and the Environment Agency

The following section is the result of interviews with farm managers and visits to a number of pig farms (Table 6.5 - Table 6.11). Some of the farms came under the IPPC Directive's threshold and would be required to submit an application for a permit in due course. Additionally, the managers of smaller pig farms were interviewed in order to discover the differences between the way in which large and small pig farms operate. Whilst it was possible to theorise the likely impacts of the regulations from a desk-study, this work intended to evaluate what the farmers are saying alongside what they are doing, it was therefore essential to visit a number of farms. Additionally, farm managers from agricultural colleges were included in the range of interviews as were the regulator (Environment Agency) and farming representatives (National Farmers' Union, National Pig Association) (Table 6.12). This helped with the development of a broader picture of the issues involved. The subsequent sections represent selected areas from the Environment Agency's SFI GBR document detailing the requirements made of intensive pig farmers. This has been done to make the process manageable and to assist in making comparisons (Chapter 7) with the responses from the landfill industry (Chapter 5).

Farm Reference	*Visit*	*Places (pigs) Sow*	*Finisher*	*Location (County)*	*Size (ha)*	*Type of farm*
Alpha 1	☑	0	4,000	East Yorkshire	1000	Pig + Arable
Alpha 2	☑	0	4,000	East Yorkshire	850	Pig + Arable
Alpha 3	☒	0	7,000	East Yorkshire	2500	Pig + Arable
Alpha 4	☒	1,000	0	The Wirral	200	Sow unit
Alpha 5	☒	1,000	0	Lincolnshire	500	Sow unit
Bravo 1	☑	1,100	2,000	North Yorkshire	400	Grower unit
Bravo 2	☑	0	4,000	North Yorkshire	250	Finisher unit
Charlie	☑	650	2,500	East Yorkshire	100	Arable + Pig
Delta	☑	1,500	6,500	East Yorkshire	150	Arable + Pig
Echo	☑	520	2,800	Essex	680	Arable + Pig
Foxtrot	☒	555	2,300	Lincolnshire	242	Pig + Arable
Golf	☑	350	750	East Yorkshire	766	Arable + Pig
Hotel	☑	350	800	Warwickshire	100	Pig Farm
India 1	☑	300	2,700	Lancashire	250	Pig + Arable
India 2	☑	1,100	0	Lincolnshire	100	Pig + Arable
India 3	☑	0	9,500	Staffordshire	500	Pig + Arable
India 4	☒	450	5,000	Yorkshire	700	Pig + Arable
India 5	☒	500	4,500	Derbyshire	500	Pig + Arable
India 6	☒	450	4,000	Staffordshire	800	Pig + Arable
India 7	☒	250	2,000	Staffordshire	300	Pig + Arable
India 8	☒	650	6,000	Oxfordshire	750	Pig + Arable
India 9	☒	300	2,500	Gloucestershire	200	Pig + Arable
India 10	☒	500	4,500	Leicestershire	300	Pig + Arable
Juliet	☑	760	2,000	Devon	250	Arable + Pig + Dairy
Kilo	☑	800	2,100	Suffolk	150	Arable + Pig
Lima 1	☒	6,000	0	Poland	850	Sow unit
Lima 2	☒	6,000	0	Poland	850	Sow unit
Lima 3	☒	4,000	0	Poland	750	Sow unit
Lima 4	☒	0	10,000	Poland	620	Finisher unit
Lima 5	☒	0	1,400	Poland	86	Finisher unit

Table 6.5 Selected size, location, and typology categorisation details of the farms included in the research (Author's work).

Farm Reference	*Age of interviewee*	*Position of interviewee*	*Interviewee background*	*Education Level*
Alpha 1	40 – 45	Environmental Manager	Farming	Agri College
Alpha 2	40 – 45	Environmental Manager	Farming	Agri College
Alpha 3	40 – 45	Environmental Manager	Farming	Agri College
Alpha 4	40 – 45	Environmental Manager	Farming	Agri College
Alpha 5	40 – 45	Environmental Manager	Farming	Agri College
Bravo 1	30 – 35	Partner	Farming Family	Basic
Bravo 2	30 – 35	Partner + Manager	Farming Family	Agri College
Charlie	30 – 35	Owner + Manager	Farming Family	Agri College
Delta	40	Owner + Manager	Farming Family	Agri College
Echo	35 – 40	Son of owner + Manager	Farming Family	Agri College
Foxtrot	45 – 50	Manager	Farming Family	Agri College
Golf	40 – 45	Manager	Farming Family	Agri College
Hotel	40	Manager	Farming Family	Agri College
India 1	40 – 45	Executive Director	Farming Family	Agri College
India 2	35	Manager	Farming Family	Agri College
India 3	35 – 40	Manager	Farming Family	Agri College
India 4	40 – 45	Executive Director	Farming Family	Agri College
India 5	40 – 45	Executive Director	Farming Family	Agri College
India 6	40 – 45	Executive Director	Farming Family	Agri College
India 7	40 – 45	Executive Director	Farming Family	Agri College
India 8	40 – 45	Executive Director	Farming Family	Agri College
India 9	40 – 45	Executive Director	Farming Family	Agri College
India 10	40 – 45	Executive Director	Farming Family	Agri College
Juliet	45 – 50	Owner + Manager	Farming Family	Basic
Kilo	40	Owner + Manager	Farming Family	Basic
Lima 1	40	Pig Production Director	Farming	Agri College
Lima 2	40	Pig Production Director	Farming	Agri College
Lima 3	40	Pig Production Director	Farming	Agri College
Lima 4	40	Pig Production Director	Farming	Agri College
Lima 5	40	Pig Production Director	Farming	Agri College

Table 6.6 Selected personal details of the farms where interviewee responses related. A Farming background means that the interviewee had worked in the agricultural sector before, or that they entered farming although their family were not farmers. Farming Family background indicates that their parents were farmers in their own right – something that may have spanned sever generations (Author's work).

Farm Reference	*Employees*				*Typology*
	Dedicated Admin		*Production*		
	✓ / ✗	*No.*	*Full*	*Part*	
Alpha 1	✓	45	14	6	Corporate Farming Co.
Alpha 2	✓		15	3	Corporate Farming Co.
Alpha 3	✓		13	4	Corporate Farming Co.
Alpha 4	✓		5	2	Corporate Farming Co.
Alpha 5	✓		6	4	Corporate Farming Co.
Bravo 1	✓	1	5	4	Family Farming Business
Bravo 2	✓		3	2	Family Farming Business
Charlie	✓	1	4	2	Family Farming Business
Delta	✗	n/a	4	2	Family Farming Business
Echo	✓	1	3	2	Family Farming Business
Foxtrot	✗	n/a	3	1	Family Farming Business
Golf	✓	1	3	Students	College Farm Business
Hotel	✓	1	2	3	Commercial Research Farm
India 1	✓	13	6	1	Corporate Farming Co.
India 2	✓		6	0	Corporate Farming Co.
India 3	✓		5	1	Corporate Farming Co.
India 4	✓		6	3	Corporate Farming Co.
India 5	✓		7	2	Corporate Farming Co.
India 6	✓		7	1	Corporate Farming Co.
India 7	✓		4	1	Corporate Farming Co.
India 8	✓		10	3	Corporate Farming Co.
India 9	✓		4	0	Corporate Farming Co.
India 10	✓		6	1	Corporate Farming Co.
Juliet	✗	n/a	2	4	Owner Driver
Kilo	✗	n/a	2	2	Owner Driver
Lima 1	✓	10	30	5	Corporate Farming Co.
Lima 2	✓		35	2	Corporate Farming Co.
Lima 3	✓		20	1	Corporate Farming Co.
Lima 4	✓		12	4	Corporate Farming Co.
Lima 5	✓		3	3	Corporate Farming Co.

Table 6.7 Selected details of the farms of the farms included in the research (not including the owner , manager, or some casual / seasonal labour required during harvest). For a description of the Typology see text (Author's work).

Farm Reference	Housing: Sows		Housing: Finishers		
	Solid Concrete Floor + Straw	Partially Slatted Floor + Slats	Solid Concrete Floor + Straw	Fully Slatted Floor	Partially Slatted Floor + Straw
Alpha 1	n/a	n/a	✗	✓	✗
Alpha 2	n/a	n/a	✗	✓	✗
Alpha 3	n/a	n/a	✗	✓	✗
Alpha 4	✓	✗	n/a	n/a	n/a
Alpha 5	✗	✓	n/a	n/a	n/a
Bravo 1	✓	✗	✗	✓	✗
Bravo 2	n/a	n/a	✗	✓	✗
Charlie	✓	✗	✗	✓	✗
Delta	✓	✗	✓	✗	✗
Echo	✓	✗	✗	✓	✗
Foxtrot	✓	✗	✗	✓	✗
Golf	✓	✗	✓	✓	✗
Hotel	✓	✗	✗	✓	✗
India 1	✓	✗	✗	✓	✗
India 2	✓	✗	✗	✓	✗
India 3	✓	✗	✗	✓	✗
India 4	✓	✗	✗	✓	✗
India 5	✓	✗	✗	✓	✗
India 6	✓	✗	✗	✓	✗
India 7	✓	✗	✗	✓	✗
India 8	✓	✗	✗	✓	✗
India 9	✓	✗	✗	✓	✗
India 10	✓	✗	✗	✓	✗
Juliet	✗	✓	✗	✓	✗
Kilo	✓	✗	✓	✓	✗
Lima 1	✗	✓	n/a	n/a	n/a
Lima 2	✗	✓	n/a	n/a	n/a
Lima 3	✗	✓	n/a	n/a	n/a
Lima 4	n/a	n/a	✗	✗	✓
Lima 5	n/a	n/a	✗	✗	✓

Table 6.8 Selected details relating to pig housing from the farms included in the research (Author's work).

Farm Reference	*Animal Waste Storage*	
	Manure	*Slurry*
Alpha 1	▪ Weeping-wall Heap	▪ Above-ground Tank
Alpha 2	▪ Weeping-wall Heap	▪ Above-ground Tank
Alpha 3	▪ Weeping-wall Heap	▪ Above-ground Tank
Alpha 4	▪ Weeping-wall Heap	▪ Above-ground Tank
Alpha 5	▪ Open Heap	▪ Lagoon ▪ Above-ground Tank
Bravo 1	▪ Weeping-wall Heap	▪ Above-ground Tank
Bravo 2	▪ Open Heap	▪ Above-ground Tank
Charlie	▪ Weeping-wall Heap	▪ Lagoon
Delta	▪ Open Heap	▪ Lagoon
Echo	▪ Open Heap	▪ Lagoon ▪ Above-ground Tank
Foxtrot	▪ Open Heap	▪ Lagoon ▪ Above-ground Tank
Golf	▪ Weeping-wall Heap ▪ Open Heap	▪ Above-ground Tank
Hotel	▪ Weeping-wall Heap ▪ Open Heap	▪ Below-ground Tank
India 1	▪ Weeping-wall Heap	▪ Above-ground Tank
India 2	▪ Weeping-wall Heap	▪ Above-ground Tank
India 3	▪ Open Heap	▪ Above-ground Tank
India 4	▪ Weeping-wall Heap	▪ Above-ground Tank
India 5	▪ Weeping-wall Heap	▪ Above-ground Tank
India 6	▪ Open Heap	▪ Above-ground Tank
India 7	▪ Open Heap	▪ Above-ground Tank
India 8	▪ Weeping-wall Heap	▪ Above-ground Tank
India 9	▪ Weeping-wall Heap	▪ Above-ground Tank
India 10	▪ Weeping-wall Heap	▪ Above-ground Tank
Juliet	▪ Open Heap	▪ Lagoon
Kilo	▪ Weeping-wall Heap	▪ Lagoon
Lima 1	▪ Weeping-wall Heap	▪ Above-ground Tank
Lima 2	▪ Weeping-wall Heap	▪ Above-ground Tank
Lima 3	▪ Weeping-wall Heap	▪ Above-ground Tank
Lima 4	▪ Weeping-wall Heap	▪ Above-ground Tank
Lima 5	▪ Weeping-wall Heap	▪ Above-ground Tank

Table 6.9 Selected details of how natural animal wastes were stored on the farms included in the research (Author's work).

Farm Reference	*Animal Waste Application* *Waste Type* *Manure*	*Slurry*	*Whose Land* *Own*	*Others*
Alpha 1	▪ Broadcast	▪ Separation of slurry ▪ Bowser + Splash-plate ▪ Injectors ▪ Rain Gun	✓	✗
Alpha 2	▪ Broadcast	▪ Bowser + Splash-plate ▪ Bowser + Dribble-bar	✓	✗
Alpha 3	▪ Broadcast	▪ Bowser + Splash-plate ▪ Bowser + Dribble-bar ▪ Rain Gun	✓	✗
Alpha 4	▪ Broadcast	▪ Bowser + Splash	✓	✗
Alpha 5	▪ Broadcast	▪ Bowser + Splash	✓	✗
Bravo 1	▪ Broadcast	▪ Bowser + Splash-plate	✓	✓
Bravo 2	▪	▪ Bowser + Splash-plate	✓	✗
Charlie	▪ Broadcast	▪ n/a	✓	✗
Delta	▪ Broadcast	▪ Bowser + Splash-plate ▪ Umbilical + Splash-plate ▪ Umbilical + Injectors	✓	✓
Echo	▪ Broadcast	▪ n/a	✓	✗
Foxtrot	▪ Broadcast	▪ Bowser + Splash-plate	✓	✗
Golf	▪ Broadcast	▪ Bowser + Splash-plate	✓	✗
Hotel	▪ Broadcast	▪ Tankered off-site for treatment	n/a	n/a

Table 6.10 Selected details of how the natural animal wastes were managed on the farms where responses were collected from and included in this research (Author's work).

Farm Reference	*Animal Waste Application*			
	Waste Type		*Whose Land*	
	Manure	*Slurry*	*Own*	*Others*
India 1	▪ Broadcast	▪ Bowser + Splash-plate	✓	✓
India 2	▪ Broadcast	▪ Bowser + Splash-plate	✓	✓
India 3	▪ Broadcast	▪ Bowser + Splash-plate	✓	✓
India 4	▪ Broadcast	▪ Bowser + Splash-plate	✓	✗
India 5	▪ Broadcast	▪ Bowser + Splash-plate	✓	✗
India 6	▪ Broadcast	▪ Bowser + Splash-plate	✓	✓
India 7	▪ Broadcast	▪ Bowser + Splash-plate	✓	✓
India 8	▪ Broadcast	▪ Bowser + Splash-plate	✓	✓
India 9	▪ Broadcast	▪ Bowser + Splash-plate	✓	✗
India 10	▪ Broadcast	▪ Bowser + Splash-plate	✓	✗
Juliet	▪ Broadcast	▪ Bowser + Splash-plate	✓	✗
Kilo	▪ Broadcast	▪ Bowser + Splash-plate	✓	✗
Lima 1	▪ Broadcast	▪ Injectors	✓	✗
Lima 2	▪ Broadcast	▪ Injectors	✓	✗
Lima 3	▪ Broadcast	▪ Injectors	✓	✗
Lima 4	▪ Broadcast	▪ Injectors	✓	✗
Lima 5	▪ Broadcast	▪ Injectors	✓	✗

Table 6.11 Selected details of how the natural animal wastes were managed on the farms where responses were collected from and included in this research (cont.) (Author's work).

Contact	*Employed by*	*Details of responsibilities*
❶	Meat & Livestock Commission.	Runs research on a Meat & Livestock Commission owned pig farm.
❷	National Farmers' Union.	Specific responsibilities for IPPC.
❸	Environment Agency.	Specific responsibilities for IPPC.
❹	Environment Agency.	Specific responsibilities for IPPC.
❺	Environment Agency.	Specific responsibilities for IPPC.
❻	National Pig Association.	Represents the pig industry.
❼	Department for the Environment, and Rural Affairs.	Specific responsibilities for overseeing the implementation of the IPPC Directive.
❽	Dairy.	Dairy & farm owner manager.
❿	Corporate farming company	Environment Manager

Table 6.12 Selected details of other contacts interviewed during the research (Author's work).

6.5.1 Management of the pig farm

The Environment Agency is promoting the adoption of the European certified environmental management system (cert. EMS) Eco-Management and Audit Scheme (EMAS) for the management of an installation's environmental impact. It is said that such a system will assist in managing the application procedure and the daily activities whilst bringing benefits for the environment. However, in the SFI GBRs there is only a little over a page relating to management techniques and the emphasis is on staff training up to the Livestock GNVQ level III qualification and the requirements to,

> "...raise awareness of the conditions of the Permit for the farm, its implications, and how compliance can be secured by the work activities of the individual; and, Awareness of the potential environmental effects of the farm under routine and abnormal circumstances" Environment Agency (2001, pp. 6).

The management style of the farms visited varied. Alpha Farms produced central guidance to be implemented at the local farm. They were looking ahead at the requirements of SFI GBRs, engaging in a dialogue with the Environment Agency and working with universities in research projects considering various aspects of the changes in technologies that might be required. The management structure of Alpha Farms included a dedicated environmental manager whose responsibilities were the implementation of all environmental regulations. The company intended that it would grapple with the SFI GBR package centrally and then disseminate a complete package to its own farms and those that it managed.

The management of India Farms followed a similar pattern to that of Alpha Farm; one of the senior managers was a member of the National Pig Association and met with the Environment Agency during its discussions on how best could the Environment Agency implement the IPPC Directive. Central decisions, planning, and the rolling out of guidance were occurring. However, beyond the more important decisions being made centrally, day-to-day management appeared to be reactive, dealing with problems locally, and making decisions at that level. Centralised decision-making and the production of guidance referred to the implementation of regulation and technicalities of maximising pig production. Once the regulatory requirements had been complied with, the centralised aspects of management were set aside and not referred to again, it was not a continual process of engagement. The other farm managers appeared to be reactive in management style and not planning for the future except in the direct processes of producing pig-meat. Everything else appeared tangential to this activity and was perceived as a burden for the manager.

When specifically asking about cert. EMS ((International Organisation for Standardisation) ISO 14001 and EMAS) standards only the environmental manager for Alpha Farms was aware of them. Further, the environmental manager of Alpha Farms believed that, "...those sorts of things are more appropriate to other industries than ours". After explaining to those farm managers interviewed, some of the requirements and the work entailed in putting together such an environmental management system, a common theme emerged, perhaps best captured by the manager of Delta Farm,

> "...if I went to the expense of putting a system together, either by myself or through hiring consultants, and I can't readily think of any who could prepare one, then when or how am I going to get my money back: I just don't see the opportunity to make my money from having such a system".

It was evident that the majority of the farmers were unsure of the details of a cert. EMSs and what was entailed. However, they appeared all too ready to suggest that they were unable to take on any more paper-work and bureaucracy without a full evaluation of costs and benefits.

Farm managers were specifically asked if they might implement a cert. EMS in the future. It was suggested that such a system may assist them in managing the implementation and continued compliance with the PPC permitting regime, and that the Environment Agency may reduce its inspection frequency under the Operator and Pollution Risk Appraisal (OPRA) scheme. The manager of Delta Farm still felt that having such a system was not financially viable. Whilst the environmental manager of Alpha Farms, one of the large pig farming management companies, was a

little more progressive in his opinions and went as far as suggesting that they,

> "...might consider investigating such systems, but the economics of it would have to be proved, and the Environment Agency would have to assure us that our commitment into such an innovative area would indeed lead to reduced inspections and be of benefit to our farming company".

The manager thought that it might be possible to produce a template, centrally, to cover many of the required aspects of a cert. EMS. However, reservations were specifically expressed concerning how cooperation from the farm managers of the farms that the company managed could be achieved. It was "all very well having these ideas at the management level, but how can they be acted upon effectively?" (environmental manager, Alpha Farms).

Whilst none of the farm managers interviewed held the Livestock GNVQ Level III qualification, they believed that they were qualified to do their jobs. For many, formal education was not a primary concern. Instead they relied upon natural succession. Their son had always worked on the farm and had "...learnt the ropes from a very young age and knew how to do the job without fancy college qualifications". Other routes into working on pig farms were through a known farmer whose son wanted to work on a pig farm as opposed to their father's arable farm. Contrary to this, the manager at Golf Farm, a commercially operated agricultural college farm, emphasised the high level of skills that the industry required from its employees,

> "...with the numbers of employees cut to the bone on a farm, you can't afford to employ anyone who doesn't know their job or who harms the pigs".

Whilst an agricultural college stresses the importance of qualified employees, it appears that the same view may not be reflected on the farms. However, whilst the managers may have learnt on-the-job it is more likely that younger employees would have attended college to learn their skills. When the managers were specifically asked, "what if you and your employees had to gain the Livestock GNVQ level III qualification?"; they appeared all too eager to offer reasons as to why this could not be accomplished. These included: the difficulties in providing time off from work when labour was at a minimum; who was going to pay; and with heightened awareness following Classic Swine Fever and Foot and Mouth Disease, issues relating to biosecurity. However, it is important to contextualise the farmers' response to the question of training. All the farmers interpreted the training requirement as stockmanship skills and for a manager, additional skills in keeping the business running. From the interviews, it was evident that the managers did not perceive training as being a prerequisite to managing the farm's environmental impact, farming was almost considered a benign activity.

6.6 Materials used on the farm

The SFI GBRs require the maintenance of an inventory detailing quantities and relevant environmental characteristics of *inter alia* biocides, pesticides, veterinary medicines, agricultural fuel oils, and bedding (Environment Agency, 2001). All the managers interviewed suggested that inventories of the above would not be a problem and each expanded upon this by giving examples of the records they are already required to keep. The "relevant

environmental characteristics" aspect initially appeared to cause some difficulty and began to turn the conversation into one of farmers versus society argument. However, once the managers were shown the "Raw Materials Pro Forma", included in the SFI GBR guidance, their reactions returned to one of acceptance, although some reluctance was expressed again about form filling and the time spent on administration.

The SFI GBR document requires that feed be tailored to the requirements of the pig (including different diets throughout the various stages of development) (Environment Agency, 2001). This requirement was made to reduce emissions of ammonia, nitrogen and phosphorous to the atmosphere from the slurry and manure that pigs produce (Environment Agency, 2001). This control has a proven research foundation in achieving reduced emissions (see for example, Mikkola *et al.*, 2001; MLC, undated*a*; undated*b*). Through the adoption of this practice the Environment Agency estimate that the levels of nitrogen and phosphorous in finishing-pig slurry could be reduced by 25 and 30 percent respectively with a similar reduction in sow slurry of 19 and 20 percent (Environment Agency, 2001).

Whilst the farmers interviewed suggested that they were already feeding differential diets to their pigs, this was for economic rather than environmental reasons. The two farms with centralised controls (Alpha Farms and India Farms) purchased specific feeds from the merchants for delivery to individual farms and therefore it was through these central mechanisms that changes to diets would or could be made. The managers shared a common belief that current practice was not significantly different from what was being proposed. However, this appears to be both a contentious issue of who is in control of farming activities and one of society

or environmental benefit at loss in production for the farmer. The manager at Charlie Farm said, "...I am not having people tell me how to feed my pigs", and the manager at Echo Farm suggested that,

> "...it is all very well the Environment Agency telling me how to feed my pigs, but what if, for production reasons, I wish or need to feed my pigs a different diet. Am I going to be compensated for any losses?".

There are obviously still many prejudices to be overcome, as opposed to actual changes required in practice. The issue of personal losses in production to achieve a wider societal-benefit remain to be resolved.

6.7 Emissions management

6.7.1 Housing

The potential changes to animal housing were an area of considerable concern for the farmers. Some had been actively thinking about the requirements within the SFI GBR document, whilst others had to have it explained. Concern was expressly based mostly upon the costs of making changes. Whilst the system of pig production was generic across many farms there were significant variations between farms because the majority of buildings were not purpose-built but had been adapted for pig production or had been constructed at different times.

There has been a wealth of published research concerning housing design, operation, and emission limits, see for example, O'Neill & Phillips (1991); O'Neill & Phillips (1992); O'Neill *et al.* (1992); Aarnink *et al.* (1995); Anderson (1996); Aarnink *et al.* (1997); Groot Koerkamp *et al.* (1998); Hinz & Linke

(1998*a*; 1998*b*); Phillips *et al.* (1998); Takai *et al.* (1998); and Wathes *et al.* (1998). The majority of the papers originate from The Netherlands, Denmark, and Germany where, because of environmental problems with their respective intensive pig industries, they have had to modernise their housing design and operation (Contact ❶). The Environment Agency is seeking is reduced emissions through;

> [1]. Changing the shape of the floor of the cellar area;
> [2]. Directing the slurry to a central channel;
> [3]. Covering the slurry with, for example, powdered clay; and
> [4]. Regularly removing the slurry to a covered silo for storage (Environment Agency, 2001).

However, in examining the content of the BREF Document it appears that the conclusions concerning housing design and operation lack true scientific rigour. The BREF Document states in respect of the comparison of techniques that,

> "Although much more factors influence the level of emissions to air, differences in diets should be clear to allow a correct interpretation of the performance data of alternative housing techniques. In many cases, the submitted information on housing designs and their associated ammonia emission levels did not contain information referring to whether reduced N-diets were applied. It is therefore not always clear, whether the performance of housing could be attributed entirely to the change in design or could have been partly due to other factors such as feeding techniques. It is assumed that in general phase feeding has been applied and that emission levels (factors) can be compared" European Commission (2001, pp. 175).

The BREF Document was written with considerable influence from countries where housing currently operates to the required standards (Contact ❶). The impact upon the United Kingdom will be to bring our installations up to

their standards, increasing production costs and consequently making export more difficult. Additionally the Technical Committee suggests,

> "It is assumed that techniques reducing the emissions of NH_3 will reduce emissions of the other gaseous substances as well...It is also important to realize that reduction of emissions from housing potentially lead to an increase of NH_3-emissions from manure storage and application" European Commission (2001, pp. 176).

All the farmers suggested that their housing systems could not be changed without considerable cost and the belief was that it would not be worth their while making the capital investment. It was not the technical aspects of making these changes that were the problem, but concern over how the costs could be recovered. The farm managers explained that they had already implemented expensive changes in 1999 to comply with the sow-stall and tether ban and were "...smarting from that". Many farmers drew a comparison with other European Member States where there were no such requirements.

Therefore, whilst the industry was not disputing the potential to reduce emissions, it was suggesting that it could not afford to make the desired changes now, or over the time-frame in which the Environment Agency expected (three to four years). However, there were moves on behalf of the industry to investigate how reduced levels of emissions could be achieved but at cheaper costs. For example, the Meat & Livestock Commission had been engaged in a research project specifically investigating measures that could be adopted to change the shape of the cellar floor below the full slats (Contact ❶). This would reduce the surface area and there would be an associated reduction in emissions – as required under the SFI GBRs. The

problems for farmers in making changes to the cellar under a slatted floor are capital expenditure and the return. Additionally there would be a period of lost production whilst the work was carried out.

Current practice is to let effluent build up in the cellar until the pigs progress to the next stage in their growth (around three week intervals), when the house is cleaned and disinfected. This contradicts the Environment Agency's proposal that the cellar be cleaned out every three days (Environment Agency, 2001). The farmers believe that the requirement to empty the cellar at three-day intervals could be met, as the manager of Bravo Farms explained,

> "...the slurry has to go to the tank anyway, so it makes little difference to me if I do it now, later, or every three days. It is relatively wet and free flowing and all I would have to do is open a gate-valve and off it goes; it just takes up some of someone's time, that's all".

Following the interviews and farm visits the divergence between Environment Agency proposal and farmer practice does not appear too great. Most, if not all, of the concerns that were expressed were of the prospect of having to make expensive modifications to animal housing. However, whilst farmers believed that their practices were compatible with the Environment Agency's proposals a gap between the two was observed during the farm visits. For example, on most farms there were ponded areas where there was not enough straw, a condition that, according to the BREF Document, would increase ammonia emissions by 30 – 35 percent (European Commission, 2001). Attention to detail is required from the farmers to bring current practice in line with what the Environment Agency is requesting.

6.7.2 Waste storage

The requirements contained within the SFI GBR document are to cover slurry stores with covers that can be either solid, flexible, or floating (Table 6.13) (Environment agency, 2001). Currently there is no such requirement and therefore farmers are likely to have to modify their facilities (Table 6.14). Manure, on the other hand, is currently left uncovered on the field whilst it composts. This practice would not be permissible and the windrow would have to be covered with either a reusable UV-stabilised plastic cover, or a 10 cm thick covering of peat (Environment agency, 2001). The objective of fitting covers is to reduce ammonia and odour emissions into the atmosphere (Environment agency, 2001) and whilst BAT as contained within the Environment Agency's SFI GBR represents a significant shift from current practice, the BREF Document hints at further changes,

> "Covering of above-ground slurry stores has been successful in reducing odour and has resulted in reductions of ammonia emissions of up to 99 %. From the information submitted no clear conclusion can be drawn, as all techniques have their drawbacks. Rigid and floating covers have been assessed, but many of the alternatives have technical (construction), operational or environmental limitations. Attention must be paid to development of gaseous compounds under a cover and the possibility of using this gas as an additional energy source should be considered" European Commission (2001, pp. 276).

In addition to infrastructure changes, the SFI GBR package aims at better management of slurry and manure storage facilities – it is not only technology that the IPPC Directive encompasses but also the techniques of use. This is important because farmers appear too ready to risk causing pollution from the physical condition of their slurry and manure storage facilities, their inappropriate management, and poor operational practice.

This became evident during the farm visits conducted as part of this research. Although a number of the farmers interviewed stated that they inspected their slurry stores regularly – their condition as seen during the visits cast doubt upon this. The requirements of the SFI GBR package are that slurry stores are emptied and inspected every year (Table 6.13) (Environment agency, 2001). In addition to above-ground slurry storage tanks, the SFI GBR document contains changes to the way in which lagoons are constructed and used. The changes detailed in Table 6.13 would make the use of lagoons more expensive than they currently are, and it is their relative inexpensive nature that has made them poplar with farmers. Manure heaps management needs to be thorough as a number were observed to have quantities of leachate around their base, which in one case presented a potential threat to a nearby watercourse.

Waste	*Storage method*	*Details of BAT requirements*
Manure		▪ Cover a solid manure stack in the field immediately when it is made. ▪ Covering with a UV-stabilized plastic covering is preferable as this can be re-used if properly applied. ▪ Covering with peat would need a minimum layer of 10 cm.
Slurry	**Tanks**	▪ To ensure that the bottom of an above-ground slurry tank is impenetrable by slurry liquid to reduce the risk of leakage of an above-ground slurry tank by fully emptying it every year & inspecting it before refilling it. ▪ To apply double valves on the filling inlet of a slurry tank.
	Covers	▪ Stirring the slurry only just before emptying the tank for application on land. ▪ Designing new slurry tanks with the option to fit a cover. ▪ Covering new & existing slurry stores with tent covers; either a flexible tent cover or a floating cover would be applicable, achieving about 90 % reduction of ammonia emissions.
	Lagoons	▪ Applying them only in areas with suitable soils; this will need a proper analysis of soil properties. ▪ Allowing sufficient freeboard to catch rainwater in the case of an uncovered lagoon. ▪ Applying a floating UV-stabilized & supported canvas cover to lagoons up to a size of at least 2000 m^2; the associated reduction is at minimum 95 %.

Table 6.13 BAT for the reduction of emissions from animal waste storage (European Commission, 2001).

Cover type	*Store diameter (metres)*	*Cost (metre²)*	*Reduction in ammonia (%)*
Above ground			
Rigid (concrete)	15 – 30	€150 – €225	95 – 98
Rigid (glass fibre-reinforced plastic)	15 – 30	€145 – €185	95 – 98
Flexible fabric membrane	15 – 30	€54 – €180	80 – 90
Floating (light expanded clay aggregate)	15 – 36	€15 – €36	72 – 82
Floating (rape seed oil)	15 – 30	€15 – €36	92
Floating (peat)	15 – 30	€15 – €36	90
Floating (expanded polystyrene granules)	15 – 30	€15 – €36	50
Lagoons			
Flexible impermeable UV-stabilised plastic sheet		€15 – €25	95
Floating (light expanded clay aggregate)		€15 – €25	82

Table 6.14 Emission reduction and costs of different types of slurry store covers (ADAS; 2000*a*; 2000*b*; Mikkola *et al.*, 2001).

Overall, the majority of farmers had not considered how they were going to comply with the requirements of the SFI GBRs. The reason behind this was the perceived expense of having to install covers of one type or another. However, Alpha Farms had been involved in a joint research project with a university investigating how emissions could be reduced with covers other than the rigid type. The motivation behind this participation was that the farming company could benefit from the research without having to finance expensive consultants to perform the same function. India Farms too had been considering the storage of slurry, but for another reason. The manager explained that the implementation of the Nitrate Directive could result in having to store quantities of slurry greater than the capacity of their current lagoon. This was because the Nitrate Directive requires a reduction in the quantities of nitrogen that many farmers currently apply to their fields

(DEFRA, 2001). Moreover, the period over the winter in which farmers would not be permitted to apply slurry or manure to their fields was going to be extended (DEFRA, 2001). India Farms were unsure of what approach they would adopt in complying with the Nitrate Directive.

Contact ❶ and the manager of Hotel Farm had also considered the options for waste management. Hotel Farm was unique in that it produced small quantities of slurry and stored the slurry in below-ground tanks, rather akin to septic-tanks, from where they periodically engaged a contractor to pump-out and dispose of the slurry at a landfill facility. However, they had not fully considered the ban on the disposal of liquid wastes to landfill because of the Landfill Directive (99/31/EC) (see Chapter 5). When told this ban, they both agreed that they would have to put more thought into what they would do with their slurry.

Although farmers were aware of the requirements to cover slurry tanks, and that the methods of construction and operation of lagoon as a means of storing slurry would be tightened, there was not the same degree of action. The farmers were refraining from making plans because it was going to be five years before they had to submit a permit application and they hoped that alternative, less expensive, covering methods would be developed and allowed. However, some of the farmers had to consider storage capacity, with a degree of urgency, because of the Nitrate Directive and the designation of additional Nitrate Vulnerable Zones.

6.7.3 The land spreading of waste

The Environment Agency would like to see farmers using methods that are more advanced that the current widespread use of a tractor-trailed bowser and splash-plate when animal-wastes (primarily slurry) are applied to the land, although these methods are more expensive (Environment Agency, 2001). Injectors are one of the methods preferred by the Environment Agency as it gives rise to less atmospheric emissions than many splash-plate designs (Environment Agency, 2001). However, the capital expenditure for this method is higher and the work-rate is lower (Contact ❷) and it is additionally a more difficult method to adopt on stony-ground (Bell, 1996). Other methods include band-spreaders or dribble-bars that also should reduce the volatisation of the slurry and lower emissions. The Environment Agency is also seeking an end to slurry being applied by a rain-gun because the small droplet size that is produced as the slurry passes through the nozzle is more likely to cause odour complaints from nearby residents, and releases relatively high levels of ammonia into the atmosphere (Environment Agency, 2001).

However, it may not be necessary to invest in technologies such as slurry injection since splash-plate spreading could be permitted providing that the slurry is incorporated within 24 hours. Viz -

> "Applications of solid manure to uncropped land or bare soil shall be incorporated within 24 hours, unless such applications are used to control wind erosion on susceptible soils, with prior agreement from the Environment Agency in writing" Environment Agency (2001, pp. 28).

This is a 'grey-area' where the requirements are not clear and the Environment Agency has not made a decision, as explained by Contact ❺.

Nevertheless, farmers are concerned at the additional costs of making two passes of the field, effectively doubling the costs of applying organic-nitrogen compared to inorganic-nitrogen. This change in the balance of costs between organic- and inorganic-nitrogen may hinder the prospect of finding a neighbouring farmer who is prepared to accept the slurry and manure and apply it to their land. This would then exacerbate the existing problem facing many intensive pig farmers of large quantities of slurry and not enough arable land to apply the waste.

Overall, the farmers who were interviewed were using techniques (and technologies) that were very traditional. Further, it appeared that it was their intention to accept the need for incorporation following application and no answers to the problem of availability of arable land for the quantities of slurry were forthcoming. However, Delta Farm was more progressive in its outlook and had invested in an umbilical system and had installed the necessary outlet infrastructure at distances from the slurry lagoon in order to spread the slurry onto its arable land, however the final delivery method was via a splash-plate. Furthermore, this farm was applying the organic-nitrogen to the crop during the spring-growing period as opposed to many farms where heavy applications are made during the autumn when the potential for run-off and water contamination are greatest.

Returning to the other objective of managing organic-nitrogen applications – whilst some farmers acknowledged that odours could be generated, all believed (as expressed by the manager of Golf Farms) that the fault lay with either,

"...residents for choosing to live there or the planning authorities for allowing such developments in the first place".

The view was that farm-odours were "...natural countryside smells, what you expect if you live in the countryside" (manager of Bravo farms). The farmers felt that they were having to address a problem that had only become apparent as the residency of the villages had changed over the years, and now saw more "...townsfolk living in the countryside" (manager, Foxtrot farm). It is difficult to access accurately the problem of farm-related odour. Table 6.15 provides some basic information on the number of complaints received from both industrial and agricultural sources. Whilst agricultural sources were cited less than industrial sources, there remain a significant number of complaints levied against agricultural activities.

Year	*Sources (no. of premises)*		*Prosecutions*	
	Agricultural	*Industrial*	*Agricultural*	*Industrial*
1989/1990	1,409	1,947	4	7
1990/1991	1,346	2,558	1	17
1992/1993	4,916	5,156	8	13
1993/1994	2,810	7,930	3	9
1994/1995	3,481	9,479	0	8
1995/1996	3,646	8,479	2	7
1996/1997	3,336	6,576	2	15
1997/1998	2,980	5,924	1	3
1998/1999	2,049	3,951	1	0
1999/2000	1,874	4,427	0	5

Table 6.15 The numbers of odour complaints received by Local Authorities for agricultural and industrial premises and the number of those complaints where a prosecution was made (Croner, 2001).

The farmers were a little coy about the issue of their farms being the subject of odour complaints. The environmental manager at Alpha Farms did suggest that they were aware of the possible problems that might be created from slurry spreading in fields in close proximity to residential areas. The manager suggested that they timed the applications of slurry and manure to the land to avoid causing a nuisance to their neighbours and that having to do so was an inconvenience for them. It may be that farmers are aware of the issue, but are not prepared to take action because they believe other people should be more tolerant of an intrinsic aspect of living in the countryside.

The manager of India Farms raised an interesting point: that many of the requirements of the SFI GBRs were already contained within the operating requirements of a Nitrate Vulnerable Zone designation. For example, the requirements to implement a manure management plan (Environment Agency, 1998), soil sampling, and matching nutrients to crop needs (Environment Agency, 2001). Therefore, with the expected designation of additional Nitrate Vulnerable Zones in 2002 or 2003 many farmers would be meeting the requirements of the SFI GBRs. This may ease the industry into having to make the required changes ahead of schedule and lessen the workload for both the farmers and the Environment Agency. However, the additional controls introduced under a Nitrate Vulnerable Zone designation may result in more farmers not having enough arable land to spread the wastes produced in intensive pig farming.

In an unusual instance of forward thinking, both Alpha Farms and India Farms, wondered what controls may be added when the Waste Framework Directive (75/442/EEC) was extended to agricultural waste. They were interested in the implications where other farmers were accepting their

natural animal 'waste' and if slurry and manure were applied in excess of crop requirements, would that operation be subject to additional controls? This ability for the farm's management to speculate over a future piece of environmental control may be explained by the different management structure, and the typology of farm business (Table 6.7) that these two farms had compared to the other farms.

6.8 Discrepancies between what was said and what was seen & the lies that farmers appear to tell

As previously mentioned, during the interviews and site visits it emerged that there were disparities between what the farmer said and what he was actually doing. The tour of the farm allowed an audit of what had just been discussed during the interview. This section discusses in some detail the types of discrepancies that were found, considers the motivation behind the need to hide the truth, looks at some of the causes, and culminates in what this means for the data capture process.

These discrepancies included inadvertent mistakes made during the interview, unfamiliarity with the way in which their farm actually operated, differences between the way in which a farmer wanted his farm to operate and the way others interpreted that, to deliberate instances of presenting false information, motivated by personal gain (as explained by the interviewee who on some occasions chose to justify his actions). Moreover, during the farm tours some farmers said that they intended to lie about some of their responses to questions on the application form in order to benefit materially; and with the belief that the authorities were unlikely to discover these lies.

The contents of Table 6.16 - Table 6.18 are significant because, by one means or another, these distortions are a little commented upon aspect of research within the farming community, or within any other field. Distortions can be intrinsic to questionnaire surveys because there is generally no corroboration of the answers given. Many published surveys appear to ignore this issue. Whilst this research does not measure the accuracy of the information gained, the fact that there is a gap between the answers obtained during the interviews and how the farms are actually operated has been fully considered during all analyses. Additionally, it is worth considering how these discrepancies may influence agricultural policy or agri-environmental policy objectives because of the inaccuracies contained within the raw data.

Interviewee	*Discrepancy*	*Gain*	*Cause / Motive*
Alpha 1 & 2	Disposal of dead stock	▪ Cheaper costs of waste disposal	▪ Carelessness ▪ Inappropriate training ▪ Financial
Alpha 1	Consideration and attitude towards neighbours when waste spreading	▪ Could perform activity when convenient for the farmer	▪ Convenience
Alpha 2	Causing runoff following animal waste spreading on fields	▪ Able to empty waste storage facilities and prevent overflow	▪ Carelessness ▪ Inappropriate training ▪ Financial
Alpha 2	That animal waste was incorporated within 24 hours of application	▪ Saves money	▪ Financial
Bravo 1	Provision of energy usage figures to the Inland Revenue	▪ Saves money	▪ Financial
Bravo 1	The number of pigs on the farm provided to the Environment Agency	▪ Avoid IPPC Directive's controls	▪ Financial
Bravo 2	Knowledge of drain and pipework infrastructure on farm	▪ Avoidance of actually discovering where it was	▪ Financial
Bravo 2	Inspection frequency of waste storage facilities	▪ Saves money	▪ Time for inspections ▪ Procedural ▪ Financial
Charlie	Causing pollution from animal waste storage	▪ Not having to construct adequate storage facilities	▪ Financial
Charlie	Placement of manure heaps on the field	▪ None	▪ Carelessness

Table 6.16 Discrepancies between information obtained during the interview process and that seen during the farm tour. Two columns consider what the gain might be and either what the cause for the discrepancy might have been and possible motivation (Author's work).

Interviewee	*Discrepancy*	*Gain*	*Cause / Motive*
Delta	Lagoon too full and too much animal waste applied to fields	▪ Not having to construct adequate storage facilities ▪ Able to empty waste storage facilities and prevent overflow	▪ Financial
Delta	Placement of manure heaps on the field	▪ None	▪ Carelessness
Foxtrot	Compliance with SFI GBRs concerning feeding of pigs	▪ Saves money / None	▪ Attitude ▪ Financial
Foxtrot	Regularity of animal housing cleaning operation	▪ Saves money	▪ Financial
Foxtrot	Compliance with prohibition of burying waste on farm	▪ Saves money	▪ Financial
Foxtrot	Compliance with incineration of farm waste	▪ Saves money	▪ Financial
Hotel	Cleaning out of animal housing	▪ Saves money	▪ Financial
Hotel	Control of resources used on farm, for example taps left running	▪ None	▪ Carelessness ▪ Lack of knowledge

Table 6.17 Discrepancies between information obtained during the interview process and that seen during the farm tour. Two columns consider what the gain might be and either what the cause for the discrepancy might have been and possible motivation (Author's work).

Interviewee	*Discrepancy*	*Gain*	*Cause / Motive*
India	Placement of manure heaps on the field	▪ None	▪ Carelessness
India	Inspection frequency of waste storage facilities	▪ Saves money	▪ Time for inspections ▪ Procedural ▪ Financial
India	Compliance with regulations concerning fuel oil storage facilities	▪ None	▪ Carelessness
India	Housekeeping of food storage and delivery area	▪ None	▪ Carelessness
India	Cleaning out of animal housing	▪ Saves money	▪ Financial
India	Compliance with regulations concerning Manure Management Plans, Nitrate Vulnerable Zone regulations and animal waste applications to fields	▪ Saves money	▪ Financial
Juliet	Record Keeping and management of the farm	▪ Saves money / None	▪ Financial ▪ Carelessness
Juliet	Existence of "muck-for-straw" arrangement and appropriate animal waste management	▪ Saves money	▪ Financial
Kilo	Quantities of animal wastes spread on field and its appropriateness	▪ Saves money	▪ Financial

Table 6.18 Discrepancies between information obtained during the interview process and that seen during the farm tour. Two columns consider what the gain might be and either what the cause for the discrepancy might have been and possible motivation (Author's work).

From the above tables it is evident that reasons of saving money feature highly upon the gains and motives accounting for the discrepancies. This is perhaps an unsurprising finding, as many firms' actions probably do not meet stated ideal practices because it is cheaper not to do so. These people must believe that they can get away with this practice, and will not be found out. Additionally, the belief that the system is overly bureaucratic and that "...its gone crazy with controls" can only foster the practice of unqualified people performing a function that they are capable of doing although not in possession of the required certificate; there is no legal defence for ability versus qualification.

Three major themes occurred across all three size typologies of those interviewed:

[1]. Carelessness;
[2]. Inappropriate training and inadequate supervisory role; and
[3]. Saving time and money, possibly deliberately

Smaller concerns having fewer staff are often sidetracked and never have time to do those things that are not central to production; people believe in some cases that they have no time to do a proper job. When it comes to larger organisations, it is more a case of control and checking from supervisors and managers as to what is being done. The gap is between what the manager knows is required and what actually is done when those implementing it have not been instructed accordingly and or that verification as to what is actually being done is not happening. When it comes to saving time and money there is a move into more deliberate and calculated risk taking processes, balancing costs of compliance against costs and risks associated with not following correct procedures.

The IPPC Directive may evoke problems of turning intentions and policy objectives into actions and results. This is because at the level of individual farms differences may occur between what might actually be written on application forms, conveyed verbally to the Environment Agency, and what later actually transpires on the farm. Without more inspections than the Environment Agency could afford a policy shortfall is likely. One example of non-compliance, or of practices that fall short of what is required, may also spark others. Many of those interviewed felt that current regulations were unevenly enforced. For the researcher it heightens the need for care in collecting survey or questionnaire data and serves as a reminder that words and actions can and do differ.

6.9 Composite of farmer experience and future scenarios

The section below builds from specific individual responses to create an overall impression as to what the interviewees were saying about how they may react to the controls contained within the IPPC Directive. This has been done through constructing a typology of farm businesses and in assimilating the data captured (Table 6.19 Tableto Table 6.22) to create composites of the typologies of the farm businesses.

	Owner Driver	*Family Farming Business*	*Corporate Farming Company*
Size (ha)	▪ 200	▪ 300	▪ 630
Age of farmer	▪ 53	▪ 38	▪ 40
Education level	▪ Basic	▪ Agricultural College	▪ Agricultural College
Background	▪ From a farming family	▪ From a farming family	▪ Farming
Sows	▪ 780	▪ 865	▪ 1607
Finishers	▪ 2050	▪ 3350	▪ 4793
Type of Farm	▪ Mixed	▪ Pigs & Arable	▪ Pigs & Arable
Full Time Labour	▪ 2	▪ 4	▪ 11
Part Time Labour	▪ 3	▪ 2	▪ 3
Dedicated Admin	▪ No	▪ Some Do	▪ Yes
Admin Staff	▪ N/A	▪ 1	▪ 23
Organisational Structure	▪ None	▪ Informal	▪ Formalised
Management style	▪ Reactionary	▪ Reactionary	▪ Planned
Income sources	▪ Farmed produce ▪ External sources of income from family members working outside agriculture	▪ Farmed produce	▪ Heavily biased towards pig although arable land farmed ▪ Possible income from the management only of other farms ▪ Contract crops such as peas ▪ Diversification of income streams within pig farming for example genetics
Produce and market	▪ Local auction markets ▪ Local small-scale abattoirs where they still remain in business ▪ Speculative sales on the whole	▪ Seek contracts with smaller processors and abattoirs	▪ Pigs farmed for contract practically no speculative sales ▪ Contract farming with larger processors / abattoirs ▪ Supermarkets and multiple retailers possible direct contract

Table 6.19 Table summarising responses to key areas for each of the three typologies of farm businesses identified in this research. Numerical data is an average of the farms in that class (Author's work).

	Owner Driver	*Family Farming Business*	*Corporate Farming Company*
Inputs (feed)	▪ Home-grown feed forms largest part of diet ▪ Supplemented with specific rations purchased from feed merchant ▪ Industrial by-products also fed in the diet	▪ Home-grown feed fed les often as not sufficiently high enough in nutrients and matching feed requirements to growth stage is more important for these farmers	▪ Specific tailored rations purchased in ▪ Home-grown feed is used although possibly milled and forms a constituent of a farm-mixed ration
Housing	▪ Modified buildings of varying ages	▪ Modified buildings and some newer ones	▪ Purpose built buildings
Sow Housing	▪ mixed	▪ Solid Concrete Floors covered with a straw litter	▪ Solid Concrete Floors covered with a straw litter
Finisher Housing	▪ Mix	▪ Fully slatted floor over an open cellar	▪ Fully slatted floor over an open cellar
Animal Waste Application	▪ Slurry ⇒ Bowser and splash-plate ▪ Manure ⇒ Broadcast	▪ Slurry ⇒ Bowser and splash-plate ⇒ Umbilical systems ▪ Manure ▪ Broadcast	▪ Slurry ⇒ Bowser and splash-plate ⇒ Dribble-bar ⇒ Injection ⇒ Umbilical systems ⇒ Rain-guns ⇒ Separation technologies ▪ Manure ⇒ Broadcast
Animal Waste Storage	▪ Slurry ⇒ Lagoons ▪ Manure ⇒ Field heaps	▪ Slurry ⇒ Lagoons ⇒ Tanks sometimes ▪ Manure ⇒ Field heaps	▪ Slurry ⇒ Above-ground tanks ▪ Manure ⇒ Weeping-wall heaps transferred to field heap

Table 6.20 Table summarising responses to key areas for each of the three typologies of farm businesses identified in this research (Author's work).

	Owner Driver	*Family Farming Business*	*Corporate Farming Company*
Technology	▪ Traditional	▪ Traditional ▪ New technologies deployed only rarely and probably purpose built buildings	▪ Technological solutions deployed in many instances – long-term benefits sought ▪ Some development of new technologies and novel solutions to lessen the impact of regulations
Decision making	▪ Ad hoc ▪ Production planning	▪ Ad hoc ▪ Some planning ▪ Production planning	▪ Central core of experts fully plan most aspects of farm management
Information sources	▪ Limited to who farmer knows ▪ Farming press ▪ Possible access to internet but not that likely ▪	▪	▪ Wide-ranging
Interactions with the Environment Agency	▪ Reactionary to pollution incidents	▪ Reactionary to pollution incidents	▪ Proactive and collaborative in a two-way relationship. ▪ Actively seeking to shape decisions in their favour
Experiences of regulations	▪ Interference to a way of life	▪ Interference to a way of life	▪ A burden but will have to work with and try to turn to their advantage and lessen the overall impact
Incentives for compliance	▪ None ▪ Avoidance of legal action for non-compliance	▪ none	▪ none

Table 6.21 Table summarising responses to key areas for each of the three typologies of farm businesses identified in this research (Author's work).

	Owner Driver	*Family Farming Business*	*Corporate Farming Company*
Intentions towards IPPC / SFI GBRs	▪ De-stock to escape threshold	▪ Consider if possible to move pigs around the farms (installations) owned and operated by the family business to escape threshold	▪ Question each and every aspect of what is being asked of them through the farming company's central core of experts – meeting and discussions with the Environment Agency ▪ Complete applications at central expert core rolling out implementation package for all their farms
Future scenario	▪ Decreasing pig numbers may only be a temporary reprieve as in the near future similar controls may be extended towards all pigs. Possible intention to move out of farming all together.	▪ Desire to continue farming to maintain the family tradition. Likely to try and make necessary investments to comply. Will try to comply at cheapest costs and do the least possible.	▪ The business is intensive pig production. Likely to comply and manage the process at least costs due to economies of scale. Possible diversification may add value to business.

Table 6.22 Table summarising responses to key areas for each of the three typologies of farm businesses identified in this research (Author's work).

6.9.1 Owner Driver

This typology, typified by Juliet and Kilo, were the smallest farms encountered during the interviews; they were the ones that were just into the threshold of the IPPC Directive's controls. These two farms were personified by an older farmer who had been farming for years, as had his

father, but now his children did not want to continue the farming tradition. The next generation had seen the hard times and chosen either to become more educated or to enter another career. This was one important defining factor separating Owner Drivers from Family Farming Businesses. In some instances, children would leave the family farm denying their parents the 'cheap' family labour they had previously enjoyed. As a replacement, even minimal hired labour was expensive and was then only employed on a casual basis.

Pigs would typically be housed in conversions of existing buildings with the floors having been dug out to enable the fabrication of full-width slats over an open cellar. In meeting the stall and tether ban, sow accommodation would have been moved onto straw or deep litter through converting another existing farm building. Feeding would typically be ad lib and water would be provided via a trough or some similar type of device. Whilst the diet would aim to maximise the pig's development it would not be as precisely controlled as the other categories of farm ownership. This type of pig unit would be furthest from the operating standards of obtaining an IPPC permit. In addition to this significant gap, on some farms it would be questionable if the existing building could actually be modified.

Slurry is likely to be stored in a lagoon which itself is probably unlined. In the past lagoons were acceptable storage structures, and many would never have been lined with an impervious barrier. Their popularity resulted from their ease of construction, with minimal costs - with equipment that was probably available on the farm. However, covering lagoons will now prove expensive as a means to reduce atmospheric emissions to the acceptable level whilst the slurry is being stored. Slurry storage tanks are

less frequently encountered because even though Government grants were available for their construction the farms have been on the economic margins for many years. Finances have just not been available to divert to storage facilities. Where tanks have been constructed, again the economic difficulties are manifest in their condition, although they are still in use. Here again there is an important and significant cost implication for these farmers in having to cover these storage tanks. Whilst floating covers may offer a cheaper alternative, they may still lay beyond the reach of what these farmers can afford; both in terms of the finance they can raise, and in justifying the expenditure. Manures would be stored on the field ready for application during the autumn, and whilst this would appear acceptable under the new operating standards, efforts are required to ensure that such heaps are positioned appropriately.

Owner Drivers had originally farmed a mixed regime, but over the intervening years had increased their quotient of pigs at the expense of other livestock and in so doing have moved to more intensive production techniques. Throwbacks to the mixed farming regime were still in evidence. For example, Juliet Farm still supported a number of dairy cows. However, it was more usual to find an arable component to the farm's overall business. In addition to providing a different income stream, the arable land provided feed, straw for bedding, and a disposal area for the waste. Whilst this diversity may provide a buffer against declines in pig meat prices – the same diversity may lead to inefficiencies and lower margins.

Selling a relatively small number of pigs restricts the markets which Owner Drivers can supply. Many customers require higher volumes than the Owner Driver can deliver. Additionally processors wish to establish

purchasing contracts with the farmer for both volume and consistency in quality – again something that the Owner Driver cannot necessarily deliver. This means that many smaller farms, which are encompassed within the Owner Driver category, sell at local markets that can at times be relatively sensitive in terms of the price the farmer receives, due to the vagaries of short-term supply and demand. This contrasts with the larger farmers who are often able to negotiate contracts. Even where these may be more advantageous to the buyer than the seller, there is more stability in the system.

Within the Owner Driver group, there is practically no knowledge of the IPPC Directive, but there was a general awareness of new regulations affecting the intensive pig farming industry. This awareness manifested itself as a fear and concern that regulation and outside interference would this time finally put them out of business; even when this judgment was made without a full understanding of what was being asked. Furthermore, they were unaware of the regulatory guidance available from the Environment Agency, thus sustaining a 'fire fighting' approach to management of concerns not directly seen to be related to that of animal production. In outlook and attitude, these Owner Drivers were all too ready to make comparisons with the "...good old days", reminiscing of times when to them they could get on with their perceived way of life without the regulatory interference. This view extended to seeing their activities as being benign and the emissions as naturally occurring by-products.

Owner Drivers are typically close to the threshold of the IPPC Directive. The decision to de-stock is a likely outcome to stem the immediate problems and associated expense. Such a reaction represents a decision

based on limited information and assistance in taking these steps. In part this was because Owner Drivers did not necessarily know where to find the information. They were not computer literate and did not have access to the world-wide-web. These farmers were typically lower down the Environment Agency's support priorities and subsequently Owner Drivers seldom saw the Agency's inspectors. There was also minimal contact with other farmers, especially larger intensive pig farmers. This was because of the different markets into which the finished pigs were sold. The information network for the Owner Driver was the local farmer's market vis-a-vis Family Farming Businesses and Corporate Farming Companies producing for contracts. Furthermore, due to time and labour constraints it proved difficult to look forward from dealing with the present problems. Day-to-day matters seemed to take up all the time.

As seen by Owner Drivers, the future is constrained by the incentives that they believe come from actively engaging in the permitting procedure. With typically a higher age (Table 6.19) access to credit appears prohibitive; and as a result it would not be possible to make the necessary investments to attain a compliant farm. Further, this level of financial risk appears unwarranted, as Owner Drivers are not necessarily concerned with passing on a viable farm to their siblings. Selling the farm and realising the most money is of greater importance. However, for the time being, Owner Drivers need to keep the farm going. They neither can do nothing else or wish to see their time out farming – perhaps there was the belief that their children would relent and come back to farming in the end.

Therefore, Owner Drivers are at a pivotal position in the argument about the shaping of the future of farming in the UK: to go small and specialised or to increase the size of farming operation until it becomes economically viable within a more free-market situation. In addition to the economic difficulties facing these small-scale farmers, there is the need to change cultures and attitudes. There is too much hankering for the "good old days" when production harmonised farming and government policy. Education and persuasion will be the watchword in bringing about change within this category. It is a theme running across many of the individual aspects concerning IPPC. Such an attitudinal change is central to the management of the farm, in particular in recognising the need for training and education to meet new demands.

6.9.2 Family Farming Business

There were a number of Family Farming Businesses (Table 6.7) encountered during the interview process. These farmers were further away from the threshold of the Directive's controls. Unlike Owner Drivers, de-stocking was not really something that they expressed an immediate interest in doing. Family Farming Businesses typically comprised the family unit living and working on the farm. The farmer's spouse would provide office administration support to the business and their children would provide labour on the farm. On larger farms within this group, additional labour may be employed on both a permanent and a casual or seasonal basis. The son or sons would have been educated at an agricultural college and would be seen to have been suitably equipped for the next generation of farmers. However, strong parental controls and an established way of doing things may make the transposition of this theory into practice a protracted process. Further,

these skills may currently be reflected in changes in production to increase efficiencies as opposed to ways in which to manage the impact on the environment of the farm's emissions.

Family Farming Businesses appeared a little better organised with the management of the farm. The farmer's wife or daughter, performing an administrative function, will have organised the office and brought a degree of order. This gave the distinct impression that the farm was a definite business – in contrast to farms visited and subsequently categorised into the Owner Driver category. There remained objections to the need to train – either the older person knew their job or that agricultural college (in the case of the son), had provided all the necessary training – and that came at a cost. Additionally, their concerns were expressed over the costs involved in funding and paying staff when not doing a job whilst receiving education; both an expense without an obvious payback. Problems with these types of 'down time' costs are typical of small businesses.

There emerges a specialisation towards intensive pig production, moving further away from mixed farming. The arable land that the farm retained was more fully integrated into the pig enterprise, with cereals being used for feed, straw for bedding, and the arable land itself deployed as a resource for waste spreading. The smaller hectareage of arable land vis-a-vis Owner Drivers pro-rata and the concentration of intensive pig production saw the purchase and feeding of specific diets for the pigs. What was happening here, although production orientated, was near to what would be required if operating under the Environment Agency's SFI GBRs.

In some cases this specialisation in intensive pig production within the farm's overall enterprise had been pursued even further. The family business provided the opportunity for siblings to purchase additional farms, possibly relying upon their father's backing and thus expanding the overall farming business. This enabled the establishment of sow, grower, and finishing units that would be of financial benefit to the overall family farming business. However, this increase in size of operation was a double-edged-sword - economies of scale came at the expense of the problems associated with waste management. Typically, additional housing had been constructed on available yard space, then through the conversion of arable land. This latter directly exacerbated the problematic ratio of much waste for too little land. Changes to Nitrate Vulnerable Zone regulation – decreasing the quantities that can be applied makes the management of animal wastes even more difficult. In many instances, these difficulties have thus far been overcome through agreements with neighbouring farmers to dispose of pig waste in exchange for straw or at no cost. Changes contained within the SFI GBRs will tighten and formalise these agreements, in addition to requiring incorporation within 24 hours of spreading; thus shifting the balance between organic and inorganic fertilisers. Managing pig waste will become an even more challenging aspect of the farm business.

Family Farming Businesses, being further into the threshold of the IPPC Directive that Owner Drivers, will find it harder to disengage from intensive pig farming. Therefore, the typical Family Farming Business will, for the present, finance the necessary changes and continue in production. Some will be able to move pigs around all their farms and thus escape the threshold. Although one farmer suggested that he would just lie about the

numbers of pigs on his and the family's farms, as it was unlikely in his opinion that anyone would discover the truth.

Family Farming Businesses can be innovative and pioneering, as was evident in the example of substituting inorganic fertiliser application during the spring with organic manure. This would both save expenditure and reduce the quantities of waste stored. Feeding pigs has become a technological process too. In some cases, troughs have been replaced by automatic feeders and collar-activated feeding stations whereby individual pigs can receive a specific diet. The knowledge for this had come through working with the agricultural feed merchants. Nevertheless, when specific nutritional requirements were not required financial constraints still necessitates the inclusion of more traditional by-products of other industrial processes. In this respect Family Farming Businesses can already operate close to the requirements of the SFI GBRs; it is an attitudinal barrier that needs to be overcome.

Another area where these more developed Family Farming Businesses have progressed in terms of technology deployment is housing design. Whilst modification remains dominant it is possible that expansion has been achieved with purpose-built housing, complete with ventilation systems and improved waste transfer systems, albeit based upon slats over cellars. The most recent developments in this area are likely to comply with the requirements of the Environment Agency's SFI GBRs. However, it is the operation of such housing that typically creates the problem, and in particular the frequency of which the cellar and straw are cleaned, compared to requirements of the SFI GBRs. Further, knowledge of the location of pipes and valves as installed on the farm was poor, which suggested that

inspections were not actually being carried out. What prevails is a negative attitude to change and concerns over who has the real control of the farm activities. In all this, there is little fear of discovery and prosecution.

Family Farming Businesses typically produce under contracts for food processors as production systems now ensure a steady finishing rate and consistent quality. This type of pig farm can produce to the price that the processors are prepared to pay because, in some areas farmers benefit from economies of scale. Larger businesses should also have improved cash-flow, and can sustain monthly accounts at the merchants and monthly or quarterly payments from the processors. In general, production is not sufficient to supply the supermarkets or multiple retailers directly; processors act as the intermediaries in aggregating supply for the supermarkets.

Difficulties in finding money to raise the standard of current animal housing was one area where Family Farming Businesses made reference to. This kind of problem – that of financing change – was the type of problems that these businesses were able to identify. The problems that this sector would have in completing the application forms, finding the information that the Environment Agency required, and in initiating organisational change was however underestimated. Whilst advisors from the animal feed companies appeared to be a source of influence on how the pigs were fed, there appears a dearth of trusted advisors whom farmers will listen to and act upon where organisation and management change is required. Advising on the most economical and productive way to feed stock is a source of trusted advice that is seen to have direct bearing on the farm's business. How the farm operates and its management would appear to be a more private affair which is not so open for discussion. Notwithstanding this

relatively closed nature of farming businesses of this, and smaller sizes, information did filter through to these farmers. This was evident where objections were raised over the requirements of the SFI GBR package proposed by the Environment Agency as their answers were more reasoned that the smaller, more isolated, Owner Drivers. They were however, not as articulated or reasoned as that put forward by the Corporate Farming Companies. Information and planning tends focuses only on production, as opposed to other, "non-essential" management matters. Being larger, than Owner Drivers, there is a higher probability of Environment Agency intervention. The feeling was that visits were more frequent, although still primarily reactionary. In fact, the most frequent visitors to the farms were food safety inspectors and inspectors from buyers who wished to check on the premises.

Unlike many Owner Drivers, Family Farming Businesses have a drive to continue to farm. The farmer's son or sons wish to continue in farming provides the motivation to raise finance and invest for the future. Additionally, the relative levels of time, effort, and money already invested in the enterprise, and a certain degree of inertia make withdrawing from intensive pig farming much more difficult. However, Family Farming Businesses are not so heavily engaged with intensive production as Corporate Farming Companies. It is possible to diversify, perhaps lowering pig numbers and, for example, opting for outdoor production. Central to these decisions and the future of this group is the time-scale over which changes must be made. The ability to finance such changes, in addition to those recently made to comply with the sow stall and tether ban, will be an important factor.

Even where these pig farmers are intent on continuing, there are likely to be difficulties in completing the application form. There is the probability of engaging consultancy services, but for many the cost is prohibitive. The actions of the Environment Agency and the degree of assistance they afford individual farmers will also be significant.

Thus far, the licensing process seems to be all about increasing costs; at the application stage, in making asset changes, or in operating in a different way. Supplying the same market with increased costs, is difficult to sustain, as margins are already reportedly low. In effect, IPPC is asking the farmers to do the same level of work, if not more, for less money. It is unlikely that these increased costs will be compensated for by higher sale prices. Corporate Farming Companies should be able to produce cheaper, as should European or foreign competitors. Despite the apparent advantages of size, interviewees never raised the probability of expanding their businesses in an attempt to lower costs per head.

6.9.3 Corporate Farming Company

Three Corporate Farming Companies were encountered during the research: Alpha Farms; India Farms; and Lima Farms. Corporate Farming Companies are characterised by their size of operation, their ownership, and probably most significantly, their organisational structure. To a high degree these farms have specialised in intensive pig production and had geared their operations to be as efficient as possible. They employ specialists who work within demarcated areas, and have structured management which is normally located at the company's head office. It is there that strategic decisions are made by the most appropriate people – to be implemented by

individual farm managers. Day-to-day management is clearly separated from the farm's future, which is carefully considered and planned as a separate activity. This is a very significant departure from the Owner Drivers and the Family Farming Businesses. People are employed on merit rathers than because they are part of the family. Corporate Farming Companies are much more than scaled-up versions of Family Farming Businesses – they are distinctly different.

Qualified personnel are important. Corporate Farming Companies either employ trained staff or train them through their own programme. For big businesses training can be done en-mass through the Company itself in a similar way to what has happened within the landfill industry. Whilst there were some objections from the Companies over this requirement, it was accepted more than the previous two categories. When speaking to those further down the hierarchy, the belief was that without training and the qualification the employee would loose their job. This employer – employee relationship is a distinctive and important characteristic. Top-down decision making is the norm.

The central core of these companies interacts directly with the Environment Agency, seeking an understanding of the requirements, and importantly challenging the Environment Agency's proposals in a coherent way, as opposed to a blanket object to any change. In turn, the Environment Agency works with these farmers in trying to get the SFI GBR regulatory package together. In this respect, these larger Corporate Farming Companies had a much greater influence via the consultation process, than the previous categories.

Corporate Farming Companies are overwhelmingly concerned with the economic implications of what was being asked of them. Costs increase whilst the price received for the produce is likely to remain the same – this remains unchanged. However, it is these larger companies are more likely to have room within already small margins to finance some of the requirements.

Emissions management remains an area where considerable costs are incurred. Even though a greater proportion of animal housing would typically be newer and purpose built it would still be based upon open cellars under partial or fully slatted concrete floors. In contrast sow housing would typically be on solid floors with a deep straw litter, having been changed for the sow stall and tether bans recently implemented. One Corporate Farming Company, Alpha Farms, had also investigated floating covers for under floor storage areas in the hope that they would prove a more cost effective method way of yielding the desired emission reduction results. At the time when the interviews were conducted, it was unclear what the results would be. This example demonstrates the different way in which these larger companies operate, and supports the hypothesis that they are much more than scaled-up versions of the smaller categories.

One disadvantage that Corporate Farming Companies tend to have is proportionally less arable land upon which the animals' waste products can be spread. Waste, which is predominantly stored in open tanks, has to be disposed of through arrangements and agreements with neighbours. Proposed changes as to how this will work in the future may shift the balance between organic- and inorganic-manures, creating particular difficulty for produces of large quantities of animal wastes. Corporate

Farming Companies are particularly exposed in this area and it presents a cause for concern. Additionally, controls implemented through Nitrate Vulnerable Zone legislation will reduce the rate and time when nitrate-rich waste can be applied to the land. Despite the practical difficulties, Corporate Farming Companies could invest in technology such as separators which would help in this aspect.

Corporate Farming Companies primarily serve large customers who demand consistency, the regularity of supply, (for example supermarkets and their processors, or large processors themselves selling branded food products). This market is competitive and prices are keen. Prices are typically set by the customer. If the farming companies are unable to produce and supply at this level then it is relatively easy for the buyer to move purchases and import pig-derived products. This is where a Corporate Farming Company such as Lima Farms, which has farms in Poland, benefits advantageously from its size of operation and in a location where costs are comparably lower. Producing these large quantities, it would be relatively difficult for these producers to find alternative markets for this volume of produce.

What of the future for these Corporate Farming Companies? It has been difficult to assess how these farms are managing under the current conditions because in being more 'business-like' they were reluctant to give information concerning profits and losses or really commenting meaningfully on the economies of their situation. In common with all those interviewed, a major concern was the current economic difficulty brought about by low prices – but this may have been a general comment as their costs per head should have been lower due to efficiencies and economies of

scale. In this respect, it is noteworthy that Alpha Farms have suspended recruitment and India Farms have undergone a significant reorganisation and have shed a number of managers (Personal Communication). Mergers and takeovers are a real prospect in an attempt to lower costs. Further, integrating arable farms into the business is attractive – if only for disposing of animal waste. In addition, crops can be milled and processed for pig feed. Corporate Farming Companies may also diversify into areas such a consultancy services and the management of other intensive pig farms, having themselves gained an understanding of the regulations and the requirements. Diversification may also include a foray into areas such as animal waste processing and energy generation through biogas plants; an area that is just beginning to interest a very limited number within England. As with the previous class, none actually suggested that they would increase the size of their operation. This may be a mistake if these Corporate Farming Companies intend to compete in a market where there are larger farms in Poland for example, and farms within the USA with up to 100,000 head.

6.10 Summary of industry response based upon analysis of enterprise characteristics

The three composites described reveal very different responses to the legislation. Defining this typology has not been an exact process, but those categories chosen encompass more than size and turnover. They attempt to encapsulate the complete farm and its organisational structure and culture. It is quiet evident that larger farms, moving through Owner Drivers, Family Farming Businesses, and Corporate Farming Companies are not scaled-up versions of the previous smaller (typically by number of pigs) category.

There are significant differences between these three, which translates into different experiences and reactions to the regulations. Common to all is the concern about additional costs and how they can be recovered through selling pigs for a price higher than they current are. Larger farms with more pigs are likely to benefit from economies of scale and be able to spread those increased costs over more pigs. The smallest farms may be forced out of business altogether or perhaps decrease their numbers to escape the current threshold. But there is a problem with this particular response. Whilst the present threshold is 750 sows or 2,000 places for finishing pigs – it may not remain so indefinitely. With increasing concerns for the protection of the environment and for the regulation of industry, it is likely that the threshold will be lowered to achieve increased environmental protection or to level the regulatory 'playing field' across the production of all pigs.

Notwithstanding differences due to the number of pigs, motives also are different. For example, for Owner Drivers, where there are no offspring willing to take over the business, the best option may be to realise the most money from asset sale. Family Farming Businesses with offspring who want to continue the family tradition are motivated and driven to maintain the farm and possibly intensive pig production. Corporate Farming Companies fit uneasily into this perspective because their specialisation and reputation in intensive pig production would make a departure from that activity difficult. However, in the case of a PLC, shareholders would still require dividends and therefore would be less concerned what actual farming activity the company performed.

One of the main features of Corporate Farming Companies is the central-core and its functioning. This comprises experts, decision-making, planning, research and development, interactivity with the regulators, and writing applications. This is all disseminated through management packages to individual units (farms) for implementation. Within the intensive pig farming industry this category most closely reflects the landfill industry (see Chapter 7 for a fuller discussion comparing industries).

6.10.1 Management and cost implications of pursuing different approaches to meting regulatory standards

There are two routes to gaining a permit and operating legally: [1] apply for and operate in accordance with the SFI GBRs; or [2] if it is believed that current operating practice achieves similar emission levels then request that the Environment Agency determine the permit individually for the farm (they may of course decline to issue a permit if they believe that the way in which the farm is to be operated will not achieve acceptable limits). The Environment Agency have developed the former route, as it believes that it will offer a simple approach based on a tick-box methodology, and standardised forms as a route to gaining a permit. Essentially the farmer buys into prescribed technologies and farms in an approved way in order to gain the permit to continue farming. However, whilst it may be advantageous for the farmers it also benefits the Environment Agency, which is likely to find it difficult to administer IPPC to this sector in any other way. A limited number of experienced inspectors, plus numerous university graduates create a skills imbalance and influence the approach the Environment Agency uses. For many smaller farming concerns (such as Owner Drivers and Family Farming Businesses) the forms may well be

'easier' to complete (although both classes will find it an ardent experience and may ultimately has to draw upon assistance from the Environment Agency), but this comes at the expense of having to operate in a prescribed way. This is dictated by the BREF Document that is heavily influenced by the higher technological status of Denmark, Holland, Germany, and Belgium. In these countries, these routes have been pursued and supported by their governments (which is important) to address specific environmental problems of a very high concentration of pigs in certain areas. These problems are not present to the same degree in the UK or indeed in some of the southern European countries (Spain, France, and Portugal). It appears there is a one-solution policy, designed to fit all, even though there are a multitude of issues to solve and the local environmental conditions are heterogeneous. This is the compromise of the SFI GBRs. In reality only the larger Corporate Farming Companies will be able to request an individually determined permit and argue that techniques and technologies not included in the SFI GBRs will achieve similar emission levels. This after all is what IPPC is supposed to be about – as opposed to selling technology. The cost advantages are significant for the farmer if modification (as opposed to making wholesale changes) achieves the desired effect. For example, a university research project was helping Alpha Farms to determine if emission standards could be met by covering open slurry cellars, rather than through expensive high technology such as flushing canals. The results are important because IPPC implies NEEC (Not Exceeding Excessive Cost), which although not as explicit as IPC's BATNEEC (Best Available Technology Not Exceeding Excessive Costs), requires a balance between emission levels and what the industry can afford. This is another point which appears not to have been argued and which is only likely to be taken up by the Corporate Farming Companies.

There are no precise data to measure the effect of regulatory compliance in numerical form, and because of that a more categorical analysis and interpretation of the data has been performed. Further, there is very little in the way of measures of impact, or a precise point at which there is a demarcation between one typology and another. This is because the typology is based on more than just the numbers of pigs on the farm. With this in mind the following paragraphs are based upon the responses obtained and examine likely consequences of management options and how the impact for the three types of farms may be felt.

Owner Drivers could de-stock and seek temporary reprieve (this strategy would depend upon how many pigs they currently have and the effects of spreading fixed costs across fewer pigs). Alternatively (and perhaps radically as found by this research) Owner Drivers could increase their size of farming operation. This would work as a strategy until the impact of having more extra pigs becomes a burden. At this point increasing the size of operation also increases the impact. A lack of resources is at the root of some of the problems. Labour cannot be readily mobilised, there is no machinery, and there is no land to spread waste. This is a different experience to the other two categories, where additional resources that can be brought into play. However, this simplistic explanation smoothes over instances where for the Owner Drivers capacities are temporarily met (for example, with animal housing, waste storage, and available land to spread the waste). For Owner Drivers following the Environment Agency's SFI GBR if they wish to remain in intensive pig farming may be the best option. Alternatively they may wish to examine outdoor production or farming for niche markets.

Reacting to the regulations through increasing the number of pigs was not a response encountered during the research. However, it can be seen that for Family Farming Businesses and Corporate Farming Companies there may be some advantage in doing so and that the burden of compliance may be lessened accordingly – these farms may have additional capacity that is currently not being used, or could organise themselves better to use their resources more efficiently. In this was Family Farming Businesses may desire to operate in a similar way to Corporate Farming Companies. This is important because as has been mentioned before, there is a marked difference between the categories that unaccounted for by the number of pigs alone. Making this degree of change for Family Farming Businesses may be a tall order, but decreasing numbers offers no solution.

Corporate Farming Companies are probably already operating very efficiently and are near if not at current capacity. De-stocking is not an option as they are heavily into intensive production. Increasing capacity on their farms is likely to be difficult as land just may not be readily available. The movements that could be undertaken by these companies would see them asset stripping smaller farms near to where they are operating so the land could be used either for housing or for organic waste application. Another management approach that could be adopted by these farms is further diversification or to increase the values to the overall business that these peripheral activities contribute. For example, these Corporate Farming Companies may increase the number of farms in their portfolio that they manage, they may manage Family Farming Businesses through agreements thus benefiting both parties.

6.11 Discussion

The timing for this research was less than optimal. Following the Farming Summit and the subsequent decision not to permit "existing installations" until 2007 there is not the urgency that there once was. However, it was a little surprising that the farmers interviewed were as unprepared as they appeared to be, especially as the permitting process was to have begun in 2003. However, Classic Swine Fever, and Foot and Mouth Disease (FMD) probably presented more immediate concerns for the farmers. Although the number of farmers interviewed was less than envisaged at the outset of the research – as diverse a range as possible were sought (Table 6.5 – Table 6.11). The structure of the intensive pig farming industry (Figure 6.1 & Figure 6.2), in addition to anecdotal evidence from the farmers who were interviewed, does suggest that many of the farms that will come under the threshold of the IPPC Directive are relatively small businesses. The inclusion of three large Corporate Farming Companies in the research data is a reflection upon how easy it was to gain access to large intensive pig farmers as opposed to the rest of the industry.

These Corporate Farming Companies appear more organised, with central expertise able to make decisions, plan, and disseminate the outcome of considered reasoning. In contrast, the other farmers appeared to object to any change without being able to look further ahead; they were more concerned with day-to-day management. This situation is well documented in small- and medium-sized enterprise (SME) research (see Chapter 7). Further, India Farms and Alpha Farms were actively engaged in shaping the regulatory package with the Environment Agency. These discussions helped the

managers of these two farms to understand the Regulations and the requirements contained within the SFI GBR package.

It appears that the Environment Agency has had an unenviable task in producing the SFI GBR/ BREF Document package. The Environment Agency has had to balance the requirements the IPPC Directive; appease the intensive pig farming industry and its powerful lobby; and manage both the Environment Agency's workload and budget. What actual benefit to the environment will be realised from this agglomeration of factors will remain to be seen. The SFI GBR package was in its third revision at June 2001 with water, energy, and odour management sections being completely redrafted, as they appeared too complex for the intensive pig farming industry to understand or to implement (Contact ❺). This is the type of problem that will be experienced where both the regulator and the regulated are unfamiliar with a system of environmental regulation as it is transposed from one industrial sector to another. This will be especially prevalent when dealing with an industry that does not want to be subjected to those controls.

Whilst this chapter has focused primarily upon the standard permitting route of the SFI GBR option, it is not the sole way by which a permit to operate can be obtained. For farmers who cannot, or choose not to follow the prescribed methodology, their alternative is a fully determined authorisation. This option is more complex requiring that techniques and technologies be justified (emissions versus costs) to the Environment Agency where they deviate from those contained within the BREF Document. Additionally, the fully determined authorisation is more expensive than a permit issued under the SFI GBR package (Table 6.4). However, the manager of India Farms

believed that many intensive pig farmers would not qualify for a SFI GBR permit, and would have to apply for a fully determined authorisation.

From the interviews, it is evident that the process of completing the application form, the provision of information, site plans and layouts, may prove difficult for some farmers (especially the smaller Family Farming Companies and Owner Drivers). The process of having to provide this information will be time-consuming and the fees associated with the process will have to be spread across fewer pigs compared to their larger counterparts.

Alpha Farms aside, there appears to be opposition to the whole concept of a permit. Permits are alien to 'standard practices' and tradition where succession and inheritance have been the control on farming. It is apparent that there is a need for a cultural shift in gaining farmer's acceptance of permitting. This may prove more difficult as the IPPC Directive is directed towards only a small and specific proportion of the farming community.

The concept of a cert. EMS was alien to the majority of the farmers interviewed. Therefore, the Environment agency has both the task of raising awareness to cert. EMSs and in persuading farmers to implement them. Only Alpha Farms had an environmental policy (one of the precursors to an environmental management system) and a structured management approach to deal with environment-related business. One of the problems encountered in the cert. EMS debate was how the expense of implementing such a system was going to be recovered. The farmers interviewed did not believe that purchasers of pig-meat (supermarkets or processors) would be prepared to pay a premium because the farm had a cert. EMS as the

Environment Agency proposed. The farmers also felt that they would not be at a competitive advantage either. They did however believe that welfare as opposed to environmental codes brought them that advantage and associated price premium.

There was the strong belief amongst the farmers that they were already adequately trained and further training was unnecessary. The smaller farming companies were particularly concerned with the prospects of both losing labour hours whilst members of staff attended training courses and with having to pay members of staff for that time without them actually adding to the productivity of the farm. However, as it is a requirement of the IPPC Directive, farmers will have to bear the costs. Notwithstanding that, it may become a long drawn-out process similar to that experienced in the landfill industry (see Chapter 5). Hitherto it appears that training courses have not been developed that would suit older members of staff who may not have gained the necessary qualification. This is an important 'target-audience' as younger members of staff are more likely to have gained the relevant qualification whilst at agricultural college. This may present the industry with the particular difficulty of having to train older people who may have become more set-in-their-ways and be more reluctant to enter into the process. Larger farming operations may be able to develop their own in-house training and thus reduce the impact of this requirement, so again it is the smaller farming concerns that may experience greater difficulties in meeting the requirements.

Most farmers are operating near to what is being specifically asked of them when feeding their pigs as it is more economical. Farmers react negatively to being told what to. Aside from issues of who is in control of

farming practices - farmers were worried that environmentally based diets might affect production. For them it was a question of how financial losses were going to be compensated for. In reality, it is likely that farmers will revert to existing conventions saying one thing and doing another – verifying what occurs on farm may be difficult.

Requirements to maintain records appear to be a practice farmers are adapting to, although grudgingly. However requiring detailed environmental assessments of materials used on-farm may be beyond what many farmers can perform especially if justification is sought for the use of one material over another. For many of the farmers this requirement appears too tangendental to the process of producing porcine and in addition to the skills deficit there is reluctance about having to make these justifications. Assistance may need to be sought, especially from the smaller farming companies where no central expertise base exists. Conversely, the Environment Agency may have to develop standardised forms to assist these and other farmers in completing the application process.

In agreement with a number of other studies (for example Lowe *et al.* (1997), some of the waste storage structures seen during the farm visits appeared to be in a less than satisfactory condition. Whilst a number of the farmers were defensive when asked about their storage facilities, others were more open and revealed the inadequacies in inspections and the lack of capacity in their stores. Covering slurry stores is likely to be expensive, and whilst there is some assistance available for the construction of new stores in Nitrate Vulnerable Zones, it will require a degree of expenditure on behalf of the farmers that they appear unwilling to commit. Flexible covers are comparably cheaper than rigid covers (Table 6.14) although there is less

awareness of their availability. Despite the fact that covering stores may prevent or reduce releases into the atmosphere from point-sources, those emissions may be released later during the application of slurry to the land. It appears that an inadequate assessment has been made of the life-cycle of slurry management, especially in the areas of divergence between theory and what may occur on-farm.

The aim of both the IPPC Directive and the BREF Document is to realise a reduction in atmospheric emissions from pig housing, for example ammonia and nitrogen oxides (European Commission, 2001; Environment agency, 2001). The BREF Document promotes the use of high-tech systems, whereas the SFI GBR document favours a more manageable modification to the design of the under-floor cellar. Associated with these changes is the need for their correct operation, for example regular cleaning and enough straw to absorb wastes (European Commission, 2001; Environment Agency, 2001). The problem seen during the farm visits was that in many instances bespoke solutions would be required at each farm. The expenditure required by the farmers was in excess of what the farmers indicated they were prepared to spend (particularly under the current economic climate), especially following the recent investment made to bring housing up to new animal welfare standards. The Environment Agency suggests that they will give farmers a number of years in which to implement changes outlined in an "improvement plan" (Environment Agency, 2001). However, the farmers are ready to argue that the economic situation within the industry is such that those changes are an excessive cost for the achieved environmental benefit, and therefore are not implementable. If these assertions are upheld it may be a protracted period before changes to existing housing systems are accomplished.

The requirements contained within the SFI GBR document to match crop nutrient requirements to organic-nitrogen application may prove particularly challenging for the intensive pig farming industry. The problem is that many intensive pig farms have limited arable land and accordingly too much waste. Changing the techniques as to how the slurry or manure is applied to the land will not have an impact upon this. Applying organic fertiliser will become more expensive compared to inorganic sources, as the former require incorporation within 24 hours (Environment Agency, 2001); thus doubling the costs and halving the work-rate. It is likely that farmers will utilise their existing bowsers, but opt for different splash-plate designs as opposed to investing in slurry injectors or band-spreaders to minimise emissions. Reduced organic-nitrogen applications as contained within Nitrate Vulnerable Zones (Table 7.4), will add to the burden of intensive pig farming. The need for formalised agreements for the application of the farm's waste onto other farmer's land (Environment agency, 2001) may deter the recipient farmer from entering into such arrangements, as will the volatility of transport costs, and the price of inorganic-nitrogen. These will serve to make the process of having to have enough arable land available for the number of pigs kept on the farm and for which the permit is issued a more ardent process.

Farmers remain trapped into managing the slurry problem in an age-old way. What is required are different approaches towards animal wastes management. Whilst newer techniques are employed in slurry management (for example methane harvesting, and slurry separation) they do not reduce the quantity of liquid that is the cause of many problems. What is perhaps required are initiatives that move towards the situation in The Netherlands

where pig slurry is processed to a more readily transportable concentrated fertiliser and a liquid that is of sufficiently high quality to be discharged to controlled waters.

Financial constraints and the ability to gain reward from making any change was a recurrent theme mentioned at most points when discussing aspects outlined in the SFI GBR package. Whilst changes could be implemented, the concern was that increased expenditure would have to be absorbed into production costs as opposed to being passed on through the supply-chain. The farmers believed that other Member States would not implement the IPPC Directive with such vigour as the United Kingdom Government, and ultimately their production costs would be lower. Consequently, imported pig-meat could be cheaper than domestic products.

All the farmers interviewed stressed that they were currently operating as efficiently as they could because of the poor profit margins. This, again, could not be verified. However, on several of the farms visited a range of resource wastage was observed, including leaking water-pipes, water-hoses without triggers, and unattended water-hoses left running. The farmers did not appear to enter into a process of 'auditing' their assertions or beliefs. Consequently, there appears the opportunity to save money and ultimately lessen the environmental impact of the farm. Auditing or introducing a system of verification should be something that the larger farming companies could implement, as they appear more systematised than the smaller farms.

From the interviews there appeared no clear coping strategies or mechanisms for how the farmers were going to manage the implementation of the controls sought by the Environment Agency, the subsequent tightening of those controls, or indeed, any other environmental-based legislative-driven control applied to their farming activity. There appeared no real answers as to how the farmers were going to recoup any expenditure. Many of the farmers either were caught-up in immediate problems, or were eager to rally behind objections to prepare for the future. It was not possible to gain a sense of a business-plan as to how these farmers were going to engineer a solution or a way forward.

6.8 Conclusion

The IPPC Directive is going to be implemented and intensive pig farmers who fall within the Directive's threshold will have to apply for a permit under the Pollution Prevention & Control (England and Wales) Regulations 2000 (SI 2000/1973), as amended. If the farmers fail to do this then it is very likely that the Environment Agency will prosecute them. The firm-stance that the Environment Agency seems likely to take is, in part, because diffuse-sources of pollution from hitherto uncontrolled sources will have to be addressed in order to implement the Water Framework Directive 2000/60/EC. The intensive pig farming industry needs to consider its future and begin planning for this increase in regulation as opposed to being in a state of denial. Farming and farmers will have to 'modernise' in order to do this, in a manner similar to that adopted by the landfill industry in meeting its regulatory objectives in order to survive under licensing. This is also important when considering the United Kingdom's intensive pig farming

industry in the context of Europe and worldwide producers. Some of these industries are either operating at the proposed standards (for example Prima Farms in Poland), or are nearer to those standards than the United Kingdom (see for example the operating standards contained within the BREF Document and where those technologies are currently deployed) and will consequently have to make fewer changes. Additionally, some European pig producers are planning to embrace the regulations and increase their size of operations to lower the costs of compliance per unit production. Overall, the interview process has found that there is a noteworthy degree of apathy within United Kingdom intensive pig producers towards both operating in conformance with the current regulatory framework and in making further changes to operate in accordance with more stringent environmental operating standards. Many intensive pig farmers fail to see their activities as an industry, preferring to empathise with 'romantic' views of farming and its position within society. To remedy this requires a cultural shift to a position where the need to gain a permit and to demonstrate competence is accepted as part of normal business activities, as opposed to the current position characterised by inheritance, succession and a continuation of the long-established ways. However, this problem is also one experienced in the smaller landfill operating companies (Chapter 5), which contrasts with their larger counterparts who have made efforts to demonstrate an embracement of regulations and the portrayal of a responsible management of the environmental impact of business operations.

The larger Corporate Farming Companies appear to have much of the infrastructure to manage the implementation of the IPPC Directive and SFI GBR controls. Notwithstanding that, they need to think more widely as to how some of the problems can be solved, they need to break with many of

the age-old traditional ways and find new solutions. This has been one coping strategy adopted by some landfill operators in adding value to their business operations and entering into new markets. The smaller farming companies will feel the capital expenditure involved in meeting those requirements more keenly than their larger counterparts. Larger pig numbers will assist in spreading the costs whilst smaller farms have fewer management staff to perform the work and less stock to spread the costs. Although some farmers suggested that they would reduce the numbers of stock on their farms to escape the threshold of the IPPC Directive, this can only be a short-term resolution. There may come a time in the future when similar controls to those contained within the IPPC Directive, the need to demonstrate competence, and environmental management, through a permit are extended to all pig farms.

By making a comparison between the intensive pig farming industry and the landfill industry it is possible to suggest that the former is currently in a similar position to that of the landfill industry when licenses were first introduced in 1974 under the Control of Pollution Act. By making this connection between these two different industries, it is hoped that the problems, experiences, and successes of the landfill industry can be used positively to benefit the intensive pig farming industry as PPC permits are introduced. These opportunities will be discussed in the next Chapter that draws comparisons between the two industries studied in this research.

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Chapter 7.

Discussion: how can the intensive pig farming industry learn from the experiences of the landfill industry in this new age of emission control and environmental impact management?

7.1 Introduction

By 2007 at the latest, intensive pig farms, as defined in the Integrated Pollution Prevention & Control (IPPC) Directive (96/61/EC), will have had to gain a permit to operate. These permits will be issued nationally under the Pollution Prevention & Control (England and Wales) Regulations 2000 (SI 2000/1973), as amended. In the interceding period, there is the opportunity for the intensive pig farming sector to prepare for the permitting process. However, the intensive pig farming industry is new to these types of controls, which are more familiar to traditional manufacturing-industry. Consequently, there are advantages in investigating another sector that is more familiar with a permitting or licensing regime in order to extrapolate the experiences in that industry into the intensive pig farming industry. The landfill industry was selected as a comparator from whence these lessons could be learnt. The landfill industry has had to adapt to licensing since 1974 when the first landfill licences were issued. Additionally, landfills are to be permitted under the Pollution Prevention & Control (PPC) regime, but ahead of the intensive pig farming sector.

This Chapter is broken-down into a number of major areas comparing and contrasting the landfill industry and intensive pig farming industry with

the aim of explaining some of the differences, difficulties, what has worked and why it has worked. The ultimate aim is that by following this process the intensive pig farming industry can be assisted in making appropriate changes to ease itself into the new pollution control regime.

Summary aims of this chapter are:

- **To make comparisons between the landfill and intensive pig farming industries**

7.2 Comparing the ownership, management, and training of the operators of the installations

Who can own or manage a landfill facility is controlled. It is not possible to do either without meeting the strict requirements of the licensing regime (see Chapter 5). In contrast, no controls exist on who can operate or manage an intensive pig farm. Probably the most significant controls on who becomes a pig farmer are: [1] being the son to the existing owner or manager; or [2] being engaged in other farming activities. Both industries now require significant capital expenditure on behalf of new entrants. This is one of the reasons why there are an increasing number of amalgamations and take-overs as opposed to new entrants to either industry.

For the intensive pig farming industry, the IPPC Directive significantly questions whether the natural right of succession can necessarily be equated with competence to manage, including the environmental impacts of, an intensive pig farm. The IPPC Directive also introduces for the first time the requirement that employees should be adequately trained to manage that environmental impact (see Chapter 6). The industry is being required to engage in formal training and education in areas other than

traditional stockman skills in a way similar to that required within the landfill industry.

The average level of formal education within the farming community is low (Table 7.1) (Curry, 1997; Wilson, 1997) and furthering educational standards could be problematic. Whilst recent graduates may be educated in the technical aspects of pig production, they may not have the ability to manage the farm's environmental impacts to the standards that are required. Curry (1997) suggests that during the 1980s courses at agricultural colleges contained inadequate environmental content. Although by the mid 1990s the majority of agricultural courses included environmental modules, Curry (1997) further suggests that students from farming backgrounds did not select those modules. Wilson (1997) also supports the view that farmer education is a strong factor influencing behaviour, with those that left school without passing exams being the most reluctant to change. The majority of farmers interviewed in this research came from farming families; they were 'taught' how to do the job by their fathers. Whilst the agricultural colleges are eager to stress the importance of trained staff in maximising production (manager, Golf Farm), the same colleges may not have staff with the relevant background to train farm employees in managing a farm's emissions or environmental impact. These observations are not confined to the intensive pig farming industry. Many smaller landfill operators exhibited a similar attitude towards training, education, and their ability to do the job. The belief appears to be that, if something has been done for long enough then it must be right. Experience always appears to be equated with knowledge of best practice.

Education level	*Farmers*	*Family workers*	*Partners*	*Employees*
None	69	66	88	77
Youth training	0	1	0	3
National Certificate	8	8	4	7
National Diploma	6	8	4	3
Higher National Diploma	4	3	0	1
Degree	4	5	2	0
Other	9	9	2	9

Table 7.1 Education and training of farm workers (percent) of 678 farmers surveyed during 1994 (Curry, 1997).

7.3 How can the provision of training and the raising of operating standards be achieved within the intensive pig farming industry?

The operation and management of a landfill will have to be in the hands of a qualified person. If the same conditions were applied, with similar rigour, to managers of intensive pig farms then the industry would have no choice but to comply. However, there was a prolonged lead-in time for landfill managers to become suitably qualified and, it would not be surprising to see this approach adopted for the intensive pig farming industry.

Training within the waste management industry has been based around vocational Certificates of Technical Competence (CoTC) tailored to meet the specific requirements of the different categories of installations operated. Whilst the qualification is reported to be challenging to gain (Waste Management Industry Training & Advisory Board (WAMITAB), personal

communication), it is practical and draws from every-day experiences. Modules are often gained whilst employed in the industry with a minimal period in the classroom. This approach has been relatively successful and could work within the intensive pig farming industry.

The financial and resource implications experienced in the landfill industry were dependent upon the size of waste management operation. Large waste management companies operating several landfill facilities developed in-house training to build upon the experience of past graduates and to reduce the costs of training individual personnel. There are few intensive pig farming companies that would be able to benefit in this way. The majority of pig farms within the industry employ the bare minimum of staff and it is therefore going to be relatively more expensive and inconvenient for them to engage in training. However, the Policy Commission suggested that education should be provided free-of-charge or at low cost by fully certified training providers (Policy Commission, 2002). The Commission (2002) suggested that,

> "Much damage by farmers is not wilful but arises out of ignorance. Advice can guide land managers to simple changes in practice which benefit the environment at negligible cost – or even profit – to the farm" (pp.72 – 73).

Whilst this would help to address some of the financial implications that the smaller farming operations may experience – there is the need to combat the belief that training is unnecessary.

A more novel approach has been taken by the Meat & Livestock Commission (MLC) that has produced a CD ROM training package (*Pig Enterprise for Managers 2*) in an attempt to raise both husbandry standards

and environmental awareness without the need for employees to leave the farm. Whilst it does not meet the requirements of the IPPC Directive or the Environment Agency's Standard Farming Installation General Binding Rules (SFI GBRs), it may serve to raise awareness to the benefits of training and the environmental impacts of intensive pig farming. The advantage that training on the farm has is that it may address apprehension of bio-security. Following the outbreaks of Classical Swine Fever and Foot and Mouth Disease (FMD) this issue is at the forefront of farmer concerns.

Summarising and learning from the experiences of the waste management industry – there are four areas that need to be addressed if the level of training is to be raised within the intensive pig farming industry:

[1]. Training needs to be a compulsory element of the permit application process to ensure that the industry engages in it;
[2]. Training needs to be promoted to an industry where reluctance to update skills and knowledge is high;
[3]. The training process needs to be manageable for smaller businesses; and
[4]. Training needs to be vocational and tailored to managing the farm's environmental impact as opposed to livestock skills.

7.4 Comparing the adoption and difficulties of implementing environmental management systems in both industries

Primarily, many within the waste management industry have adopted certified environmental management systems (cert. EMSs) because they can win custom because of having such a system in place. Secondly, the landfill industry has adopted such systems (certified or otherwise) to demonstrate to the Environment Agency and other stakeholders their

responsibility and ability to manage the facility's environmental impact. Environmental management systems (EMSs) are voluntary initiatives to encourage firms to adopt beyond-compliance environmental practices with the aim that the firm operates in a more environmentally sound way compared to a firm that has not adopted such a system (Prakash, 1999).

In contrast to the intensive pig farming industry where it is believed that cert. EMSs have not been adopted, the landfill and waste management industries have been more proactive. provides an overview of the adoption of environmental management systems within the landfill industry, although it only includes information from those operators who are members of the Institute of Waste Management (IWM). From this Table it is evident that the International Organisation for Standardisation's (ISO) 14001 system standard has been implemented more frequently than the Eco-Management and Audit Scheme (EMAS) standard. However, it also shows that the majority of environmental management systems conform to neither of the recognised system standards. Notwithstanding, it is the larger companies that have pursued certification whilst smaller operators have developed their own 'environmental management systems'. During the research it was found that these bespoke systems were tailored towards meeting regulatory requirements as opposed to the wider encompassment of environmental impacts contained within certified system standards. Whilst many in traditional industry recognise the ISO 14001 or the EMAS standards, this research has found that, the majority of intensive pig farmers are unaware of these standards and are ignorant of environmental management systems; to them 'environmental management systems' are synonymous with conservation initiatives.

Company	*EMS in place?*	*Certified at one site at least?*
BFI (now SITA)	YES	ISO 14001
Biffa	YES	EMAS & ISO 14001
Haul Waste (now Viridor)	YES	ISO 14001
Onyx UK	YES	EMAS
Terry Adams (now Viridor)	YES	ISO 14001
UK Waste	YES	ISO 14001
SELCHP (part of Onyx group)	YES	Hoping for EMAS
Greenways (now Hanson)	YES	NO
LWS	YES	NO
Midland Land Reclamation	YES	NO
Cory	YES	NO
Grundon	YES	NO
Wyvern Waste	YES	NO
3C Waste	YES	NO
Beacon Waste (now Focsa)	YES	NO

Table 7.2 The Institute of Waste Management (IWM) member survey on the waste industry's progress on implementing certified and other environmental management systems (ENDS, 1999).

This research has found commonalities with other research on implementing environmental management systems. Additionally, it is important to draw upon the generalisability of the findings of other research because research within either the landfill or intensive pig farming industries on implementing environmental management systems does not exist. This research has found that only some of the larger waste management companies have adopted cert. EMSs (see Chapter 5 and Table 7.2). There may be two primary reasons to account for this: [1] there is a well-documented literature that suggests that small- and medium-sized enterprises (SMEs) find it particularly difficult to resource the implementation of a cert. EMS (see below); and [2] there are important supply-chain relationships between the landfill operator and its customer, the waste producer (see below). These

tend to be more apparent when the customer is a larger company and when that customer is trying to present an image of being environmentally responsible.

Where a cert. EMS had been implemented, employees of the waste management industry highlighted the Environmental Protection (Duty of Care) Regulations 1991 (SI 1991/2839) as being the indirect mechanism by which rewards could be gained. This confirms Hillary's (1999) suggestion that a market based instrument or mechanism is required to get firms interested in committing the resources to the implementation of a cert. EMS. Hobbs (2000); Fanshawe (2000); and Powell (2000) suggest that larger companies, which are more in the public eye, fear their reputation will be tarnished by the actions of a supplier (Hobbs, 2000). Their responsibility to ensure the appropriate disposal of their waste is clearly defined in the Regulations. As a result, these customers periodically visit the landfills where their waste is received in order to satisfy themselves that pollution is not being caused, and they cannot be linked to causing environmental harm (manager, Landfill Hotel).

There does not appear to be the same level of concern expressed by the supermarkets or processors about the environmental impacts of farm produce; they appear concerned with delivery of produce and hygiene. Although Lowe (1992) believes that food processors, retailers, and consumers are exerting pressure on the food chain, and are becoming 'regulators' this study did not find this to be the case. However, Ytterhus *et al.* (1999) suggested that such companies could become "ecological gate-keepers" with the right kind of purchasing policies.

The Environment Agency in implementing the IPPC Directive is trying to link the cert. EMS standard of EMAS into the regulatory framework. This is not a new idea. Her Majesty's Inspectorate of Pollution (HMIP) before the Environment Agency explored the idea with Integrated Pollution Control (IPC) (ENDS, 1997*a*). In 1997 it was reported that there was a strong influence from the then Department of the Environment (DoE), and the Department for Trade & Industry (DTI) who were at the time facing difficulties in promoting environmental management standards to companies (ENDS, 1997*a*). The Environment Agency's approach was to offer 'carrots' to industry in order to boost uptake of the schemes through a "...lighter regulatory touch" (ENDS, 1997*a*). The ISO 14001 and EMAS standards have important differences and it is because of these that many industries have favoured the ISO 14001 standard, whereas the Environment Agency has expressed a preference for the EMAS standard. Specifically, for example, there are advantages for the regulator in a firm having to seek compliance with relevant environmental legislation (EMAS) as opposed to striving for compliance (ISO 14001).

To implement a cert. EMS sufficient short-term funding is required to realise long-term benefits. This is more difficult for SMEs that are often unable to plan for the longer term (Kirkland & Thompson, 1999). Additionally, the culture of SMEs does not support the implementation of a cert. EMS (Gunningham, 2002). For example, Hutchinson & Chaston (1995) found that most SMEs do not have an environmental policy – the precursor to a systems approach. Management of a small- or medium-sized enterprise can tend to be short-term, and reactionary (Hutchinson & Chaston, 1995). Each day's work deals with immediate incidents in an *ad hoc* manner and, unless environmental issues have a direct impact on the bottom line,

management time may not be given over to them (Hutchinson & Chaston, 1995; Hillary, 1999). Welford (1994) suggests that only a small percentage of firms actually put environmental management into practice, as they believe their impact is negligible, competitors will take no action, or are waiting to see what other firms are doing. A cert. EMS requires, as a starting-point, knowledge of current emissions and current compliance with environmental legislation. This, Welford (1994) suggests, is something, that typically, most SMEs show little evidence of wanting to know. Johannson (2000) believes that cert. EMSs are not effectively marketed to SMEs and as a result, awareness is low. This was confirmed in this research. Johannson (2000) additionally suggests that SMEs were not involved in the shaping of the ISO 14001 standard. This explains why Hutchinson & Chaston (1995) suggested that cert. EMSs (voluntary standards) are not tailored to the needs of the SME. However, notwithstanding the above comments, it should not be forgotten that there could be a marked difference in the experiences encountered by "small-sized enterprises" compared to "medium-sized enterprises" and between individual firms.

7.5 What needs to change for the intensive pig farming industry to be persuaded to adopt the implementation of a certified environmental management system?

To realise the Environment Agency's desire that intensive pig farmers implement cert. EMSs as part of the farm's management of both the PPC permitting regime and the environmental impact, there are a number of factors that need to be addressed. These are particularly apparent after examining the driving forces behind the adoption of cert. EMSs within the landfill industry (see Chapter 5).

Landfill operators and waste management companies have been able to derive a reward for committing the resources towards the implementation of the cert. EMSs. Such a reward needs to be available for intensive pig farmers. This reward may be realised through competitive advantage or tangible benefits when entering into the permitting process and in dealing with the Environment Agency. However, one of the problems is that many farms are not currently operating in compliance with environmental legislation or even following voluntary codes of good practice. Additionally, awareness of cert. EMSs appears very low compared to other industries.

In addition to the above, because of the relatively small size of business, it would appear unlikely that any intensive pig farmers would implement a cert. EMS. The majority are akin to SMEs and have insufficient resources. Added to this there are no rewards at present for implementing such systems. Although the larger "Corporate Farming Companies" could resource the implementation of such systems, there remains no direct financial reward. The IPPC Directive is unlikely to have any impact upon this.

In 1992, Edwards-Jones *et al.* (1992) suggested that,

> "...agriculture cannot afford to ignore the prevailing business attitudes on the environment, and farmers and agribusiness should be proactive in developing an environmental strategy for their businesses" (pp. 75).

However, to date, MAMCO, a 2,600-hectare arable farm business in Northumberland, is the only United Kingdom farm business known to have implemented the ISO 14001 environmental management system standard

(Wright, 1999). It is reported that it took two years and many consultancy services to complete (Wright, 1999). However, Doug Niven (Managing Director),

> "...believes that the standard brings marketing advantages, [and] tightens management...Thanks to the standard, MAMCO... won a contract from one of the big supermarket chains to supply organic potatoes, turnips, barley, and wheat...Many international brewers work to ISO 14001 and they will demand that same standard from their suppliers" Wright (1999, pp. S2).

Mr. Niven was contacted but declined an interview on the grounds that discussing the motivating factors, costs, and difficulties would "...assist other farmers and erode my competitive advantage".

ISO 14001 and EMAS are not the only 'environmental management systems'. For example, Linking Environment & Farming (LEAF) has "The LEAF Audit", the University of Hertfordshire has produced a CD ROM package called "Environmental Management for Agriculture", and the Environment Agency is developing their "Environmental Management Systems for Farms" (EMSF). Unlike the others, the Environment Agency's system would appear to be compulsory and linked to the receipt of Common Agricultural Policy and other subsidy payments. The details are, yet, unclear (October 2002), but formalise the Policy Commission's vision for the future of farming. The Policy Commission advocates the need for a farm audit that will collate general farm data and will contain specific questions relating to the compliance with legislation.

> "...a new whole-farm audit and plan which will identify the environmental assets on the farm, identify the gaps that have to be plugged, and provide environmental regulators with the information to take a risk assessment-

based approach, rather than burdening all farm businesses with the same heavy load of inspections" Policy Commission (2002, pp. 131).

The Commission believes that farmers should compile the whole farm plan audit as soon as possible, and that it is of particular significance to the intensive pig and poultry sectors where there have been pollution problems (Policy Commission, 2002).

The LEAF Audit, and Environmental Management for Agriculture consider current farming activities and highlight changes needed to move towards best practice. Many of the changes are directly related to increasing biological diversity and few relate to pollution-causing activities. The Environment Agency's Environmental Management Systems for Farms (EMSF), appears to target regulatory compliance and emission management – the former of which will be used by the Environment Agency in targeting its efforts where the risk to the environment appears higher.

There may be an incentive for arable farmers to engage in the Environment Agency's Environmental Management Systems for Farms if it is linked to the receipt of subsidy payments. However, pig farmers do not currently receive subsidies as part of their primary business activities and consequently the same incentive does not exist. Whilst the Environment Agency use the incentive of a "lighter regulatory touch" – realised through better Operator and Pollution Risk Appraisal (OPRA) scores – these benefits remain less tangible than the quantifiable cost of conducting the audit.

More recently, (April 2003) has seen the launch of the new British Standard BS 8555 on the phased implementation of an environmental management system (WYG, 2003). This was developed on the Acorn Method,™ by consultants White Young Green Environmental as part of a Department for Trade & Industry funded project (WYG, 2003). The Acorn Method™ delivers a phased approach compatible with either ISO 14001 or EMAS, and provides a defined and logical structure to cert. EMS implementation (WYG, 2003). Consequently, it combats the barriers faced by many organisations (WYG, 2003). The advantage is that each phase can be tackled incrementally, with the benefit of progress recognition on the way. The focus on environmental performance is reported to have,

> "...assisted many organisations realise additional improvements in their operations, including increased business efficiency, cost savings and improvements in staff morale through greater participation" WYG (2003).

However, phased implementation will only appeal to a limited audience and will not combat the inertia present within many SMEs. Whilst the phased approach awards progress and the achievement of certain objectives, these intermediate stages are not substitutes for full cert. EMS status. This maybe particularly apparent when dealing with external parties who may only be aware of or recognise full cert. EMS status. In the context of the intensive pig farming industry, BS 8555 is unlikely to have any significant impact in persuading farmers to adopt cert. EMS.

For the agricultural industry to become interested in ISO 14001, EMAS, or other systems their customers (the supermarkets and processors) need to

introduce producer responsibility into their purchasing policies and reward their suppliers with a higher price for the products. Hillary (2001) confirms this,

> "Customers are the key driver for the adoption of EMSs and have influence far beyond any other stakeholders...Paradoxically, customers also show lack of interest in, or are satisfied with, SMEs' current environmental performance. Micro enterprises, in particular, found their customers to be uninterested in their environmental performance" Hillary (2001, pp. 144 – 145).

Currently the only premium offered to some producers comes from assurance schemes focusing on animal health and welfare standards – not emissions management.

7.6 Comparing industry structures and why it is more difficult to induce change into smaller landfill operators and the intensive pig farming industry

Smaller landfill operating companies are facing particular difficulty in managing the PPC licensing process, and as a result, many may decide to close their landfill facilities. Similarly, because of size of operation the majority within the intensive pig farming sector (who are small companies) are likely to experience similar problems – possibly with similar consequences. The literature on SMEs is able to offer an understanding of the problems faced by these companies. However, one problem associated with assessing the literature is that sometimes the definitions of small- or medium-sized business vary slightly between respective authors. One definition that prevails is that published by the European Union in 1996,

> "...less than 250 employees and an annual turnover less than €40 million or an annual balance sheet of €27 million and an independent enterprise where 25 per cent or more of the capital or voting rights are not owned by a larger company" CEC (1996, pp. 39).

The sector is further divided by some into micro, small, and medium sized based on number of employees (<10, 10 – 50, and 51 – 250 respectively). From the literature, it appears that the micro end of the SME categories is frequently ignored and therefore the understanding of very small firms is less well documented. This is a problem since many intensive pig farms and some smaller landfill operators will undoubtedly fall within this category.

It is difficult to assess the numbers of micro-, small-, medium-sized, and large firms in the waste management industry since there are no formal recordings of statistics by contrast to agriculture. Notwithstanding this, it is evident that there has been a trend away from small companies towards amalgamation. For example, UK Waste Ltd., and Wastewise Ltd. have been taken over by Biffa Waste Services Ltd. (part of Severn Trent PLC.) and Waste Recycling Group PLC. respectively. Probably most landfills are owned and operated by large waste management companies or are subsidiaries to large companies, for example, some landfill facilities owned and operated by Corus PLC. accepting "in-house" waste. Amongst the intensive pig farming industry, and particularly those farms over the threshold of the IPPC Directive (750 sows or 2,000 finishers), there are very few large "Corporate Farming Companies". Therefore, the majority of the waste management industry is owned and operated by relatively large concerns – which contrasts with the intensive pig farming industry where the majority of the industry (number of farms) probably remains within family-based farms.

SMEs have become of interest particularly within the last decade. This sector is said to be the most important one for a nation's economy – in the United Kingdom circa 99.8 percent of businesses fall within this category (Hillary, 2000). Further, their environmental impact, although unknown or accurately quantified, is estimated as being the source of 70 percent of all industrial pollution (Hillary, 2000). As a result, there has been a drive to improve the environmental performance of these businesses (Smith *et al.*, 2000).

Whilst it is suggested that environmental legislation can be a driver for improved environmental performance (Welford, 1994), the lack of tailored assistance towards SMEs often means that the first meeting with the regulator is because of a pollution incident (Fanshawe, 2000). For many SMEs, inaction is the result of a low level of awareness of potential environmental impacts (Smith & Kemp, 1998). Many SME owners or managers believe that their firm's environmental impact is proportionate to their size (Welford, 1994; Holland & Gibbon, 1997; Smith & Kemp, 2000; Smith et al., 2000). Many firms have,

> "...limited awareness of business issues relating to environmental management and have not adopted management practices designed to improve their environmental performance. This is despite the fact that most profess positive attitudes towards environmental issues in general and, more particularly, the responsibilities of business in response to these issues" Merritt (1998, pp. 99).

Further, many SMEs appear to believe that the costs of compliance are not justified or immediately affordable (Bianchi & Noci, 1998) and that legislation is a burden, restricting competitiveness (Tilley, 2000). Hutchinson & Chaston (1995) go as far as to suggest that only 50 percent of SMEs may be

complying with environmental legislation. In general, SME managers have to multi-task and cover a range of responsibilities with no dedicated manager accountable for environmental compliance.

Many SMEs have trouble in interpreting the requirements of legislation (Tilley, 2000) before considering if they should take action. This, combined with the perceived impact and the costs, often results in firms taking no action. SMEs have become comfortable with this culture because of either falling outside the thresholds of some regulations (Tilley, 2000), remaining unnoticed, or escaping regulatory enforcement (Tilley, 1999). This fits well with the belief of some employees of SMEs that if enforcement action and prosecutions were tougher then compliance would be improved (Petts *et al.*, 1999; Petts, 2000). Firm action is required by the Environment Agency to drive compliance since customers, public opinion, and supply chain pressures, appear to have limited effect on SME behaviour (Petts, 2000). Whilst the research suggests a lack of knowledge of current regulatory requirements, there is also an underlying culture of non-compliance because it is perceived as beyond core-functioning of day-to-day activities. Additionally, many SMEs have fewer resources and are less able to deal with planning for forthcoming environmental regulations (Baylis *et al.*, 1998).

It is important that these smaller firms are in a position to resource improvements because cultures can be changed through education. However, the inability to pass costs of compliance or costs of environmental improvements, on to the customer (the "polluter-pays-principal") hinders the implementation of many of the desired improvements (Bianchi & Noci, 1998; Gunningham, 2002). SMEs appear to experience particular difficulty in doing this, especially where their operating costs may be higher than larger

competitors. Without this ability, it may be difficult to make any change without putting the firm out of business. Although European policy from the mid 1980s aimed at making the "polluter-pays-principal" applicable to agriculture (Baldock, 1992), this may be difficult to put into practice because,

> "...it is often argued that farmers are generally less able to pass on the costs of complying with environmental standards to consumers than are other producers, such as companies engaged in manufacturing. There are a large number of relatively small producers supplying most agricultural markets, none of which normally could expect much control over end prices. In addition, many markets are highly artificial, dependent on state intervention; in the EC political decisions within the Common Agricultural Policy have a major influence on end prices of agricultural commodities. Thus farmers tend to be price takers, and individually they may not be able to recoup the net costs of pollution control measures" Baldock (1992, pp. 55).

Whilst the European Union and Government can implement the "polluter-pays-principle" through regulations and taxes *etc.*, it has no powers to increase the price either that the farmers receive for the commodity or that the consumer pays (Baldock, 1992).

The IPPC Directive may encourage the development of larger intensive pig farms in order to reduce unit (per pig) production costs. Alternatively, there may be a continued trend toward farm management by larger farming companies. Although this trend is difficult to detect in the agricultural statistics, it was reported by interviewees. For example, farming companies such as The JSR Farm Group Ltd. may find that their management services are more in demand. These management companies are able to produce guidance centrally, using appropriate experts, to be put into practice on individual farms. Alternatively, some intensive pig farmers who currently have more that 750 sows or 2,000 finishers may decide to reduce pig numbers to below the threshold of the IPPC Directive. This is a course of action

referred to by some of those farmers interviewed. However, this may only be a short-term option as it is likely that the IPPC regime will eventually be extended to pig farms outside the current threshold limits. Additionally, by reducing the number of pigs on the farm they may increase unit costs to a level that makes the farm uneconomical.

7.7 Supply chain relationships and the ability to pass cost on: a comparison between landfill operators and waste producers versus farmers and wholesalers/supermarkets

Many landfill operators (especially the larger waste management companies) have been able to pass increased operating costs to the waste producer, notwithstanding the competitive nature of the landfilling industry. Customers, who are themselves larger companies tend to 'accept' these charges because they need to be seen to be acting responsibly when dealing with their waste. Waste producers are obligated to dispose of their waste in a proper way – consumers are not obligated to take account of the environmental impact of farmed produce when they make their purchases. Farmers are price takers – landfill operators are able to set prices. Additionally, the Landfill Directive explicitly requires the full cost of landfilling waste to be charged to the waste producer (CEC, 1999). This supply-chain relationship is important because it is a limiting factor upon what the intensive pig farming industry is likely to achieve in managing its own environmental impact.

The Agricultural Select Committee in its investigation of the United Kingdom pig industry failed to explain the disparity between farm-gate and retail prices (see Figure 6.7) (House of Commons Agriculture Select

Committee, 1999). Moreover, the Meat & Livestock Commission has shown that the substantial decline in farm-gate price during 1995 – 1998 has not been reflected in supermarket retail prices (Meat & Livestock Commission quoted in: Competition Commission, 2000). Additionally, the Competition Commission are concerned over: [1] perceived price differences between the United Kingdom, Europe, and the USA, and [2] the demise of high-street stores caused by large out-of-town supermarkets (Competition Commission, 2000). These culminated in the Competition Commission's investigation into the supply of groceries from the supermarkets (Table 7.3).

Supermarket	*Store numbers*	*Share of UK grocery sales (%)*	*Turnover 1998 – 1999 (£ million)*
Aldi	219	1.3	No data
Asda	227	13.4	7,546
Budgens	177	0.4	411
Co-Ops	1,920	4.2	No data
Booth	24	0.1	109
Iceland	770	0.1	2
Lidl	173	0.9	400
Marks & Spencer	294	5.0	2,372
Netto	120	0.5	No data
Safeway	498	12.5	6,869
Sainsbury	424	20.7	No data
Somerfield	1,442	8.5	5,898
Tesco	642	24.6	15,785
Waitrose	119	3.3	1,636
Morrison	95	4.3	2,534

Table 7.3 Selected information on supermarkets with 600 square meters or more of grocery sales area identified in the Competition Commission's report on the *Supply of groceries from multiple stores in the United Kingdom* (data based on 1999) (Competition Commission, 2000).

Whilst the Competition Commission's findings are somewhat cautiously expressed, they did conclude that farmers experience a disproportionate

burden in the supply-chain network,

> "...cost reductions at the farm gate had either been passed through to retail prices or, where they had not, that there had been cost increases elsewhere in the supply chain. In a competitive environment, we would expect most or all of the impact of various shocks to the farming industry to have fallen mainly on farmers rather that on retailers; but the existence of buyer power among some of the main parties has meant that the burden of cost increases in the supply chain has fallen disproportionately heavily on small suppliers such as farmers" Competition Commission (2000, pp. 4).

The Competition Commission found that supermarkets routinely engage in practices that ultimately affect the farming community. The Commission identified 30 such practices, including:

[1]. Negotiating low prices from processors and other suppliers;
[2]. Negotiating favourable accounting terms;
[3]. Misleading consumers who wished to distinguish between different production methods and welfare standards by labelling as "British" produce that was only re-packaged in Britain;
[4]. Threatening to de-list a supplier's products if the supermarket's terms could not be agreed upon;
[5]. Making charges on the supplier for shelf-space for their products;
[6]. Making charges for better shelf-space for a supplier's products;
[7]. Accepting goods on a sale-or-return basis;
[8]. Charging the supplier to promote their products; and
[9]. Making retrospective charges against suppliers without prior approval (Competition Commission, 2000).

Additionally it appears that processors are able to source their raw-materials on a European and world-wide basis and that the intensive pig farming industry is forced to compete on these terms. Currently it is very difficult for farmers to seek higher prices for their produce from either processors or supermarkets.

Although the Competition Commission's code of practice concerning the relationships between supermarkets and their suppliers has had limited support (Asda, Tesco, Safeway, Sainsbury, and Somerfield) (Office of Fair Trading, 2001), its language of "reasonableness" does not go sufficiently far to prevent pressure being exerted by the supermarkets over their suppliers. Additionally, whilst the Ministry of Agriculture, Fisheries & Food (MAFF) and the National Farmers' Union (NFU) have had initiatives to promote British produce, they do not support individual farmers. Notwithstanding the good intention, there are strict rules applied by the European Commission in the promotion of national produce with, for example, the Union-Jack flag. This has led to the National Farmers' Union developing the "little red tractor" logo to demarcate British produce. However, the Policy Commission was of the opinion that although supermarket supply-chain relationships need to change - farmers could themselves become more involved in adding value to their produce (Policy Commission, 2002).

7.8 Comparing the management of installation emissions: putting emissions to good use

Increasingly the landfill industry is finding ways in which it can control its emissions in the way required by the Regulations, whilst at the same time generating income from the process. This contrasts with the intensive pig farming industry where, notwithstanding a few exceptions, emissions are still viewed and dealt with as a waste by-product of the pig production process.

The landfill industry is being faced with more stringent emission control – building upon preceding controls and tightening specific parameters. Therefore, the culture of emission control and monitoring already exists within the industry, especially amongst the larger landfill operators. Although the intensive pig farming industry is also facing controls that are more stringent, many of the requirements to implement the IPPC Directive are new to the industry.

For the landfill industry, emission control falls within two groups: [1] those that can be turned into income sources; and [2] those that have to be absorbed into operational costs. For example, there is a regulatory move away from flaring landfill gas to using it as a fuel to generate electricity (Environment Agency, 2001). For this, the infrastructure costs can be offset against future revenues. Additionally, the University of Hull is involved in a research project investigating how ammonia may be recovered from landfill leachate (because of tighter emission limits) to yield a saleable product (Frostick, personal communication). A number of operators are composting biodegradable green- and household-waste in order to reduce the volume of waste landfilled as was seen at Facility Alpha, Facility Hotel, and Facility Indigo. In addition to business-orientated benefits for the landfill operators, they are contributing towards reducing atmospheric emissions from landfilling. These operators are hoping either to sell the compost or to use it in the restoration of the landfill. Cleanaway Ltd., at their Materials Recovery Facility (MEFR) at Rainham, Essex are additionally separating wood waste with the aim of re-using some material and composting the remainder as was seen on a visit to their processing facility and adjacent landfill.

The landfill industry is in a position where it can pass the costs of controlling emissions onto the customer through higher-gate fees. However, some operators are concerned that this will not be possible if the Environment Agency prolongs the re-licensing process and some operators face the new higher operating standards in contrast to their competitors. Additionally, the export of waste for disposal was prohibited in 1996, which assists landfill operators' ability to pass costs back to the waste producer, as there is a limited supply of waste disposal capacity.

Some indications of change have been detected within the intensive pig farming industry, and some of the interviewees talked about how they were trying to use their natural animal wastes as an inorganic-fertiliser substitute during the spring, as opposed to spreading all the waste in autumn. Heavy applications of manures and slurries during the autumn are more akin to a waste management operation as opposed to deriving maximum crop nutrient benefit.

It is evident that the intensive pig farming industry has found that waste from one process may be a valuable product in another; however, it needs to build upon the experiences of these pioneers and apply these techniques more widely. Farmers are going to face a challenge in optimising their waste usage, as many of the farms visited did not have sufficient arable land to continue the practice of spreading animal wastes on the land. Currently close cooperation with neighbours prepared to apply the pig farm's waste to their arable farm is essential.

The intensive pig farming industry needs to take a long-term view and look beyond traditional ways of dealing with animal wastes. Larger intensive pig farms may need to investigate ways of reducing the waste's water content in order to concentrate the nutrients and make the product less bulky for transport. In other countries, for example, The Netherlands, farmers and government have invested in chemical plants that can process the liquid slurry and produce a bagged-fertiliser that can be sold and transported to where it is needed. This should be investigated for adoption in the United Kingdom.

Odour emission control is challenging and perhaps more so for the intensive pig farming industry than for landfill operators. There is a cultural hurdle to overcome – the realisation that the odour can be offensive to some and that farming operations will have to be performed with the aim of minimising the release of odorous material. The landfill industry has pursued odour-modelling in order to gain planning permission to open and operate facilities – this is something that may be required for new intensive pig farms. In Germany and The Netherlands, many slurry and manure storage tanks are already covered, and in some instances, the methane is collected as a fuel to generate electricity (European Commission, 2001). This is another example of where the costs of emission control can be supplemented by an income stream.

7.9 Forthcoming legislation that will affect the intensive pig farming industry

7.9.1 Waste directives

The IPPC Directive is not the only regulation that agriculture will have to come to terms with. The Waste Framework Directive (75/442/EEC) was to have been fully implemented (and included agricultural waste) in the early 1980s, but agriculture was excluded because of the difficulty of both regulating the sector and the politics of including it. The inclusion of agricultural wastes could cost the agricultural sector £25,000,000 – £40,000,000 and absorb up to 200,000 more Environment Agency inspections (Environment Agency, 2000).

There is a culture of non-compliance within the farming community – this is of concern to both the Government and the Environment Agency, for example, the practice of burning or burying waste on-farms in contravention of guidelines and regulatory requirements (Marcus Hodges Environmental Ltd., 2001). It is feared that the extension of the Waste Framework Directive to non-natural agricultural wastes (Figure 7.1 quantifies the diverse range of wastes involved) will prove challenging. Additionally, new Regulations have been passed to implement the Waste Incineration Directive (2000/76/EC) tightening the controls on the use of many of the small on-farm incinerators (Marcus Hodges Environmental Ltd., 2001). The extension of the Waste Framework Directive is another example of where the farming community will be subjected to the same regulations as other industries. Both these Directives have the potential to add to the operating costs of an intensive pig farm ahead of the 2007 date when they need to obtain a permit to operate under the PPC regime.

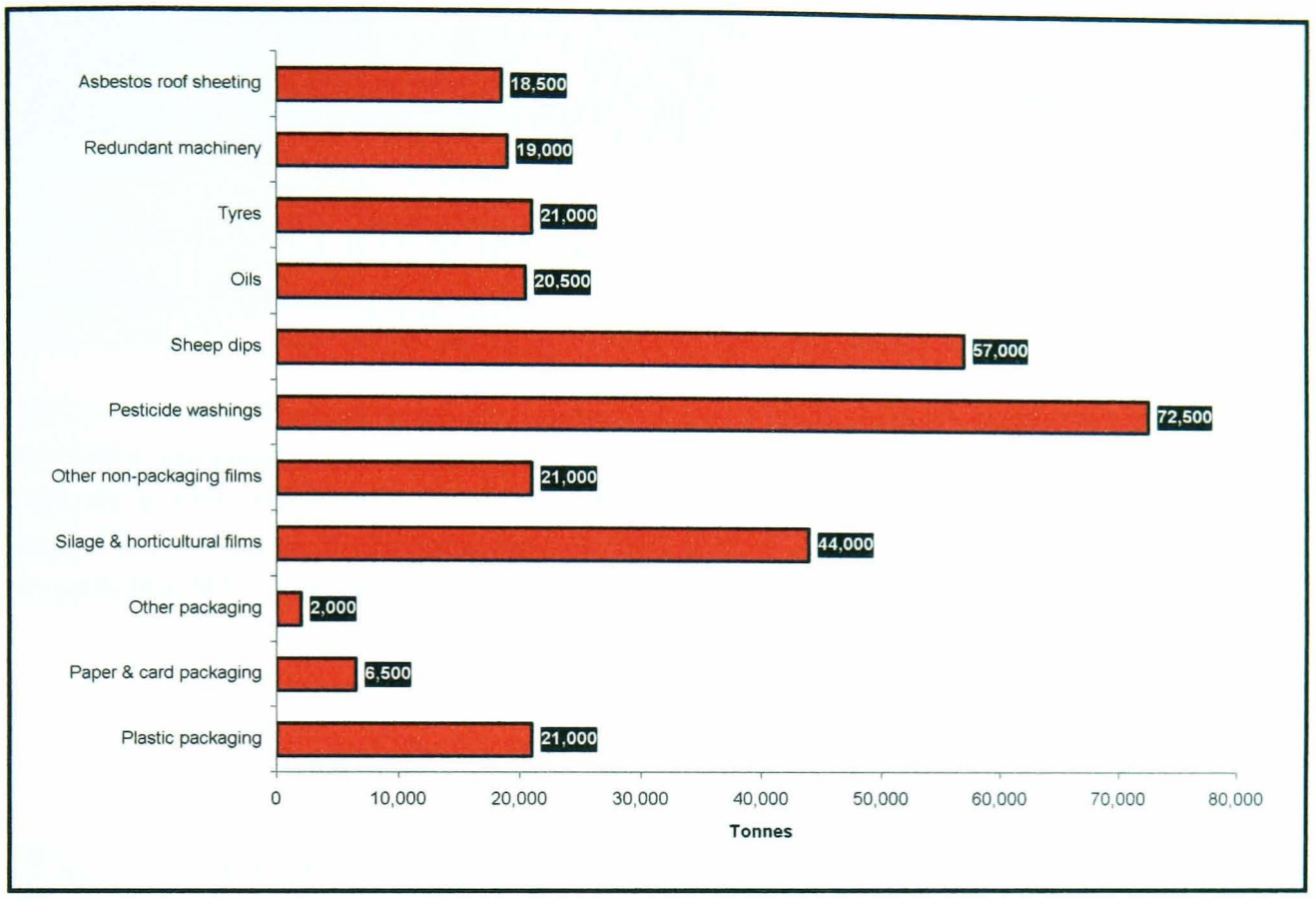

Figure 7.1 Estimates of the quantities of non-natural agricultural wastes produced in England per year (tonnes) (Marcus Hodges Environmental Ltd., 2001). These figures do not include wastes stockpiled on farms.

7.9.2 Water quality

The Government had to designate additional Nitrate Vulnerable Zones following a European Courts of Justice decision in December 2000 that the Nitrate Directive (91/676/EC) applied to all waters and not just drinking water (DEFRA, 2001). Previous controls had designated 600,000 hectares in 66 Nitrate Vulnerable Zones with limits of inorganic- and organic-nitrogen that could be applied to the crops (Table 7.4) (DEFRA, 2001). If the Government fails to make proper provision for the control of nitrate it is likely to face annual fines of £50 million (DEFRA, 2001) from Europe.

Year	*Existing scheme NVZ*		*New scheme NVZ*	
	Grassland	*Arable*	*Grassland*	*Arable*
19 December 1998	250 Kg/ha	210 Kg/ha	n/a	n/a
19 December 2002	(250) Kg/ha	170 Kg/ha	(250) Kg/ha	210 Kg/ha
19 December 2006	(250) Kg/ha	170 Kg/ha	(250) Kg/ha	170 Kg/ha

Table 7.4 Nitrate Vulnerable Zone limitations on organic manure applications. Inorganic fertilisers are restricted to that required by the growing crop. Figures in parenthesis indicate a level the Government is seeking from Europe through derogation. A closed period for inorganic application applies between September and February, and between August and November for organic nitrogen (DEFRA, 2001).

The outcome of Government consultation was the decision to designate further Nitrate Vulnerable Zones covering 55 percent of England (Figure 7.2) (DEFRA, 2001). The Farm Waste Grant Scheme will be extended to 40 percent of capital investment with a ceiling of £85,000 to assist farmers with slurry storage facilities (DEFRA, 2001). It is estimated that it will affect an additional 500 pig farms with compliance costs averaging £3,600 per farm (DEFRA, 2001). The newly designated Nitrate Vulnerable Zones are likely to introduce controls similar to those that would have been made under the IPPC Directive, albeit ahead of the 2007 date.

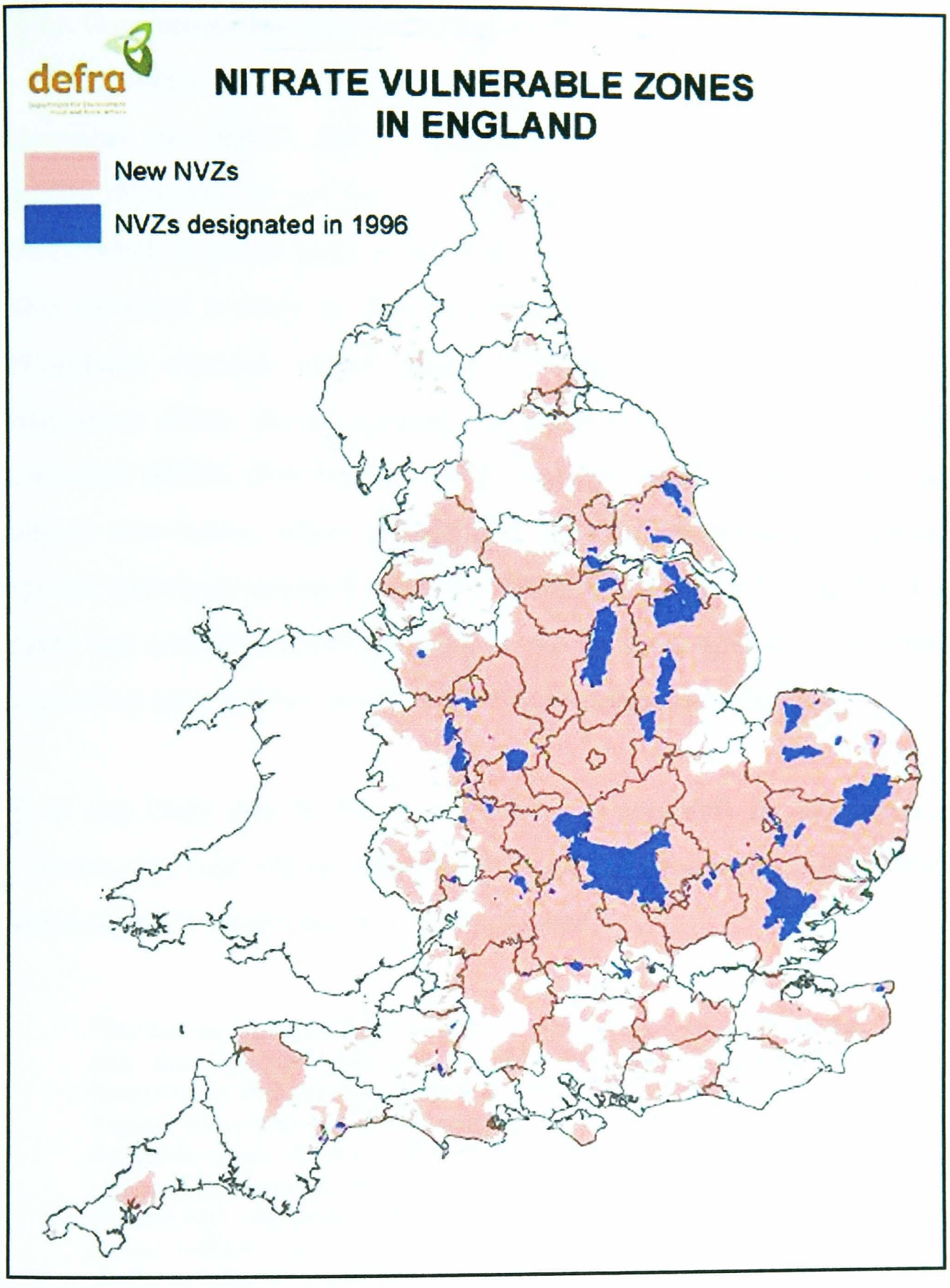

Figure 7.2 A map of the newly designate Nitrate Vulnerable Zones where additional controls began from December 19th 2002 (DEFRA, 2001).

The Government has also to implement the Water Framework Directive (2000/60/EC) by transposing its requirements into national law by December 2003 (DETR, 2001; DEFRA, 2002). Although the environmental quality objectives do not have to be reached until 2012, it is likely that controls will be put in place ahead of that time (DETR, 2001; DEFRA, 2002). This Directive is likely to introduce controls on more than just nitrate. Phosphate, chemical oxygen demand, biological oxygen demand, and suspended solids are all examples of parameters that are likely to be controlled (DETR, 2001; DEFRA, 2002). England and Wales will be divided into 11 river basins, where management plans will be adopted to achieve specific river basin targets (DETR, 2001; DEFRA, 2002). In achieving this, it is likely that additional constraints will be placed upon agricultural activities depending upon location and the river basin management plan target.

It is also likely that the Policy Commission's proposals on the *Future of Farming and Food* will be acted upon, in part at least, by the Government and funding diverted towards realising its aims.

> "We look for a profitable and sustainable farming and food sector, that can and does compete internationally, that is a good steward of the environment, and provides good food and a healthy diet for people in England and around the world...farmers continue to receive payment from the public purse, but only for public benefits that the public wants and needs...they receive a fair return for the food they produce...Farmers provide high standards of environmental management, food safety and animal welfare, and can demonstrate these to consumers. Unjustified regulation does not disadvantage them against overseas competitors. ..The retail and catering industries fully participate in this chain...the Government has, with the end of CAP production subsides, withdrawn from its close control of agriculture" Policy Commission (2002, pp. 9 – 11).

The Policy Commission makes clear suggestions on the direction, in which farmers will have to change their activities, which will place agriculture alongside other traditional manufacturing industries,

> "Just as other industries have had to get used to the concept of a 'licence to operate', in the future we see this becoming part of the unofficial 'licence to farm' that society will expect from those involved in managing land" Policy Commission (2002, pp. 128).

7.10 Discussions of key findings associated with the responses of the industries categorised according to enterprise characteristics

Although the analysis has been developed with the number of pigs as a critical determinant, this is never a precise measure. At any given time a farm may have unoccupied pig units, suggesting a greater size of operation than the number of pigs would indicate at the time. These minor discrepancies do not alter the fact that the three categories are also identified by a range of other factors (for example organisational structure and culture). In using a combinational approach to categorisation, a number of themes have emerged. Using size as a key determinant has enabled a useful comparison between intensive pig production and the landfill industry.

INDUSTRY	*SIZE CHARACTERISTIC*		
Landfill Industry *Intensive Pig Farming*	*Small Independent* *Owner Driver*	*Medium Co.* *Family Farming Business*	*Total Waste Management Co. Corporate Farming Co.*
Age	▪ Older person, experienced, and nearing retirement	▪ Older person, experienced, but with many employable years remaining	▪ Late thirties, holding responsible management job
Education Level	▪ Low level of formal education	▪ Variable	▪ Higher education, industry qualifications typical
Background	LANDFILL ▪ Various PIG FARMING ▪ Longstanding involvement for many generations in farming although intensive pig production relatively new	LANDFILL ▪ Various ▪ Waste management PIG FARMING ▪ Farming family have been involved in farming for many generations although intensive pig production relatively new	▪ Elements of career progression within the industry and new entrants to the industry from associated industries

Table 7.5 Comparing key findings associated with the responses of both the industries studied and categorised according to three enterprise characteristics - focusing on interviewee analysis (Author's work).

INDUSTRY *Landfill Industry* *Intensive Pig Farming*	*SIZE CHARACTERISTIC* *Small Independent* *Owner Driver*	*Medium Co.* *Family Farming Business*	*Total Waste Management Co.* *Corporate Farming Co.*
Management	▪ Multi-tasking ▪ Compromising doing anything excellently	FARMING ▪ Family head, with family as labour LANDFILL ▪ Single manager	▪ Central cores of expertise performing specific roles and functions
Dedicated Admin	▪ No	▪ Some	▪ Yes
Training	▪ Reluctance to engage in training ▪ Experience outweighs need to train ▪ An expensive and inconvenient process	FARMING ▪ Sons and daughters may have received formal training	▪ Training is more accepted overtly although some reluctance to costs expressed privately ▪ Training and investing in people marketed for benefit of company ▪ Can be performed in-house or en-mass reducing costs ▪ Deputies available to stand in whilst others trained ▪ Many of those employed already trained

Table 7.6 Comparing key findings associated with the responses of both the industries studied and categorised according to three enterprise characteristics - focusing on management, training, and employee analysis (Author's work).

INDUSTRY *Landfill Industry* *Intensive Pig Farming*	*SIZE CHARACTERISTIC* *Small Independent* *Owner Driver*	*Medium Co.* *Family Farming Business*	*Total Waste Management Co.* *Corporate Farming Co.*
Decision Making	▪ Performed as another function of the manager	FARMING ▪ Head of family in consultation with spouse or family labour LANDFILL ▪ Single manager making all decisions	▪ Made by the central core and implemented by the managers
Planning	▪ Reactionary	▪ Mainly reactionary	▪ Planned
Employees	▪ Commonly people employed for reasons other than merit	FARMING ▪ Family labour LANDFILL ▪ Family sometimes but not always employed, many employees are long standing	▪ Employees selected for their ability to do the job

Table 7.7 Comparing key findings associated with the responses of both the industries studied and categorised according to three enterprise characteristics - focusing on management, training, and employee analysis (continued) (Author's work).

INDUSTRY *Landfill Industry* *Intensive Pig Farming*	*SIZE CHARACTERISTIC* *Small Independent* *Owner Driver*	*Medium Co.* *Family Farming Business*	*Total Waste Management Co.* *Corporate Farming Co.*
Emissions management	▪ Tendency for emissions to be viewed as natural-by products hence reluctance to control ▪ Management of emissions seen as an interference with the businesses activity ▪ Low but proven technology used	▪ Although the perception and the view expressed concerning emission management is favourable, the reality is that most share similar attitudes and practices as their smaller counterparts	▪ An overt acceptance towards emission management although practice may fall short of this stated position ▪ Emissions managed appropriately but at the calculated least cost ▪ Cost recovery wherever possible by generating income as a by-product of the process ▪ Innovative solutions at times ▪ Deploy new technology ▪ Develop new technology

Table 7.8 Comparing key findings associated with the responses of both the industries studied and categorised according to three enterprise characteristics - focusing on emission management (Author's work).

INDUSTRY *Landfill Industry* *Intensive Pig Farming*	*SIZE CHARACTERISTIC* *Small Independent* *Owner Driver*	*Medium Co.* *Family Farming Business*	*Total Waste Management Co.* *Corporate Farming Co.*
Customers	▪ Smaller customers ▪ Cheapness	▪ A variety of customers, but not as large or prestigious as the larger companies	▪ Larger more prestigious customers ▪ Price and quality
Product	▪ Supplying lower volume ▪ Price over quality ▪ Sometimes specialised market	▪ Variable, but more similarities with smaller, rather than larger counterparts	▪ Supplying higher volumes ▪ Regular supply
Income Sources	▪ Primary activity ▪ Outside income sources may be supporting the business	▪ Primary activity	▪ Diverse range of income sources but derived from primary activity

Table 7.9 Comparing key findings associated with the responses of both the industries studied and categorised according to three enterprise characteristics - focusing on markets, customers, and income sources (Author's work).

INDUSTRY *Landfill Industry* *Intensive Pig Farming*	*SIZE CHARACTERISTIC* *Small Independent* *Owner Driver*	*Medium Co.* *Family Farming Business*	*Total Waste Management Co.* *Corporate Farming Co.*
Interaction in consultation	▪ Don't enter into the consultation process ▪ Expensive and time consuming to get their voice heard	▪ Unlikely to participate in the consultation process unless individuals are particularly interested in doing so	▪ Engage in the consultation process proactive try to shape regulations to suite themselves ▪ Learn what is required through consultation process
Knowledge about the regulations and where from	▪ Knowledge poor and verges of hear say	▪ The level of knowledge is mixed, most information gleaned second-hand	▪ Knowledge good often gained first hand
Interactions with Environment Agency	▪ Mainly in response to a pollution incidence or a complaint	▪ Mainly in response to pollution incidents, although larger operations may attract Agency interest	▪ Proactive relationship
Criticisms of the Environment Agency	▪ General criticisms of regulation ▪ General criticism of the Environment Agency's work ▪ General criticism that the firm is being singled out and that they know of others who are getting away with it	▪ General criticism of the Environment Agency ▪ Those with multiple sites talk about equality and how regulation varies between inspectors within areas	▪ Concern of differing standards in the different regions of the Environment Agency ▪ Concern that regulation is only really being applied to big business – they are paying to clean the environment up

Table 7.10 Comparing key findings associated with the responses of both the industries studied and categorised according to three enterprise characteristics - focusing dealings with the regulator and regulations (Author's work).

INDUSTRY *Landfill Industry* *Intensive Pig Farming*	*SIZE CHARACTERISTIC* *Small Independent* *Owner Driver*	*Medium Co.* *Family Farming Business*	*Total Waste Management Co.* *Corporate Farming Co.*
Current compliance status	▪ Ignorance to what is required means compliance is low ▪ A belief that they are doing things right irrespective of what they actually are ▪ Belief that individual regulations are wrong so a tendency to comply with only the ones they believe in	▪ Awareness is low - compliance similar ▪ Desires to perform well are seldom realised as resource limitations mean that central business activities remain the primary focus	▪ To a good degree there is knowledge as to what is required ▪ Tend to act out a 'game' with the regulator, taking what they see as acceptable risks of non-compliance ▪ Large size at times means supervision is poor
Discrepancies between words and actions	▪ A strong tendency to deliberately mislead and provide incorrect information – no one will know	▪ Carelessness and a lack of auditing are at the root of discrepancies	▪ Failing to supervise those at the lower tiers infringes managers or owners projected position
Beliefs about being caught	▪ Do not believe that they will get caught, also tied to a belief that they are not really doing anything wrong	▪ Concerns about being caught or not complying are evident, but are short-lived as management of central business activities takes over. A belief that the impact is small also lessens the concern	▪ Feeling in both the Environment Agency's and the Public's gaze heightening the risks of being caught in addition to the repercussions from adverse publicity and the loss of business instil a degree of fear.

Table 7.11 Comparing key findings associated with the responses of both the industries studied and categorised according to three enterprise characteristics - focusing on compliance with regulations both now and the future (Author's work).

INDUSTRY *Landfill Industry* *Intensive Pig Farming*	*SIZE CHARACTERISTIC* *Small Independent* *Owner Driver*	*Medium Co.* *Family Farming Business*	*Total Waste Management Co.* *Corporate Farming Co.*
Incentives for compliance	▪ Avoidance of prosecution – finances are constrained to making changes is difficult, many are on the verge of leaving the respective industry, and the penalties of being caught are perceived as low	▪ Many wish to do the right thing, but pressures on central business activities vie for the same time ▪ The drive not to cause problems in the relationship with some of their existing customers who themselves wish to be seen to deal with credible firms	▪ Harm to reputation, image, and possible impact through share prices ▪ Don't wish to be seen as being in contravention as may harm relationship with customers ▪ Lowering insurance company premiums
Beyond compliance measures: EMS	▪ Considered to be of no importance ▪ Seen as expensive to establish ▪ Lack of knowledge about EMS ▪ A present there is no mechanism for any payback	▪ None – many similarities with their smaller counterparts	LANDFILL ▪ Seem able to gain competitive advantage through supply chain relationship with customers PIG FARMING ▪ No supply chain relationship exists at present – payback unlikely

Table 7.12 Comparing key findings associated with the responses of both the industries studied and categorised according to three enterprise characteristics - focusing on actions towards the implementation of the IPPC Directive and subsequent regulations (Author's work).

INDUSTRY *Landfill Industry* *Intensive Pig Farming*	*SIZE CHARACTERISTIC* *Small Independent* *Owner Driver*	*Medium Co.* *Family Farming Business*	*Total Waste Management Co.* *Corporate Farming Co.*
Ability to pass additional costs on	LANDFILL ▪ Able to increase gate price providing that regulations applied equally and to all landfills ▪ Incineration capacity a competitor which will produce an effect if and when more becomes available ▪ Many existing customers may find alternative 'disposal' routes for their inert wastes PIG FARMING ▪ No mechanism to pass increased costs on – product easily substituted through imports unless specialised markets are supplied	LANDFILL ▪ Able to increase gate price providing that regulations applied equally and to all landfills ▪ Incineration capacity a competitor which will produce an effect if and when more becomes available PIG FARMING ▪ Very dependent upon their customers: ▪ Where competing in an area that the larger operators could supply, it will be almost impossible to increase prices ▪ Where supplying smaller more specialised markets there would be some ability to pass costs on through premium product labelling	LANDFILL ▪ Able to increase gate price providing that regulations applied equally and to all landfills ▪ Limited competition for facilities accepting more difficult wastes to dispose of ▪ Incineration capacity a competitor which will produce an effect if and when more becomes available PIG FARMING ▪ No mechanism to pass increased costs on – product easily substituted through imports

Table 7.13 Comparing key findings associated with the responses of both the industries studied and categorised according to three enterprise characteristics - focusing on actions towards the implementation of the IPPC Directive and subsequent regulations (Author's work).

INDUSTRY *Landfill Industry* *Intensive Pig Farming*	*SIZE CHARACTERISTIC* *Small Independent* *Owner Driver*	*Medium Co.* *Family Farming Business*	*Total Waste Management Co.* *Corporate Farming Co.*
Intentions over future	▪ Continue for as long as possible in present state making no changes ▪ Await Environment Agency to inform them what to do ▪ See how much 'free' assistance will be forthcoming ▪ Balance costs against a relatively short time to retirement – likely to leave the industry	▪ Wait and see what concessions are made and what information is available. Overall desire if possible to continue due to both family links and long-term employees that may be in line to buy the business	▪ Aim for compliance at least cost ▪ Awaiting information and key decisions to be made before deciding ▪ Awaiting information before planning future ▪ Unlikely to close although may be some divergence

Table 7.14 Comparing key findings associated with the responses of both the industries studied and categorised according to three enterprise characteristics - focusing on actions towards the implementation of the IPPC Directive and subsequent regulations (Author's work).

7.10.1 Similarities of key findings between the two industries studied based upon enterprise characteristic

The management of small companies tends to be compromised because there are not enough employees to cope with both management and production (Table 7.6). Many activities are either neglected or are not performed well. Small companies probably don't comply with current regulations and the culture is such that compliance is seen as an overburden

on resources and not important to the central functioning of the firm. This is a common finding between both landfill operators and intensive pig farmers (Table 7.11).

These small companies tend to employ people for reasons other than their ability to do the job (Table 7.7). For example, friends, doing someone a favour, and in the case of Family Farming Companies, family members. This may mean that some who are employed are not really able to do the job, but because of the ties that existed at the time of employment the same degree of inertia exists in getting rid of them. To ask these employees to leave becomes a personal affair as opposed to a realisation that they cannot perform the function they were originally employed for.

The central cores of the large companies are of paramount importance to their functioning and were common between both industries studied. This makes them stand apart from the other categories, and which makes them not just scaled-up versions of the other two categories: they are completely different.

The smaller companies encountered during this research have tended to have an older person as manager, or the manager / owner was an older person compared to the largest category (Table 7.5). With a wealth of experience, they were able to recount times when controls did not exist or were not so stringent, and consequently they objected to regulatory control. What was being asked of them was seen to make life harder and a way of putting them out of business. This attitude presents a real cultural problem. It appears not to be understood that a personal objection to control would be no defence in a court of law if they were prosecuted for being in breach of the

regulations. It would be better to accept the regulations, spend less time complaining about them and to use time constructively to find a way of complying that minimises the impact upon the firm.

Smaller firms have become excluded from the consultation process (Table 7.10). When this is combined with a limited knowledge base, and restricted networking, their perception of the regulations outweighs real knowledge. This failure to participate in the regulatory debate is a stance that larger firms have avoided, thus ensuring that their voice is heard, and that they fully understand what is required of them. They take every opportunity to shape the regulations and make them work to their advantage. The large firms definitely have cultured a relationship with the regulator and although it is not without costs to these companies, it appears a practice they are willing to participate in and was common to both industries studied.

7.10.2 Differences between key findings associated with the responses of the industries categorised according to enterprise characteristic

In contrast to the similarities, few differences were found to be specific to the individual industries when comparing the key findings at the size of the firm – significantly, many similarities were actually found far beyond what was envisaged at the outset of the study. The few differences that became evident are detailed below, and appear to be more industry related that size. The smallest types of business share many features. Costs may however, be able to be passed on to the waste producer, or consumer of the landfill, which is different to the smallest pig farmers (Table 7.13). Conversely small scale pig farmers may be able to diversify into a specialist niche market which is something that the landfill operators will be unable to do. Within

the medium types of businesses the Family Farming Businesses are far more orientated around the family unit than the medium-sized landfill operator. The landfill operator of this size is just as likely to employ other labour rather than being solely reliant upon the family unit. Similarly, it may be easier for the landfill operators to pass costs on than the pig farmers (Table 7.13). Supply chain relationships appear to be more significant to the larger landfill operator than the intensive pig farmer. Whilst the farmer is in a position of doing as much as possible to meet standards due to the relationship, the same farmer does not necessarily reap the reward. Import substitution for a homogenous product and the strength of the large buyers are at the heart of the relationship. Landfill operators would however seem to be able to charge more and gain customers in the relationship from following these measures. The difficulties and costs of transporting waste are defining factors.

7.11 Possible future scenarios: how could the intensive pig farming industry's inclusion in the IPPC regime be improved?

The intensive pig farming industry is facing a tougher challenge than the landfill and industry. This is because many of the provisions of the IPPC Directive, and ultimately the process of gaining a permit to operate under the PPC regime, are new to them. The landfill industry is a veteran of licensing and the requirements of both the Landfill and IPPC Directive essentially tighten existing controls. The larger landfill operators are better placed to deal with this re-licensing process compared to their smaller counterparts. Whilst the IPPC Directive is aimed at the larger intensive pig farms (through the use of a threshold), these farms are still relatively small businesses and are likely to experience problems in gaining permits comparable to the difficulties faced by small landfill operators. A change in cultural outlook

towards environmental controls is needed within the intensive pig farming industry. More effort from within the industry needs to be directed towards assisting with compliance as opposed to opposing regulation. The intensive pig farming industry could learn in this respect from many within the landfill industry.

Under the PPC regime, the Environment Agency is drawing what were once beyond-compliance initiatives (cert. EMSs) into part of regulatory compliance. If the Environment Agency is to continue this trend (already evident within paper- and pulp-production, see Chapter 4) within the intensive pig farming industry, then more needs to be done to raise awareness and to make the implementation of a cert. EMS a feasible proposition. Currently the same supply chain relationships that make the implementation of a cert. EMS within the landfill industry economically viable do not exist within the intensive pig farming industry. These supply-chain relationships are important as Contact ⑩ who had overseen the implementation of a cert. EMS on Polish and North American intensive pig farms specifically referred to them during the interview.

Further, although there is the notion that the Environment Agency would extend a "lighter regulatory touch" towards firms with cert. EMSs in place, this benefit is less tangible than the costs of implementation. Additionally, the mistrust that exists between the regulator and farmers may hinder the necessary good relationship that less enforcement, and reliance upon self-regulation requires. Even though the Environment Agency is developing their own Environmental Management System for Farms (building upon the ideas of the Policy Commission), it appears more relevant

to farmers receiving Common Agricultural Policy subsidies as opposed to pig farmers who are not eligible for subsidies.

The intensive pig farming industry needs to heed the lesson that the costs of emission management can be offset against cost savings or income generation. The industry needs to move beyond ideas traditionally held within agriculture and consider methods that have been adopted and have worked successfully in other industries. Some moves in this direction were detected amongst the managers interviewed for this research, but further encouragement and assistance is required to achieve this kind of thinking throughout the intensive pig farming industry.

Further accessions to the European Union by: Cyprus; the Czech Republic; Estonia; Hungary; Latvia; Lithuania; Malta; Poland; Slovakia; and Slovenia in 2004, could increase competition to supply the United Kingdom domestic market for porcine. Increased competition in supplying the domestic market may coincide with increased operating costs because of controls made to implement the IPPC Directive. As opposed to absorbing the costs to maintain sales (which may be difficult under the current economic operating conditions), the intensive pig farming industry may benefit if it follows the example of the landfill industry in diversifying from primary business activities (composting for example) in order to maximise revenues. In addition to the improvements in competitiveness that the intensive pig farming industry needs to make, the Government has an important part to play too. The United Kingdom Government needs to consider more fully the implications of its actions of when and how it decides to implement European Directives compared to other European Member States in order that it does not create undue burden upon the national pig farming industry.

Looking to the future, there appear to be two distinctly different routes that members of the intensive pig farming industry may follow: [1] compliance with the requirements of the Pollution Prevention and Control regime; or [2] non-compliance. More than one intensive pig farm in the North East of England area allegedly should have submitted an application under the Pollution Prevention & Control (England and Wales) Regulations 2000 (SI 2000/1973), as amended, because of "substantial modifications" to their farming operations (Environment Agency, personal communication). However, it is also believed that no action has been taken by the Environment Agency (December 2002) over this matter – although this stance may change in the near future (Environment Agency, personal communication). What is interesting is that one manager from within the Environment Agency suggested that if the intensive pig farming industry as a whole adopted this stance the Environment Agency may find it difficult to prosecute (Environment Agency, personal communication). However, it was not evident if this was due to a difficulty with the prosecution process or to the lack of political will to pursue this action. In addition to this example, during the interviews the manager of Bravo Farms suggested that information submitted as part of the Climate Change Levy agreement had been manipulated. This was performed to ensure that the farm qualified for the 80 percent reduction in fees because energy savings had been demonstrated per head of livestock on the farm.

7.12 Conclusion

The way in which the environmental impact of intensive pig farming is going to be managed is markedly different from historic conventions. Similarly, this study breaks with the traditional approach for agricultural research and draws a comparison with another industry. The landfill industry has proved to be a good comparator. In addition to being regulated under the same European Directive (IPPC) and permitting regime (PPC), the landfill industry as a comparative industry has brought with it numerous experiences of licensing. There are important conclusions from this comparative study that should be considered by the intensive pig farming industry if that industry is to curtail the impact that the PPC permitting regime is to have on it.

A great deal needs to change within farming. There needs to be a process of modernisation and a change in the perception to regulation, where the necessary regulatory controls are offset against a new way of working. However, this is not a process without difficulty. Unlike the landfill industry where the majority of landfills are under the control of large companies, most of the intensive pig farming industry is within the control of small companies. Small companies, because of their size, have their own particular problems in managing their environmental impact according to the research literature on SMEs.

This research into the intensive pig farming industry has found that more than isolated or discrete factors are behind the problems apparent in the industry in implementing permitting under PPC. The way forward in addressing the problems is through a holistic approach that considers many

of the interlinked aspects. This approach is required to realise ultimately benefit to the industry. This approach will have to address both internal factors within the farm and external factors to the farm and the industry's relationship with other ancillary industries and society.

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Chapter 8.

Summary & Conclusion

8.1 Introduction

The intensive pig farming industry in England and Wales is on the precipice of having to make decisions that will affect the industry's future survival. The Integrated Pollution Prevention & Control (IPPC) Directive (1996/61/EC) necessitates that the largest intensive pig farms (with places for 750 sows or 2,000 finishers above 30 Kg) apply for permits, and operate in such a way as to protect the environment from harmful emissions. In England and Wales, permits will be issued by the Environment Agency under the Pollution Prevention & Control (England and Wales) Regulations 2000 (SI 2000/1973), as amended. Although for the majority of intensive pig farmers this will not be until 2007 – now is the time to consider seriously the implications of the permitting process and the new ways in which the farm will have to be operated. If the industry and individual farmers fail to take heed, many more intensive pig farmers may be forced to leave farming.

This research has examined, in detail, the requirements of how these large intensive pig farms will have to operate. Through conducting interviews and visiting a number of farms, the difficulties facing the industry have been explored. Further, analysis has been made of differences between the way farmers say they operate and their actions. Moreover, comparisons have been made with the landfill industry and the ways in which that industry has managed both the licensing process initiated in 1974 and the way in which

the re-licensing process is being managed because of the IPPC and Landfill Directives.

The outcome of this research is clear. Intensive pig farmers have either to embrace the requirements of the IPPC Directive and increase the size of farming operation – or to decrease their current herd size to escape the threshold of the Directive. However, the latter option may only be a temporary reprieve, as it is likely that the current threshold will eventually be lowered to include many smaller intensive pig farms. Additionally, reducing the number of stock on the farm may actually increase the costs of production per head to a level where it is uneconomic and unsustainable.

Although there are inherent difficulties in the changes required by the IPPC Directive and in the process of gaining a permit – they are not insurmountable. This is apparent because comparisons can be made of United Kingdom production with European or worldwide production systems where, for example, both Poland and North America have intensive pig farms that already meet all the necessary conditions. Additionally, these farms have, or will be implementing, certified environmental management (cert. EMS) systems to the internationally recognised (International Organisation for Standardisation) ISO 14001 system standard. However, these farms are considerably larger than is typical in England and Wales – and for that reason, the only way forward for the intensive pig farming industry may be to expand production on a smaller number of farms.

Additionally, this research contributes an insight into two industries where the environmental management of the complete installation has been rarely studied. Previous studies of the landfill and intensive pig farming

industries have often ignored the human element and focused instead on techniques and technologies. This theme has persisted in studies of certain individual aspects of environmental management, for example, studies of which technologies may be best in the management of landfill leachate, landfill gas, or for the application of pig slurry to the land.

This research also assists the academic community in providing a collated source of information on the development of the intensive pig farming industry, something that was particularly difficult to produce as the information is so sparse. Chapter 2 also collates and condenses many divergent sources into a single Chapter on how agriculture has changed over about 150 years, which will be of interest to students of agricultural history. IPC has been in operation for the past 13 years and apart from being studied at its inception (most notably Allott in 1993) interest has waned in this influential multi-medium permitting regime. Similarly, interest in the application of the IPPC Directive is currently at a high level whilst aspects are discussed and the first industrial sectors that will require PPC permits are issued. However, thus far, a detailed comparison of IPC and PPC has not been performed and therefore Chapter 4 makes an interesting connection between these two permit-based multi-medium pollution control regimes. Overall, this research should contribute to specific and individual areas of study whilst remaining readable and of interest to those looking at the multi-disciplinary subject of environmental management.

8.2 Problems encountered in the research and how they were overcome

During the research several disasters hit agriculture, including, Classical Swine Fever, and Foot and Mouth Disease (FMD). These widely reported outbreaks effectively closed the farming community to outsiders and non-essential visits. Furthermore, falling prices for finished pigs and general economic difficulties for pig farmers made them less receptive to visitors. Moreover, when the research plan was drawn-up the Government had intended to permit intensive pig farms in 2002/2003 – this was postponed until 2007. The plan was to study this process interactively through interviews, case studies, and farm visits. This proved impossible and created a situation where the research plan had to be altered: the landfill industry was brought into the research as a comparator. The consequence was a study with additional depth, breadth, and research from which it was possible to draw some interesting comparisons.

Because of the disease concerns within the intensive pig farming industry (even following the official 'all clear' from the Government), it became especially difficult to recruit candidates to interview and farms to visit. The technique of "snowballing" became particularly useful as personal recommendations from one farmer to another eased cooperation. "Cold calling" proved relatively unsuccessful at yielding subjects with farmers offering many reasons or excuses as to why they could not assist. However, although the number of farmers interviewed and farms visited was less than was envisaged at the outset of the research, efforts were made to diversify candidate selection. This was essential to both ensure the sample attempted

to represent the industry and that the problems were being understood from different viewpoints.

Arranging interviews with landfill managers and visits to the landfill facilities that they managed was much easier than trying to arrange the same degree of cooperation from the intensive pig farming industry. However, this process was assisted by being able to utilise the Environment Agency's Register of Waste Management Licences to select candidates for inclusion in the research. Many of the difficulties encountered in gaining information on intensive pig farms and farmers were due to the lack of such a register. The problem of engaging suitable candidates from the farming community for the inclusion in this research is similar to those experienced by other authors.

8.3 Limitations of the research

The selection of interviewees and visits within both the landfill and intensive pig farming industries was not systematised. Because of the difficulties of gaining access to the intensive pig farming industry, it would have proved almost impossible to manage. Additionally, it was not possible to apply rigorous selection criteria to either industry before selecting candidates. Moreover, throughout the research process the landfill industry was in a state of flux with a series of mergers and takeovers. For example, the 'medium-sized' landfill operator UK Waste Ltd. was purchased by Biffa Waste Services Ltd., a larger, total waste management company.

The approach adopted in this research was a postmodernist one where the output is personal. It covered a range of operations in both industries studied and investigated the people, approaches, and cultures. Candidates were selected based on how they would add to the research, assist in the final analysis of the industries studied, and add to the understanding of what was occurring within the industries.

Additionally, the date when intensive pig farmers were due to apply for a permit under the Pollution Prevention & Control (PPC) regime was postponed. Further, appropriate guidance from the Environment Agency and from Europe was not finalised during the research period. The research is therefore based upon the limited information that was available at the time – some of which was in draft form.

Although it would have been possible, in some instances, to apply monetary values to the changes requested of the intensive pig farming industry in order to operate in compliance with the Best Available Technique Reference (BREF) Document – it was decided that this was inappropriate and would not add significantly to the research findings. Pellini & Morris (2001) attempted this but because official guidance and critical decisions are yet to be made, such work remain speculative. Significantly, their research does not cover an important aspect that is a focus of the current study: how is the environmental impact of a farm managed and how can change be induced in the intensive pig farming industry.

8.4 Research findings

8.4.1 Agriculture's position in society has evolved again – now it is like any other traditional manufacturing industry

Agricultural pollution control has evolved over many decades. However, unlike traditional manufacturing-industry, agriculture has been granted many exceptions to the application of regulations at each evolutionary step. This has been especially prevalent when the political objectives were food security and production at all costs. However, farmers' attitudes towards agricultural emission control have not kept pace with either changing political and regulatory aims or society's attitudes towards pollution. It has proved difficult to change farmers' approaches to emissions – too many farmers still see them as inevitable by-products of production, naturally accruing, and an integral part of living in the countryside. Adherence to 'codes of conduct' or voluntary measures appear to have met with only limited success. The inclusion of intensive livestock farming (pigs and poultry) in the remit of the IPPC Directive now places agriculture firmly alongside traditional manufacturing-industry, and removes many of the previously granted exemptions. This change is revolutionary rather than evolutionary and consequently demands radical change from pig farmers.

8.4.2 Multi-medium pollution control again challenges the regulator despite having the experience of Integrated Pollution Control

The implementation of the IPPC Directive has been an interesting subject to study. Integrate Pollution Control (IPC) was the first attempt in the United Kingdom at a permit-based, multi-media, pollution control regime. It was administered initially by Her Majesty's Inspectorate of Pollution (HMIP) before being incorporated into the Environment Agency. The Environment

Agency will continue to issue permits under PPC to meet the requirements of the IPPC Directive. Chapter 4 specifically compared the issuing of permits during the first three years of Integrated Pollution Control (IPC) with the permitting process during the first year of PPC. Although almost 10-years separate these two pieces of regulation, many of the problems encountered in the early years of IPC reoccurred with PPC:

[1]. Guidance was inadequate or was not available on time;
[2]. Applications from industry were poor;
    a. Industry failed to adequately explain their choice of abatement techniques(Best Available Techniques (BAT)); and
    b. Failed to justify on the grounds of costs why particular BAT were not adopted in their process.
[3]. The resources available to the regulatory agency were inadequate:
    a. Budget's were inadequate;
    b. There were not enough suitably experienced staff; and
    c. Retaining existing staff who had gained the necessary experience was problematic.

Consequently, the regulator has been forced to implement "risk-based" and "targeted efforts" to manage a resource deficiency. This is part of the rationale behind the Environment Agency pushing firms to implement the European cert. EMS system standard: Eco-Management and Audit Scheme (EMAS). However, industry favours the ISO 14001 standard because it imposes the less strict criteria of "striving for compliance with regulations" as opposed to "compliance with regulations". Ultimately, however, there may be a cost to environmental protection because the regulating body is under resourced and may be forced to make decisions based upon budgetary constraints as opposed to measures that would protect the environment.

8.4.3 The smaller landfill operator faces extinction in the latest round or re-licensing

Action on the IPPC Directive coincides with the need to implement the Landfill Directive. The Environment Agency is in the process of re-licensing all landfills in accordance with the Landfill Directive with those above the threshold of the IPPC Directive having to meet additional standards. The new licences or permits will be issued under the Pollution Prevention & Control (England and Wales) Regulations 2000 (SI 2000/1973), as amended.

The landfill industry comprises a multitude of operators and operations. Interviews conducted with managers of landfill facilities highlighted a range of attitudes and cultures towards the control of emissions. Whilst there is a move towards larger operations (primarily through takeovers) as a result of the increasing costs of opening and operating a facility, many smaller independent operators still remain open for business. However, there is a difference in outlook between the managers of small- and large-scale operations. The smaller operators appear to be reluctant to progress their operations towards the required standards. Fewer employees, and managers having to fulfil a variety of roles, have made it more difficult for them to manage the re-licensing process. By comparison, the larger landfill operators have centralised technical expertise to manage the regulatory process. Once the decisions have been made by the technical experts they can be passed to individual facility managers to implement. For these landfill operators, licensing is not a one-way-process as they are better placed to challenge the Environment Agency's decisions. Notwithstanding the more positive attitudes exhibited by the managers of the larger landfill facilities, they do

not always filter through to the operatives employed at the facilities. Operatives appear more concerned with volume of waste placement than following strict guidelines. Underlying these attitudes are rewards for waste placement in the form of productivity bonuses.

The larger landfill operators appear to have the resources to meet the requirements of both the IPPC and Landfill Directives. Re-licensing is essentially a tightening of the current regulatory process with limited additional responsibilities to take into consideration. The higher operating costs associated with working to more exacting standards of environmental care will be passed to the waste producer. Although some wastes are, and others will be, prohibited from landfill in the future, it will be some time before landfill faces serious competition from incineration as a waste disposal option.

Many landfill operators have pursued the implementation of cert. EMSs. Overall, they have favoured ISO 14001 as opposed to the Environment Agency's preferred option of EMAS. The landfill operators have chosen to make this investment because it helps them gain additional customer's business. Large companies in the public 'eye' wish to be seen to be acting responsibly in dealing with the waste they produce. Landfill facilities operating with cert. EMSs in place appear to have met that criterion.

Overall, the prospective closure of many small independent landfill facilities has attracted relatively little attention when compared to the plight of the farming industry or other industrial sector in decline. Industry representation appears to be in the hands of the major players, the Environment Agency appears to consider the smaller operators to present a

greater risk to the environment, and society appears to be intolerant to landfilling operations.

8.4.5 Intensive pig farmers give their opinion as to how they will react to IPPC

The IPPC Directive is aimed at the larger intensive pig farms. However the majority of those farms that will fall within the threshold of the Directive are, in fact, small companies. These farms, as a consequence of, *inter alia* their low staff numbers, tend to exhibit many of the characteristics of small- and medium-sized enterprises (SMEs). This is an important observation, as on the whole, SME research has ignored the farming community. Therefore, whilst the majority of landfills being re-licensed are large companies, the majority of those that will have to be licensed within the intensive pig farming industry are small companies. However, the large intensive pig farming companies tend to exhibit some of the characteristics found within the larger landfill operating companies: centralised management and decision making; the rolling-out of centrally-made decisions to be implemented on individual installations; and a greater degree of interaction with the Environment Agency in the regulatory process.

The intensive pig farming industry's relationship with their customers appears to be different from the landfill industry. The supermarkets and processors appear to dominate and dictate the price that they are prepared to pay farmers to produce porcine. Without changing the balance in this supply-chain relationship, it may be difficult for farmers to recoup their increased capital and operating costs. The landfill industry, by comparison, appears to be in a position where it is able to recoup the additional costs

through higher gate-fees. These issues were of concern to almost all of the intensive pig farm managers interviewed. Elaborating upon this, the farmers were worried as to how they would raise the finance in order to operate in compliance with the Environment Agency's Standard Farming Installation General Binding Rules (SFI GBRs), in addition to paying the high level of fees charged by the Environment Agency to issue the permit, and the ongoing annual charge. For this reason, many intensive pig farmers may have to increase their size of farming operation to lower production costs and retain business from competing European Member States. The problem of competition from imported landfill void-space does not, on the whole, exist. The intensive pig farm managers who were interviewed also expressed concern over their ability to compete on a European-basis because they felt that the costs of compliance would be higher in the United Kingdom compared to the competition. This, they felt, had been demonstrated by the Government in the United Kingdom who decided to pursue unilateral implementation of higher farm welfare standards without enough consideration having been given to the competitiveness of domestic production.

Chapter 2 highlighted some of the difficulties encountered as farms moved from mixed farming systems to specialised production systems. These included *inter alia* problems with the management of animal waste, and specifically the problems of not having enough arable land to spread the animal manures and slurries. These problems discovered in the literature became apparent during interviews with intensive pig farmers. Some farmers had adopted innovative measures to utilise slurry as an inorganic-nitrogen fertiliser substitute for application to the crop during the spring. Other farmers had to make agreements with neighbouring farmers for the

removal of slurry and manure. These neighbouring farmers, after collecting the animal waste, would apply it to their fields as a substitute for inorganic-nitrogen fertiliser. Increasing the number, coverage, and prohibited activities within designated Nitrate Vulnerable Zones, will make these types of agreements more difficult to arrange. Overall, innovation did not flourish, traditional techniques (perhaps soon to be outdated) of animal waste management prevailed. By comparison, in The Netherlands there are centralised slurry processing plants, funded by central government, from where the liquid waste can be separated leaving a bagged solid product that can be transported more easily throughout the country to where it is needed.

On the whole, the farmers encountered during the research process appeared to be reluctant to change their way of running or managing their farming business. Whilst progress and change was detected in the way in which the financial and livestock aspects of the business were being managed, the farm managers had failed to manage with the same degree of professionalism and competence the farm's environmental impact. Tradition and experience were often equated with a process being right. Underlying the problems in environmental management were disparities between the way farm managers said they operated and the way they actually operated. However, many farmers were, at the same time, prepared to take risks with uncontrolled emissions. They believed that the likelihood of being caught was minimal, that it would be difficult to attribute blame for pollution, and that the effects of punishment would be negligible.

8.4.6 The role of size and industry characteristics

Demarcating the two industries that were studied in this research it is evident that similarities exist that are attributable to size (Table 7.5 – Table 7.14). Size can be used to explain difficulties at the lower end of the spectrum, and the benefits of the larger size. Small firms have difficulty performing functions that are beyond the day-to-day management or that are seen to be outside their central business activities. Conversely, the larger and largest firms have a central core of experts that can consider, plan, and manage those long-term issues that prove so difficult for smaller firms to address. It is within these cores that both landfill operators and intensive pig farmers can debate, challenge, and find the best and least cost methodology of implementing the PPC regulations. This decision is rolled out in a management package for the site manager to implement on the day-to-day basis.

Medium-sized farms and landfill operators encompass great variation in their characteristics. The general literature on SMEs from the likes of Ruth Hillary would suggest that they lie somewhere in the continuum between small and large. However, this continuum needs examining further as it is not a smooth transition between small and large but one that is characterised by significant 'steps' as different factors come into play. This research has found that there are real differences between different types of firms and this makes for a discrete categorisation as opposed to a position on a line charting the relationship between size and attribute. This is demonstrated in the case of Family Farming Businesses. The family unit may be advantageous in supplying labour at below the market value, but the desire to hand the business on may be the reason for inertia that keeps the

business going when it would otherwise be uneconomic to do so. These businesses are likely to comply with the regulations as best they can because of this desire to continue even though their size would suggest similarities in problems with their smaller counterparts. These medium-sized firms also have the problem that they may just be that little bit too big to downsize successfully – they are neither small enough in the case of the farm to de-stock and escape the threshold, or large enough to derive the benefits of extra pigs. The Corporate Farming Company and the Total Waste Management Company have different cultures which is more important that purely physical attributes.

In addition to size characteristics there are industry specific differences that are worthy of comment in this section. It is the inability of the intensive pig farming industry to pass the costs of complying with these new environmental regulations on to their customers that is making the financing of the required changes so difficult. Additional expenditure on capital will have to be absorbed into the business as domestic production can be substituted for imports. For the landfill industry, there are few if any practicable alternatives. Incineration capacity is only slowly being developed and will take a number of years yet for sufficient plant to gain planning permission. Even considering increases in separation and composting of waste (both of which the larger Total Waste Management Companies are diversifying into) which will reduce the absolute quantity, there will still be a need for landfill. If the whole industry increases the gate price for disposal to reflect the higher operating costs then the waste producer will have to pay. Of concern to the operators are the fair and equal application of the

regulations and the phasing of the re-licensing process so that one operator, or one area is not disadvantaged over another.

8.5 Options and recommendations for how the intensive pig farming industry can make the desired changes whilst remaining profitable

There are no quick-fixes to turning the current situation within the intensive pig farming industry around and make things straightforward for the implementation of the IPPC Directive. This research has found many intrinsically linked factors involved in shaping the intensive pig farming industry, many of which are outside farmers' controls. Therefore, whilst farmers have an important part to play in shaping their future, they must be assisted by Government, the Environment Agency, the National Farmers' Union, and consumers.

One problem facing United Kingdom farmers is that whilst they stagnate and deliberate over the changes required to meet the IPPC Directive, competitors will take advantage and begin to penetrate the domestic market. In Poland, for example, Prima Farms is just one company that is developing IPPC compliant farms (Grey, personal communication). This company has three sow farms, two farms of 6,000 places, and one farm of 4,000 places, and their largest finisher farm is for 10,000 pigs; and all buildings meet the requirements contained within the BREF Document (Grey, personal communication). Moreover, Prima Farms manages its environmental impact with the assistance of an ISO 14001 cert. EMS. Part of the success of Prima Farms has been because of the integration of the supply-chain covering farm, feed, slaughter, and processing (Grey, personal communication). This may be

of concern for producers in the United Kingdom if, following accession to the European Union, Prima Farms becomes an example of best-practice.

Prima Farms believe that these scales of operation are required in order that the costs of compliance with the IPPC Directive are distributed sufficiently to allow a profit to be made from farming. Prima's farms are significantly larger than many of the farms within the United Kingdom. The intensive pig farming industry in the United Kingdom is at a significant juncture in deciding its ultimate future: [1] **Farmers can either embrace the required changes and evolve their businesses;** or [2] **follow the traditional approach of make-do-and-mend, which may ultimately prove uneconomical and lead to bankruptcy.**

8.5.1 Recommendations and actions aimed at farmers

Some of the difficulties that the intensive pig farming industry faces in adapting to the requirements of the IPPC Directive and operating in accordance with the SFI GBR package relate to economics. Additionally, there are problems caused by the very culture of the farmers involved in intensively producing pigs. Therefore, there is the need to address both these factors to revive the industry. Intensive pig farmers need to accept that farming is just another industry and must adhere to constraints and responsibilities commonly shared by all industry. This is especially important for intensive pig and intensive poultry farmers who will be the first within the farming sector to have to implement and adhere to traditional manufacturing-industry pollution control regulation. This change requires a fresh outlook on the part of farmers and the intensive pig farming industry.

The following section outlines recommendations for change that need to be implemented.

- Farmers need to realise that agriculture is progressively being considered as just another industry. Its special status is being eroded, and this is particularly prevalent within all aspects of 'intensive' agriculture. Commensurate with this belief is the need to regulate agriculture and control emissions equitably with industries where these comparisons are being made. For government this is becoming increasingly important, as compliance with European Union Directives on environmental quality standards (the Water Framework Directive 2000/60/EC) does not grant exceptions to agriculture. To address this issue, farmers require educating as to the changes and the new way of working. The Department for the Environment, Food, and Rural Affairs should publish a long-term strategy of where they want farmers to be in managing the environmental impact of their business, and how that is to be achieved. This strategy needs to go further than the recommendations made in the Haskins report (Haskins, 2003). Haskins (2003) focuses on the coherent and cost effective delivery of a policy, a policy which is yet unclear and does not unify the divergent goals for agriculture: [1] food production; [2] countryside management; and [3] the management of the environmental impact of the farm business similar to other non-farming businesses. Once such a policy is in existence the National Farmers' Union, who may be closer to the farming community, should take up this educational challenge.

- Farmers need to recognise that although they may have excellent husbandry skills they may not be best placed, now, to manage the farm's environmental impact, specialist advice is therefore essential. However,

many farms are akin to SMEs and consequently share, with other SMEs, barriers to achieving this. Other SMEs have been targeted for assistance with environmental impact management. Now would be an appropriate time to develop assisted 'business-orientated' environmental impact management for farms. This should corroborate with the Policy Commission's suggestion that limited free advice should be available to farmers. This advice should be made available through the Small Business Service (SBS), the Learning and Skills Council (LSC), and the Regional Development Agencies (RDA). However, this needs to be handled in a coordinated way unlike the current system administering rural policies and rural assistance.

- There is potentially a significant gap between the ways in which farmers believe they operate their farms and the ways they actually do. Potentially this is a 'dangerous' situation as it could lead to pollution being caused, followed by punishment. Additionally, competitiveness may be being eroded through resource wastage. Farmers need to audit critically their own beliefs on the way in which the farm is managed. Additionally, it may be beneficial if outside experts were brought in to conduct an environmental compliance audit, and a resource-use audit. The costs of these services may be recovered through potentially identifiable savings.

- Farmers should not feel compelled to follow the Environment Agency's SFI GBR package without considering a fully determined permit. It may be possible to argue that some techniques and technologies need not be adopted because the local environment can tolerate higher emissions. Money saved through operating different techniques or technologies may offset the initial more expensive cost of a fully determined permit. Farmers

need detailed advice on this and the National Farmers' Union should conduct trial studies.

- More farmers need to investigate novel approaches to managing the farm's animal waste, for example applying organic-nitrogen to growing crops during the spring. More information, advice, and cost implications of adopting these practices are needed. The Department for the Environment, Food and Rural Affairs should make this an area where research funding is available and should promote demonstration projects. These novel approaches should include an investigation of centralised manure and slurry processing plant.

- Farmers need either to integrate more fully into the supply-chain or to diversify into supplying more local markets. The first option requires ownership of the abattoirs or processing facilities, which produce the more processed food, or raw materials that supermarkets now appear to be demanding. Supplying more localised markets may mean a return to porcine that is in a more natural and perhaps wholesome state.

- Farmers should explore the role that cert. EMSs may have in both assisting with the farm's relations with the Environment Agency and their role in enhancing the farm's competitiveness. However, individual intensive pig farmers are reluctant to pioneer the implementation of a cert. EMS on their farm. What are required are demonstration projects from where farmers can contextualise cert. EMSs and make an informed choice as to the costs and benefits. This may also be of help to the Environment Agency, if they continue the identified trend of requiring the adoption of a cert. EMS at an IPPC installation, as both sides will have a better understanding of what is

required, the expenditure and how it can be recouped, and the advantages. Cert. EMSs (ISO 14001 and EMAS) may also be of more benefit to the intensive pig farmer than the Environment Agency's own Environmental Management Systems for Farms (EMSF) because ISO 14001 and EMAS and common to food processors and retailers.

- Intensive pig farmers need to consider expanding production to spread the costs of compliance with the IPPC Directive and operate in accordance with the SFI GBRs. Further, intensive pig farmers need to realise that the current IPPC Directive threshold is likely to be lowered in the future. Therefore, approaches taken to decrease the numbers of pigs on the farm and thus escape current controls may not be a long-term solution.

8.5.2 Recommendations and actions aimed at the Government and the Environment Agency

The Government has an important part to play in juggling its responsibilities for supporting farming in the United Kingdom and protecting the environment. Thus far, it is evident that no attempt has been made to account for the environmental "foot-print" or for "food-miles" when importing cheaper pig-meat products from either within the European Union or from other non- European Union countries. The Government additionally fails to take sufficient heed of the higher costs of production, and the effects of the 'uneven playing-field' caused by regulation within, in particular, the European Union. All have an impact upon our national intensive pig farming industry.

The following are recommendations for the Government and the Environment Agency:

- The Government should look at the impact that "food-miles" have on the environment. Currently the effects that importing food has on the environment are not quantified, for example its transport. Domestic producers, including the intensive pig farming industry, may benefit if consumer had to pay a more realistic price for imported produce. The Government should consider levying eco-charges and eco-taxes.

- The Government should investigate the demise of small, local, abattoirs with the aim of removing unnecessary barriers to their functioning. If these services could be re-built, it would assist in reducing food-miles and help the development of more localised selling of porcine. However, food safety concerns cannot be ignored, and the consumer has to be confident that this issue has been fully considered.

- Clearer country of origin labels could assist in helping consumers make a more proactive choice about their food purchasing policies. This could be extended to include eco-labelling to make the consumer aware of the associated environmental effects that the consumption of a particular product has.

- The Department for the Environment, Food and Rural Affairs, the National Farmers' Union, and the Agricultural and Horticultural Development Service (ADAS) should fund research into, and conduct trials of manure and slurry re-processing plants, in order to reduce the

quantities of manure and slurry that are applied to the land during the autumn causing nitrate-related problems in water.

The Government also needs to consider how it can deliver relevant training to intensive pig farmers. The SFI GBR package clearly indicates that the Environment Agency has to taken into account training at the permit issuing stage. However, many farmers have been engaged in the industry for a protracted period and would have left agricultural colleges a number of years ago. Many farmers never attended colleges and have no specific agricultural qualifications. It is therefore essential that:

- Intensive pig farmers are encouraged and facilitated to improve their skills at managing the farm's environmental impact.

- Distance learning, and vocational routes to gaining qualifications, should be explored as they may be of more assistance to farmers attaining the desired skill level. As opposed to the requirement that the manager of an intensive pig farm be qualified to the GNVQ Livestock III qualification, specific vocational qualifications should be developed for the management of an intensive pig farm. This would include the knowledge and skills necessary for the effective management of the farm's environmental impact. LANTRA could be an ideal organisation to develop these specific vocational qualifications.

- Publicly funded, small business advisors, and projects to deliver advice on managing a farm's environmental impact should be explored. Many projects aimed at improving the environmental impact of SMEs have failed to connect with the farming community. It is time to reconnect

farmers with their counterparts from other industries. The Small Business Service, the Learning and Skills Council, and the Regional Development Agencies should become engaged in developing these services and skills.

- Demonstration farms may additionally prove successful in delivering advice and knowledge in managing a farm's environmental impact. Predominantly, the management of a farm's environmental impact has been directed towards restoring biodiversity. Whilst this is important, the environmental management of a farm, in this new era of environmental impact management, has to be directed towards emission management. Agricultural colleges could have an important part to play in delivering this information, but have to themselves, move away from the past focus on husbandry skills.

Government needs to consider more carefully the effects of competition distorting legislation and regulations. This is particularly relevant in two areas:

- Cross-comparisons between Britain and other European countries in how Directives are implemented; and

- Inter-comparisons among England, Wales, and Scotland, for example, the charging structure for PPC permits varies widely between the Environment Agency and the Scottish Environmental Protection Agency (SEPA). These serve only to distort competition between the respective territories.

The Environment Agency has thus far consulted and worked extensively with the more assessable, larger intensive pig farming companies, and industry bodies. However, because many intensive pig farms are small concerns, they have been overlooked. This may have significant repercussions for the majority within the intensive pig farming industry. It is therefore suggested that:

- The Environment Agency should actively seek participation in the consultation and debate process from smaller farming companies. In an ideal world, responses from a consultation process should reflect more accurately, than at present, the industry being consulted.

- Smaller farming companies, themselves, should come forward and enter into the consultation process. More effort should be extended towards promoting the importance of soliciting opinion from smaller operators. This could be achieved through advertising or, if necessary, by posting to individual farmers notice of consultations. The National Farmers' Union should play a more significant part at the local level in encouraging smaller farmers to come-forward.

8.5.3 Recommendations and actions aimed at the National Farmers' Union

The National Farmers' Union has played an important role in lobbying at the national level on behalf of its members. However, more could be done at the local level to assist farmers. The National Farmers' Union needs to move away from opposing the implementation of regulations to focus on delivering assistance to farmers.

- The National Farmers' Union should focus on delivering assistance to farmers at the local level, during, for example, the permit application stages. The National Farmers' Union should also assist farmers to adapt the required changes during this new era of farm environmental impact management.

8.6 The future for the intensive pig farming industry and British agriculture

The past two years have seen the publication of two highly influential reports on the future of British agriculture and the rural environment: one by the Policy Commission (2002) and the other by Lord Haskins (2003). Both authors have attempted to spell out the future for British agriculture, the failings of government, and what the respective authors believe is required to drive forward a profitable farming businesses, a rural policy, and its cost-effective delivery. However, the Haskins report leaves some important questions unanswered, the data are open to other interpretations, and some of his main findings have been questioned.

Lord Haskins' suggestion that self-assessment may be a way forward is unlikely to be successful if the experiences encountered during this research prevail. Further, Haskins also suggests that the Farming and Wildlife Group (FWAG), and Linking Environment and Farming (LEAF) are used as independent bodies that could audit farmer's claims and compliance with regulations (Haskins, 2003). However, FWAG's and LEAF's knowledge

and expertise lies in wildlife and the physical environment with a skills deficit in industrial-style environmental management. In the example of PPC permitting of intensive pig farms, Haskins suggests that some of this work is moved from the Environment Agency to the Local Authority, a move that is likely to be rejected by the Environment Agency. However, although this idea does adhere to the local proximity issue for resolving environmental protection, it might preclude consistency across different areas and thus distort competition.

What is more certain is that directives from Europe concerning environmental quality will increase in number and scope and will therefore have some degree of impact upon agricultural businesses. For example, soil erosion, climate change, diffuse pollution, habitats, water, nitrates, and waste. The Water Framework Directive will have far-reaching ramifications for agriculture. These may include the possible need to extend the area designated as Nitrate Vulnerable Zones (NVZ) from 55 percent of England to the Environment Agency's original proposal of 100% (ENDS 2003a). The consequences may be an increase in farmers' operating costs by an estimated £30 - £210 million (ENDS 2003b). This estimate is so wide-ranging because the Environment Agency will only draw up the river basin management plans by 2009 and it is only then that the measures needed to be taken will be determined.

However, although there appears to be the trend towards agriculture being treated similarly to other industries, some exceptions still appear to remain. The exclusion of small on-farm incinerators "...to avoid new controls on the agricultural sector" (Department for Environment, Food and Rural Affairs quoted in ENDS (2003c, pp. 38)) being one example. Haskins appears

unfavourable to this kind of exceptional status, preferring the inclusion of agriculture within main-stream regulation and business support. Significantly, Haskins suggests that there is the need to rationalise inspections and design a "one-stop-shop" for agricultural advice and regulation. Whilst the former suggestion may be unwise and difficult to achieve without compromising quality, the latter suggestion appears consistent with recommendations made in this research. The Environment Agency's NetRegs may be a suitable gateway from whence to consolidate and simplify farm regulation.

8.7 The need for further research

This research has begun a distinctly different style of environmental management research within agriculture. This research breaks from tradition because it considers farming in a way that is more akin to traditional manufacturing-industry. This reflects the style of environmental regulation that the farming industry is facing. To continue to bring benefit to the farming community, and to answer some of the remaining questions there is the need to continue this style of research, and go further than it has been possible here. In particular, it would be of benefit to conduct a major investigation into the licensing of intensive pig farms in Southern Ireland. They have had a permit-based system in operation since 1991, and it would be useful to discover the problems and solutions encountered in their licensing regime.

Agricultural research appears to be fragmentised, very specific and specialised. Research fails to connect with other research and the

development of macro-scale solutions at the holistic level never materialises. In response to multi-media pollution control regulations, this needs to change. More research should be conducted to investigate the whole farm's environmental impact and that management of that impact. Considerations will have to be extended to the farm's environmental impact of improving crop or animal yield. How managing emissions in one area, released to a single medium, may actually have undesirable consequences when considering the farm as a whole.

There is the need to consider other cross-industry comparisons where there are comparable cultures in bringing benefit to the intensive pig farming industry and to the farming industry in general.

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