



Developing approaches to ex-post assessment of regulatory change impacts at the farm level: prototype study

Final Report

**To
Defra**

**By
The Countryside and Community Research Institute**

July 2011



Summary of Project

Project Title: Developing approaches to ex-post assessment of regulatory change impacts at the farm level: prototype study

Client Reference: FFG1006

Start Date: 15/10/2010

Finish Date: 30/03/2011

Duration: 152 days

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Date of Report: 8th April 2011

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When quoting this report use the following citation:

Powell, J., Mills, J., Short, C., and Courtney, P. (2011) Developing approaches to ex-post assessment of regulatory change impacts at the farm level: prototype study, Report to Defra. CCRI: Gloucester.

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Executive Summary

The research described in this report explores the potential for methodological improvement of the impact assessment (IA) of regulatory change. The specific project objectives addressed in this study were to identify potential improvements in the general methodology used in IAs, and to develop a framework methodology for the conduct of ex-post assessment of regulations.

The research examined two sets of regulations affecting the agricultural sector:

- 2008 Nitrate Pollution Control Regulations
- 2006 Agricultural Waste Regulations.

The ex-ante IA for each regulation was analysed to identify impacts, and a post-implementation review was conducted during the period January–March 2011 to identify actual impacts resulting from the regulations as implemented. The range of impacts identified was condensed down into a set of ‘impact categories’ for analysis of underlying causes. The focus throughout the study was on exploring and understanding the causal factors accounting for differences in impact at the farm level; wider societal impacts were not explicitly considered. Once the range of causal factors had been identified these too were grouped into a set of ‘causal categories’ made up of broadly similar factors.

In the case of the Nitrate Regulations the estimated total costs and benefits were broadly similar, across the ex-ante and ex-post assessments, but there were significant differences between some impact categories (e.g. record keeping; storage costs; spreading costs), suggesting that the similarity in totals was based on an element of chance. The most significant differences between ex-ante and ex-post studies can be attributed in large part to some of the assumptions that were made. Assumptions made in the ex-ante IA regarding take-up of various alternative behavioural practices were not identified in the ex-post review, leading to differences in estimated costs to farmers.

Linked to this is a lack of ‘sector knowledge’ which has led to some erroneous estimates of changes in farmer behaviour. In some ways the ex-ante study was too much of a broad brush overview of impacts by farm type that did not account for a wide range of other factors affecting farm business decisions (e.g. whether owner or tenant), nor the larger socio-political context in which some farmers are operating. Other differences could be attributed to methodological issues, for example: discounting costs over a 20 year time horizon does not reflect the real world in which the farmer operates; and use of a ‘standard model’ to measure time requirements for record keeping (with perhaps some erroneous assumptions about time needed by farmers).

In the case of the Waste Regulations the ex-ante impact assessment over-estimated the costs to farmers of compliance with the Regulations. This was largely due to a lack of consideration of the value of waste materials and the scope for recycling. The key causal categories which account for the most significant differences between ex-ante and ex-post studies are ‘assumptions’, ‘external drivers’, and ‘sector knowledge’. The initial assumption that farmers would landfill all waste and not engage in recycling was found to be erroneous. Knowledge of the waste sector would have revealed the increasing demand for waste plastics (and products created from waste plastic) and identified the market forces driving up the value of plastic recycle and contributing to changes in behaviour in the agricultural sector.

The study identified scope for methodological improvements in the IA process including the following:

- Workshops/case study methods that would: modify assumptions about strategic behaviour underpinning cost and benefit estimates; and improve understanding of the potential effects of technological change
- Scenario modelling to provide insights into the potential impacts of unpredictable external drivers, such as market prices
- Improved guidelines for measuring implementation impacts
- Identification of market forces (e.g. commodity prices; energy prices; demand for products such as plastic recycle and fertilisers)
- Qualitative analysis of costs and benefits to improve understanding of the nature of impacts at farm level.

Improvements were also suggested for post-implementation review (PIR) of regulatory change, based on a particular understanding of the role of impact assessment in policy formulation. Impact assessment is viewed as a tool for improving the quality of regulatory activity through a process of consultation and analysis of evidence. This study suggests modifications to the current IA process, to a situation where consultation is integrated into a more streamlined ex-ante IA and post-implementation review. The report proposes an impact assessment process more closely linked with consultation to achieve deeper understanding of likely impacts, and better utilisation of evidence collected through consultation. In addition, a modified post-implementation review process could achieve the following functions:

- Analysis of the accuracy and validity of ex-ante impact assessment studies, identifying areas of strength and weakness
- Identification of a range of external (outside the farm boundary) and internal (farm based) drivers influencing policy instruments
- Evaluation of the effectiveness of policy instruments
- Identification of characteristics of particular groups with the agricultural sector that may be unduly impacted
- Identification of good practice/problems with current policy tools and pointing the way towards potential solutions for the next round of policy review.

PIR can thus go beyond the fundamental task of reviewing ex-ante impact assessments, but it requires careful study design, and clarity on the role of the PIR in the wider policy process.

1. Developing approaches to ex-post assessment of regulatory change impacts at the farm level

Aims of the project

The overall aim of the research was to develop a methodology to improve understanding of the systemic and other factors influencing impacts arising from the implementation of regulatory change, and to use this knowledge to improve the approaches and methods applied in impact assessment of regulatory change. The specific project objectives addressed in this study were to:

1. Understand the form and magnitude of errors that are present in current impact assessment approaches.
2. Identify potential improvements in the general methodology used in impact assessments, in order to reduce the frequency and size of errors.
3. Develop a framework methodology for the conduct of ex-post assessment of regulations that identifies generic issues needed to be addressed by such studies.

The focus of the project was on exploring regulatory impacts at the individual farm level, and not the wider impacts affecting environment, economy or society. The project methodology was based on a three-step procedure: 1) collection of empirical data; 2) comparison of ex-ante and ex-post impact assessments; and 3) identification of causal factors accounting for differences, which then feeds into proposals for a framework methodology for undertaking ex-post impact assessment of regulatory change. This report presents the results of the study.

Throughout the report reference is made to 'impact assessment' rather than 'regulatory impact assessment' (RIA), which is a term often used in the literature to refer to impact assessment methods as applied to legislative or regulatory change. Impact assessment (IA) as used in this report refers to assessment of the impacts of regulatory or legislative change.

2. Understanding the form and magnitude of errors in current impact assessment (IA) approaches

The role of IA in the policy process

The key to effective evaluation of impact assessments of regulatory change is to understand its role in the policy process. In theory, impact assessment (IA) of the policy process is considered to be a straightforward tool for examining the potential impact of changes in legislation or regulations on society. In practice, however, there are significant questions about the role of IA, in particular whether it should be a tool undertaken relatively early in the policy process to enable comparison between alternative policy approaches, or whether it is more of a means for enhancing understanding of selected policy options at a later stage in the policy process. The intended role of an IA will clearly have implications for the approach taken to measuring impacts and the type of information considered useful.

Impact assessment (IA) has been defined as a “method of policy analysis...to assist policymakers in the design, implementation and monitoring of improvements to regulatory systems”¹. IA would then focus on bringing about such improvements in proposed regulations. Whether the present UK approach to IA accomplishes this goal is open to debate. Radealli² (2009), for example, suggests that in the UK IA is not fully embedded in the policy formulation process, despite a high level of discourse among civil servants over the technique.

The extent of the differences between policy intentions and policy as implemented have always been of concern to central government as unintended consequences, unforeseen events, and local interpretation of policy, all serve to deflect from original aims and objectives. Radealli³ (2005) refers to impact assessment as a “cornerstone” of programmes for improved regulation and governance in the EU but notes that such an agreement on the value of undertaking IA has not resulted in convergence in practice. For Radealli, IA plays a key role in the entire policy process by providing “...standards for the whole process of policy formulation, by showing how consultation, the socio-economic costs and benefits, and the major trade-offs in policy choice have been taken into account in the assessment of regulatory proposals...”. This rather idealistic view is tempered by a realisation that political context, bureaucratic capacity, policy processes and stakeholder concerns in each member state have resulted in a wide array of practices appearing under the generic title of ‘impact assessment’.

In the USA impact assessment has been described as “...the use of cost-benefit or cost-effectiveness analysis to examine the implications of government regulations”⁴, but its origins lie in its use as a tool for controlling regulatory activity. Such activity started in the early 1980s to enable the Office of Management and Budget (OMB) to control the huge growth in social legislation that had occurred in the 1960s and 70s.

¹ Kirkpatrick, C. and D. Parker (Eds) (2008) *Regulatory Impact Assessment: towards better regulation?* Edward Elgar, UK.

² Radealli, C. (2009) Desperately seeking regulatory impact assessments. *Evaluation* vol. 15(1): 31-48.

³ Radealli, C. (2005) Diffusion without Convergence: how political context shapes the adoption of regulatory impact assessment. *Journal of European Public Policy*, 12:5, pp.924-943.

⁴ Harrington, W. and Morgenstern, R. (2003). Evaluating regulatory impact analyses. In, *Proceedings from the OECD expert meeting on Regulatory Performance: Ex-post evaluation of regulatory policies*. OECD Paris, 22 September 2003.

Impact Assessment of regulatory change in the UK – recent experience

In the UK ‘impact assessment’ (IA) is viewed in a more comprehensive way to inform policy making. It could be partially viewed as ‘a framework for exploring consequences of regulatory action’ but in a sense it is more than this, it is the process by which policy is made. The National Audit Office and the Better Regulation Executive (based in the Department for Business, Innovation and Skills) have been keen to integrate ‘impact assessment’ (IA) into policy-making processes. The NAO view IA as a ‘tool to assist government in making interventions’ and assessments that are required for all interventions with costs over £5 million affecting the public sector. The NAO, however, take a very economic-based approach to IA, insisting that “robust analysis of costs and benefits is at the heart of quality impact assessments and is key to their effectiveness”.

The Better Regulation Executive view ‘impact assessment’ as part of the consultation process on proposed new policy options. Two primary roles are identified for impact assessment (IA):

“a continuous process to help the policy-maker fully think through and understand the consequences of possible and actual Government interventions in the public, private and third sectors” and,
“a tool to enable the Government to weigh and present the relevant evidence on the positive and negative effects of such interventions, including by reviewing the impact of policies after they have been implemented.”⁵

The suggested roles: to understand possible consequences of government intervention, and to weigh evidence both before and after implementation, imply that impact assessment should be continuous and integrated within a wider public consultation process. Impact assessment is thus made up of several stages including consultation and review stages, in a continuous process of policy development. In practice the process is often not as neat as the literature would suggest. Although there can be initial qualitative assessments and both partial and full impact assessments, they can be costly, time consuming and must take place at a specific point in time, often separated from any public consultation process. In practice, the consideration of costs and benefits of proposed policies usually takes place independently of wider consultation on policy options being considered.

Evaluating the quality of ex-ante impact assessments

The two key aspects of the whole process of using IA to improve policy making are: the quality of the ex-ante assessments, particularly the predicted levels of impact which might occur at some distant future point in time; and the role of post-implementation review in identifying existing problems and thereby contributing to policy review and improvement. If predicted impacts from an ex-ante IA, in terms of costs and benefits, are erroneous then the use of IA as a policy tool becomes suspect. If post-implementation reviews exploring actual impacts are not integrated into the policy process, then they effectively become a waste of resources. If PIR is not conducted at all then there is no check on the accuracy of the ex-ante IA, and no feedback on the actual effectiveness of policy as implemented. Unless PIR is conducted the utility of ex-ante IA in the policy process will decline. Both ex-ante and ex-post reviews are thus necessary, but both have problems when it comes to implementation.

A recent study⁶ indicated that ex-ante IA costs might be either over or under estimated compared to ex-post costs for a number of reasons:

⁵ Better Regulation Website (2011) Impact Assessment. <http://www.bis.gov.uk/policies/better-regulation/consultation-guidance/impact-assessment>

⁶ MacLeod, M., Moran, D., Aresti, M. L., Harington, W. And Morgenstern, R. (2006) Comparing the ex-ante and ex-post costs of complying with regulatory changes. Final Report prepared for Defra, Contract no. EPES 0405-19.

- Ex-ante costs might represent worst case scenarios
- Strategic behaviour by those being regulated
- Compliance issues might result in different costs
- Innovation might result in different costs
- Incorrect assumptions are used to estimate costs and benefits.

The study concluded that in half of the sample of regulatory assessments examined ex-ante costs had been overestimated compared to the ex-post costs (where ex-post costs differed from ex-ante costs by more than 25%). It also suggested that in some cases ex-ante costs were underestimated and only occasionally accurate. There is, of course, an issue here of what constitutes 'accuracy'. Increasing the margin of error clearly makes more ex-ante studies appear accurate but there is no clear agreement on what might constitute acceptable margins of error. The study made several recommendations for improving accuracy of ex-ante estimates:

- Examine the validity of data provided by groups with vested interests in the regulation
- Examine baseline trends
- Examine the potential for innovation and adopt dynamic assumptions where appropriate
- Make pragmatic assumptions about compliance
- Treat the small firms impact test with caution, especially when based on small samples, or on sensitive issues.
- Distinguish between expenditures and costs
- Include all major cost elements, including those often overlooked, e.g. time.

Others⁷ have identified a range of barriers to ex-post regulatory analysis, such as who should undertake ex-post evaluative studies, data barriers, and timing related barriers (timing relates both to when an ex-post analysis should be carried out, and also to the timing of the initial IA itself, i.e. how soon in the regulatory process was it conducted). Additional barriers exist for those conducting ex-post studies including: understanding how ex-ante analyses were conducted; the assumptions that might have been made using modelling approaches; or even what sources of data were used in setting the baseline situation. Some have indicated that it is not the barriers that create the most problems for IA, but the emphasis on cost-benefit approaches that are not able to adequately capture and measure the full range of changes occurring⁸.

Recent studies⁹ on the quality of impact assessments in the UK reveal significant variation in quality of IAs implemented, in terms of description, depth of analysis and quantification of costs and benefits. Key findings in the report include the suggestion that over half of a sample of 50 IAs reviewed in 2008-09 only considered one regulatory policy option and that most IAs did not fully consider all likely effects of proposed policy changes. In addition, 18% of the sample IAs were assessed as not providing sufficient evidence to persuade the reader that the best option had been selected and only 50% of policy staff surveyed across 11 government departments deemed IAs to be useful in the policy process.

⁷ Harrington, W. and Morgenstern, R. (2003). Evaluating regulatory impact analyses. In, Proceedings from the OECD expert meeting on Regulatory Performance: Ex-post evaluation of regulatory policies. OECD Paris, 22 September 2003.

⁸ Shapiro, S. And Schroeder, C. (2008) Beyond cost-benefit analysis: a pragmatic reorientation. Harvard Environmental Law Review 31.

⁹ National Audit Office (2010) Assessing the impact of proposed new policies. Report by the Comptroller and Auditor General, HC185 Session 2010-2011. London: The Stationery Office.

3. Comparison of ex-ante impact assessment and ex-post review impacts

This section addresses Objective 2 of the project, which aims to ‘identify potential improvements in the general methodology used in impact assessments, in order to reduce the frequency and size of errors’. The methodology used was to examine two sets of regulations affecting the agricultural sector:

- 2008 Nitrate Pollution Control Regulations
- 2006 Agricultural Waste Regulations.

Each set of regulations was analysed to identify aims and objectives. The ex-ante IAs were then analysed to identify impacts, and a post-implementation review was conducted during the period January–March 2011 to identify actual costs and benefits resulting from the two sets of regulations as implemented. The focus throughout the study was on exploring and understanding the impacts at farm level; wider societal impacts were not explicitly considered. This section describes the differences between ex-ante and ex-post impact studies and explores reasons for the differences.

2008 Nitrate Pollution Control Regulations

The 2008 Nitrate Pollution Control Regulations implement the 1991 Nitrates Directive. The Regulations have a dual aim of environmental improvement and reducing agricultural pollution of drinking water. Far more significant, however, has been the need for the UK Government to comply with the Nitrates Directive in order to avoid infringement proceedings and the large costs associated with any court proceedings initiated by the European Commission.

The Final IA was published in August 2008, building on a Partial IA conducted in August 2007, a consultation process. It also built on several studies exploring the impacts of nitrates on the environment, and impacts of controls on the agricultural sector.

The ex-post regulatory review was based on a small sample of farmers (12), other stakeholders (2), and the implementing bodies (2). Face-to-face interviews were conducted to identify impacts of the Regulations since adoption. The focus of the data collection was to enable understanding of the effects of the Regulations on farming, and how they had changed behaviour and the level of activity¹⁰.

Differences between the overall benefits estimated by the two studies are hard to gauge as the ex-post review did not attempt to measure actual benefits, largely because most of the benefits from reductions in nitrate concentrations are long-term and not yet apparent. The ex-ante study suggested present value benefits (discounted over a 20 year period) of £28-274 million, a rather large range caused by high levels of uncertainty surrounding estimates of benefits to water companies resulting from reduced water treatment costs, and benefits to consumers from reductions in environmental externalities from diffuse water pollution.

Indications from the ex-post study suggest that benefits will be small, most likely caused by other factors (such as the drop in fertiliser applications resulting from price increases), and in some cases (e.g. groundwater) may not be apparent for several decades.

¹⁰ The evidence collected is detailed more fully in Annex 2.

The anticipated overall costs of the Regulations on the agricultural sector are not that different between the two studies. The ex-ante study indicated total Present Value costs of £655 – 1,009 million (average annual costs at between £48.5 – 68.6 million per year over 20 years discounted at 3.5%). The ex-post study has found it more difficult to calculate a total cost from limited sampling but suggests it might be somewhere in the region of £300 – £900 million, the majority of which would occur during the first few years after adoption of the Regulations. The ex-ante impact assessment and ex-post review costs and benefits are summarised in Table 3.1. The table reveals that the main differences between the two studies are related to behavioural changes by farmers, the timing of financial impacts, the limited effectiveness of the dairy derogation, record-keeping burdens imposed, and implementation issues. These are discussed below.

Behavioural changes by farmers,

Overall, the ex-post review suggests that the compliance costs in terms of storage, spreading and moving slurry, are significantly higher than those predicted by the ex-ante study. The ex-ante impact assessment recognised the high level of variability that would occur between farms and methodologically made allowances through undertaking sensitivity analysis to capture the possible range of costs by farm type. The ex-post review, however, suggests that differences are much more subtle relating not just to farm type and size, but also to characteristics of the farm (e.g. age of the farmer, financial situation, succession arrangements, tenure and location).

Timing of financial impacts,

It was always going to be very difficult to predict farmer behaviour in relation to the Regulations given the wide range of options available and the characteristics of farms as noted above, but a larger problem for farmers is the issue of timing of the financial impacts. The ex-ante study presented costs annualised over a 20 year time period, while evidence from the ex-post study suggests that, while certain costs will occur annually (e.g. record keeping), the major costs for improved storage and spreading equipment will need to be met in the short term (between 2009 and 2012).

Limited effectiveness of the dairy derogation

The ex-ante IA calculated that the dairy derogation negotiated by Defra would be significant in reducing dairy farm compliance costs by up to 60%. The limited uptake of the derogation suggests the benefits are not as high as originally suggested. It was not clear from the ex-post survey why the uptake was low but there were suggestions that the additional benefits were limited. Evidence indicated that smaller dairy farmers (producing 4,500 to 5,000 litres/cow) felt that they were easily within the 170 kg limits and therefore did not require derogation. One larger farm that had derogation felt that it restricted future planning and was not viable for any business looking to expand.

Record-keeping burdens imposed

Record keeping was identified as problematic in the ex-post review, and costing anywhere from £300 to £3,000 per year, depending on the size of farm and the extent to which consultants are used, significantly higher than predictions in the ex-ante small business impact study. The nutrient planning and slurry management requirements are viewed by farmers as complex and burdensome.

Implementation issues

There were minor differences between the two studies on a range of implementation issues. The most significant related to setting the boundaries on the NVZ, resulting in a large numbers of appeals, many of which were upheld. Costs to Defra were significant in terms of money and reputation. The ex-ante study did not identify any potential problems other than increased mapping costs, which were not quantified separately.

Table 3.1: Comparison of ex-ante and ex-post studies: 2008 Nitrate Regulations

Category	Initial prediction of Costs/benefits	Ex-post estimates of current Costs/benefits	Magnitude of difference	Reason for difference
<p>Total costs Discounted at 3.5% over 20 years</p> <p>Total benefits Discounted at 3.5% over 20 years. Benefits are linked to enhanced control of nitrate entering waters. Changes in ammonia emissions not explored.</p>	<p>Present Value total costs= £655.1- 1009 (not including enforcement costs). Average annual costs = £48.5–68.6 million</p> <p>Present value total benefits = £28.1 – 274.2 million Average annual benefits = £1.77 – 18.4 million</p>	<p>Present Value=£300–900 million over 20 yrs.</p> <p>Not estimated but indicates: increase in ammonia emissions; small decrease in nitrates in surface and groundwaters; catastrophic events could do damage at end of closed period.</p>	<p>Low</p> <p>Unclear - Low</p>	<p>Key difference is timing of costs. Costs are highly variable and farm specific.</p> <p>IA recognised full benefits might take several years in respect of surface water and several decades in the case of groundwater.</p>
<p>Compliance costs:</p> <p><i>Storage capacity</i></p> <p>Covered yards/run-off reduction measures</p> <p>Reduction in stocking rate</p> <p>Additional spreading costs</p> <p>Spreading techniques</p>	<p>£12.8 – 16.5 million per annum (two thirds on the Dairy industry)</p> <p>No estimate</p> <p>£17.9 – 21.8 million per annum</p> <p>£8.5 – 11.3 million per annum</p> <p>£3.7 – 8.4 million per annum</p>	<p>£250 – 500 million over period 2008-12.</p> <p>£75-150 million over period 2008-12.</p> <p>No indication.</p> <p>More time to empty stores.</p> <p>£25 – 280 million over period 2008-12.</p>	<p>Medium</p> <p>Low</p> <p>Unclear</p> <p>Unclear</p> <p>Low</p>	<p>The ex-ante IA study recognised a number of site specific actions open to farmers to mitigate the impact of storage requirements. Large number of farms need to comply with storage requirements.</p> <p>Various measures being taken by farms to reduce impacts and come into compliance – with variable</p>

				cost implications.
Compliance costs: Moving slurry Making more efficient use of slurry Reduction in fertiliser use	None estimated	Cost = £15 million per year (based on 5,000 farms) Benefit = £7.5 million per annum from reduction of N, P, K fertiliser.	High Unclear	Some evidence slurry being moved and extra land rented out. Difficult to disentangle increased fertiliser prices from impact of Regulations.
Compliance costs: Recordkeeping	£0.4 – 2.7 million per annum (averaged over 10 yrs).	£1.5 – 30million per annum.	High	Record keeping is complex
Increased farm labour/time costs	None estimated	£6.25 – 12.5 million per annum	High	Evidence that compliance is increasing level of labour
Dairy Derogation	Reduces costs by half where it occurs. Estimated to reduce total costs by £16 – 27 million if applied across 70% NVZ scenario	No estimate of reduced costs. Only 400 – 450 applied for.	Unclear – possibly high.	Low level of uptake suggests impact of derogation is small.
Planning costs	Not included – estimated to be very small.	£1.25 – 2.5 million (2008-12).	Low	Costs per farm are low.
Implementation and enforcement Costs				

Increased costs to the EA/Defra from increased mapping, consultation, advice and training.	£2.4 to 3.4 million/year for four years (until next Action Programme Review).	£0.8 million from appeals process. Mapping costs unknown. £0.25 – 0.4 million per annum in monitoring costs. Training/guidance/advice £22 – 25,000/yr for 2008-2012.	Unclear – possibly low	High costs of mapping and appeals process. Continuous monitoring required for evidence base. High costs of training and guidance in first few years.
Small firms impact test Wide range of costs estimated	Costs in £ per farm per year Main measures £62 – 3,336 Admin burden £129 - 752 Total £195 – 4,088	Highly variable depending on farm size, farm type and location. Farms needing storage varies £10 – 100,000 per farm; Admin burden ranges £300–3,000/farm.	Low	Estimates similar in magnitude over 20 year period. But many costs fall in the period 200-12.
Competitiveness A short competitive assessment was carried out.	None	Some evidence farms in NVZ areas adversely affected through increased costs. Little evidence of slurry export outside the NVZ zone, or any migration of quota.	Unclear – possibly high	Some evidence that small farms in the NVZ leaving the dairy sector.

2006 Agricultural Waste Regulations

The objective of the Regulations is somewhat unusual in that it is not developing new requirements or new legislation but simply extending existing regulations that apply elsewhere. The Regulations extend to agricultural waste the management controls which are already in place for other sectors of industry, to reduce risk from agricultural waste and ensure objectives of Article 4 of the EU Waste Framework Directive (WFD) are fulfilled. (Article 4 ensures waste is recovered or disposed of without endangering human health or the environment).

The Final IA was published in March 2006. The main purpose of the IA was to assess the impact of extending the controls already in place (to fulfil the requirements of the EU Waste Framework Directive) to agricultural waste and non-mineral waste from mines and quarries. The IA explored three policy options for assessing regulatory impacts of proposed waste regulations. A 'do nothing' option was not possible as UK was subject to infraction proceedings resulting from an adverse ECJ judgement. Costs and benefits were therefore set out against a base case of 'current practice continuing'.

The ex-post regulatory review was based on a small sample of farmers (12), other stakeholders (3), and the implementing bodies (2). Face-to-face interviews were conducted to identify impacts of the Regulations since adoption. The focus of the data collection was to enable understanding of the effects of the Regulations on farming, and how they had changed behaviour and the level of activity.

Environmental benefits were not estimated in the ex-post review, although there are suggestions that predicted benefits appear to be overstated in the ex-ante IA. The ex-ante IA adopted figures applying to the whole agricultural sector, implying that some aspect of damage costs avoided could be attributed to agricultural wastes. However, there was no indication of what proportion might be appropriate. The ex-post review suggests that the environmental impacts of waste are overstated and not related to the changes being made in farming practices. Evidence suggests that benefit measures could have been measured more carefully, for example:

- there is no mention of reduced air emissions from changes in the level of on-farm burning waste;
- many on-farm practices related to the storage and disposal of hazardous wastes are already being applied to comply with assurance schemes.

Table 3.2 identifies the major differences between ex-ante and ex-post studies for the 2006 Agricultural Waste Regulations. Overall, the ex-post estimates of costs to the farming community are similar to the ex-ante predicted costs. Overall costs of compliance are estimated at £35.4 million per annum, which falls at the lower end of the range of costs predicted by the ex-ante study. The manner in which costs were calculated in the ex-ante study appears to be related to 2005-06 landfill tax costs which have altered significantly, and do not take into account potential levels of recycling. The largest difference in impacts can be accounted for by the lack of consideration of re-use and recycling of materials in the ex-ante study, in particular the reprocessing of waste plastics. This is partly due to increases in the value of waste plastic, however this was already apparent in 2006 when the regulations were being adopted.

The variation in implementation costs between ex-ante and ex-post studies appears high, although actual figures have not been calculated in either case. One reason for the difference is the cost of building an IT system for registering and managing exemptions

(which exceed 500,000), a cost which does not appear to have been considered in any detail in the ex-ante IA. Variation between predicted and actual costs to the court system also appears to be high, based on a predicted number of court cases which has not materialised. This may be due to a light touch regulatory regime, and to a higher than expected level of compliance.

Table 3.2 Comparison of ex-ante and ex-post studies: 2006 Waste Regulations

Category	Initial prediction of Costs/benefits	Ex-post estimates of current Costs/benefits	Magnitude of difference	Reason for difference
<p>Environmental Benefits</p> <p>Ammonia Loss of fishery value Bathing waters pollution Direct impact of faecal pathogens to soil/water</p>	<p>£43 million for UK £28 million Eng + Wales £69 million for UK £20 million for UK</p>	<p>Not calculated but considered to be much less than estimated.</p>	<p>High</p>	<p>Environmental impacts appear to be overstated and not related to changes being made in farming practices. Many practices related to hazardous wastes already altered to comply with farm assurance schemes. No mention of emissions from burning plastic and other wastes.</p>
<p>Compliance</p> <p>Overall impacts of:</p> <ul style="list-style-type: none"> • On farm hazardous waste storage • On-farm disposal/recovery • Off-farm disposal/recovery 	<p>Overall costs to farmers and growers are estimated at £28.7 - £69.8 million per year.</p> <p>Estimated cost per farm is £177 – 430 per year (mid-point = £304/yr).</p> <p>Average costs are estimated by farm type to range from 1 – 12% of income.</p>	<p>Overall costs to farmers/growers estimated at £35.4 million/yr.</p> <p>Estimated average cost over sample is £219/year. Costs range from £124 – 750 per farm depending mainly on size.</p>	<p>Low</p>	<p>Most farmers already in compliance with hazardous wastes; costs are minimal.</p> <p>Largest waste stream (plastic) is recycled.</p> <p>Farmers not disposing of all wastes. Some ‘wastes’ are re-used on-farm (e.g. tyres); batteries have a value; scrap</p>

				collected for free.
<p>Implementation costs</p> <p>The Environment Agency (EA) will face increased costs in administration, monitoring and enforcement.</p> <p>Administration costs from issuing of licences and inspecting sites will be covered by charges. Enforcement costs are funded by a Grant in Aid from central government.</p>	None estimated	<p>Evidence of increased costs – in particular in building IT system for registration and management of exemptions.</p> <p>Significant communication costs (brochures, guides, web support, workshops and meetings) on part of NFU and EA. At least 1 FTE established in NFU</p>	High	Communication costs not considered – in particular those of associated stakeholders outside of government.
<p>Costs to the court system</p> <p>Estimated 11 court prosecutions involving the agricultural sector.</p>	Annual average costs after the first year are estimated at £3,300 per year.	None recorded	High	<p>Lack of waste focused inspections.</p> <p>EA prefers light touch approach to regulation.</p> <p>Some evidence of reduced payments from RPA as result of non-compliance.</p>
<p>Small firms</p>	None undertaken	Evidence that new firms and new service activities established to deal with	Unclear	No consideration of significance of plastics recycling.

		agricultural plastics as a result of the Regulations. 66 firms established services in 9 months leading up to adoption of regulations, and approx. 30 firms anticipating to expand in 2006.		
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4. Exploring the reasons for the differences between ex-ante and ex-post estimates

A key issue is to account for the differences between the ex-ante impact assessment and the ex-post regulatory review. A number of potential causal factors had already been identified in the literature (e.g. assumptions, technological change) while others were drawn from the analysis and comparison of ex-ante and ex-post data collected for the two regulations under examination. Causal factors used to explain ex-ante/ex-post differences in this study have been categorised as follows:

Causal Category	Description
Assumptions	Differences caused by assumptions made in the ex-ante IA about the state of the world, or expected behaviour.
Methodological	Difference caused by ineffective or inaccurate methods used in the ex-ante study
Technological	Changes in technology that were not foreseen, or anticipated changes that did not develop, or have not had an impact due to lack of support, finance, or knowledge
Sector Knowledge	Erroneous or imperfect understanding of the sector and how it operates leading to inaccurate estimates of impacts
External drivers	Failure to account for the impact of external forces (such as market prices) which influence farmer or other stakeholder behaviour and actions
Implementation support	Erroneous accounting relating to the level of support required in implementing the regulations (e.g. relating to level of enforcement needed, training, guidance and advice, monitoring).
Systemic	Failure to carry out actions or undertake studies required by rules governing conduct of ex-ante impact assessments; or, it could relate to specific 'ways of doing' that cause erroneous results.

The major differences between ex-ante and ex-post studies are summarised in Tables 4.1 and 4.2 below. The explanations for the differences for each of the causal categories are described in the right-hand column.

Nitrate Regulations

The differences between ex-ante and ex-post estimates of costs are not large overall but there are significant differences between specific items. Predicted estimates of storage costs, while not being unduly out-of-line with actual expenditures, did not take into account the timing of expenditure and the need for short-term borrowing in order to invest in new structures. The ex-post study found that moving slurry exceeded original predictions in the short term, but costs may decline in future. Compliance costs appear to be accurately predicted although the variation in costs was found to be much higher than that predicted in the ex-ante IA. Results of the ex-post study suggest that while increased workload is greater than that predicted, implementation and compliance costs were in line between the two studies. There are several instances where either the ex-ante or ex-post study was not able to estimate/measure costs (e.g. the dairy derogation), making comparison between the two studies difficult. Some differences were due to unexpected events, such as the number of NVZ boundary appeals, and some changes were driven and/or assisted as much by increases in fertiliser prices as by regulatory implementation. The small firms impact test appears to have fairly accurately predicted the impacts on farms, although again the observed variability in farm costs was found to be much greater in the ex-post study.

The key causal categories which account for the most significant differences between ex-ante and ex-post studies are 'assumptions', and 'sector knowledge'. Several of the assumptions made in the ex-ante IA regarding take-up of various alternative behaviours have not been supported in practice, leading to differences in estimated costs to farmers. Linked to this is a lack of 'sector knowledge' which has led to some erroneous estimates of changes in farmer behaviour. In some ways the ex-ante study was a broad brush overview of impacts by farm type that did not account for a wide range of other factors affecting farm business decisions (e.g. farm tenure).

Table 4.1 Causal categories accounting for differences between ex-ante and ex-post impact assessments: 2008 Nitrate Regulations

Factor accounting for difference	Causal category
Derogations will reduce costs to dairy industry	Assumption <ul style="list-style-type: none"> - incorrect assumptions regarding financial impacts of derogation - relatively few farms have applied suggesting financial impacts are limited.
Reduction in stocking rate to come into compliance	Assumption <ul style="list-style-type: none"> - incorrect assumption that farmers will reduce stocking density; this is an option but not a viable one for farmers in the dairy sector - farmers more likely to switch to alternative activities (e.g. into extensive beef production)
Spreading of slurry evenly across the months in the open season.	Assumption <ul style="list-style-type: none"> - farmers concentrating spreading into shorter periods immediately after closed season.
Presenting costs annualised over a 20-	Methodological

year period does not reflect reality facing the farmer.	<ul style="list-style-type: none"> - farmers face immediate ‘up-front’ costs, and must also pay costs of borrowing, which are not included in the IA estimates. - Difficulties for some farms (especially those with older farmers/small farms) to access financing.
Increased time requirements to manage sources of nitrate	<p>Methodological</p> <ul style="list-style-type: none"> - Farmers report longer hours spent spreading waste and emptying stores - Record keeping is complex and difficult – using the Cabinet standard model does not reflect the complexity of the issues being dealt with by farmers.
Anaerobic digestion technology not utilised.	<p>Technological</p> <ul style="list-style-type: none"> - AD too expensive with complex requirements. - Infrastructural support not available in most cases to make this a viable option.
Renting land to increase area available for spreading slurry.	<p>Sector knowledge</p> <ul style="list-style-type: none"> - Renting land not a viable option in livestock intensive areas. - In areas with intensive dairy – most farms have slurry issues, and there is no land available for slurry application. - High costs of rental
Variable impacts on farms need to be taken into account in more detail.	<p>Sector knowledge</p> <ul style="list-style-type: none"> - Small farms at a disadvantage – less able to respond quickly to change - Tenanted farms not receiving investment support from landlords - Older farmers might not be prepared to invest – or find access to funding more difficult. - Older farmers have greater difficulties accessing information and take longer to make changes
Rising fertiliser prices having significant impact- led to reductions in purchase and application.	<p>External drivers</p> <ul style="list-style-type: none"> - failure to adequately account for market forces (commodity pricing)
Provision of advice and guidance	<p>Implementation support</p> <ul style="list-style-type: none"> - complexity of regulations created demand for advice and guidance from farming organisations - Complex measures require higher level of advice and guidance to ensure

	<p>compliance.</p> <ul style="list-style-type: none"> - Number of 'grey' areas creates uncertainty among farmers. - a full IA should pick up potential effects on other stakeholders, in particular those whose members will be expecting support to translate, explain and guide farmers in complying with new legislation.
Mapping costs and appeals process	<p>Implementation support</p> <ul style="list-style-type: none"> - Mapping costs significant and number of appeals was unexpected. - Consultation process should have identified boundaries as a key problem area and addressed the issues.
Monitoring costs	<p>Implementation support</p> <ul style="list-style-type: none"> - Need for continuous evidence base to support government policies and present to the European Commission.
Systemic	<p>Timing of the ex-ante study</p> <ul style="list-style-type: none"> - Timing of the IA in relation to the date the final proposals are submitted can influence impacts - Timing in relation to external factors can multiply or diminish predicted impacts <p>Options explored</p> <ul style="list-style-type: none"> - Limited options explored in detail <p>Methodological constraints</p> <ul style="list-style-type: none"> - Limited to using CBA and standard monetary valuation approaches - Time horizons do not reflect reality of timing of expenditure and benefits.

The other major category of factors causing differences is 'methodological'. Methods used to calculate annualised costs over a 20 year time horizon do not reflect the real world in which the farmer operates, and thus do not capture the magnitude of the 'individual burdens' imposed by the Regulations, and use of a 'standard model' to measure time requirements for record keeping (also based on provision of 'templates' to speed up the process) do not reflect the level of knowledge and skills in the farm population.

Other causal categories that contribute towards differences between ex-ante and ex-post studies include 'technological' and 'implementation support'. The main technological issue related to anaerobic digestion systems; the ex-ante study assumed there would be significant interest from farmers but there is no evidence of farmers adopting the technology, which appears to be more complex to operate and costly than anticipated. In a few years the situation might be different but at the present it does not appear to be a viable option. In

addition the ex-ante study did not adequately consider some of the implementation issues such as: the level of appeals against boundary mapping; the demand for advice and guidance; and the complexity of record-keeping.

Agricultural Waste

Overall the ex-ante impact assessment over-estimated the costs to farmers of compliance with the Regulations. This was largely due to a lack of consideration of the value of waste materials and the scope for recycling. The key differences were examined and allocated to one of the categories identified above. Table 4.2 below describes the results. The key causal categories which account for the most significant differences between ex-ante and ex-post studies are ‘assumptions’, ‘external drivers’, and ‘sector knowledge’. The assumption that farmers would landfill all waste and not engage in recycling is erroneous, especially as they generate large quantities of specific types of plastic. Linked to this is the lack of sector knowledge which would have revealed the increasing demand for waste plastics (and products created from waste plastic), and market forces driving up the value of plastic recycle, which was happening before the ex-ante IA study was carried out.

The differences between ex-ante and ex-post studies are not large, the assumptions made in the ex-ante study produced a reasonable estimated range of costs to farmers, and the assumptions made regarding hazardous waste management were largely correct. If anything, the ex-ante study over-estimated farm costs, and under-estimated (or did not consider) implementation costs and benefits to other stakeholders (e.g. waste collectors). Clearly, some of the differences can be accounted for by external drivers, such as the high value of clean waste plastics, although this should have been apparent even in 2006 when the initial impact assessment was conducted. Failure to consider EA and other stakeholder expenditure on providing guidance and raising awareness is a surprising omission given that the regulations are imposing an entire body of controls on a whole sector of activity made up of a large number of small businesses.

The major differences and the characterisation of the causes are described in the table below.

Table 4.2 Causal categories accounting for differences between ex-ante and ex-post impact assessments: 2006 Waste Regulations

Factor accounting for difference	Causal category
No consideration of recycling made in the ex-ante study regarding farm disposal options.	Assumption - incorrect assumptions regarding farmer behaviour
Estimation of on-farm costs through basing waste management on waste disposal of all materials.	Methodological - no consideration of alternative forms of waste management (e.g. recycling)
The failure to take into consideration the value of waste materials and recycling/re-use activities which have made collection easier (and possibly cheaper).	External drivers - failure to account for market forces (commodity pricing) and growing demand for waste plastic products
No measures of effects on other stakeholders.	Sector knowledge - a full IA should pick up potential effects on other stakeholders

No allowance made in the ex-ante study for the difficulties of communicating complex definitions of 'waste'. Thus no consideration of EA and other stakeholder expenditure on providing guidance and raising awareness.	Implementation support <ul style="list-style-type: none"> - IA should consider implementation costs and benefits, including activities such as awareness raising, and where those costs will fall.
No estimate of implementation costs (e.g. IT system to manage registrations).	Implementation support <ul style="list-style-type: none"> - IA should consider implementation costs and benefits
Limited options reviewed as UK government had no choice but to apply existing regulations to agricultural sector.	Systemic <ul style="list-style-type: none"> - IA could have reviewed alternative management regimes for different wastes and avoided the situation where a large number of farm-level exemptions currently exist.

Making methodological improvements to the ex-ante impact assessment process

This section explores the implications of the identified factors accounting for ex-ante/ex-post differences, and makes some suggestions for improving ex-ante impact assessments in the farm-focused regulatory arena. A number of issues were identified in the analysis as key causal factors influencing the differences between ex-ante and ex-post studies. These are discussed in more detail below.

Assumptions

Predictive approaches will always require assumptions about future states of the world and behavioural change. Accuracy of assumptions can be increased by improved knowledge of the sector and how it operates. In the case of the Nitrate Regulations this would have enabled more accurate assumptions in two out of the three cases identified in Table 4.1. In the third case, higher levels of slurry applied over a shorter time period would be difficult to predict as it is doubtful if farmers themselves had considered how they might respond to the proposed closed periods; it is only when faced with the actual situation, at a particular point in time, that farmers can work out the best options for action. In the case of the Waste Regulations, using the assumption that all waste would be landfilled as a basis for estimating costs was an error. This could have been avoided through better knowledge of both farmer behaviour and the waste sector itself, as it was apparent even in 2006 that the value of waste materials and thus recycling was increasing, and farm plastics offered a relatively clean and large source of recycle.

One possible option to reduce errors from this category is to test assumptions through small scale workshops, or scenario case study events where individuals or a small group of farmers engage in some detailed 'what if...?' explorations of how they would react under particular scenarios. This might highlight potential behavioural change and provide insights into characteristics of both costs and benefits under changing conditions, something that current consultation processes are unable to accomplish.

Linking this form of activity with an examination of markets that influence the strategic behaviour of those being regulated, would strengthen the value of scenario workshops. Any assumptions about market behaviour should be verified by independent experts familiar with those markets.

Methodological

Methods and tools selected to measure predicted impacts will influence the magnitude and perhaps even the form of impact considered. An emphasis on cost benefit analysis, for example, will focus attention on monetary measures rather than psychological or social effects that might also be occurring. Methods (such as cost-benefit analysis) have specific requirements dictating how they are to be applied that can hide as well as illuminate certain areas. There are thus three issues to consider: first, was the method conducted according to best practice; secondly, did the application of the method create systematic errors that need to be modified in future studies; and third, did the method miss or fail to identify specific impacts. Given the importance of understanding impacts in monetary terms CBA will almost always be the method of choice, but there needs to be some consideration to improving the predictive capacity of the approach.

For both the Nitrate regulations and the Waste Regulations the main approach was a cost-benefit analysis (CBA) which in the case of Nitrates was carried out to very high standards identifying both costs and benefits, the analysis of Waste Regulations was not as diligent in terms of estimating benefits or costs. Even in the case of the Nitrate Regulations, however, certain aspects of methodological application could be considered as a potential cause of errors - for example, the application of discounting over a 20 year time period. This is standard practice in cost-benefit work but application in this instance resulted in the study failing to identify two important issues: the fact that many of the costs faced by farmers would occur in the short-term, and that many of the benefits would occur far into the future – well beyond the 20 year time frame over which impacts were being discounted. In many ways this is the classic problem of applying cost-benefit analysis leading to two problems. First, in terms of measuring environmental impacts, costs are often immediate while benefits occur far into the future, such that discounting reduces the present value of benefits to very small amounts. Second, there is often conflation between ‘costs’ and ‘expenditure’. Costs to society (for example in terms of water or air pollution) are not the same as expenditure occurred by farmers required to comply with specific regulations. The small firms impact test is one approach to tackling this second problem but more explicit delineation between expenditure likely to be incurred/income gained, and societal costs/benefits would improve the utility of current CBA.

In the Waste Regulations IA the benefits are poorly defined at societal level, and the time period over which costs and benefits are measured is not clear. The actual expenditure predicted was similar (or slightly higher) to that found in the small sample of farmers undertaken, even though ‘costs’ were based on the assumption that all waste materials will go to landfill.

Did the CBA approach miss any important impacts? The Nitrates study was very thorough but due to the emphasis on monetisation of impacts and its focus on farm type rather than farm size it may have missed some important ‘business psychology’ issues relating to farmer perceptions of their future financial position. There is evidence to suggest that small dairy farms in particular may be pushed beyond a ‘tipping point’ by the demands of the Regulations and forced to leave the sector. This was not an impact considered by the ex-ante study. A second area missed was the level of skills and knowledge required to comply with all the regulatory requirements, which for some types of farmer has been difficult. Treating all farms in the same way within a sector misses out on significant variation that

occurs across farms and farmers. In the Waste study the focus on monetising impacts was useful but due to other reasons a key factor – the increased demand for recyclable materials – was overlooked. The result was an analysis that missed this important set of benefits.

Reducing this type of methodological effect in an ex-ante study is not easy, as selecting the method usually dictates the types of impacts that will be measured and those that will not, and for the most part the emphasis will be on monetisation of costs and benefits. Cost-benefit analysis itself could be improved through more realistic scenarios that build in more of the actual variability present in the agricultural sector. Simple computer modelling could illustrate the ways in which different types of farm might be affected, but understanding business decisions requires additional information that illustrates what different types of farmer (e.g. young vs. old; small vs. large) might do when faced with new and costly regulatory requirements. Such information is costly and painstaking to obtain but illustrative case studies could be used to inform a CBA about the impact of costs at the farm business level under a range of scenarios, before calculations are made.

This would require collection of qualitative behavioural data from a range of farm types in order to improve understanding of costs and benefits at the individual business level. Consideration of timing of impacts could also be anticipated through discussions with farmers over what might happen when regulations are adopted – with a focus on understanding the points at which they perceive action would need to be taken.

Technological

It is difficult to predict the point at which new technologies become viable and attractive at the individual business level. There were no technological issues for the Waste Regulations analysis. In the case of the Nitrates Regulations anaerobic digestion appeared attractive as an alternative form of energy generation when the IA was conducted, but at the present time does not appear to be financially attractive to farm businesses. However, as the methodology is measuring costs and benefits over a 20 year time frame it may be that in 5 or 10 years the technology will appear much more financially attractive. This could be a case of the ex-post analysis being undertaken too early, in which case the problem is more systemic and related to decisions about when an ex-post review should be carried out.

To reduce errors from this causal category assumptions made about take-up of new technology should be explored from the farm business point of view and not from those selling or promoting the technology. This might provide a more considered view of the likely uptake of technology over a period of time, although this will remain an area of uncertainty.

Sector Knowledge

Detailed sector knowledge could enhance the accuracy of predicted impacts, particularly in relation to understanding the options open to farmers in different situations and locations. The disadvantage of broad-brush approaches that treat all individuals the same is that impacts on farm businesses at both ends of a spectrum are not well understood. There is a need to understand the key characteristics that influence business decisions (e.g. age of farmer, size of farm, ownership status). This was an issue that caused errors in both the Waste and Nitrate studies. In the case of waste there was a lack of knowledge about both agricultural and waste sectors. Waste collectors and plastics re-processors were already approaching farmers before the Regulations were adopted and a more comprehensive IA would pick up the market opportunities and other potential effects on a wider range of stakeholders. In the case of the Nitrates Regulations the issue was one of the need for detailed understanding of variability between farm types, as well as geographic location.

Discussions with farmers and/or other knowledgeable stakeholders in different parts of the country could enhance understanding of the way in which regulatory change might affect local business decisions, and illuminate potential problems with alternative options. Although a costly approach to improving ex-ante studies it could also be used to identify potential problems that can be addressed before Regulations are adopted.

External drivers

External drivers can be volatile and unpredictable, particularly if a study is exploring costs over a long time period (e.g. five years or more). The CBA of the Nitrate Regulations appears to have completely ignored the role of increasing fertiliser prices in its analysis, a trend which was apparent before 2007 when the study was conducted. Fertiliser, as a key input to agriculture, should be included in any study of predicted impacts, in terms of both price increases and decreases. In this case it is particularly important, to a certain extent manure and fertiliser are substitutes so the price of one will affect the perceived value and use of the other. In a similar vein the Waste Regulations CBA appears to have ignored the rising value of waste plastics (and other materials such as lead and iron) which were apparent before the ex-ante study was conducted, and yet highly significant in determining stakeholder behaviour.

In the case of the Nitrates Regulations, the high price of fertiliser is partially responsible for a change in use of slurry and manures, and a change in perceived value; compliance might be a lot lower if fertiliser prices were low, thus an ex-ante impact assessment should consider alternative scenarios of changes in market prices. Different scenarios can easily be modelled, but again must be underpinned by understanding of decision making at the farm business level for farms with different characteristics.

Implementation support

Implementation is often a grey area in ex-ante studies, namely:

- there is lack of clarity over what costs should and should not be included (e.g. what constitutes 'normal' work as opposed to 'new' or 'extra' work?);
- a lack of clarity over what benefits might accrue to an enforcement or implementing body; and
- a lack of consideration of the costs accruing to other bodies of providing support services (e.g. guidance, advice, training).

Although the ex-ante study on the Nitrate Regulations provided an estimate of implementation costs it is not clear how they were derived, nor whether they included any allowance for other stakeholder costs. In addition the ex-ante study did not anticipate a costly appeals process against NVZ boundary mapping. In terms of the Waste Regulations the level of support and guidance was not appreciated, while the need for creation and maintenance of a large data base of exemptions was not clearly costed. A large body of existing regulations were applied to the agricultural sector for the first time, and inevitably some concepts (such as the 'duty of care', the definition of 'waste') are difficult to comprehend in a new environment. Awareness raising and provision of guidance are significant costs that need to be accounted for beyond the implementing agencies to include other stakeholder bodies providing advice and guidance.

One way to improve this would be to develop clear guidelines for identifying new legislation implementation costs. For example, the amount of personnel time spent on developing and reviewing legislation, time and personnel requirements for enforcement, training costs, and guidance and advice expenditure; a clear delineation is also required between one-off and annual costs (and benefits). At the moment many of these costs are assumed to be the 'normal' work of government that do not need to be included. Identification of potential costs

to other stakeholders could be accomplished through simple survey methods that expand the scope of the CBA. Other stakeholder bodies should be included in terms of identifying levels of support provided, and the associated costs and benefits.

Benefits might accrue in the form of more highly trained and knowledgeable personnel, and efficiencies from developing new approaches to implementation. These are harder to identify and monetise, as are 'damage to reputation' which Defra identified as a major cost in the ex-post study.

Systemic

Timing of ex-ante and ex-post studies is an issue that can affect impact measures. An ex-ante assessment conducted late in the policy process may only be able to look at a limited range of options (as is the case here where limited policy options were already established), while an ex-post study carried out too early may not pick-up the full range of costs and benefits that actually occur (for example the potential role for anaerobic digesters, and the long-term benefits to water supplies from implementing Nitrate controls).

The Waste Regulation ex-ante IA was limited in scope as the regulations applied already existed and were being applied in other economic sectors. The policy options were thus limited, which is not uncommon where transposition of EU legislation sets constraints. However, it could have been useful in this instance to explore alternative management regimes for different agricultural wastes. The current system where farmers are required to register for exemptions for managing a wide range of materials is costly and inefficient, as well as being confusing to farmers. The ex-ante study could have performed a useful function by investigating the inclusion of more clearly delineated regulatory requirements for certain forms of waste in the legislation, rather than requiring farmers to apply for exemptions. Ex-ante IA could be used more effectively as a tool for exploring alternative administrative options, as well as alternative policy options.

These are difficult issues to avoid, however, and the way forward is seldom clear when developing new legislation. To a certain extent options are driven by political imperative and how policy makers want to use ex-ante impact assessment as a tool in the policy process.

Summary of suggested methodological improvements

Use of workshops/case study methods

Detailed discussions with those potentially affected by proposed regulations might improve predictive capacity in a number of ways:

- Modify assumptions about behaviour underpinning cost and benefit estimates
- Improve knowledge of the sector(s) affected
- Improve understanding of the potential effects of technological change
- Identify the extent to which other schemes/policies might be overlapping with the proposed new legislation.

A CBA approach that builds-in detailed understanding of farm business decision making might improve the quality and utility of CBAs, and lead to more targeted policy making. It may also help to identify potential overlaps with existing schemes and policies, as well as helping to avoid costly mistakes. The Waste Regulations were never going to have large financial impacts on farms so the focus in this case could have explored farmer attitudes towards waste management and recycling. Such an approach would help identify areas of good and poor understanding of key concepts.

Workshops/case studies may also help improve the quality of 'small firms tests' which are complex due to the variability in farm characteristics making it almost impossible to capture the full range of effects across the sector.

Scenario modelling

Greater use of scenario modelling can provide insights into the potential impacts of unpredictable external drivers, such as market prices. In turn this might enable tailoring of proposed legislation to incorporate unpredictable change (for example, where a price rise in one commodity might change behaviour a regulatory requirement can be made stronger to counter such action). Scenario modelling can also be utilised to develop sensitivity analyses on specific variables within the overall CBA to provide greater understanding of the likely range of impacts.

Improved guidelines for measuring implementation impacts

Greater clarity on how to measure the impacts of implementation would enable more accurate observation of internal government costs and benefits. Benefits of improved knowledge among personnel, and more efficient ways of operating are often not addressed in any detail. It might also identify potential overlaps and duplication of effort, and act as an incentive to explore alternative approaches to implementation.

Identification of market forces

Ex-ante IA methodologies could integrate a requirement for examination of key market forces linked to the policy area under study. A standard analysis (perhaps with a template form) could easily identify and prioritise the relevant markets and prices requiring consideration. In the current case key issues relate to Landfill tax, fuel costs (transport of waste), and the demand for recyclates. Looking at the demand for recyclate would provide better information on which to make informed predictions, the other part is understanding farmer behaviour, which is dealt with below.

Estimating costs and benefits

The pilot study has indicated that in many ways it is easier to measure costs than benefits. Costs are often viewed as direct and relatively easy to measure using market prices. The study also reveals that more 'indirect' or intangible costs are often overlooked in impact assessments, examples include: changes in time required to undertake new or even familiar tasks in order to comply with changed requirements, additional time and expenses in getting trained-up to meet requirements or gain the guidance and advice needed, and psychological effects (stress) of dealing with additional regulatory burdens, especially for those operating at the margins of financial sustainability.

Benefits have often been the more difficult aspect of CBA, particularly when it comes to measuring improvements to environmental, social, or human capital. The impact assessments explored in this study both used damage cost estimates to provide some monetised measure of environmental improvement. In terms of post-implementation review it is doubtful if this approach can be improved upon as the same damage cost estimates would have to be utilised. Where physical impacts can be demonstrably shown to be different than anticipated, a post-implementation review can indicate the change in benefits. In the Regulations explored it is clear that in both cases benefit estimates should be adjusted: the Nitrate Regulations study suggests that price changes are having more influence than the Regulations, while the Agricultural Waste Regulations study indicates increased societal benefits from reprocessing of waste plastic, as well as significant reductions in air emissions due to decreased burning of wastes. Social and human capital improvement can be harder to define and to monetise; for example, there are potential

benefits from increased understanding of nutrient cycles in soil and water, on the part of farmers, enforcement bodies, and advisors resulting from Nitrate Regulations; and, 'feeling better', or 'less guilty' about new waste management practices arising from the Waste Regulations. These are difficult to monetise effectively and at present can only be reported in a qualitative manner.

There is a case for qualitative presentation of costs and benefits, both to enhance understanding of the monetary figures, and to give greater clarity on which aspects have not been included in the monetary estimates.

5. A framework methodology for the conduct of ex-post assessment of regulations

Figure 5.1 below illustrates a proposed iterative methodology for conducting a post-implementation regulatory review. The process starts with analysis of the relevant legislation or regulations to identify aims and objectives and the target populations affected. Alongside this the partial and full IA documents require analysis to understand the scale of predicted impacts (costs and benefits) and to whom they were predicted to accrue, along with assumptions made and the methods and data sources used. Once these two analyses have been carried out a first round of data collection is required to identify the actual impacts resulting from implementation of the legislation/regulation. This part of the review will require data collection from relevant sources including reports, survey data, websites, the media, and interviews with key stakeholders, representatives of affected groups and those involved in monitoring and implementing the regulations. The aim of the first round of data collection is to 'sketch' the structure of the implementation process in terms of identifying and measuring the following:

- The major impacts
- Who/what is affected and in what manner
- Benefits and costs
- Other forces at work influencing impacts

The focus is on understanding attitudes and behaviour of the 'business unit' affected. In the agricultural sector this is most likely to be the farm unit.

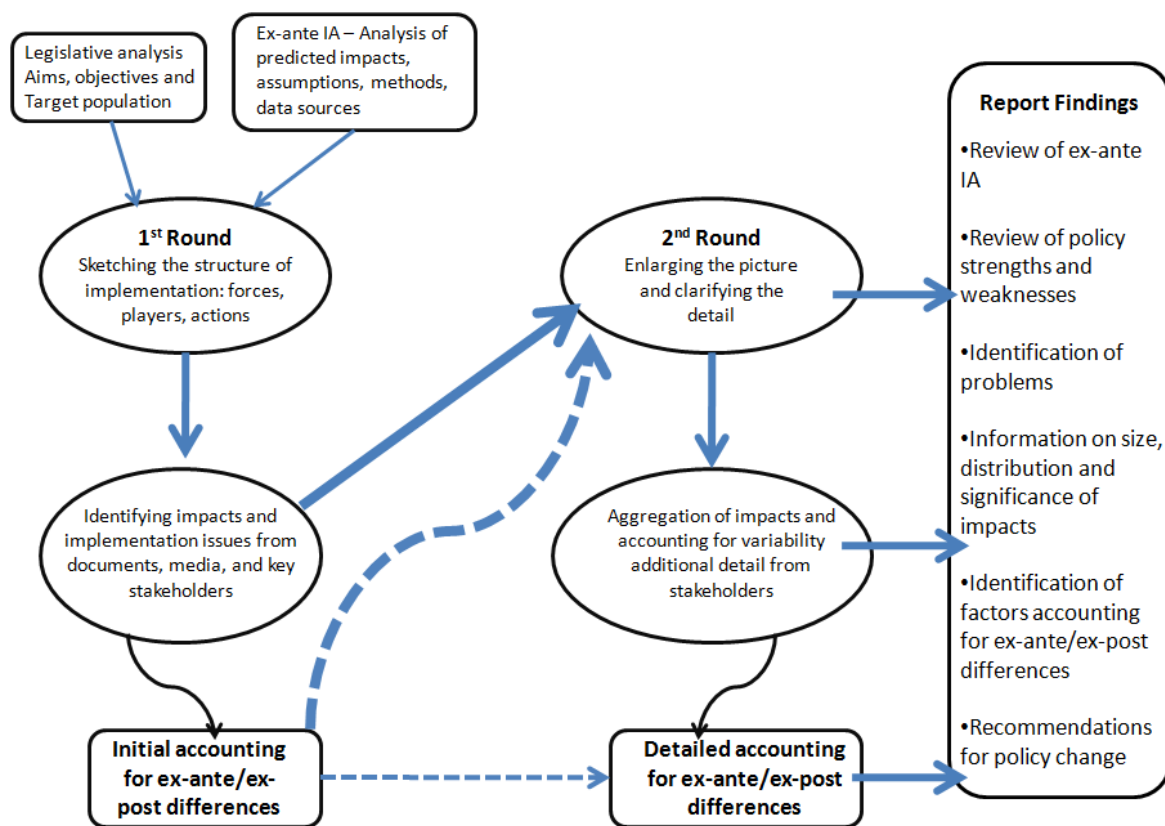
The final two steps in the first round are to undertake a comparison of ex-ante and ex-post impacts, and to account for differences through understanding causal factors at work.

The second round of post-implementation review takes the understanding of the impacts and implementation structure and uses it to obtain a deeper understanding of ex-ante/ex-post differences. This incorporates a detailed understanding of the assumptions and methods used in the ex-ante IA, linked to aggregation of impacts measured in the ex-post review. The ex-post review must account for variability of impacts across time and space using a range of evidence including survey data, reports and stakeholder insights to verify the scale of impacts. The final output is a more detailed understanding of the nature of regulatory impacts and analysis of causal factors which account for ex-ante/ex-post differences.

The methodology is thus a 2-step iterative process that builds a detailed picture of regulatory implementation. Pattern matching and triangulation are applied to verify validity and reliability of results. Pattern matching refers to exploration of the data collected to identify 'patterns' that support the analysis and interpretations of the evidence, or patterns that conform to theoretical predictions. The research seeks expected 'patterns' of agreement

and disagreement with evidence from specific sources. For example, one would expect farmers with the same characteristics to agree on similar questions; and one would expect 'disagreement' or differences in farmers of different ages, or form of ownership. Where expected 'patterns' occur they provide support for the way in which the data is interpreted. Where inconsistencies are found checking of the evidence is required to identify causal factors that might be accountable. This process in itself can lead to new insights where unexpected 'patterns' are found, or even to questioning of underlying theory. Triangulation compares evidence from a range of sources (for example, stakeholder interviews, reports, survey data) and looks for inconsistencies and gaps. Where inconsistencies occur they can be checked (either through going back to the source of information, or obtaining additional information) to ascertain the validity of the evidence, and the interpretations being made. Pattern matching and triangulation would occur during the second phase of the iterative process. The two 'rounds' can be conducted close together in time, or further apart if the initial round indicates that it is too early to effectively capture the costs and benefits from regulatory change.

Figure 5.1 Methodology for conducting post-implementation review



Proposed post-implementation review process – detailed approach

Issues that need to be addressed in ex-post studies relate to the following:

1st Round analysis

Task 1: Detailed analysis of the legislation/regulation

- Identify

- the aims and objectives of the legislation including target dates, deadlines, standards, limits, compliance requirements, etc.
- tools for implementation and enforcement (e.g. incentives, minimum standards, prescribe practices)
- to whom the legislation is directed
- other actors who might be affected.
- Summarise the major elements in terms of what the legislation is trying to achieve.

Task 2: Analysis of the ex-ante IA

The ex-ante IA is a process consisting of:

- Initial, Partial and Final IA documents (with supporting studies and research reports)
- Formal public consultation
- Informal/formal stakeholder consultation

The documentation for these may or may not exist, and may be of variable quality. The initial and partial impact assessments will be of limited utility as policy options may have altered by the time the final IA is published. The public consultation can provide good background information on stakeholder views, and when considered together with changes in policy options from initial through to final IA can indicate the extent to which options have changed or were modified.

Methods:

- Detailed analysis of the ex-ante IA (and where appropriate the partial IA, public consultation and other supporting documents).
- Discussions with relevant policy personnel involved in the public consultation and impact assessment processes.

Task 3: Identification of impacts arising from the legislation/regulation

The ex-ante IA provides a starting point for identification of economic, social, environmental impacts, of who is impacted and which general elements of the agricultural sector and wider society this corresponds to. This information is utilised to identify relevant affected stakeholders for the ex-post review, and to draw samples for data collection through survey methods. The elements most likely to be affected include:

- Farmers
- Farm advisors
- Agricultural membership organisations
- Enforcement/implementation agencies
- Central government policy personnel
- Those indirectly affected include:
 - upstream suppliers of inputs and service
 - downstream purchasers of outputs and service

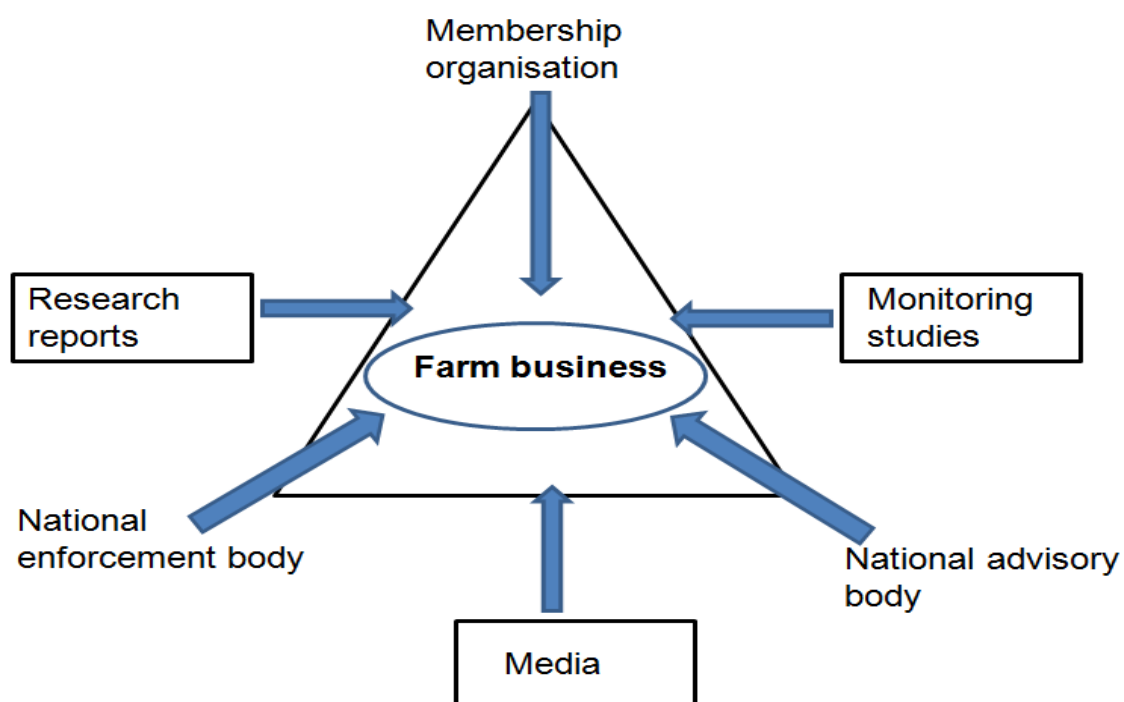
Sample sizes need to be kept small and carefully drawn, the aim being to capture the range of impacts across farms and other organisations of different characteristics, rather than to create valid samples for statistical comparisons. Where large amounts of regional variation are expected, or suspected, sample sizes will need to be larger to capture regional differences as well as differences based on farm characteristics (e.g. type, size, ownership structure). Where regional variation is high there should also be more effort to discuss issues with regional rather than just national level personnel engaged in enforcement and support.

Data should be collected through face-to-face interviews, although some follow-up interviews could be undertaken via telephone if data being collected is relatively simple (e.g. largely quantitative in nature). Data should be collected on the following:

- Perception and understanding the regulatory requirements
- Direct effects of the regulation on the respondent, and the business or organisation (quantitative in terms of costs/benefits, and qualitative in terms of changes in attitudes or outlook for each of the main areas of activity identified in Task 1)
- Changes in behaviour or practices that have taken place to adapt to the regulation (extent and timing)
- Other factors influencing changes to the business/organisation (the counterfactual)
- Views on implementation and enforcement
- Level and quality of support received
- Unintended or unexpected consequences

The farm level data must then be compared to information from other sources (e.g. advisory bodies, enforcement agencies, research reports, articles in the media, monitoring data) in a 'pattern matching' or triangulation exercise in order to verify the scale and significance of impacts that have occurred, check the influence of counterfactual activities, and to identify any geographical, individual farm business, and organisational variations (see Figure 5.2 below). Small sample sizes and the qualitative nature of much of the information collected will make statistical analysis infeasible, thus comparison of data across different sources is crucial to ensure the validity of results.

Figure 5.2 Triangulation of data sources to verify farm business impacts



Task 4: Comparative ex-ante/ex-post analysis

Once the relevant data has been collected, the impacts of the regulation as measured in the review need to be summarised and compared to the impacts predicted in the ex-ante IA study. The simplest way to do this is to characterise impacts in the same way as in the

earlier ex-ante study and present comparisons of data in a series of matrices, along with some qualitative indication of the magnitude of the difference (e.g. low, medium, high). The examples presented earlier in this report for Nitrate Pollution and Agricultural Waste Regulations illustrate this approach. The intention is to identify where differences occur, and their characteristics. This task may also highlight specific categories, regions, or aspects where differences occur.

Task 5: Accounting for ex-ante/ex-post differences

Once Task 4 has been carried out the more difficult task is to account for the differences between the two studies. This requires careful analyses of a wide range of qualitative information that has been collected to explore the factors influencing measured effects in both ex-ante and ex-post studies. One approach is to develop a set of criteria to aid this task and ensure that the qualitative data is rigorously examined for causal influences. In the agricultural sector the set of criteria outlined in the previous analysis of Nitrate and Waste Regulations offers a starting point, but researchers need to be aware that there may be other regulation-specific factors that need to be drawn out of the interview data collected.

Analysis will reveal causal factors at work and the extent to which each is having an influence on outcomes from the legislation of interest.

2nd Round analysis

The aim of the 2nd round of analysis is to engage in detailed clarification of identified issues, aggregate impacts and add additional detail from stakeholders where necessary.

Task 1: Clarification of detail

Where conflicting information appears, for example between farm businesses in the sample and advisory bodies, then further investigation might be required to reveal the reasons for the differences. This may require additional interviews or a second round of interviews with existing respondents. Where confusion persists the sample sizes may have to be increased to reach a suitable level of confidence in the data.

Task 2: Validation of evidence

Triangulation of data should be carried out to check for consistency between sources of information. Where inconsistencies or gaps are found the researcher can go back to the original source, or seek verification from additional data sources (e.g. interviews with different stakeholders to clarify the situation). Pattern matching may be undertaken to ensure findings correspond to theoretical predictions, or to explore mis-matches between expected similarities and the evidence at hand.

Task 3: Aggregation of data

Data from small samples should be aggregated up to the large population where relevant in order to indicate national, regional, or sub-sectoral impacts. Data may also need to be aggregated over specific time periods, in which case the use of present value comparisons might become necessary.

Task 3: Identifying strengths and weakness

The final task in the 2nd round is to summarise the strengths and weaknesses of the existing regulations in order to provide input into policy reviews. Strengths, weaknesses, and factors responsible should all be identified where possible, along with evidence, and some recommendations made for improving the situation. Qualitative analysis of the actual effects of the regulations will identify where the regulation is successful and where there are problems, as well as point towards possible deficiencies and solutions. The post-implementation review can then play a stronger role in the impact assessment process itself by feeding into the next round of the policy review.

Evaluation of the proposed approach

The approach proposed in this report does not eliminate all the difficulties associated with undertaking ex-post impact assessments. The influence of some factors, such as the timing of the assessment, and the methodology selected for identifying and measuring impacts, cannot be erased. The approach does, however, deal with some of the significant issues such as focusing on the 'business unit' as the focus of analysis and using qualitative approaches to gain a better understanding of the strategic behaviour of farmers (or those towards whom the regulations are directed). Strengths and weaknesses of the proposed approach are identified below.

Strengths

Impacts considered from the perspective of the business unit affected

- 'Expenditure' and 'costs' analysed separately
- The 'business unit' is the correct level for analysis as this is where internal attitudes, perceptions, aims for the business and external influences are brought together
- More effective small firms analysis

Focus on identifying causal factors influencing differences

- Enables a wide range of factors to be taken into account
- Lends weight to attitudes, knowledge and perceptions of those impacted by regulations
- Incorporates qualitative data in analysis.

Pattern matching approach

- Enables use of small samples.
- Complex impacts can be explored and verified through cross-checking.

Qualitative assessment of costs and benefits

- Helps highlight those impacts that are not monetised
- Puts more emphasis on behavioural strategies under different scenarios, which enables greater understanding of the impact of external drivers.

Feeds recommendations into the next round of policy review

- Provides detailed insights into strengths and weaknesses of current policies, and may point the way towards areas for further exploration to bring about improvements.

Weaknesses

Level of compliance

- Difficult to gauge compliance levels with small samples and often even enforcement agencies do not have a clear idea, particularly if a 'light touch' approach to regulation is being adopted.
- Affected by timing of the post-implementation review, if too soon after adoption of the regulation then data might not be available and/or those affected might still be developing approaches to come into compliance.

Capturing variability

- Small sample sizes may not capture the full range of variability in the farm sector. Samples can be carefully drawn but accessing farmers is difficult.
- National level stakeholders do not always understand regional variability.

Systemic differences

- Some systemic differences cannot be accounted for through the approach; for example, timing of the study will influence quality and accuracy of data availability.
- All methods have some inherent bias.

Benefit measures

- Does not provide any improvements to methods of measuring benefits, particularly indirect benefits to stakeholders.
- Small differences are difficult to detect using the approach.

Timing

- The timing of a post-implementation review can have significant impacts on the actual effects identified and measured. Studies conducted too early might identify non-compliance as an issue, or miss the impact of anticipated changes (e.g. technology, prices); those conducted too late risk stakeholders forgetting the changes they have made and the details of resource and cost implications.
- Timing must be based on judgement on the extent to which a specific regulation/policy change has 'bedded down'.

Resource requirements

- The approach is resource intensive, requiring detailed discussions with a representative range of stakeholders (see next section below).
- Data collected must be cross-checked to ensure validity.

Implementation of the proposed approach

The proposed methodology for ex-post assessment of regulations is based on a particular understanding of the role of impact assessment in policy formulation, as it applies to agricultural regulatory activity at the farm level. Impact assessment is viewed as a tool for improving the quality of legislation and regulations through a process of consultation with those likely to be impacted and the implementation bodies, coupled with analysis of primary and secondary sources of information that incorporates measures of uncertainty. This report suggests modifications to the current approach, in order to integrate consultation more closely with appraisal in the 'impact assessment' process.

Rather than rely on postal or electronic submissions by individuals, which then have to be collated and analysed either by Defra or a 3rd party before they can be utilised, a wider range of consultation approaches (e.g. case studies, workshops, and interviews) could provide greater understanding of issues across the sector. A consultation process that enabled particular aspects of the proposed policy/regulatory change to be investigated through a small number of case studies, or focused workshops, might provide insights useful in conducting cost-benefit analyses and small firms' impact tests, for example. The consultation element would then become a more integrated element of the partial and full IA procedures, rather than acting as a separate function that is often carried out by a different group of people from those undertaking the IA.

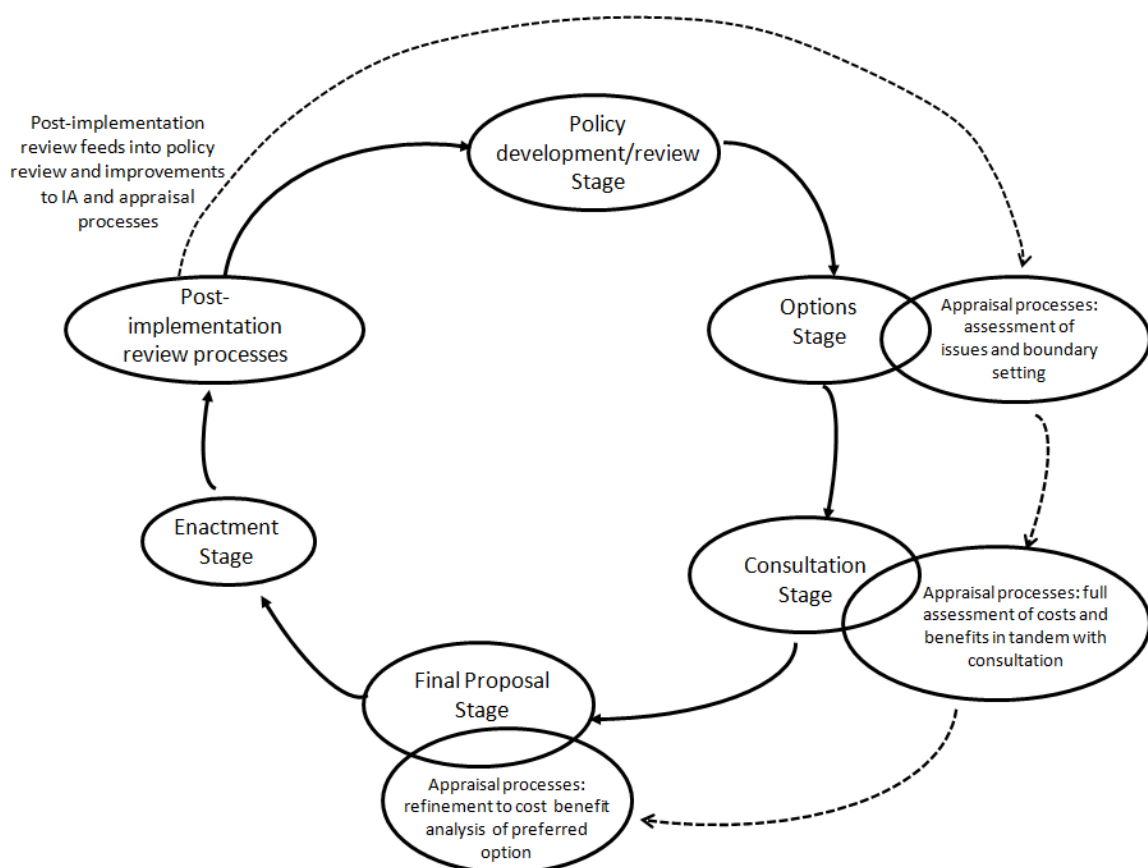
One suggested modification to the current procedure is illustrated in Figure 5.3 and is described below:

Initial IA: ensure discussions with major stakeholder representatives as an element of identifying and commenting upon policy options. Such a ‘scoping’ study could be utilised to eliminate unlikely options, identify the range of potential policy options (effectively ‘setting the boundary’ around the appraisal process), and highlight potential problem areas.

Partial IA: integrates case studies, interviews and workshops and written submissions in the consultation process into the appraisal process. Rather than being an ‘adequate’ CBA, the ‘partial’ appraisal stage would become more important to enable better selection of the final option and possible variations. Workshops could allow deeper exploration of specific issues identified in the written submissions, while in-depth case studies can provide examples to illustrate impacts, and interviews can shed light on specific issues from a range of vantage points. Those undertaking the IA should also be involved in the consultation process.

Full IA: additional case studies and interviews could provide assurance regarding predicted impacts of selected policy options, and enable refinements to be made at a later stage in the process. Evidence from case studies/interviews could also be utilised in the policy process itself to defend the selected policy option.

Figure 5.3 The role of ex-ante and ex-post impact assessment in the policy process



A modified IA/PIR process within the agricultural sector could achieve the following:

- Link consultation and options appraisal (CBA) more closely within the IA process and increase the utility of consultation evidence.

- Improve the accuracy and validity of ex-ante impact assessment studies
- Identify a range of external (outside the farm boundary) and internal (farm based) drivers influencing policy instruments
- Evaluate the effectiveness of policy instruments more efficiently
- Provide information on the magnitude, extent, and distribution of impacts
- Identify characteristics of particular groups with the agricultural sector that may be unduly impacted
- Identify areas of overlap with other policy areas/tools, and gaps where issues are not being addressed
- Identify good practice and problems with current policy tools (legislation, regulations, guidance, incentives), and possibly point the way towards solutions for the next round of policy review.

Resource implications of the modified IA and PIR approaches

IA and PIR processes are resource intensive and expensive. The suggested role for PIR in the policy process requires greater expenditure of resources on data collection, analysis and interpretation. But modifying both PIR and ex-ante IA procedures might also generate savings in terms of reducing costs on consultation exercises that require high expenditure for information that is of limited utility, and through providing a more accurate picture of likely impacts at the farm level.

The PIR consists of a series of linked activities (illustrated in Figure 5.1) which include:

- Legislative analysis
- Analysis of the ex-ante IA
- Identification of impacts (interviews, case studies, workshops)
- Comparative analysis and Accounting for differences
- Aggregation
- Strengths and weaknesses analysis

The process would require an estimated 35-75 person days (plus travel costs for data collectors) depending on the size and complexity of the regulation under review. The potential benefits include the following:

- Improved understanding of the aims of the legislation
- A summary of anticipated impacts, and a review of the methodology used in the IA
- In-depth understanding of regulatory impacts
- Identifies unintended impacts of the regulations as implemented
- Identifies good and poor practice, mistakes and errors in the ex-ante IA
- Identifies areas for improving regulatory policy, and future ex-ante IA studies

Benefits of PIR can be difficult to quantify in monetary terms but certainly might avoid some of the costs associated with regulatory development by identifying problem areas that need attention, and thus enabling more targeted consultation. Benefits in terms of avoiding costly mistakes may also occur, and policy personnel are likely to be better informed and more capable if they become more closely involved in processes of regulatory review of the areas in which they operate.

Additional modifications to the ex-ante IA approach as illustrated in Figure 5.3 are based on closer integration of consultation and appraisal processes through activities such as workshops, case studies, scenario modelling, guidelines, exploration of market forces, and cost-benefit analysis. Resource requirements would be in the region of 70 – 90 person days but again will vary depending on the complexity of the legislation. The approach might reduce resource expenditure on more ‘standard’ consultation approaches currently used. Benefits would include the following:

- Opportunity to explore issues with a mix of farmers or a mix of farmers and other stakeholders and obtain a range of views on anticipated impacts of alternative scenarios (from scenario modelling)
- Insights into perceived impact of driving forces (e.g. commodity prices)
- Targeting of sectors/specific farm types to provide in-depth understanding where appropriate.
- Information on likely strategic behaviour of farmers under different conditions/states of the world
- Improved CBA sensitivity analysis.
- Improved understanding of the opportunity costs of implementation approaches.
- More 'accurate' measures of implementation costs
- Improved understanding of the conditions under which farmers are operating, including the nature of impacts, timing, and business implications at the farm level.
- Where EU legislation limits the flexibility and scope for action, IA (and PIR) could become more of a tool for identifying and ameliorating impacts, as well as providing evidence to take to the European Commission.

We suggest that the modified approaches for both ex-ante IA and PIR are initially tested on a small number of regulations in the agricultural sector, to explore their cost-effectiveness, and potential for adoption across the full spectrum of regulatory activity in the sector. In addition, such an exercise would almost certainly indicate the scope for improvement and streamlining of the processes described here, and may point the way towards improved IA and PIR practices in other regulatory arenas.

ANNEX 1

Summary of The Nitrate Pollution Control Regulations 2008 and The Agricultural Waste Regulations 2006 Final Regulatory Impact Assessments

Nitrate Pollution Control Regulations 2008

Date published

Final RIA August 2008

Partial RIA August 2007

Key results

- AP Option D with 70% NVZ coverage was selected as the best option.
- No significant impact on the public sector is anticipated.
- Main costs to farmers of 1 – 30% of farm business profit.
- Enforcement costs to the EA estimated at £2.4-3.4 million/yr
- Total costs (Present Value discounted at 3.5% over 20 years) is £665.1 – 1,009 million.
- Average annual costs (excluding one-off payments) estimated at £48.5 – 68.6 million.

Main benefits to water companies, and consumers from reduced water treatment costs, reduced environmental externalities of diffuse water pollution, ecological and recreational users of water courses. Key monetised benefits (Present Value discounted at 3.5% over 20 years) estimated at £28.1 – 274.2 million, or £1.77 to £18.4 million/year.

Study indicates high level of uncertainty surrounds estimates of both costs and benefits, resulting from site specific nature of impacts and uncertainties over costs to farmers which will vary with behavioural response.

Methodological approach

Based almost entirely on analysis and application of secondary data sources (some empirical data collected for enforcement costs). Estimated costs based on application of data from previous studies.

The RIA explored three policy options for assessing regulatory impacts of proposed revisions to NVZ areas:

NVZ Option 1: “Do nothing”

NVZ Option 2: Increase the NVZ coverage to 70% of land in England

NVZ Option 3: Increase the NVZ designations and apply action programme measures to all land in England (i.e. 100% NVZ designation of land)

Option 1 was not considered as a viable option since the Nitrates Directive requires further extension of the areas designated as NVZs. It was used as a baseline against which to compare other options.

The RIA explored four options for assessing regulatory impacts of proposed revisions to the ‘Action Programme’ part of the regulations:

AP Option A: “Do nothing”

AP Option B: Introduce revised and uniform ‘action programme’ measures, specifically:

- Reduce whole farm loading limit for all livestock manures to 170kgN/ha
- Establish a storage capacity requirement of 26 weeks for pig and poultry units and 22 weeks for cattle
- Extending closed periods for organic manures with high available N to all soil types and increasing length of closed periods to 5 months for grassland (1 Sept to 1 Feb) and 6 months for arable land (1 Aug – 1 Feb).

- Introduce measures limiting use and application of manufactured nitrogen fertilisers and organic manures in NVZs.

AP Option C: The same as Option B except allow soil types to influence length of closed periods (i.e. reduction in closed periods for soils other than sandy and shallow soils).

AP Option D: The same as Option C except allowances made for rainfall when setting length of closed periods. In drier areas (under 1050mm/yr the closed period shortened even further to 3 months for grassland and 3.5 months for arable on soils that are other than sand/shallow.

The RIA also looked at the impact of adding a requirement to grow cover crops. Each of the Options for the action programme described above are examined 'with and without cover crop' costs included in the analysis.

AP Option 1 was not considered as a viable option since previous work indicated that the existing Action Programme is not sufficient to meet the aims of the Nitrates Directive. It was used as a baseline against which to compare other options.

A consultation carried out in 2007 and the Partial RIA indicated NVZ Option 2 with AP Option D was lowest cost option while still delivering benefits similar in scale to the other options explored. Some stakeholder comments from the consultation process carried out in 2007 were used to refine some of the options studied in this RIA. The RIA makes clear that the study is focused on the final package of proposals selected for implementation, suggesting that it is not intended as a means of improving or altering the proposals, but more as a means of understanding where impacts will occur.

Identification of Sectors and Groups Affected

The study identified the following groups/sectors as potentially impacted by the Regulation:

- Farmers and livestock farmers in particular – due to need to comply with Action Programme
- Water industry – due to possible restrictions on spreading of sewage sludge – but could also benefit through reduced water treatment costs
- Environment
- Recreation
- Tourism

It is not clear from the RIA how these groups/sectors were determined.

It was also suggested that unintended consequences might result from associated reductions in ammonia and phosphorous emissions, potential increased transport of manure, dumping of manure, while NVZ designations may impact land values and affect competition between NVZ and non-NVZ farmers. It was also suggested there might be cost implications for developing soils policy, since any policy would have to work within the framework of nitrate controls.

Principle Costs Identified

Identified costs include:

- Costs to farmers from restrictions (e.g. reduction in loading limits, extension of closed periods)
- Impacts on water industry from closed periods which will impact land application of sewage sludge
- Administrative costs (up to 31,000 more farmers will be affected)

The RIA recognises costs to farmers are uncertain due to complexity of farm structure and difficulty of predicting how farmers will respond. However, modelling information suggested that the dairy sector would bear two thirds of the estimated Action Programme costs.

Administration costs were calculated using the Cabinet Office Standard Cost Model for measuring administrative costs. The model used assumed that Defra would create standard templates for forms to record fertiliser use and calculate compliance with organic loading limits (which should reduce the administrative burden). The model also assumed that related policies with similar requirements (e.g. soil, crop, manure and nutrient management plans, and Defra's whole Farm Approach) would act to simplify and reduce the overall bureaucratic burden. Estimates suggest that the additional burden on farmers already in a NVZ is small, but is much more significant for farmers in newly designated NVZs.

There may be a small additional burden for planning costs where additional manure storage is needed but this was not included in the estimated burden of administrative costs.

Assumptions were made regarding farmer response to the new regulations regarding limits on nitrate loading, spreading and storage. The study assumed farmers would increase their land area available for spreading as it was identified as the most 'cost-effective' option. Additional storage capacity was estimated to cost between £12.8 and 16.5 million/year. The study recognised that there were a number of site specific actions open to farmers to mitigate the impact of storage requirements.

Costs of reducing the Nmax for grass was estimated to cost £0.3 – 3.4 million/year. Costs of adapting spreading techniques was estimated to cost £3.7 – 8.4 million/year based on assumption about current equipment costs, depreciation and life span of existing equipment. These assumptions are not specified in detail. It was assumed that costs associated with the requirement to incorporate organic manures within 24 hours would be achieved at no cost through changes in behaviour.

Costs were estimated using a range of data sources including:

- Entec 2008 study modelling the costs to agriculture of the proposed regulations
- British Survey of Fertiliser Practice to estimate the area of grassland affected by the Nmax requirement.

Overall annual costs to agriculture are presented below. Two-thirds of these costs are estimated to fall on the dairy sector.

Cost type	Low estimate (£ million)	High estimate (£ million)
Additional storage costs	12.8	16.5
Reduction in stocking rate	17.9	21.8
Additional spreading costs	8.5	11.3
Spreading techniques	3.7	8.4
N max (from 2012)	0.3	3.4
Admin burdens	0.4	2.7
Total	44.3	65.2

The small firms impact test

The test estimated annualised costs to farmers over a 20 year period, indicated that costs varied by farm type and region. Ranges of costs were provided to deal with this variability. Impacts were estimated to range from <1% of farm business profit up to 10 to 14% of farm business profit for dairy and pig farms. There is also the suggestion that the potential impact on some lowland beef farmers could be as high as 21% of farm business profit. Costs to

poultry farmers are estimated to be small. Farm income data from 2005/06 was utilised to identify impacts. The table below summarises the estimated annual costs per farm of the NVZ regulations (in £ per farm/year).

Type of effect	Dairy	Beef	Pigs	Poultry	Other
Main measures	62-2,913	227-1,235	309-3,336	183-984	0
Admin Burden	129-752	129-752	129-752	129-752	129-752
Total	195-3,665	356-1,987	438-4,088	312-1,736	129-752

Competitiveness Assessment

A short competitive assessment was carried out and determined that a 'significant' production cost differential could arise between dairy farmers inside and outside the NVZ areas resulting in a migration of quota and export of manure into non-NVZ areas.

Enforcement Costs

The RIA suggested there would be increased costs to the EA (and possibly to Defra) from the increase in coverage of NVZs from 55-70% of the land area; resulting from increased need for mapping, consultation, provision of advice and training. Costs were estimated at £2.4 to 3.4 million/year for four years (until next Action Programme Review).

Upstream and downstream effects

The RIA suggests the following:

- reductions in fertiliser use will have negligible impacts on fertiliser manufacturers in the UK due to the global nature of the business
- small positive short-term effects on slurry and manure storage markets
- no effect on parlour washing equipment
- little or no impact on manure spreading equipment manufacturers
- little or no impact on manufacturers of slurry separators and anaerobic digesters
- Impacts on milk production might be important locally but not considered in the assessment

Principle Benefits identified

Benefits are identified as being linked to enhanced control of nitrate entering waters which will have the following effects:

- Improve natural habitats through reducing nutrient enrichment of waters
- Potential reduction in drinking water treatment costs (where drinking water is abstracted from ground or surface waters).

Monetised environmental benefits are derived using EA 2007 estimates of damage costs incurred by water pollution from agriculture in England and Wales.

Reductions in treatment costs are estimated through adoption of OFWAT 2004 estimates of the industry treatment levels required to reduce high nitrate levels in drinking water over the period 2005-10. The study recognised that full benefits might take several years in respect of surface water and several decades in the case of groundwater.

The study used a University of Hertfordshire 2008 study to provide an estimated reduction in greenhouse gas emissions of 28,100 – 36,100 tonnes CO₂ equivalent (per year) as a result of reduced pumping and treatment processes within the water industry.

It is suggested that changes in ammonia emissions might result from the Regulations, with resulting high costs, but this is not explored any further in the RIA. The study notes that only impacts from the 'main Action Programme measures' have been quantified and thus the RIA is likely to underestimate impacts.

The RIA explored reductions in nitrogen applications to the land resulting from the key actions required under the regulations (i.e. closed periods, crop requirement limits, whole farm limits) using previous studies commissioned by Defra to explore particular aspects of the nitrate problem and to estimate monetary values of impacts from agriculture on air and water quality:

- ADAS 2007 modelling impacts of closed periods
- University of Hertfordshire 2008 study on nitrate losses
- Warwick HRI review of evidence on market and non-market values of the costs of diffuse pollution from agriculture (source and date unknown).
- Rahn 2007 damage estimates from agriculture
- IGER 2007 benefit estimates from agricultural mitigation

RIA methodology: Strengths

- Due to uncertainty in the monetary estimates of environmental impacts from diffuse pollution the study only estimated ranges of costs and benefits (-£1.639 million in a low benefit/high cost scenario to £18.246 million in a high benefit/low cost scenario).
- Range of cost estimates is given due to uncertainties and variability in farm structure and likely behavioural responses. Modelling scenarios incorporated high and low estimates for various activities.
- Assumptions made regarding farmer behaviour based on survey data where possible, and expert judgement.
- Use of a wide range of recent studies to estimate benefits of nitrate reduction and farm impacts.

RIA methodology: Weaknesses

- The study identifies a number of areas where costs and benefits were not quantified.
- Un-quantified costs and benefits include:
 - Ammonia emissions
 - Reduced farm chemical contamination of coastal waters
 - Benefits of reduced stocking rates
 - Reductions in costs where double handling of manures is avoided
 - Better control of fertiliser use
 - Loss of yield reduced flexibility in manure management
 - Savings from adopting the Whole Farm Approach to record keeping
 - Changes in peak labour demands before/after closed periods
- Sources of data not always clear.
- Reliance on modelling studies carried out in previous studies; assumptions made by models not transparent.
- Significant number of assumption made to deal with variability in farm characteristics and uncertainties over farm response to regulations.
- Limited assessment of administrative burdens on government.

- Small firms business impact test reveals wide variability in on-farm costs and potentially very high impacts on farm business profits for some sectors. Basis of estimates and method of calculation not clear.
- Limited range of alternative regulatory proposals explored.

The 2006 Agricultural Waste Regulations Final RIA

Date published

Final RIA March 2006

Carried out by:

Defra internal analysis.

Key results

Summary costs and benefits table indicated positive benefits for all three options selected and no negative benefits (except for the 'Do Nothing' option).

Limited analysis of impacts, particularly benefits.

Methodological approach

Cost assessments refer to hazardous/special waste. Main purpose of the RIA was to assess the impact of extending controls already in place (to fulfil the requirements of the EU Waste Framework Directive) to agricultural waste and non-mineral waste from mines and quarries.

The RIA explored three policy options for assessing regulatory impacts of proposed waste regulations:

Option 1

Apply to agricultural waste the existing permit/licence exemption, which have been provided under Article 11 of the WFD including:

- Landspreading of waste for agricultural benefit
- Use of waste as a fuel
- Open burning of untreated wood and plant matter
- Composting
- Waste used for construction purposes
- Exemptions to avoid unnecessary dual control with other regulatory systems

Option 2

Amend the 1994 Regulations to provide additional permit/licence exemptions for agricultural waste.

Option 3

Use both the above option to encourage recovery of agricultural waste. This is also a 'deregulatory' option as it would allow farmers and growers to be able to register exemptions for a number of activities rather than have to apply for a full waste management licence/permit which would be costly.

A 'do nothing' option was not possible as UK was subject to infraction proceedings resulting from an adverse ECJ judgement. Costs and benefits were therefore set out against a base case of 'current practice continuing'.

Principle Costs Identified

Environmental Costs

The following impacts were estimated for agriculture as a whole and agricultural waste is considered to contribute to these costs:

Ammonia contribution to atmospheric emissions	£43 million for UK as a whole
Loss of fishery value	£28 million for England and Wales
Bathing waters pollution	£69 million for UK as a whole
Direct impact of faecal pathogens to soil/water	£20 million for UK as a whole
Disease pollution – not available	
Health effects – not possible to quantify	
Methane – not possible to quantify	

Compliance costs

Compliance costs for farmers and growers relate to the following:

- On farm hazardous waste storage – relating to costs of secure storage of pesticides, dilute pesticides, veterinary medicines and products; motor vehicle parts (e.g. oils), asbestos.
- On-farm disposal/recovery – related to the costs associated with permit/licence allowing operation of a waste disposal facility.
- Off-farm disposal/recovery – costs of consigning waste to a licensed waste carrier for landfill or recycling. Costs will vary with quantity of waste generated, ability to recycle, and local waste carrier charges. Average costs are estimated by farm type to range from 1 – 12% of income. Average costs are estimated to be highest for lowland cattle and sheep and lowest for dairy farms.
- Overall costs to farmers and growers are estimated at £28.7 - £69.8 million per year. Estimated cost per farm is £177 – 430 per year (mid-point = £304/yr). Unit costs calculated using average figure of £18/tonne landfill tax for 2005/06, and total costs based on assumptions about unit costs of collection and transport, disposal, and landfill tax for a small range of different waste types (i.e. industrial waste, mixed waste, hazardous waste, asbestos, tyres and batteries). Note that all batteries are classified as hazardous waste with total disposal costs calculated at £238/tonne.

Implementation costs

The Environment Agency (EA) will face increased costs in administration, monitoring and enforcement. Administration costs from issuing of licences and inspecting sites will be covered by charges. Enforcement costs are funded by a Grant in Aid from central government.

Costs to the court system

Estimated 11 court prosecutions involving the agricultural sector. Annual average costs after the first year are estimated at £3,300 per year.

Key assumptions

- Costs are based on the assumption all farmers and growers will adopt Option C (i.e. consign all their waste for disposal off-farm, and that all such waste is consigned for disposal at a licensed landfill site (i.e. no consideration of recycling).
- Assumed that farmers and growers are already complying with the 'Green Code – Code of Practice for the safe use of pesticides on farms and holdings' (PB3528), and that suitable pesticide storage is already in place (to allow up to 12 months storage) and no additional costs will be incurred for this waste stream.

- Assumed that farmers and growers will not wish to store dilute pesticide and will dispose of waste either by spreading it to crop, or disposing of it to land under a Groundwater authorisation from the EA. Assumed no additional costs from this waste stream.
- Assumed some additional costs incurred in securely storing waste animal medicines and veterinary and clinical waste. May involve construction of secure facilities or purchase of secure containers. No cost estimates made in the RIA but costs assumed to be minimal as Farm Practice Survey suggests farmers return needles and veterinary products to veterinary surgeons.
- Assumed only 1 – 2 % farmers/growers will apply for waste management licence to dispose of or recover waste on-farm. Assumed that most farmers/growers applying for a licence will do so to operate a waste transfer station – i.e. for storage prior to recycling. Assumed waste will either be non-hazardous or, if hazardous will be limited to contents of motor vehicle batteries, hazardous waste which is part of or contained in motor vehicles, or bonded asbestos. Assumed most on-farm operations will be <5,000 tonnes per year, and thus costs per farm applying will be: one off application charge of £2,548 and annual subsistence charge of £873.
- Assumed small minority of farmers might select other forms of licence such as large scale composting licence. Costs per farmer applying (assuming ,5,000 tonnes pa) would be: one-off application charge of £2,864 and annual subsistence charge of £995.
- Assumed some farmers/growers applying for licences will have to undergo training. Costs will be in the range £2,500 - £3,500 per individual.
- A range of costs calculated for farms using cropping areas and livestock numbers from the Farm Business Survey of 2000/01 and the unit waste arisings from the Agricultural Waste Mass Balance Report (C-Tech Innovation Ltd., 2002).
- Total costs calculated include £6.4 million for landfill tax (at £18/tonne) which is identified as a transfer payment between agriculture and government and thus not an additional cost to the UK as a whole.
- Costs for disposing of controlled agricultural waste do not take into account existing off-farm disposal of waste, cost estimates may therefore be overestimated.

The small firms impact test

None undertaken.

Competitiveness Assessment

Costs estimated to vary between different types of business but not considered likely to create any disproportionate cost burdens on any market.

Principle Benefits identified

Most benefits are not quantified due to a shortage of data.

Environmental Benefits

Agricultural waste currently excluded from definition of controlled waste meaning it can be disposed of on farm in an uncontrolled manner. In practice most waste is disposed of by open burning or in farm dumps or tips. Benefits will accrue from reduction in pollution impacts from uncontrolled disposal – but there are no quantitative estimates of impact.

Open burning of waste produces dark smoke and toxic pollution, and may be in contravention of the 1993 Clean Air Act.

- Estimated contribution to local air pollution - £11 million for UK.

Atmospheric emissions from waste include:

- Methane – estimated at £94 million for UK
- Ammonia – estimated at £43 million for UK
- Soil and water impacts as identified under costs above.

Discarded substances that may have a negative environmental impact:

- Silage effluent
- Milk
- Treated blood
- Vegetable washings

These can potentially cause pollution, eutrophication, heavy metal contamination, faecal pathogen presence and phosphorous or nitrate pollution.

Health benefits

No estimates made.

Encouraging re-use and waste minimisation

No estimates made.

RIA methodology: Strengths

- Innovative methodology for calculating off-farm waste disposal costs by farm type, using estimated production levels and technical information on unit waste arisings.
- A public consultation was undertaken December 2004 – March 2005. Responses were largely positive.

RIA methodology: Weaknesses

- Shortage of data meant that exact scale of risks to human health and the environment arising from agricultural waste were not calculated. Estimates are therefore derived from the impact of the agricultural sector as a whole.
- No systematic data on agricultural waste arisings as they have not been subject to controls.
- Large number of assumptions made on the basis of limited information.
- Estimated costs of off-farm waste disposal estimated using 200/01 data.
- No comparisons of monetised costs and benefits.

- Benefits were not quantified.

ANNEX 2

Post-Implementation Review of the Nitrate Pollution Control Regulations 2008

1. Perceptions of the regulation

1.1 Farmer Views

Farmers broadly perceived that the regulation was trying to reduce the level of nitrates in watercourses and in the water table. But they also regard it as a 'sledge hammer to crack a nut', a phrase used by both farmers and stakeholders.

Some did not feel that farmers were the only polluters and were unjustly penalised. Reference was made to other industries and sewage works contributing to the nitrate pollution in water. Several farmers questioned the need to reduce nitrates in the water. Some referred to research which had shown that nitrate levels were falling before the introduction of the 2008 NVZ regulations.

One farmer interviewed couldn't see the rationale behind the regulation 'as it's a lottery whether you're in the zone or not, travel a mile and farms aren't in it!' However, this farmer maintained a positive attitude to the regulation, arguing that if you can use it to your advantage then there should be some benefits in terms of efficiencies and cost reduction. Although this was the main driver behind the positivity, he was acutely aware that the need to build the storage would put an extra cost on the business. 'In turn you have to see a potential saving in offsetting these costs'.

The same farmer felt that the spreading period was about right. 'The drop from 250 kg/ha to 170 has meant that we have had to consider carefully the slurry and record keeping. That is quite a challenge on a wet farm!'

There was a general recognition that the NVZs are trying to make farmers use their nutrients more efficiently. This is particularly the case for the smaller dairy farmers. Some farmers acknowledged that they were previously applying too much fertiliser. Due to the large amount of slurry they produce, pig farmers have a much greater awareness of the nutrient value of their slurry.

One mixed dairy farm, argued that 'the trouble is that everyone will be spreading at the same time – from around mid January - and a bit of bad weather at that time will cause severe problems. It would actually be more sensible for spreading to be done over longer periods!' Several farmers mentioned this as a significant issue. Whilst they understood the rationale for the closed period in terms of spreading when there is more uptake of nutrients by the plants, they felt that a concentration of spreading immediately after the closed period could lead to higher pollution rates, particularly after a heavy rainfall event.

1.2 Policy Implementation personnel views

The general perception of the enforcer was that farmers don't understand the risks associated with nitrate pollution so in turn they don't see that they're getting anything back from the regulation. 'They see it as a regulatory burden with a structure being imposed on them'.

This burden is mainly in the form of time, and the fact that there is no grant scheme available to assist in slurry storage in England can make compliance a difficult, costly and contentious issue (particularly as other EU countries offer such grants). The most common form of non-compliance identified by the enforcers was breaches of record keeping. 'There is a gap in trying to get farmers to understand the regulation – it is difficult for them to understand and is therefore difficult to regulate'. The enforcers also admitted to not having a full appreciation of

where the 170kg/ha limit came from, arguing that it was not scientific. 'There is a time lag anyway but politicians are looking for quick wins. In any case it's very difficult to quantify the outcome of the regulations, which doesn't help'.

One enforcer believed that there would be many more non-compliances if they conducted more inspections. Currently the number of inspections is decreasing. The Defra guidance is very complicated and even a number of the enforcement officers don't fully understand it. This enforcer felt that it would be far simpler to concentrate on educating farmers about nutrient management planning, this way farmers would fully understand the nutrient requirements of the farm and appropriate applications of slurry. The current plan only considers nitrogen, which makes it pointless; it should also incorporate other nutrients, such as phosphorus and magnesium.

One enforcer believed that replacing RB209 with Nmax had made enforcement of the nitrogen limits easier.

Defra, who designed the regulations, indicated that the policy aim was to decrease water pollution (nitrates) from agriculture, with the implicit aim of ensuring that the 1991 Nitrates Directive is fully implemented, and that there is a contribution towards meeting the aims of the Water Framework Directive. The EA is viewed as having two roles: as an expert advisor on water quality, and as the enforcement agency. Defra felt that derogations for the dairy industry with extra controls on phosphates and more record keeping probable put some farmers off from applying.

The key benefit from Defra's perspective was avoiding infraction costs from being taken to court by the European Commission. Defra indicated that the current Regulations are already under review, in particular areas for designating new nitrate vulnerable zones were being explored. Any designation would require large amounts of technical work on nitrate levels. Work on reviewing the action programme itself has not yet started.

1.3 Other Stakeholder Views

According to one organisation providing advice and support to farmers, there was reluctance on the part of the farmers to accept and engage with the extension to the regulations in 2008. There was also concern expressed about the full extent of the measures and their implications for the sustainability of farm businesses. 'Farmers were clearly worried about costs, and in particular the costs of providing appropriate storage facilities in the dairy sector. Arable farms were more accepting, and in fact some welcomed the new methodology for calculation of the maximum levels of N across the holding

According to one, farmers have had great difficulties in understanding the regulation and as such there has been opposition to them. The main reason for this is that it is restrictive on, and costly to, their business.

One stakeholder questioned the need for the costly NVZ measures for reducing nitrate levels as they were already declining by 2005. There is Environment Agency (EA) data that shows falling trends which started around 2000. This was due to a 40% reduction in total consumption of fertiliser due to better utilisation prompted by price increases. EA-commissioned work by Glasgow University shows a downward trend in nitrates in surface water but an upward trend in groundwater. In groundwater there is a 20 year time lag. In the Midlands, 14% of the rivers have moved from failing to passing, although there are more in the SW that are failing.

The same stakeholder organisation also questioned the regulations focus on nitrogen, suggesting that the regulation may increase levels of ammonia, which is even worse for the environment. Also the introduction of the closed period may result in greater soil impact risks. If farmers are putting on the slurry in the spring rather than during the autumn, the wetter soils at this time of years means there is a greater risk of soil damage and therefore run-off which contravenes the cross-compliance rules.

Defra indicated that the water companies were very keen to see the nitrate regulations vigorously applied but suggested that land spreading of sewage sludge was not an issue that had been raised with them.

2. Changes to farm business and behaviour

2.1 Farmer Views

Record keeping

The most significant changes brought in to comply with the regulations were associated with record keeping. For the majority of farmers interviewed this was brought in exclusively for NVZ regulations, and in all cases record keeping was undertaken by a consultant, who was commonly employed to keep records for organic manure spreading; the amount of artificial N per field; how much manure is being produced, and in the case of dairy farms, to monitor whether derogation was needed. In most cases record keeping was implemented immediately following enforcement of the regulation.

None of the farmers interviewed felt they were able to produce the required management plans without assistance. In all cases farms had external help or were considering external help to produce their nutrient management plans. One farmer employed a dairy consultant for many years at a cost of £2,000, and although they no longer had any use for his consultancy services, felt the need to keep him on just for the NVZ record keeping. "If I weren't in an NVZ I wouldn't bother with the dairy consultant. All the record keeping can be a bit overwhelming that's why we give it to the dairy consultant". Others were getting in outside help as a one-off payment to put the plans in place.

One farmer reported that the consultant used a MAGIC?? MANNER package to keep the records, which calculated with relative ease slurry applications, livestock numbers, slurry spread per field etc. This was found to be helpful in maximising the efficiency of nitrogen fertiliser and slurry use on the farm. One farmer commented, 'They are much improved and I'm always up to date now!' Another felt that the records weren't that useful or necessary, feeling that he could usually judge appropriate and necessary slurry requirements easily enough without records.

With the help of his consultant, the same farmer was attempting to cut back on N, P and K and as a result was now making more use of slurry. He was also looking into lime levels on the farm 'because soil is very acidic and in an area of high rainfall. The aim is to make N fertiliser and slurry use more efficient, primarily to reduce costs'.

One intensive dairy farmer felt that Defra should invest more in nutrient management planning training. This would solve most of the nitrate pollution problems. He felt that the farming community was currently split into those that want to learn and those that don't want to learn and are not interested.

Slurry storage

Another common change which had been implemented without too many problems was the restriction of slurry spreading during winter months, commonly between mid October and mid February. One farmer commented that whilst it wasn't a significant problem in itself, potential problems could arise if after the closed period a spell of wet weather coincided with all farmers in the area spreading at the same time. Another remarked, 'We're in a transition phase – getting used to system. The farm is wet so historically we have always had to take opportunities when the ground could take it. Now we are trying to work to restricted timetables it isn't so easy!'

Other changes and planned changes as a result of the regulations illustrate the resourcefulness of farmers in integrating the compliance measures with improved efficiency, modernisation and expansion of farm enterprises. This usually centred around storage provision, where attempts at making improvements were being integrated into the plans for new storage facilities to provide added value and help absorb and justify the significant cost outlay. This was especially the case where succession was an issue – 'With the next generation coming on we'll have to press ahead and build the store anyway!'

This farmer was planning on putting in new buildings to modernise the farm and increase capacity anyway, as the present building was not efficient for modern dairying and because his son would be taking over the farm was keen to expand. 'It needs updating so we will convert the buildings, put in modern day dairy unit and integrate the slurry store at same time' In this case the surveys and plans would have been done irrespective of the regulations, the only addition being the new slurry store. The problem currently being faced by this farmer was one of funding, as the farm was currently in probate the bank was unwilling to lend him to funds to undertake the works. The same farmer commented that 'NVZs are the biggest single issue to be facing the dairying sector full stop!'

Another farmer was planning on building a new slurry lagoon as a separate unit but implementing further efficiency changes in an attempt to offset some of the costs of this, which in itself he felt wouldn't have a payback. This project had been set back because archaeological surveys had had to be done, but would be completed by the end of 2011. Plans to roof over yards to reduce dirty water and in turn help reduce the storage requirement were also being drawn up, although funding for this was a particular issue.

Slurry spreading

Other changes being looked at to tie into this efficiency drive was the use of umbilical spreading systems and the use of GPS to facilitate more accurate spreading. The benefits it was felt would be less wastage of artificial fertilisers and the farmer would be able to apply slurry at a more favourable stage of the crop. However, both technological changes had been too costly to implement as yet.

Due to the restricted period for spreading slurry some farmers are investing in high capacity equipment to spread the slurry as quickly as possible after the closed period. Farmers will take advantage of the first dry spell after the closed period in case the weather conditions deteriorate. As one farmer explained "After the closed period we have only 5 or 6 weeks to spread. On the wet areas of the farm over the 5 week period we might have 3 or 4 days when conditions are right. We have to pay staff extra overtime to come on the days when it is dry".

To deliver the higher volumes of slurry out on to the farm in the shortest possible time, farmers are investing in high capacity systems, such as umbilical systems and larger

tankers. One dairy farmer interviewed had invested in a larger tanker in order to get the slurry out faster and also needed a larger tractor in order to pull the tanker.

As large quantities of slurry are being spread in a small time-scale this may lead to increased public nuisance. Two farmers reported that spreading in an intensive period was resulting in more mud on the roads. "We used contractors who came with 2 spreaders. We did 7 hours of spreading on Tuesday and put on the lot. We travel down the road into the meadows because it is alongside the road. If you do a lot on one day, even when it is dry some of the mud comes onto the road. Sometimes it is so deep we have to shovel it off. If it was only half a day and you left it for a while it wouldn't churn up so much".

Some farmers referred to the additional time spent in loading, travelling and spreading the slurry. Because of the increased slurry storage requirement, spreading has become another chore. For one farmer it used to take just half an hour to empty the store, but now it takes 2 weeks to empty the store between milking amounting to around 4 hours extra work a day. Another farmer was concerned about availability of contractors for spreading due to the heavy demand during any dry spells after the closed period.

Applying for Derogation

Some of the smaller dairy farmers, producing between 4,500 litres to 5,000 litres/ per cow felt they were easily within 170 kg limit and therefore did not need a derogation. A larger more intensive dairy farm with yields of 8,500 litres/cow had a derogation and found that the 4 year derogation timeframe was restricting future planning. They needed to know where to invest on the farm, either to put an extension on the shed to bring in more heifers or to wait in case they lose the derogation and have to buy in more land. It was a stalling point for the business. This farmer's view was that at a 200 kg limit most farmers can afford to expand and purchase land, at the 170 kg limit they have to purchase land just to cover the derogation and it is not viable for any business that is looking to expand.

Extending the grazing period

One small dairy farmer was leaving the dairy young stock out until January in order to reduce slurry storage requirements.

Changing from winter to spring crops

One pig farmers was previously drilling winter crops up until the end of November and applying the slurry whilst ploughing the fields. As he is now unable to get all his crops planted by the start of the closed period on 1st October he has had to switch to growing spring crops which is less profitable. For example, he would hope to produce 2t/acre for winter OSR but only produces 1 t/acre for a spring crop. He could top-drop dress the winter crops in spring but the fertiliser spreader at this wetter time of year would make a mess. It would be possible with a small tractor to put on a bag of nitrogen fertiliser, but a slurry tanker with a big tractor requires good ground conditions.

Renting additional land

For one intensive dairy farm, if the current derogation is removed they would have to rent a further 20 acres of land at £100/aces. To do that they would have to go 2 to 3 miles away from the farm, which will increase both travel time and the costs of slurry haulage. This rented land would be used to grow a whole crop, rather than keeping animals away from the farm. Contractors would then have to be employed to bring in the crop as they don't have the necessary equipment to do this.

Exporting slurry

Many of the dairy farmers interviewed were in a predominantly livestock area so exporting the slurry to arable farms was not a viable option. One pig farmer exported slurry to a neighbouring arable farm throughout September in order to reduce the slurry pit volume enough to provide 6 months storage. It took three weeks to empty the pit and if hiring labour, a tractor and a slurry tanker would cost around £30/hour. He feels he is fortunate as the neighbouring farm manager previously kept pigs and recognises the value of the slurry. However, he feels vulnerable as should this farm manager move on the new manager may not continue this arrangement. Not all arable farmers value pig slurry as the nutrient content is not always consistent enough for arable farmers who are using precision farming techniques.

One dairy farmer mistakenly thought that if he exported slurry the recipient would not be able to apply it for 6 months due to disease risks.

Anaerobic digestion

One pig farmer had attended several meetings to discuss using his slurry for anaerobic digestion to heat a local swimming pool. The problem is that this process does not significantly reduce the volume of waste. If he put in 10 gallons he would still be left with 9 gallons which would be classified as slurry and would have to be transported and disposed of under the NVZ rules. It might be feasible if there was financial assistance to separate the dirty water and solids which could be composted. However, this along with the hardware for the digester would require a significant investment.

2.2 Policy Implementation personnel views

When questioned about changes to farming practice, the informant remarked that the closed period was crucial to enforcement, in addition to being the easiest part of the regulation to comply with. It was acknowledged that complying with storage requirements is very difficult because of the cost. They also acknowledged the difficulties faced by farmers due to the complexity: 'And the whole package is difficult to comply with because there are a lot of aspects to it and it is overwhelming. Some set out to do their best, and be pragmatic about it, although there is a cunning wheeze in trying to turn slurry into farm manure!'

In coping and adjusting with the regulations it was reported that some farmers were reducing stocking levels, some exporting slurry to adjacent farmers not in the NVZ and others were renting out extra land to bring down their N average. It was also perceived by the enforcer that the regulation has encouraged some dairy farmers in the South West to move out of the sector, and that quite a few dairy farms had decided not to renew the derogation, both points tying in with comments made in the farmer interviews. Some dairy farms were reportedly going into cereals, but this was largely dependent on whether they had the necessary storage capacity.

Commenting on differences between farms, the enforcer stated, 'The more youthful farmers are quicker and more willing to comply. They have a more scientific approach, are more up for a challenge and are more open to innovation' Again, the experience of farmers revealed in this study conform to this view, and reinforced the urgency of compliance where the farmers son was aiming to take over the farm.

The point was also made about farm size, 'It is the bigger farms and those with more money to invest that are quicker to respond, because its easier for them. Some smaller farms may not want to do it and are restricted through not being able to raise the necessary finance'. It was also felt that the regulations were more straightforward for arable farmers because very

often they are already doing what is necessary. 'It is much more challenging for livestock farmers'. Again this confirms the experience of the farmers themselves.

One CSF project officer in West Midlands reported an increased demand for gants for cattle tracks which are designed to reduce poaching and run-off and reflect a move towards keeping livestock out longer in the winter. His view was that all livestock farmers in area will have to increase storage, "Grandfather had 40 cows now they have 300-400 cows and storage is inadequate". As a response to the NVZ requirements, many farmers are now selling their cows, "once you used to be considered lazy if you sold up, but now there is no stigma or shame attached to selling your cows".

Defra suggested that for arable farmers (for example in East Anglia) reduced nitrate limits were not much of a problem, and the Nitrate Regulations had not really affected them in any way. It was felt that the limits set in the Directive (and Regulations) were quite generous, and with the costs of fertiliser increasing they were keen to minimise fertiliser applications. Defra also suggested that for most livestock farmers the 170kg/ha limit was not really an issue, even dairy farmers were felt not to be unduly affected as indicated by the small number of derogations requested. Around 1,500 applications for derogations had been expected, but only 450 were received in 2010 and 405 in 2011. Defra had pushed hard for derogations in discussions with the European Commission arguing that if it was not available then farmers were likely to turn some low nitrate grazing land into high nitrate input arable land which would be worse for the environment. Defra indicated that had heard anecdotally of more farmers renting land for spreading of slurry but were not aware of any transport of slurry.

Defra suggested that the major concern of farmers, and the most difficult part of the regulations for compliance, were the slurry storage requirements, largely due to the costs, and linked to the increase duration of closed periods. The level of concern was seen as linked to overall farm performance, with the farming media indicating that farmers were starting to view slurry as a valuable asset.

Defra had a number of concerns regarding the regulations:

- Perception of slurry as a waste: part of the issue is that slurry stores are perceived as storage of waste rather than as storage of an asset. If the perception was changed then farmers might think differently about the regulations.
- Recordkeeping was identified as an aspect of the regulations that were not popular. In Defra's view the record-keeping was seen as "too burdensome" requiring capture of large amounts of information. Defra were aware of other stakeholders views on the importance of record-keeping but felt it was too onerous.
- Closed periods were seen as potentially problematic by farmers as they stated the need to spread slurry in dry conditions; it was felt this was to avoid costs of investing in slurry storage.

In Defra's view the decline in fertiliser application was due as much to price increases as to anything else. It was felt the Regulations might have had some impact in reducing fertiliser applications but the decline would not have been nearly as great without the price increases.

2.3 Other Stakeholder Views

According to one support organisation, a variety of strategies were being employed by farmers for dealing with the regulation, including 'taking on extra land, reducing headage, burying their head in the sand, paying consultants to deal with paper work, attending meetings and learning about the regulations. It was reported that some had decided, either

to give up dairying and move to less intensive systems, or to get out altogether and some dairy farms were moving into less intensive livestock systems. 'Arable farms aren't hugely affected, in fact in some cases it can be a benefit'

When questioned about changes made to farming systems, one stakeholder organisation reported that a number of livestock farms had acquired additional land for spreading outside of NVZs. '[This was] particularly likely in the South West where designations are more disjointed than in other parts of the country, it's a bit of a patchwork'. The majority were considering the feasibility and costs of building additional storage infrastructure while others were looking at ways of producing dryer manure that isn't classed as slurry, for example through installing weeping wall systems, slurry separation equipment, incorporating straw into the slurry and roofing over areas to avoid water contamination. Other responses are to reduce the housing period by leaving livestock out for longer or moving to a New Zealand rotational grass system which means livestock can be outdoors for longer, this is particularly the case in Shropshire and Wiltshire. Also a few are changing their bedding system to loose straw housing.

One stakeholder organisation suggested that the need to comply with the NVZ requirements was a tipping point for some dairy farmers to leave the industry. This is dangerous for the UK which is currently below its quota for milk. A survey of 150 NFU members undertaken in November 2010 found that 45% did not have enough slurry storage to comply with the five month storage requirements. The survey found that in order to meet the storage requirement the majority of farmers are looking at the lower cost options of maintaining roofing to reduce rainwater run-off into slurry stores. This is considered a particularly cost-effective option in high rainfall areas. Others are looking at investing in new slurry stores or extending the current store. It is estimated that 70% of slurry stores are older than 10 years, and around 5,000 need upgrading.

One stakeholder organisation identified those who are not complying with the storage requirements as:

- Farmers reaching the end of their life and about to retire who won't realise the value of investment
- Farms that are too small to generate the capital required for investment
- Sites that are too small to physical put in storage
- Some who just see it as not worthwhile

There is concern that some who are putting in new storage may be miscalculating the amount of storage required. It does not simply correlate with the 5 month closed period, but is a more complex calculation and the required volume can change monthly or even daily. Some may be overspending if storage volumes are simply calculated on the basis of keeping livestock indoors for 5 months.

One stakeholder suggested that there was a landlord/tenant issue. Landlords have a statutory requirement to upgrade slurry stores to meet NVZ requirements. However, some landlords are not making the investment. For example, many County Councils are in the process of selling their estates and are therefore not putting the investment into their County Farms. The same is true of other landlords, such as the Crown Estates and the Church.

According to one stakeholder applications for derogations are lower than expected. Only 400 out of 7,500 dairy farms who are over the 170 kg limit have derogations. The NFU survey also found that 46% of the farmers surveyed are farming over the 170 kg nitrogen/ha farm limit yet very few farmers applied for the grassland derogation in 2010 and 2011, citing the conditions being too laborious or the farm being ineligible.

In terms of changes to outputs and enterprises, it was felt that the vast majority are looking to stand their ground and make no changes. Again the move out of the dairy sector as a

result of the regulation was acknowledged: ‘Some smaller dairy farms are giving up milk production and moving into suckler cows and less intensive beef systems. It is becoming apparent that the younger generation of dairy farmers are contracting out their services to carry out relief milking on larger farms. They are also undertaking contracts for ploughing and hedge trimming to supplement farm incomes where milk production has ceased, as well as seeking other sources of off-farm income’. It was reported that smaller farms were also utilising existing farm resources for the benefit of other farms, through for example contract rearing, or sharing of machinery. This was fairly widespread, and principally to reduce costs.

In relation to farm inputs, it was felt that there had been no change in pesticide use as a result of the regulation, although farmers were now wishing to make better use of organic manure sources. Again, the export of slurry from regulated farms was acknowledged, ‘There are now more opportunities to import slurry from neighbouring farms – farm within NVZs exporting to those outside the zones.’

This informant also felt that the NVZ regulation presented another barrier to succession: ‘The drive continues to be to maximise yield, thus input prices are the major driver. There is reluctance throughout the industry of younger members to take over family farms, and NVZ regulations present another barrier to succession, mainly due to the lack of ability to invest. The declining profitability of farming enterprises combines with increased regulations and restrictions to make it less and less attractive. TB is another factor in the mix of barriers to succession’. Thus, the NVZ regulation is clearly playing a role in the demise of farming in certain areas, although as also acknowledged earlier, farmers can be quite determined to hang in there and comply where the son is keen to take over the enterprise.

It was certainly perceived that there would be more changes made to farming systems in the future as a result of the regulation, mainly because of the time lag in complying fully: ‘There are a number of farmers who know there is a requirement but have not actually made the required changes yet. From 1st Jan 2012 they need to have storage in place, so take up will need to be rapid as this year progresses’.

One stakeholder suggested that the Regulations were forcing a range of changes in farming behaviour, for example using the New Zealand system or maybe not even housing livestock at in areas where the ground was suited to grazing year round and there was access to grass in wet conditions (parts of the West Midlands were cited as where this might be happening). Some export of slurry was reported as occurring in pig and poultry areas, but not in the dairy sector.

Summary of changes within the organisation

Both organisations interviewed reported that the regulation had taken up a vast amount of time, for example in producing guidance and running workshops to educate farmers about their obligations. One reported to have run 60+ meetings and workshops since 2008 and had ‘lobbied hard for support to farmers through the RDP’.

In addition to having spent a lot of time and money in producing guidance, another felt that the organisation had been forced to become more reactive as a result of the regulation. “The most difficult part has been having to go tell people about the regulations and that they have to comply, which is depressing. There are a lot of grey areas in the guidance, and the regulations are difficult to explain to farmers because they are ambiguous – farmers prefer certainty”.

3. Summary of costs and benefits

3.1 Farmer Views

One farm (dairy, beef and sheep) was in probate so the farmer was unable to obtain finance from the bank to fund a new slurry store combined with a new building for 110 cows. Whilst trying to comply with the regulations the farmer was at the same time attempting to add in further efficiencies and facilities in order to grow and strengthen the business. The new building, which would contain 200 cubicles and a slurry store, would cost £80-120K, with benefits only in terms of expansion and modernisation of the dairy unit. If the farmer was unable to obtain funding then the alternative would be to build a slurry lagoon at a cost of £38K, but this wouldn't be in the ideal place and would fail to produce other cost synergies. In this case the son was planning on taking over the farm, so it was imperative that the farm complies and follows its plans for growth.

Storage provision was the major cost reported by all farmers interviewed, with costs ranging anywhere between £10K and £100K for building the necessary facilities. Some of the farmers were using their own labour to construct the storage facilities in order to reduce costs. In addition to building a slurry lagoon at a cost of £10K, and looking into putting in place some covered yards at a cost of 15-20K. Some farmers were aiming to invest in equipment to facilitate more effective slurry application in the spring period at a cost of £5-28K and one was aiming to invest in GPS to facilitate more accurate spreading at a cost of £1.5K.

Some farmers estimated the costs of record keeping were as much as £3K per annum with the employment of a consultant. Others estimated this to be nearer £300-£600 p.a. with the potential benefits in the form of a saving in long run from improved efficiency, the assistance in planning total N applied to each field and ensuring that the whole farm stays within the 170kg/ha limit. The amount saved is, however, difficult to quantify and as input prices are rising anyway it is likely that some efficiency savings would be counterfactual. There were also additional costs to the farmers of keeping records. One young, computer literate, couple had spent 4 days entering everything on to the PLANET software and employ a consultant for one day annually at £600 to check the information. The potential costs and benefits of these various activities are summarised in Table 3.1.

Table 3.1: Estimated costs and benefits to farms of changes associated with NVZ compliance

Activity	Estimated cost (£)	Estimated benefits	Estimated value of benefit (£)
Storage provision	£10-100K / £500 per cow	Potential time savings	£1K per annum
Planning application for storage construction	£70 - £500	Nil	
Covered yards	15-20K	Reduce rain water cut down on amount have to spread estimated	£500 per annum saving
High capacity slurry spreading equipment	£5-28k (or similar on contractors)	Negligible financial benefit	
Making more use of slurry	Nil	Less waste and more efficient use of N	£15-20 per ha per annum
Reduction of N, P, K fertiliser		Improved efficiency	£1K per annum saving
Use of GPS to facilitate more accurate spreading	£1.5K	Less wastage of artificial fertilisers and can apply at a more favourable stage of the crop.	£300 per annum. 5 year pay back
Exporting slurry – haulage costs	£3k over 3 week period	Nil	
Record keeping for all slurry and fertiliser applications and related field data	Consultant at £300-3K per annum	Potentially greater efficiency of N use. Reduced fertiliser usage	Difficult to quantify

Costs were generally more significant for smaller dairy units, and for farms that suffered higher rainfall, had more run-off and were closer to major water courses.

3.2 Policy Implementation personnel views

According to the enforcer, 'Nitrate legislation is not particularly good. It is very prescriptive, which is both a curse and a blessing. It is one element of helping to achieve the [organisation's] aim of improving the environment. It helps to indirectly reduce pollution incidences as part of a wider programme.'

The enforcer confirmed the biggest cost to be slurry storage, 'but this is different for every farmer so costs vary hugely. Small farms face a greater cost per head of livestock than larger farms, thus it is weighted in favour of larger farms'. Other costs include investing in more land, costs associated with de-stocking, making changes to spreading equipment, and

calibrating spreading equipment. Ultimately the system is then less intensive so less profitable'

When questioned about the costs to their own organisation, they reported that there had been 'massive costs incurred this time round (2008), with costs from both interpreting the regulations and in training and educating, both staff and farmers'. Training had clearly proved a major issue, 'Its required a lot of training and has been a lot for staff to get to grips with, especially as there is a lot of grey areas'. Designation was reported to have been very time consuming and costly and it was felt that they could improve cost effectiveness in the future. The action programme – to assess compliance and enforce the regulation - is part of an integrated programme for regulatory cost effectiveness. NVZ was reported to be part of that.

According to the enforcer, nutrient planning should help make the farm more efficient and protein levels should improve. Efficiencies should also be gained through investment in new kit for managing nutrients and the more efficient use of N. However, this is not yet evident from farmers, although some agree with the logic and the principles and it makes them more willing to invest and comply. Notably, slurry is now viewed by farmers more as a resource rather than a waste to get rid of, so there are positives in that respect, a view which is also shared by the farmers themselves. There should be financial benefits if using more slurry as opposed to N fertiliser – a £ per cubic meter saving can be applied to slurry. And of course the reduced risk of persecution and loss of single farm payment as a result of complying was highlighted.

It is the enforcer's perception that there are no costs or benefits to the wider economy or communities as a result of NVZ. They argue that the SFP, milk prices, influence of supermarkets and farmers markets are all much more powerful influences than NVZs. With respect to water quality itself, they commented, 'There is no way of knowing whether there have been improvements to water quality because of the time lag. It would take 30 years plus to assess any impact'.

Defra suggested there had been a small number of court cases and fines in connection with the regulations, and there had been some instances of farmers getting reductions in their Single Farm Payment due to non-compliance with certain aspects of the Regulations, in particular record-keeping.

The main costs, as far as Defra was concerned, were the unexpected costs of appeals from farmers regarding designation of NVZs and the number of cases upheld, costing approximately £0.8 million. Defra also indicated a significant impact to their reputation as a result of the appeals, which has not been costed in monetary terms but is perceived as large.

3.3 Other Stakeholder Views

The two main costs to farmers were perceived by one stakeholder to be record keeping, which had posed a particular challenge to smaller farmers, followed by storage. Consultants were estimated to be costing farmers around £500-750 per year for record keeping, with records being updated about 4 times per year. 'The need to employ consultants to assist in keeping records has come as a bit of a shock.' In some cases consultant fees were reported by farmers to be significantly greater than this. Record keeping was viewed as a 'biggest cause of cross-compliance failure' and was described as "very demanding, very intricate and difficult to do...the complexity is absurd".

Storage costs were estimated by one stakeholder at around £500 per cow, and by another at roughly £30,000 – 50,000 per farm. There was also the indirect cost of the farmers time in trying to understand the regulations, which it was felt could take a good few days a year. Another said that the costs to farmers of storage provision had not yet been examined but the view was that farmers would have had to spend considerably more in terms of both time and financial resources in complying with the regulations than was originally expected.

'If farmers don't comply then they face further additional costs through the implementation of draconian measures. Reducing the N limit of 170kg/ha any further, which is a possibility, would almost certainly impinge further on productivity'.

Another cited wider costs to be borne by the farmer, including infrastructure, fencing, buffer strips, slurry storage, covered yards, 'costing the farmer anywhere between £5-50K , and all this has to be done by 2012. The benefits of this are better use of N (although there is a minimum 5 years to kick in) and greater efficiency for larger farms (where there is a minimum 10 years to reap any rewards). In the dairy sector in particular this is more of an issue for tenant farms, whereby landlords are reluctant to make the necessary investment and tenant families are short of the funds to put the storage in. 'Dairy has been hugely affected. Due to the costs imposed by slurry storage the regulation has the potential to kill of dairy farms altogether, especially the small ones. Farmers don't see it as an investment but just an upfront cost!'

One stakeholder indicated that spreading equipment required significant investment but at reasonably low risk, and a payback through enabling earlier re-entry onto a field for livestock if the latest technology was applied.

One problem identified with the RIA was over the issue of spending and the cost of borrowing which could vary greatly from year to year. It was suggested that the RIA gave an impression spending would take place over a number of years (i.e. through annualised costs) when the reality for farmers was that much of the cost was upfront and immediate requiring borrowing.

When questioned about wider impacts of NVZs in the economy, one stakeholder felt that there had been a loss of revenue upstream of farms: "The number of agricultural contract businesses have reduced due to the closed period. Some businesses are selling or reducing equipment and staffing levels due to the reduction in the number of dairy farms".

According to one informant it is too early to call the nature and extent of benefits, they can only be regarded as potential benefits. However, there is some anecdotal evidence that less manure application is required earlier in spring, either due to storage on a reduction in stocking levels. There was reported to be anecdotal evidence that farmers are recovering greater financial value from the application of manures, so reducing pollution through leaching and run-off. But generally benefits were felt to have been less than expected, a feeling expressed by both farmers and stakeholders. The regulations were described by one stakeholder as being 'too onerous, too heavy-handed and are a large sledgehammer to crack a small nut!'

Farmers were perceived by both stakeholders to be finding it difficult to appreciate the link between their farming practices and water quality, although they are now starting to view organic manures as a resource rather than as a waste product. If utilised fully, this was estimated to be worth a potential £15-20 per ha per annum, given the increased price of nitrogen fertilisers. Higher fertiliser prices also means that the payback period from organic manures is now shorter.

“Potentially the regulations can produce more economic efficiency, but this will only happen over a much longer term and it requires economies of scale, so will only really benefit the bigger farms. It is too early to say whether there have been any benefits to drinking water quality as it will be many, many years before any benefits are. The lack of evidence that the measures are developing the required benefits does not encourage farmers.”

Costs and benefits to the organisation

Two organisations reported that the costs associated with educating farmers had been far higher than ever anticipated and they suspect that further monies will be need to be spent on education over the next 12-24 months. Additional training was reported to have cost £8-10K on an annual basis, around 800 per head, although on-going training and CPD costs were less. Provision of guidance booklets and workshops had also required a considerable investment, with the organisation employing additional resources and re-deploying existing resources. Again, estimated at around £10K per year annually, Development costs for advisory packages were estimated to have cost £4-5K per annum.

‘We have had to invest more in terms of training, especially as advisors have needed to gain accreditations. A large amount of time has been spent attending technical training meetings to keep up to speed with the regulations. So it has required a change in direction and has been more onerous than anticipated’. Another reported that their main cost had been in terms of staff time – attending meetings, providing resources, dealing with member enquiries, all which is on-going. The only perceived benefits were that the regulation helps to indirectly support jobs. The provision of guidance tools costs around £5K per annum, with some benefits in terms of skilling staff in NVZs - ‘We now have NVZ consultants’.

Indeed, an improvement in the capability and skills of staff as a result of accreditation programmes and training associated with implementing and educating farmers about NVZs was also cited by another organisation: ‘Although on paper the financial costs far outweigh benefits, as a result of training and accreditation programmes, staff can now deliver a broader range of advice regarding nutrient use and crop management as a result of the regulation. The regulation has also led to the development of robust support services that are a good template for future advice and regulatory programmes’.

This organisation had also been an indirect beneficiary as there has been an increase in demand for advice – direct advice to farmers, through consulting arms and through the delivery of funded advisory programmes. NVZ health checks were reported to have covered costs, although hadn’t yet made a profit.

One stakeholder organisation estimated that a series of consultation meetings before the introduction of the NVZ regulations had cost them around £4-5k. This organisation has found it difficult to engage constructively with the implementation of regulation, as it is being driven purely for compliance purposes which makes their job of engaging farmers with it harder.

Table 3.2 Estimated implementation costs of Nitrate Regulations

Activity	Estimated Cost	Comment
NVZ designation and appeals process	£0.8 million Mapping and on-ground determination - £unknown Reputational costs –ve	Appeals process was expensive, large numbers of appeals upheld. Employed ADAS to undertake mapping and on-ground detailed field identification for NVZ boundaries. Defra’s reputation suffered during the appeals process.
Monitoring	£0.25-0.4 million per annum	Annual costs. Ongoing research under contract to ADAS for monitoring effectiveness (ongoing over last 9 yrs to provide evidence for 4-yearly reports)
Administration costs	Keeps 3 people employed in Defra	Nothing exceptional – already implementing and reviewing nitrate control regulations.
Enforcement costs		Some court cases indicated – no cost data available
Stakeholder consultation costs	£4 – 5,000	One stakeholder’s estimate of consultation meeting costs. More concern expressed over resources that were applied to consulting and lobbying; viewed as a ‘huge waste of resources’.

4. Counterfactual

4.1 Farmer Views

Two main drivers behind a number of changes acknowledged by both farmers and stakeholders were market forces and other schemes and regulations. In relation to the former, a principle force is input costs, which have been rising steadily for a number of years and were in turn driving the need for greater efficiency at a reduced unit cost. To quote one farmer, ‘One of the main changes has probably been using less fertiliser than I used to and planting red clover ..But I did this because fertiliser was getting expensive, and also protein expensive. I never used really high amounts of nitrogen anyway’. Indeed, this experience is

supported by the enforcer who admitted that 'the change in fertiliser use over recent years is largely down to market forces.'

All farmers interviewed spoke of similar experiences, and principally that the rising cost of fertiliser continued to undermine its use. As well as slurry, an increase which has been driven more by NVZs than anything else, other sources such as clover and chicken dung from local growers were also cited as being a help to reduce reliance on nitrogen fertilisers. For the most part record keeping was instigated almost exclusively for NVZ compliance, although as one farmer explained, 'We were already keeping some records but this has concentrated the mind. The regulations are making grassland farms think like arable farms where input costs have to be justified'.

One farmer argued strongly that he felt soil testing to be more important than record keeping because it showed what needed to be applied to field, rather than what had already been applied. For this farmer the majority of ground testing was routine, and part of normal farming practice. He also routinely carried out testing on grassland because Natural England offered free soil testing and sampling.

In relation to other schemes and regulations, one farmer explained how his yard covering was completed under the Natural England Catchment Sensitive Farming scheme, which wasn't voluntary. A grant was provided in this case, the principal aim of the scheme being to improve the water quality of the local river.

The same farmer explained how being in the ELS also tied in with the aims of the NVZ regulation in that he had already moved to applying no fertiliser on a couple of fields, a change not related to NVZs and which wasn't influenced by the record keeping. Another farmer had already developed a nutrient management plan under their ELS scheme and when this option was withdrawn ELS they decided to continue with it. Another farmer already had to allow for run-off from steep fields as part of Environment Agency's soil protection review, a farmer who was already in the HLS and had worked this so as to tie in with the NVZ regulations, in terms of the location of buffer strips etc. In this case it was felt that being in the NVZ had actually helped the farm get into the HLS.

When questioned about whether they would have made any of the reported changes in the absence of the regulation the majority said they would continue with some of their plans, although the most expensive projects such as storage provision and covering yards would be shelved because the costs far outweighed the benefits. One farmer did feel that he would press ahead with plans for a slurry lagoon and one said that he would probably spread more manure in winter, if and when the weather allowed. Another remarked that plans for technological changes would be followed through because it allows fertiliser to be used more efficiently and over time would help to save money.

In Defra's view a significant proportion of reduction in fertiliser application can be attributed to rising market costs. Improvements in slurry spreading equipment not viewed as being driven by regulations but more by more modern farmers wanting to maximise value from slurry (also means they can put livestock back on grass more quickly). No evidence the Regulations are persuading farmers to invest in anaerobic digestion systems.

4.2 Other Stakeholder Views

Most of the above arguments were supported and confirmed by the stakeholders interviewed, both of whom felt that if the regulation was removed current farming practices wouldn't change significantly. It was felt by one that farmers were already taking a lot of stops to mitigate and control pollution. 'A lot of it best practice!'. According to another,

farmers' evidence of pollution is anecdotal and a lot of them have been taking measures to prevent pollution anyway.

The impact of rising costs on nitrogen fertiliser use was emphasised very strongly by both stakeholders: 'Nitrogen fertiliser use has declined massively, its been dropping since 1996 due to the increasing cost of fossil fuels and other input prices'. A number of changes have been driven through cost...commodity price rises, fuel costs (for example in exporting slurry to other farms) and the reduction in credit available have also worked to exacerbate an already difficult situation'. While the main driver towards change was felt to be the increasing costs of raw materials, which had led an industry drive towards N efficiency, it was felt that the regulations had given a 'kick' to these changes. Fertiliser use was indicated as being 40% lower than peak use in 1987 due to rising costs and better utilisation of nutrients. Nitrate pollution of surface water was perceived as having a downward trend before the start of the Regulations (from 2005 onwards) although it was recognised that in some groundwater based streams and rivers there was still an upward trend due to contamination of groundwater which would take some time to reveal any reductions.

The increasing cost of inputs was also reported to have led to a number of changes, especially the better use of organic nutrients, which due to spiralling costs have been recognised and supported through a number of farming advisory programmes. It was also acknowledged that higher fertiliser prices also means that the payback period from organic manures is shorter. 'Some recording and nutrient planning systems have happened anyway as result of farm assurance schemes and associated accreditation'. The general feeling was that things like buffer strips, while implemented by agri-environment schemes, had been improved by NVZs.

If the regulations were taken away, it was felt strongly that farmers would carry on with N efficiency measure because input costs are rising. Speaking more candidly and acknowledging the wider impacts of the regulation, one stakeholder argued that removing the regulation may prove to be a positive move: 'Some farmers may actually be inclined to do something if the regulation was removed, they haven't been asked or treated nicely!'

'In the dairy sector TB is having a big impact anyway, and NVZs are the icing on the cake in making them close or change farming system'.

5. Overview of regulatory impacts

The regulation was regarded generally as 'just another layer of red tape', which had been implemented pretty much as had been expected, 'we just haven't seen any impact yet'.

None of the dairy farms interviewed had needed to apply for the derogation. One said he could get by with the 170 limit, but only because he had reduced the size of his flock and had spare acreage. Another felt that derogation was very restrictive and was difficult to comply with. That said he still felt that he may have to apply in the future. Over and above the assisted drive towards the more efficient use of nitrogen on farms, perceived positive impacts were few and far between, although one farmer acknowledged that not spreading in winter had meant that the ground wasn't getting as compacted or rutted.

Overall, the stakeholders felt that the impacts of NVZs had been negative, 'and for most farmers its negative – spending on slurry stores and having to rent more ground than what they would normally'. The costs of complying, particularly in relation to storage provision

were perceived by farmers and stakeholders alike to be the biggest negative. 'And to comply you can't use every acre right up to the watercourses, so you're effectively losing land'. One stakeholder implied that the benefits were insignificant and the costs very large. The Regulations were seen as being driven by political imperatives rather than good science, or good agricultural practice.

At a regional level the impact on the dairy sector was felt to be the most detrimental impact of the regulation, 'In the South West you are likely to be left with fewer, larger dairy farms as a result of the regulation', commented one stakeholder.

5.1 Suggestions for improving the 2008 regulations

When asked about how they thought the 2008 regulations could be improved, farmers generally felt that the 170kg/ha limit is liveable. 'I can see the theory but don't know the ins and outs. Time is limited to actually engage with it properly, there is a lot to take in.' One dairy farmer felt that it was not cost-effective to have non-intensive farming at the 170 kg limit as well as a large storage requirement. It would be better to say that those with 170 kg limit need 3 months storage because they produce less slurry and therefore the risk is less, whereas those with the 250 kg derogation need 5 months storage.

More flexibility in the closed period was a common suggestion, and the argument was summed up well by one farmer, 'Allowing a window to spread when it is reasonable to do so would make sense and avoid all farmers spreading at the same time, irrespective of what the weather is like. It could be very wet but is still allowed. This would also help to encourage those that don't want to comply'. Another suggested restricting the proportion of the farm on which spreading could take place during the winter months provided the conditions were favourable for spreading. A pig farmer who was no longer able to grow winter crops because of the closed period, suggested moving the start of the closed period to 1st November so that he was still able to drill his winter crops using slurry.

In addition to the lack of grant funding to assist with storage provision, farmers also questioned what they perceived to be the fairly indiscriminate nature of NVZ designations, arguing that 'it would be fairer if the regulations applied to the whole country, not just singling out areas. Very often individual farms that should be in aren't in it'. Some leeway to farmers on the 2012 deadline was also highlighted as a need by all farmers. 'The principle is OK but the implementation is too inflexible'.

One pig farmer favoured the idea of aerobic digesters but to make it financially viable suggested that financial assistance should be given to deal with the by-products which still need to be disposed of, including dirty water separation or composting.

5.2 Policy Implementation and stakeholder views

The difficulties of enforcing the regulation were acknowledged by those responsible, who in fact advocated the need for a more rounded approach to tackling the problem, 'Enforcement of the regulation is difficult, so if enforcement was driven by the market, for example through supermarkets or water companies, that would work better. We need a range of ways of dealing with it, not just enforcement of regulations.

Other stakeholders also put forward some suggestions as to how the regulation could be made more effective. One suggested implementation of a Nitrogen threshold, a calculation to determine whether farms would need to undertake the full range of changes. It was argued that this would mean less onerous obligations for smaller units that have low N inputs, 'The extent to which smaller farms actually impact detrimentally on water courses is questionable, the focus should be more on the larger, more intensive farms'. Other

suggestions focused on the need to make the regulations easier to understand and interpret for farmers, with the regulation described as over-burdensome, a duplication; and enforcing high capital costs. 'It is an expensive way of educating people!'

'The most difficult part of the regulation has been associated with the relationship with farmer clients. Farmers have had a poor understanding of the requirements for compliance and find it daunting. This has posed a challenge for [the organisation's] staff, who have had to not only explain the detail of the regulations, but also to pose it in a positive light'. In some cases staff of this organisation had had to counsel and mentor farmers because the regulations and guidance were daunting, confusing and a huge worry to them.

In addition to some basic improvements to make the regulations less complex and easier to interpret (the difficulty for farmers to differentiate between manure and slurry was given as an example), other suggestions by stakeholders included linking it more to assurance schemes such as Red Tractor; linking more generally to codes of good practice; providing financial support to help with slurry storage; and providing support for record keeping. It was also felt that the regulation needed 'more hard evidence sitting behind it' to encourage and reassure farmers that what they were doing was worthwhile.

One stakeholder felt that the closed period requirements of the Regulations could have an 'insidious effect' over longer periods as a result of large and damaging 'pulses' of water pollution arising from concentrated spreading at the end of the closed period in wet years. This was seen as partly being caused by farmers spreading as much and as fast as possible (because they do not know how wet it will be in the immediate future), and partly a shift from nitrate to ammonia (especially on heavy soils), which was viewed as the result of pursuing a single goal – that of reducing nitrate pollution – rather than taking a more holistic view. It was suggested the risk of a pollution event that would kill aquatic life (fish) was one in five. Closed periods also created problems for farmers if they undertook application later in spring which might result in soil compaction, increased run-off and breach of non-compliance rules. The stakeholder recognised that the imposition of closed periods had been a policy decision to avoid being taken to court by the European Commission. Much of the blame was laid at the door of the European Commission who were considered inflexible and without regard for the needs of a food production system.

Defra suggested that there was some conflict over policy objectives for reducing nitrate levels in water and reducing emissions of ammonia. It was suggested that forcing farmers to spread slurry in spring and summer when it is warmer increases ammonia, NO_x and particulate emissions. A second area identified for further study is record keeping where the aim will be to simplify the requirements by giving farmers more scope in how they met EA requirements for a nutrient management plan. Other areas to be examined include the issue of cover crops that take up nitrogen over the winter, estimates of certain types of manure production, the appropriateness of closed periods and the potential for incorporating the 1991 Silage, Slurry and Fuel Oil Regulations into the next set of nitrate regulations.

One particular area that will be improved will be the addition of an appeals mechanism before the final decisions are made on NVZ boundaries. It was felt that this would significantly improve the implementation of new regulations, and reduce potential non-compliance, as well as reducing Defra's costs of fighting appeals. Under the previous regulations over 750 farmers appealed the NVZ designations and a significant number were upheld costing Defra approximately £0.8 million. From Defra's perspective the NVZ designation and appeal process has been the most difficult aspect of the Regulations.

Defra is in favour of the Regulation because it is viewed as a straightforward and clear set of rules that can require farmers to act in a certain manner, and it is one of the few regulations of this sort that can be enforced to improve water quality, many other instruments operate

by incentives. On the other hand Defra realises the damage to its reputation by implementing a Regulation that is considered to be based on “uncertain science”. A ‘disconnect’ is perceived in implementing a Directive based on standards set for drinking water to achieve environmental objectives.

6. Sources of information on the regulation

All farmers reported to have looked on the internet and in the press to obtain information about the regulation although not all had received any direct correspondence informing that they were in an NVZ. Guidance booklets had been received and most farmers had attended some workshops and meetings run by Natural England, ADAS, the Environment Agency and the NFU, to learn more about the detail of the regulations. One farmer felt that it would have been useful to have a farm visit, as he had been too reliant on literature coming through the post.

Although consultants had been employed primarily to do the required record keeping, having a consultant with all the information to hand was reported to have been a great help in understanding and interpreting the requirements, although this had obviously come at a cost to the business. Indeed, the enforcer reportedly communicates mainly through the Internet, and it is their explicit hope that consultants access and use the information. They also communicate through farmers organisations and press/media, although acknowledge that this isn't always straightforward, 'But farmers need to want to hear, 25% of farmers in NVZs say they aren't!'

Stakeholders also acknowledged communication difficulties, but stressed that the onus lay with farmers to engage with the regulation and obtain the correct information, 'Yes, mistakes were made, farmers get the farming press and information is there, but they to be proactive. Inclusion is a grey area as there is no letter saying they are in the NVZ'. Age of the farmer was also noted as an issue when it came to accessing the appropriate information, 'A lot of older farmers won't be proactive, won't look for information and don't use computers – which is a major barrier'.

Stakeholders reported that some mistakes were made in interpreting the regulations, but given their complexity this was inevitable. For example, the guidance hasn't adequately explained the definitions of slurry and dirty water, meaning that remains a grey area for farmers. Various tools and sources of advice were identified as being available to farmers but some of the tools were cited as being difficult to use, and there was recognition that not everyone had the capabilities to use them. One problem was the loss of free extension services on which farmers had relied for advices.

The view held by stakeholders is that excessive information in a largely illegible format has been given to farmers. The guidance has reportedly served to make a complex set of rules even more difficult to understand and record. 'The problem stems largely from the interpretation of the nitrate directive by UK authorities and the way its been implemented in this country. Defra have failed to grasp the scope for farmers to understand and implement these complex and onerous regulations'. Two stakeholder organisations reported to have invested a lot of time and resources overcoming and dealing with misunderstandings about the regulation, which is perceived to be primarily due to this complexity. 'Sources of information have been provided too late, are ambiguous, and they need clarity on what everything means'. Serious flaws in the methodology that was used for designation were

also perceived by the stakeholders, as was the perceived lack of coordination between schemes and advisors.

Defra suggested that the guidance on the Regulations was not universally popular due to the amount of calculations that had to be carried out.

ANNEX 3

POST-IMPLEMENTATION REVIEW OF AGRICULTURAL WASTE REGULATIONS 2006

1. Perceptions of the regulation

1.1 Farmer Views

Overview of farmer perceptions/understanding of the regulations

Farmers had a range of views on the regulations, most regarding it as a means of improving environmental quality. Most farmers indicated the primary aim was to stop pollution, particularly from burning of plastic, and increase recycling. One commented on the added burden of paperwork and another indicated he thought it had very little application to farmers, apart from recycling of plastic. One farmer felt the primary aim was to ensure farmers were brought in line with other industries in regards to controlling waste. Some felt it would help in meeting assurance scheme requirements (e.g. Red Tractor) that they were part of.

Judgement on accuracy of perception/understanding

All respondents were aware of the regulations. Only one farmer from the sample did not seem to have a clear understanding of why farmers were being regulated, but several were unclear about the extent of their responsibilities. The majority seemed to think it was a good thing as it was preventing burning of wastes, particularly plastics, which created a lot of black smoke.

For the majority of the sample the focus was plastics. Few farmers related the regulations to storage and disposal of hazardous waste as many were already engaged in this activity in order to comply with a range of farm assurance schemes. There was even less understanding over registration for exemptions and what materials actually constituted 'waste'. For example, several farmers wanted to talk about fallen stock as waste, believing that the waste regulations covered this aspect of livestock and provided detail on how they dealt with dead animals. Others had some notion that ditch dredging, or crop residues might be an issue, and one or two indicated no knowledge at all of what might or might not be a waste material. A large number of farmers had registered exemptions but not all were sure what this meant in practice, and very few were aware of the need to re-register their exemptions.

1.2 Policy Implementation personnel views

Extent to which farm data is confirmed or refuted

The Environment Agency (EA) indicated that in the initial period after adoption of the regulations there was a lot of concern on the part of farmers in relation to costs and what they needed to do in order to come into compliance. The EA indicated that there had been a large programme of awareness-raising which resulted in a high level of farmer response with 82,000 farms registered for exemptions under the Regulations. As far as the EA is concerned the agricultural sector response was good and comparable to other industries, although they did agree that a certain amount of burning and burying still occurs, and some farmers are not aware of their responsibilities. In particular there is concern that farmers do not understand the concept of 'duty of care' in relation to waste.

Although somewhere between 500,000 and 600,000 individual exemptions had been registered the number of farms registering was only about half the farms in England. There

was some concern that some farmers were registering exemptions for activities they may not necessarily engage in, but were 'playing safe'.

Defra indicated that farm reactions when the regulations were first adopted had been varied and the regulations were initially perceived as imposing a lot of burdens.

1.3 Other Stakeholder Views

Two issues arise according to the NFU, lack of understanding, and lack of engagement. The NFU suggest farmers view the Regulations as a hindrance rather than as a benefit. Particularly in the sense of requiring more work to continue to undertake activities they are already doing (e.g. the need for registration and exemptions), or to change behaviours. The NFU also suggested that there was a lack of understanding over exemptions, the need for registration, and what materials constituted 'waste'. This view supports data collected from farmers regarding their knowledge and understanding of the Regulations.

2. Changes to farm business and behaviour

2.1 Farmer Views

Identification of most significant changes

Plastic

The most significant change is the move away from burning of plastic and other waste materials (e.g. oil, straw, paper, cardboard) to having plastic materials collected and recycled. All farmers in the sample stated that prior to the regulations being adopted they regularly burned plastic waste, including pesticide containers, sometimes using waste oil to get a hot fire going. Most farmers in the sample recognised that the activity caused air pollution and most seemed to be content to have made the change to storage and collection/disposal, for some it had been viewed as their only means of waste disposal, suggesting that they would have changed their behaviour earlier if other options were available.

The regulations seem to have had little impact on farm management or practices in general. The main difference is that instead of collecting plastic for burning it is often now collected in large bags and stored for up to 12 months for either collection or transfer to a waste depot. Most farmers made it clear the plastic was neatly stored in a dry area in order to minimise collection costs. Only one farmer mentioned an increase in paperwork. The majority of farmers in the sample had changed practices during the first year of operation of the Regulations. One or two had delayed changing practices by a year while they searched for the best/cheapest waste management option. One had moved away from plastic using other (organic) materials to seal the silage clamp.

Hazardous waste

There was relatively little concern caused by the regulations in regard to storage and disposal of hazardous materials. Most farmers reported already being in compliance

through having locked storage areas, only one farmer suggested he had herbicides lying around in an unlocked area of the farm. Driving forces for this included the need to prevent theft of high value products, and the need to comply with farm assurance schemes. Many farmers reported annual inspections from assurance schemes. Only two farmers indicated any increase in costs to create a bunded storage area. Only one farmer suggested labour costs had increased, and this was in relation to the need for triple rinsing of spray containers, which took more time. All farmers indicated secure storage for animal health materials and all reported having a sharps container for return to a local vet.

Disposal of hazardous waste containers varied. In some cases spray contractors were dealing with containers, in other cases farmers were crushing containers after rinsing (using a tractor to crush) and storing containers in large bags for later collection by a contractor. One farmer indicated a lack of knowledge regarding what happened to animal medicinal products suggesting that they were discarded in the normal rubbish. One farmer reported using 'pour-ons' for sheep which eliminated need for dipping and disposal of containers.

Other Waste Materials

A range of other waste materials were discussed by farmers, including batteries, oils, scrap metal, wood and tyres. In general for any material of value (e.g. batteries, metal) farmers had no problem with disposal either at no cost or for some return. Farmer reported merchants and dealers regularly visiting farms to enquire about scrap metal. Oils are often stored on farm, in some cases in a range of containers, not always in a bunded secure area. Farmers preferred to build up a store of 1,000litres or more in order to get the oil picked up and taken away at no cost. In one case waste oil was re-used as a lubricant.

Tyres were not viewed as a waste material. Although piles of tyres were visible on several farms visited, and commented on in the interviews, for most farmers these were viewed as a valuable asset for silage clamps. Where tyres were being changed (e.g. tractor tyres) old tyres were usually disposed of by the dealer.

Changes in behaviour appeared to be minimal. Farmers do not have to do much to get rid of materials as they are often approached by dealers, recyclers and others to remove materials. One farmer reported having to register as a waste carrier and purchase a licence in order to take some batteries to his local waste depot. This was unusual as most farmers only indicated they transport small quantities of waste at the most once every year or two, and thus do not see the need to obtain a licence.

There are a range of other materials about which farmers were less sure, for example, road planings, ditch dredge materials, unsold crops, dead animals, and manures.

Rationale for making the changes

Driving forces for making the changes were first and foremost to ensure that farmers were in compliance with farm assurance scheme requirements.

Most farmers also recognised that previous practices were causing air, and possibly water, pollution. Burning of plastics created a very visible sign (black smoke) of the activities occurring on their own and neighbour's farms. Non-compliance was difficult to hide in regard to plastics.

In addition, it was not difficult for farmers to find a low cost solution to dealing with plastics as they had often been approached by recyclers to collect the material. Little change in farm practice was required in order to come into compliance (a switch from picking up bags/sheeting for burning, to picking up bags/sheeting for storage).

Changes in storage of hazardous waste were minimal due to the need to comply with farm assurance schemes.

2.2 Policy Implementation personnel views

Extent to which farm data is confirmed or refuted

The EA indicated that for the most part farmers had stopped burning plastic waste and were using a range of farm waste collection systems to deal with plastic materials, while some continued to take materials to waste management facilities themselves, and some were using local authority services. Compliance with the regulations is viewed as being more comprehensive for materials 'imported' onto the farm (e.g. cardboard, plastic, etc.), while 'in-situ' materials such as ditch dredging were often not considered as waste.

Defra was not aware of the extent to which the Regulations had changed on-farm practices although they had some anecdotal evidence of changes in behaviour, for example, changes in application of pesticides, and farms taking wastes onto the farm (e.g. for composting). Defra suggested a lot of farms had taken waste on-farm to engage in composting. This could not be verified as none of the sample of farmers looked at engaged in the practice and it did not appear to be viewed as something worth doing.

Defra indicated that farmers had found some aspects of the legislation difficult, in particular when a material would be classed as a waste (e.g. manure spread on land not a waste but when composted (i.e. treated) in brought it into the definition of a waste).

Overall, the information from implementers and other stakeholders supports the farm level data regarding the Waste Regulations. There is some confusion over the definitions of waste, in particular over other sources of on-farm waste materials such as ditch dredging. Other than plastics, which is a clear source of waste that can be recycled, farmers seem uncertain as to what does and does not constitute waste. The other major area of confusion is over the need for permits and exemptions. Many farmers registered exemptions when the Regulations were adopted and are not aware of changes made in 2010 requiring re-registration. In most cases farmers were not aware they needed to be licensed to transfer wastes off their farms.

General views over larger area

There were perceptions from central government levels that a significant amount of on-farm composting was occurring, and some anaerobic digestion (AD). This was not borne out by evidence on the ground, which found little evidence of composting, or any interest in composting off-farm wastes. In addition one stakeholder felt that AD was a huge investment and might only be suited to a very small number of farms.

Defra indicated that the Regulations had achieved the objectives set, which was to comply with EU legislation and decrease the damaging impacts of farm pollution from improper waste disposal.

2.3 Other Stakeholder Views

General views over larger area

One large stakeholder indicated the main issue was that understanding of the Waste Regulations varies greatly across members. The Regulations are considered to be a big change from the 'do as you please with your wastes' culture, to one of abiding by a set of rules. Some aspects are less well understood than others. For example, farmers understand the requirement to dispose of plastic wastes by using a registered carrier, but other forms of waste are not considered as 'waste materials' by farmers, for example, plant materials and ditch dredging. Farmers do not understand the need to register in order to deal with these materials.

A key issue for farmers is the need to register for what are often seen as routine activities. For many farmers it just seems easier not to bother registering, especially as the focus of the EA is seldom on routine activities, but on activities likely to have more significant impacts on the environment. This element of the regulations has not been helped by changes to made in 2010 requiring farmers to register again when in 2006 they were informed registration was a one-time event.

The most difficult task has been in getting farmers to engage with the issue of waste and communicating accurate information. The Regulations are not viewed as simple or easy to communicate.

In terms of compliance the stakeholder suggests less than total adherence to the Regulations. There are some complaints to the call centre about neighbouring farms burning materials, the need to train people at the call centre to answer technical queries suggests lack of understanding among farmers, and lack of questions on a wide range of materials (e.g. tyres) would indicate that these are already taken managed or not considered as waste.

3. Summary of costs and benefits

3.1 Farmer views on costs

Identify major costs

The main costs identified (see Tables 3.1 and 3.2 below) relate to disposal of agricultural plastics and storage of hazardous wastes.

Plastics were the over-riding concern for all types of farm in the sample. Plastics included: chemical spray containers, fertiliser bags, silage sheets, wrap, plastic netting, and string.

Quantities varied depending on the size and type of farm, though estimates of tonnage were difficult to ascertain as most farmers talked in terms of volume, the number of bags filled, or the size of a trailer or skip that was filled. Most farmers are storing plastics on farm for annual collection. Large mixed farms mentioned around 1 to 2 tonnes per year, for example. A range of approaches were identified including: self-transport to a local recycling depot, paying a private contractor to collect and dispose of the plastic, making use of local authority recycling services, and joining an association that would engage a contractor to collect and dispose of the plastic.

Hazardous materials costs largely related to provision of secure storage. Most farmers interviewed had already provided secure storage before the regulations were adopted, as part of farm assurance schemes, so costs of coming into compliance were minimal and related to bunding of secure storage. Animal health products (e.g. old medicines, sharps) were being taken care of through arrangements with local veterinary offices, and every farmer interviewed had a box for sharps which was either collected or delivered back to the local vet.

Costs varied depending on the type of arrangements made and are identified in Tables 3.1 and 3.2 below.

Table 3.1 Plastic waste materials – farm level data

Farm type	Plastic			Hazardous materials
	<i>Disposal arrangements</i>	<i>Quantity</i>	<i>Cost</i>	
Large mixed WO1	Local contractor collects	1-1/2-2 tonnes/yr.	average £200 per year	No additional cost
Large cereals WO2	Local council collects regularly,	Small amounts	£140 per year	No additional cost. Spray contractor used for disposal of containers
Large cereals WO3	Local contractor	1tonne/yr	£180-200 per year plus c.£50/yr in extra labour for storage	No additional costs for storage but increased time for washing out containers in spray operations –adds £400 – 500/yr to cost.
Large mixed WO4	Local contractor collects containers. Sheeting is transported to local waste depot where landfilled.	2 bags crushed plastic containers/yr. String and sheeting – loaded onto trailer once per year, taken to waste depot. 2 tonnes plastic/yr	Containers - £70 per year Sheeting/other plastic cost c. £200 per yr.	Created banded & secure storage from old dairy building. Cost c. £1,500
Large cereals WO5	Collected by specialised recycler, arranged through Anglia Farmers	1 1/2-2 tonnes/yr	£250 per year	No additional costs
Large dairy WO6	Local contractor	6-8 cu. M. skip/yr	£180 per year	Added bunding to existing storage –additional cost £50.
Large mixed WO7	Self-delivery to local waste depot nearby	Trailer load – c. 5-6 tonnes/yr	£700-800 per year	Converted old building before regulations came out.
Small mixed WO8	Self-deliver to local recycler – shared transport with neighbour.		Not sure – only done it once – in 2009 and sharing cost	Chemical store already on-site – no additional cost.

	Mineral buckets often re-used on farm.		with neighbour/	
Small diary WO9	Local contractor collects: Birch Farm Plastics	1 tonne / yr. Min payment £94/yr or £124 /tonne	£124	Lock proof area and secure area. Fuel in bunded area.
Small Dairy WO10	Self-deliver to local recycler. Phone to book slot on farm 2 miles up the road.	2 x tonne bags of black wrap, 1 tonne black sheet, 10 rolls of fertiliser bags and 1 of string.	£160/year	No additional costs
Large Mixed WO11	Local Council collect fortnightly	One-off fee	£150/yr	No additional costs
Large Cereal WO12	Self-deliver to local recycler – share transport with smaller neighbour	One-off fee plus handling charge for each load	£180/yr plus handling charge of about £35 per load	No additional costs

Table 3.2 Other waste materials – farm level data

Farm type	Waste Materials					
	<i>Animal Health products</i>	<i>Tyres</i>	<i>Batteries</i>	<i>Metal/scrap</i>	<i>Pallets/wood</i>	<i>Oils</i>
Large mixed WO1	Sealed box in locked cupboard, returned to vet.	Not waste – used to hold down plastic silage sheets. Others dealt with by tire dealer when renewed.	Used for electric fence units	Skip	Pallets collected by feed firm, or used for kindling	By dealers when serviced
Large cereals WO2	Sharps in locked cabinet – back to vet.	Local garage (£5 per tractor tyre)	Council tip	Local scrap man	Collected, very few used	Council tip
Large cereals WO3	Sharps box, back to vet.	Supplier take them back	Local waste depot	Local scrap dealer	Recycled/burned	Held in containers, take to local waste depot
Large mixed WO4	Yellow tub from vet.	Back to suppliers, costs c. £10 per tyre	To waste depot	Scrap merchant provides skip for no cost.	none	Bunded store purchased for storage (cost £300)
Large cereals WO5	Locked cupboard, sharps go back to vet.		Recycled – picked up by local dealer			Stored on-site in containers, collected by local dealer
Large dairy WO6	Sharps back to vet	Used to hold down plastic on silage clamp	Scrap dealer	Scrap dealer	Burned in stove	Got some stored in drums, need to get rid of it.
Large mixed	Back to vet	Sold to a man from	Sell to	Skip	none	Used for on-farm

WO7		Leicester	scrapyard			oil burner to heat workshop
Small mixed WO8	Bottles go in the boss's garbage, container for needles – back to vet.	Used in silage pit	Scrap merchant picks up	Scrap merchant picks up	Burned on fire	To waste depot
Small dairy WO9	Back to vet	Used on silage clamps	Scrap merchant picks up	Scrap merchant picks up.	Burn in homes, have some exemption	Stored on-site in containers. Engineer has offered to take but would charge.
Small dairy WO10	Protected in locked building and kept in bunded area.	Used on silage clamps	Self-delivery to local scrap merchant.	Self-delivery to local scrap merchant.	Burn in home, have exemption	Stored on-site in containers
Large Mixed WO11	Protected in locked building and kept in bunded area.	Self-delivery to local scrap merchant.	Self-delivery to local scrap merchant.	Self-delivery to local scrap merchant.	Burn in homes	Self-delivery to local scrap merchant.
Large Cereal WO12	Back to vet and sharp needle box but not full after 4 years	Tyre supplier keeps or takes them	Self-delivery to local scrap merchant or John Deere who have a scheme	Self-delivery to local scrap merchant.	Burn in home, have exemption and use Farm 2000 burner. Takes linseed bales	Use as lubricant and preserver on site

3.2 Policy Implementation personnel views on costs

Extent to which farm data is confirmed or refuted

The EA did not have any information on costs to farmers of regulatory compliance. There was some anecdotal information on the costs of plastics collection and disposal but no studies had been carried out on overall costs of compliance. In the view of the EA the only significant costs to farmers were for collection and disposal of plastics. It was felt that the exemption system had provided a lot of flexibility for farmers to re-use waste materials on the farm.

Defra had no evidence of costs imposed by the Regulations.

General views over larger area

Exemptions are reviewed annually by Defra and one issue that has been picked up is registration of waste carriers. Any business transporting its own waste needs to be registered with the EA and it seems this has not been happening. This is backed up by evidence from talking to farmers where it was clear several respondents were transporting waste to collection or recycling sites but not aware of the need to be registered as a waste carrier. In some cases it was felt that what was in fact no more than an annual event should not require registration.

Costs to the organisation

The EA itself had clearly incurred costs as a result of implementing and enforcing the legislation. There was no clear indication of the size of these costs though it was suggested they could be substantial and included:

- an IT system had been constructed to manage the registration and exemptions submitted by farmers (approximately 600,000 exemptions registered);
- provision of advice and guidance.

Enforcement was linked into other farm visits and thus would not incur separate costs. Light touch enforcement was practiced initially to allow farmers time to adapt to the new waste management regime.

Defra's costs were linked to the 'normal machinery of government'. The regulations had required liaison with industry and the EA, but no additional costs. Defra is currently providing input to the Macdonald Review (The Task Force on Farming Regulation) and seeking to simplify burdens of agricultural regulation and waste has been picked up as an issue, in particular problems arising from misunderstandings over the definition of waste. Another issue is exploration of ways to make compliance easier through enabling registration of a range of activities at the same time.

3.3 Other stakeholder views on costs

Extent to which farm data is confirmed or refuted

Information from plastics recyclers/collectors suggests that the farm level data is accurate. Most farms generate around 1 tonne of plastic per year. Farms tend to store plastic waste on the farm, usually in a dry place and separate different types of plastic. A significant amount of plastic sheeting is contaminated and/or dirty which raises collection costs. There was little information on other on-farm waste arisings.

General views over larger area: Agricultural waste plastic (AWP)

Data from 2003 suggests that agricultural plastic packaging represents approximately 1.5% of the overall volume of plastic packaging in the waste stream in England. There are an estimated 120,000 farm holdings producing approximately 21,000 tonnes of plastic packaging and 65,000 tonnes of non-packaging plastic per year (2003 data). Approximately 40% of the non-packaging plastic is thought to be contaminated in some way. The average quantity of plastic generated per holding (without contaminants) is approximately 0.5 tonnes per annum¹¹.

In a 2006 study¹² Valpak found that 92% of plastic waste collection schemes obtained wastes directly from farms and 46% from farm hubs (where plastics are stored centrally but usually on a farm). Only 19% of schemes collected from Licensed waste sites. The average number of farms visited for collection by operators was 107 although large regional collectors would visit from 100 – 400 farms per year. The average amount of waste collected varied with the majority of operators collecting under 1,000 tonnes per year and the large operators collecting over 1,000 tonnes per year. Two thirds of the sample of operators had been collecting agricultural waste plastic for less than one year and 84% indicated that specific cleanliness standards in their contracts with farmers.

A survey of the ten plastics re-processors indicated that 58,647 tonnes of agricultural waste plastic (AWP) was reprocessed in 2005-06 (88% of which was re-processed by four large companies) with a significant amount of spare capacity remaining. This represents 43% of the total of AWP being used at the time.

Defra undertook a consultation on a possible producer responsibility scheme for non-packaging agricultural plastics (NPAP) in 2009-10. The consultation revealed little support for a statutory collection scheme as the current private schemes were operating effectively. It is estimated that prior to the introduction of the Agricultural Waste Regulations in 2006, approximately 80% of agricultural plastic waste products were disposed of by burning or burying on farms¹³.

¹¹ Agricultural Waste Plastics and Recovery Programme (2011)
<http://www.agwasteplastics.org.uk/agri/about.html>

¹² Anderson, H., Nicolaou, K., Brassington, T. And N. Hudon. (2006) Agricultural Waste Plastics Collection and Recovery Programme (Valpak/ADAS).

¹³ Defra, (2010) Summary of responses to consultation on proposals on non-packaging agricultural plastics published. <http://www2.defra.gov.uk/news/2010/10/18/agri-plastics/>

Plastics recyclers/carriers

A large number of waste carriers/plastics recyclers were contacted for their views on the impact of the Waste Regulations, but only four actually agreed to respond to questions. In general the availability of agricultural plastics is viewed as a commercial opportunity although there is a significant amount of the waste stream that is contaminated in some way (e.g. chemical containers, silage sheets).

A wide variety of organisations are involved in collecting farm waste, from standard small contractors collecting and baling materials before passing them on to re-processors, to 'clubs' established to arrange for collection and disposal of waste plastic for their members. Operations of organisations vary from simple collection to baling, cleaning and re-processing. Collection costs also show some variation but seem to currently centre around £75 - 130 per tonne collected. The results of discussions are summarised below.

Waste carriers/recyclers suggest that only a proportion of existing waste is being collected for disposal/recycling. One carrier for example, suggested that about 50% of farmers fully comply with the regulations whereas others either do a little bit, in order to appear as if they are complying, or do nothing and continue to burn or bury their waste. A second carrier suggested that farmers seem to be getting more involved in recycling and correct waste management, and indicated that they are now more aware of what they are required to do. They have been getting a lot more enquiries lately and more farmers have been ringing up to get their records to show to inspectors.

Plastics Recycler 1

Located in the East Midlands was set up because of the introduction of the Waste Regulations. Before 2005 they were a firm of grain merchants. Many of their customers were asking them how they should deal with the forthcoming waste regulations so they decided to set up a separate company solely to deal with agricultural waste. They collect recyclable non-hazardous waste, pesticide containers (triple rinsed), silage bale wrap and silage pit covers, IBC fertilizer, feed bags and other bulk bags (inners & outers), feed buckets, cardboard, string and netwrap. They recycle approximately 1,000 tonnes of farm waste each year. Virtually all of the waste collected is recycled into a range of plastic furniture and horticultural and agricultural equipment (e.g. chicken coops, sheep pens) some of which is sold directly back to the farmers. In terms of the charge to farmers, there are two systems. The first is a liner system whereby farmers can fill a liner of 1800 litres with segregated waste. The farmer is charged £30 per liner, with a minimum collection of 3 liners. The second system involves a waste collection vehicle of 120 cubic yard capacity going to the farm to be filled with liners; it can fit up to 60 liners and farmers are charged £300 to fill it. If it is only arable waste there is not further charge, but farmers may be charged extra if the waste requires more complex processing. The collection systems and prices are flexible and depend on the quality, type and quantity of the waste.

Plastics Recycler 2

Collects plastic direct from farms in and around the counties of Hereford, Worcester, Gloucester and Shropshire and take it back to their centre for sorting and baling. It is then transported to

the plastics recycling plant where it is recycled into imitation timber used for benches, fencing, decking, street furniture etc. The collection charge for plastics is £85 + VAT per tonne and there are approximately 500-600 bale wraps to 1 tonne. If the farmer has less than ½ tonne for collection there is a minimum collection charge of £42.50 + VAT.

Plastics Recycler 3

The business was set up in response to the regulations in 2006. The managing director is a farmer himself so understands the issues facing farmers in the face of the regulations.

The company has a number of franchises throughout the East of England and recycle a range of agricultural plastics such as feed bags, shotgun cartridges, tree guards etc as well as cardboard. As well as farmers, they deal with shoots and clay pigeon shoots.

In terms of the cost to farmers, it varies between the franchises but the company recommend a guide price of around 75p per acre, although this varies depending on crop and yield. Some of the franchises charge per load but they weren't sure how much they charge for it. The price also varies according to the type of waste, what state it is in and where it has to be collected from (fuel costs). They have a set price for farming groups.

The company reports that some farmers store their waste for longer than they should so it isn't in the right state for recycling, requiring further processing, or must be sent to landfill. Sending waste to landfill costs the company £85 per tonne but they don't pass the cost onto farmers. Overall the company recycles 100% of shot cartridges and about 90% of all the other waste.

After they clean and shed the plastic they make it into extruded plastic which can then be sold into the plastics industry. It can then be made into anything other than food containers and children's toys. The price they receive for the plastic varies week by week (like fuel) so it is difficult to say what they get for it. The price they charge to farmers doesn't change so their profit margin varies depending on the price they receive.

There are no costs which the company incurs directly associated with the regulations.

Plastics Recycler 4

The business existed before the Regulation came out but was purchased by its present owners just before the Regulation came in.

They collect about 80-90 tonnes/month; around 1000 tonnes a year. The amount of waste they collect fluctuates depending on the time of year, with April being their busiest month.

The price they charge farmers is based on the acreage of the farmed area of the farm:

- <100 acres = £130
- 100 - 250 acres = £165
- 250 – 500 acres = £220
- 500-1000 acres = £300

The waste must be separated into bags by the farmer which can be purchased from the company for £6 or the farmer can use their own. Farmers are encouraged to fit as much waste in the bags as possible by squashing it down with a bale for example.

If the farmer delivers the waste himself to the site they don't make any additional charges, but if they collect the waste from the farm they charge £85 for collecting 16 bags.

Once the waste is on site, they wait until enough has built up and they bring in a baler to bale the waste. The waste is then sold on to recycling places. The price they receive for waste depending on its type but for silage wrap they get an average of £25 per tonne, although this varies month by month depending on how much of the waste is around. For example, a lot of silage wrap is being brought in from Ireland at the moment which is driving the price down.

The waste they receive from farms varies depending on the farm type. From horticulture units they generally get polytunnels and crop covering. From cow units they get a lot of silage wrap and feed bags and from arable farms they get seed bags and fertilizer bags.

Other Plastics Recyclers identified but not contacted

Solway Recycling

Established in 1992 and currently one of the longest and most established waste farm plastic recyclers, Solway Recycling Ltd has long experience in farm plastics recycling. Many recycled plastic products are sold back onto the farms from which agricultural waste has been collected, creating a closed loop both ecologically & physically.

The National Farmers Recycling Service (NFRS) has been developed by Solway Recycling Ltd. to help Farmers and Growers comply with the new waste legislation, and provide them with a comprehensive waste service. Each Farmer is given a NFRS Waste Policy, which includes a Recycling Certificate, a section for storing Waste Transfer Notes (Waste Transfer Notes are issued each time a Controlled Waste is moved). At the end of each year farms will be given an Annual Statement, which details all of the holdings waste movements for that period. Information held in the Waste Policy proves that you have disposed of your waste in an acceptable and legal manner. Farmers may also be asked to provide this evidence for the Environment Agency, SEPA, Farm Assurance or other regulatory bodies.

Allerton Recycling Club

The Game Conservancy Trust's Allerton Project at Loddington, in Leicestershire set up a 'Farm Plastics Recovery Club' to deal with the problem of farm waste such as fertiliser bags, feed sacks and other plastic packaging. When the Regulations were adopted the Trust held a Farm Waste Management Workshop to explain the new Agricultural Waste Regulations and to invite people to recycle their plastics on a monthly basis through the Trust's recycling scheme. Membership to the club is £40 per year and this includes providing a local plastic collection point for members once a month. The fee also includes providing a Transfer Note as well as feedback on the recycling scheme and updates on topical issues.

The Game Conservancy Trust was awarded a grant from Leicestershire County Council for £1,500 to help fund the purchase of a specially adapted baling machine. The machine can bale up to 30 fertiliser sacks at a time which are then palletised and delivered to a recycling plant in Loughborough for recycling into plastic pellets.

Table 3.3 Plastic Waste Recyclers contacted

Name of organisation	Activity	Quantities	Charges
Plastics Recycler 1	Collection of non-hazardous waste (mostly plastic)	1,000 tonnes per yr.	£30 per 1,800 litre liner filled; minimum pick-up is 3 liners. £300 for 120 cu yard capacity trailer.
Plastics Recycler 2	Collecting, sorting, baling, reprocessing		£85/tonne collected + VAT
Plastics Recycler 3	Operates through a number of franchises throughout the East of England; recycle a range of agricultural plastics such as feed bags, shotgun cartridges, tree guards, etc. as well as cardboard. Also deal with shoots and clay pigeon shoots.		Recommended guide price £0.75 per acre. Some franchises charge per load collected.
Plastics Recycler 4	Collect plastic waste – sell on to re-processors	1,000 tonnes/yr.	Based on farm size: <100 acres = £130 100 - 250 acres = £165 250 – 500 acres = £220 500-1000 acres = £300 Plus £85 for collection

Extent to which farm data is confirmed or refuted

The evidence from waste recyclers and collectors suggests that a significant proportion, but by no means all, of farm wastes are being collected and managed according to the regulations. One stakeholder also suggest that not all farmers might be abiding by the regulations.

Evidence from the recyclers/collectors suggests that costs reported by farmers for managing plastic wastes are realistic. Farmers in the sample indicated that costs varied from around £100 – 300 per year and amounts generated ranged from <1 – 5 tonnes. These figures seem to be in line with indicated charges from the carriers outlined above. The NFU are aware of ‘recycling clubs’ where organisations have been established to charge farmers for plastics collection which they then sell on to re-processors using the money to keep collection costs low. In general, however, the NFU did not have any information on the cost implications of the regulations for farmers. They had a sense that plastics were the most expensive aspect of the Regulations for farmers to deal with, but had no hard evidence.

Organisational costs and benefits

The NFU indicated that the Waste Regulations had increased the workload of the organisation requiring four people being trained up to answer technical queries at the national call centre, and creation of one full time post (in 2003-04) to oversee the area of agricultural waste and to lobby in this area on behalf of their member’s interests, both before the regulations were adopted and since. During the period 2005-07 a significant amount was spent on lobbying, workshops and other forms of communication.

3.4 Farmer views on benefits

Identify major benefits

The major benefits were identified as:

- Decrease in air and water pollution from stopping burning of waste
- Farms are tidier
- Livestock don’t get into waste plastics
- Farmers feel like they are contributing to a healthier environment.

Highlight differences between farm types, farm size or location

There were no significant differences noted between farm types. In general small farmers tended to have a lower level of understanding regarding the Regulations but this is just an indication and cannot be extrapolated from such a small sample.

Farms dealing with farm assurance schemes appeared to be more responsive to the regulations, and in many cases were already in compliance with many elements of the waste regulations regarding storage and management of hazardous wastes. The major concern was to ensure compliance with the farm assurance scheme rather than with EA regulations.

3.5 Policy implementation personnel views on benefits

Extent to which farm data is confirmed or refuted

Overall benefits are viewed as the reduction in pollution from open burning and burying of waste, and tighter controls of a range of other on-farm waste materials. The EA view the

regulations as bringing farming into line with other industrial sectors and resultant benefits from controlling a previously uncontrolled waste stream.

General views over larger area

Defra indicated there was some potential for conflict with Nitrate Pollution Regulations over the issue of composting as the Waste Regulations are seen as encouraging composting (including off-farm wastes). Another issue is cross-compliance and difficulties that arise when a farm is found to not have the required permit or exemption for an activity (usually through misunderstanding of the definitions of waste and need for an exemption), and this can cause problems in relation to single farm payments from the RPA.

3.6 Other stakeholder views on benefits

Extent to which farm data is confirmed or refuted

The NFU suggested that composting of green waste from municipalities was occurring on a number of farms (they have a list of 20 but indicated it was more widespread). It was suggested that some farms had invested in in-vessel composting, which was being used for on-farm as well as a mix of on and off-farm biodegradable wastes. It was suggested that farm produced compost might be considered as higher quality due to the care taken by farmers in ensuring good production standards.

There was no evidence of on-farm composting from the sample of farmers interviewed, and no interest in taking in off-farm green waste. This is one area where the picture is unclear as anecdotal evidence from some stakeholders suggested farm composting of wastes was widespread, farmers themselves suggested it was not.

4. Counterfactual

4.1 Farmer Views

Many farmers were already in compliance with regulations on storage and disposal of hazardous materials through the need to comply with farm assurance schemes.

It is unlikely that farmers would have stopped burning plastic in the absence of regulations – although some implied that burning was the only option available to them suggesting that they might have changed if other alternatives were available. The largest impact in terms of behavioural change is to move from regular on-farm incineration of plastic (and other waste), usually carried out in an old oil drum or metal container, to storage of plastic for annual collection. All farmers indicated that they would not have made this change without regulatory pressure.

Having made the change, however, most farmers report that they would not go back to burning, they would rather see the material recycled. No farmers indicated they would return to their old methods. This may in part be due to not wanting to indicate that they might ignore existing regulations, but for most farmers the costs did not appear to be an undue concern, there was no real increase in labour required, and the general attitude was that collection and recycling reduced on-farm pollution. One farmer, for example, indicated that he would “feel guilty” if he had a fire today and burned plastics.

4.2 Policy Implementation personnel views

The EA believe that farmers would not have changed any behavioural practices without the legislation.

The increase in fertiliser costs causes people to look at other sources of nutrients – such as compost, and the increased interest in composting and anaerobic digestion (energy from waste driven by higher energy prices) may have occurred in the absence of the regulations.

4.3 Other Stakeholder Views

The NFU suggested there were other drivers to dealing with pollution, in particular farm assurance schemes which many farmers belong to, and NVZs which are viewed as the main driver for decreasing water pollution. However, farm assurance schemes do not deal with plastic so are unlikely to have brought about changes in behaviour that are seen. Without the Regulations it was felt that on-site burning of plastics would continue, although there was a feeling that the EA may have used other pollution control regulations to control it following on-site inspections.

5. Overview of regulatory impacts

5.1 Farmer Views

Identification of differences between the actual impacts of the regulation on the farm, and the impacts originally anticipated.

Farmers did not know what to expect. There was no real awareness on the part of farmers or other stakeholders as to what impacts originally intended – other than stopping the on-farm disposal of waste, which has largely succeeded.

Farmers were not aware initially of the need for exemptions for a range of materials that they would not normally consider as waste (e.g. road planings, ditch dredging). Farmers find the need to register exemptions a burden – especially for activities in which they might engage only once a year or every two or three years. Understanding what constitutes waste continues to cause problems.

Overview of positive impacts resulting from compliance with the Waste regulations

In general farmers did not have much to say about either positive or negative impacts. The Regulations are not seen as unduly onerous, and in many cases farmers were already engaged in activities to control hazardous waste due to the need to meet requirements of assurance schemes.

A small number of farmers indicated some benefits, that farms appeared tidier, there was more thought put into where rubbish goes and how it is stored on the farm, and more awareness of what they were doing with waste materials. For example many farmers were now storing waste plastics under cover in order to ensure they are clean and dry when collected (collection costs are increased otherwise). One farmer indicated that in his view the benefits of the regulations outweighed the costs.

Overview of negative impacts resulting from compliance with the Waste regulations

The only aspects mentioned were the costs (in particular of plastics collection) and one farmer mentioned an increase in vermin (rats) due to the need to store fertiliser bags.

Relationship to other Regulations

There was no indication of any overlap with other Regulations. It was clear that many farmers had previously changed practices regarding storage and use of hazardous waste to meet farm assurance scheme requirements.

One farmer indicated that as a result of the Waste Regulations they had looked at other issues around the farm and ended up investing £3,500 on 'proper' bunded fuel storage, another larger farm indicated they had spent £13,000 on bunded fuel storage in 2007 but did not link it to the Waste Regulations.

Suggestions for improving the 2006 Regulations

There were no suggested improvements from farmers. Two farmers indicated that there were still some 'rogues' who were not in compliance with the regulations and suggested that enforcement might be improved.

5.2 Policy Implementation personnel views

Extent to which farm data is confirmed or refuted

The EA indicated that compliance was not complete and there were still some farmers not aware of their responsibilities. Overall they felt the legislation brought benefits at little cost to farmers.

The most difficult aspect of the Regulations as far as Defra is concerned is the confusion over what constitutes a waste material. Getting this communicated in a clear and simple manner is still seen as the biggest challenge.

Anaerobic digestion was not viewed as a viable activity for most farms by Defra. It was felt it might be suitable for a small number of large farms but not the majority. Defra did note that there was a lot of interest from a wide range of people looking to spread materials on land, as a result of regulations to divert wastes away from landfill.

General views over larger area

Central government stakeholders intended to bring agriculture into line with other sectors of industry. It was realised the large numbers of small businesses would present a problem and more effort was put into communicating the aims and requirements of the regulations to encourage compliance. The major differences have been the large number of exemptions registered (over 500,000) and the misunderstandings over the definition of what constitutes waste.

5.3 Other Stakeholder Views

General views over larger area

The NFU indicate that benefits in the form of reduced pollution are the most likely outcomes from the regulations. Pollution events are less likely to occur if waste is managed and disposed of properly.

6. Sources of information on the regulation

6.1 Farmer Views

Summary findings of how farmers obtained information

A mix of sources of information were utilised including:

- Land Agent
- Course and workshops (FWAG, NFU, etc.)
- Advice days, meetings (not always on waste but sometimes for other events where they found out about the Waste Regulations, e.g. sprayer certification courses)
- Information sent through the post (Defra/EA)
- Membership of farm association
- The farming press
- The internet
- Talking to friends and neighbours
- Commercial waste operators

All farmers had received information from at least one source. Several had attended meetings or workshops to find out about the regulations. At some workshops farmers had registered for exemptions at the meeting, which was felt to be particularly helpful. Others indicated that they had received information but there had been no real follow-up on what to do. One farmer

indicated that the most useful *practical* advice had been from waste contractors who explained what they needed farmers to do.

Quality of information available

The majority of farmers felt that had been given adequate advice and support on what to do to comply with the Regulations. One farmer indicated that they had continued with their existing waste practices for the first year after the regulations had been adopted, looked around at options and then selected the most suitable approach to come into compliance.

Adequacy of support

Most farmers felt they had sufficient information and noted that the regulatory requirements were not very onerous. No farmers in the sample indicated that they had been inspected in relation to the Waste Regulations.

One farmer indicated he had help from a farm assurance scheme that provided advice to help bring his farm into compliance with the Regulations.

6.2 Policy Implementation personnel views

Extent to which farm data is confirmed or refuted

The EA indicated that much more provision was made to support the introduction of these regulations than for most other regulations, in terms of advice, guidance and support. The provision of advice and supporting guidance was described as “a Rolls-Royce job” and in the view of the EA most farmers were aware of the requirements of the Regulations.

Defra indicated that there had been large amounts of effort in simplifying the regulations and providing advice and guidance. They noted that the main farming organisations had stated the legislation was well promoted and well implemented.

6.3 Other Stakeholder Views

Extent to which farm data is confirmed or refuted

There seems to be agreement between farmers and stakeholders that there was plenty of information and guidance on what needed to be done. However, this has not prevented some misunderstandings, which might account for the limited number of farms registering exemptions, and the lack of understanding over which materials are and are not considered as wastes under these Regulations.

General views over larger area

The NFU felt there had been a lack of guidance and advice from other organisations and were currently engaged in producing a brochure to inform farmers of what they can and cannot do under the regulations. EA guidance was felt to be very technical and detailed and aimed more

at waste disposal experts than at farmers. A large number of enquiries had been received requesting practical guidance for farmers on how to comply with the regulations.