CONTENTS **Page**

APPENDICES

ABBREVIATIONS AND ACRONYMS

AHD	Animal Health Division
APHIS	Animal and Public Health Information System
BCT	Backward Check Test
BR	Brucellosis
BSE	Bovine Spongiform Encephalopathy
CFT	Complement Fixation Test
CVO	Chief Veterinary Officer
DAFRD	Department of Agriculture, Food and Rural Development
DARD	Department of Agriculture and Rural Development
DEFRA	Department of Environment, Food and Rural Affairs
DFP	Department of Finance and Personnel
DMB	Departmental Management Board
DNA	Deoxyribonucleic Acid (polymer carrying genetic information)
DVO	Divisional Veterinary Office/Officer
EC	European Commission

(Continued overleaf)

ELISA	Enzyme Linked Immunofluorescent Assay
EU	European Union
FCT	Forward Check Test
FMD	Foot and Mouth Disease
GB	Great Britain
GIS	Geographical Information Systems
I-EIA	Indirect ELISA (term used by DAFRD)
LCT	Lateral Check Test
MLA	Members of the Legislative Assembly
MRT	Milk Ring Test
NI	Northern Ireland
NIAO	Northern Ireland Audit Office
NPV	Net Present Value
NPC	Net Present Cost
NSMC	North/South Ministerial Council
OBF	Officially Brucellosis Free
OTMS	Over Thirty Months Scheme
PAC	Public Accounts Committee
ROI	Republic of Ireland
SAT	Serum Agglutination Test
TB	Tuberculosis
TOR	Terms of Reference
UK	United Kingdom
UTMS	Under Thirty Months Scheme
VO	Veterinary Officer
VS	DARD Veterinary Service
VSD	DARD Veterinary Science Division

1. EXECUTIVE SUMMARY

1.1 Introduction

This document represents the Department of Agriculture and Rural Development's (DARD's) review of the approach adopted to control and eradicate Bovine Brucellosis (BR).

This report has been developed for consideration by DARD's Departmental Management Board (DMB). It is envisaged that the DMB will consider the issues and policy options presented within this document to form the basis of a revised approach to BR eradication.

Given considerable political and other pressure to complete this review exercise quickly, DARD has judged it preferable to complete the exercises as fully as possible within a timeframe that facilitated completion by the end of March/early April 2002. The option of taking longer to produce a more detailed report (e.g. to include an equality impact assessment of proposals) was thought to be unacceptable, given that the incidence of the disease continues to rise.

Consequently, the proposals that form the recommended policy approach, are largely based on indicative costs and qualitative assessments of their benefits.

1.2 Factors Driving the Need For a Policy Review

- DARD has a policy of periodic review of its major animal health programmes, including BR and Bovine Tuberculosis (TB);
- Following a period of many years when the disease was entirely absent from Northern Ireland (NI), the prevalence of BR has increased significantly;
- The increasing levels of BR pose significant human and animal health risks and the disease is of real economic significance to the agri-food industry, as it causes abortion in cows, with the possible sequel of infection and infertility;
- The current testing and compensation arrangements associated with BR mean that it is becoming a serious drain on DARD manpower and financial resources. The cost to DARD of the BR eradication programme in 2000/01, i.e. the last full financial year prior to the Foot and Mouth Disease (FMD) outbreaks, exceeded £10.7 million; and
- European Commission (EC) legislation also places constraints on how the disease is monitored and controlled, which must also be taken into consideration, given the increased prevalence of the disease.

1.3 Value For Money of Current Approach

An assessment of the efficiency of the BR eradication programme highlights that efficiency measures based on staff costs suggests that efficiency has been maintained or improved over the period profiled, except for the year 1999/2000. However, when the effectiveness of the BR eradication programme is assessed in terms of its actual results compared to those intended, it is clear that it has not been 'effective'.

Consideration of costs and benefits associated with the BR eradication programme indicates that it requires a relatively low level of economic benefit (as a proportion of the sectors output) to cover its costs. However, the level of benefit produced by the programme cannot be accurately quantified, as it is difficult to predict the value of losses that would occur in the absence of such a programme.

The Republic of Ireland (ROI) experienced BR trends comparable to NI up to 1999, when it achieved a marked reduction in the disease. This suggests that there are aspects of the ROI's approach that, if applied to DARD's programme, could facilitate an improvement of the effectiveness of DARD's BR eradication programme.

1.4 Future Policy Aims, Objectives and Performance Measures

The Group responsible for this policy review has developed the following aim and objectives to guide the future BR eradication programme.

1.4.1 Overall Aim

To eradicate BR from NI within seven years of implementation of the revised programme.

1.4.2 Intermediate Objectives

To reverse the trend in BR outbreaks, so that it is reduced to less than 150 outbreaks per annum within three years of implementing the revised programme; and

To reduce the 2000/01 level of BR compensation payments by at least £1.5 million within three years of implementing the revised approach.

1.4.3 Immediate Objectives

To ensure compliance with EU Directive 64/432.

1.4.4 Future Performance Measures

The performance of the revised DARD BR eradication programme will be measured in the future using the following key performance indicators:

- total cost of the BR control programme;
- compensation paid per year;

- compensation paid per reactor[1]/in-contact[2];
- number of breakdowns, reactors and in-contacts per year;
- total cost of taking a sample;
- total cost of carrying out sample analysis; and
- the cost of DARD's Veterinary Service's administration per test.

1.5 Areas Offering Improved Economy, Efficiency and Effectiveness

The policy review team identified the following as measures that would improve the economy, efficiency, effectiveness and/ or statutory compliance of the existing policy.

1. European Commission (EC) Directive 64/432 Compliant Testing

DARD currently carries out annual testing in the three Divisional Veterinary Office (DVO) regions with the highest BR incidence and carries out biennial testing for herds in its other seven DVOs. It is proposed that DARD maintains biennial testing for dairy herds in the other seven DVOs, utilising monthly bulk milk sampling, and introduces annual testing for non-dairy herds in these areas. This would provide compliance with the 64/432 Directive.

2. Use market prices for valuation and introduce compensation ceilings

Valuation of animals is currently carried out by DARD staff except where an independent valuer is requested by a herd owner. Valuations are carried out on a subjective basis. Compensation is currently paid for BR reactors at 75 per cent of its valuation. No limits are in force in relation to compensation for BR in-contact animals.

It is proposed that:

- initial valuations be carried out by strict reference to a list of market prices produced by DARD on a weekly basis;
- the herdowner be given two working days to accept the valuation or to request an independent valuation;
- independent valuations be carried out at the herdowner's expense by reference to a list of independent valuers, which will be maintained by DARD;

[1] a 'reactor' is an animal that has shown a positive result to a recognised BR test

[2] an 'in-contact' is an animal, which although produces a negative test result, has been at risk to exposure to the brucella organism

- where valuations are considered unacceptable to either the herdowner or DARD, the matter will be referred to an arbitration panel consisting of a professional arbitrator, an industry representative and a DARD representative;
- a ceiling of £1,500 for compensation on all in contact animals, including pedigrees be introduced; and
- DARD will seek powers to deduct compensation where a herdowner has been proved to be negligent (e.g. in relation to failure to test on time, failure to report abortions, failure to properly dispose of abortions, failure to isolate the aborting animal, failure to cleanse and disinfect etc).

3. Introduce a targeted programme of testing under 30 month cattle at abattoirs

The Review Group proposes that a targeted programme of sampling of cattle aged less than 30 months takes place at slaughter. This will provide an additional level of surveillance of cattle in herds that neighbour a breakdown.

4. Directive 64/432(EC) compliant pre movement testing

It is proposed that the BR eradication programme incorporates pre-movement testing to ensure 64/432 compliance.

5. Enhance/implement powers to enforce housing and movement restriction

It is proposed that DARD clarifies, obtains and/or implements powers to enforce:

- the restriction of cattle to specific farm locations (e.g. the home farm); and
- the restriction of cattle within farm locations to particular areas of the premises (e.g. specific fields/buildings).

6. Enhance/implement powers relating to depopulation, restocking and slurry treatment

It is proposed that DARD clarifies its current powers and/or obtains powers to enforce:

- a six-month break between depopulation and restocking with breeding cattle, following a breakdown; and
- treatment of slurry of infected herds with Thick Lime Milk to minimise the risk of any potential spread of infection via this route.

7. Evaluation/ implementation of biometric identification of cattle

It is proposed that the feasibility of biometric identification of cattle using current genotyping technologies be determined, including the evaluation of appropriate new developments on sampling, DNA analysis and eye-imaging.

8. Augmentation of DARD's Animal and Public Health Information System (APHIS)

It is recommended that a working group is established to review the BR (and TB) control functionality on DARD's Animal and Public Health Information System (APHIS) and make comprehensive and specific recommendations for modifications and improvements. It is suggested that the recommendations emanating from the working group be funded as a priority issue, either under the umbrella of APHIS Phase II or otherwise, and that modifications to APHIS start before September 2002.

9. Re-evaluation of Diagnostic Tests

DARD propose to embark on a programme of laboratory experimentation and comparative field testing including parallel testing in order to provide a platform for future decision making on how the current testing regime could be modified or enhanced, to deliver value for money.

Specifically, it is proposed that DARD screens higher risk cattle with two tests, the traditional SAT and a serological ELISA. This would be carried out in a pilot study in the worst affected area in Northern Ireland and involve approximately 5,000 cattle. The prime purpose of the study is to identify infected herds as early as possible and thus reduce the likelihood of spread especially during the grazing period.

DARD also propose to produce a protocol for an extensive parallel trial, nested within the BR programme, whereby the sensitivity and specificity of the SAT relative to a range of other tests is assessed.

1.6 Option Generation and Analysis

In order to determine the relative merit of each of the above proposals, they were subjected to a weighting, scoring and rating process. By combining proposals with different ratings differing policy options were then developed. The shortlisted options are described below.

Option 1 - Do Nothing (actual) - the do-nothing option is the base case against which all other options are measured. In this case it reflects the current nature and level of activities carried out by DARD in relation to BR. The financial year 2000/01 has been used to form the base case, as it is more representative of DARD's activities than 2001/02, as 2001/02 was dominated by the FMD crises. 2001/02 expenditure levels have been adjusted to reflect recent bids for the 2002/03 financial year.

Option 2 - Do Minimum - this option reflects an eradication programme that is fully resourced as reflected in bids for the 2002/03 financial year, plus changes to the current policy that ensures compliance with the EU 64/432 Directive i.e. introducing annual testing for non-dairy herds in seven DVOs, in addition to the three DVOs where annual testing currently takes place and introducing pre-movement testing.

Option 3 - Option 'Class A' Modifications Only - whereby, in addition to the changes associated with Option 2, the current policy is modified to incorporate:

- the use of market prices for valuation and introduce compensation ceilings;
- enhancement/implementation powers to enforce housing and movement restriction;
- augmentation of APHIS;
- enhancement/implementation of powers relating to depopulation and restocking; and
- re-evaluation of diagnostic tests.

The policy review team considers that the package of measures provided by this option provides the minimum level of change required to achieve the identified policy aim and objectives.

Option 4 - Class A, B and C Modifications - whereby the current policy is modified to reflect those incorporated under Option 3 plus:

- evaluation/ implementation of biometric identification of cattle; and
- introduction of a targeted programme of testing under 30 month cattle at abattoirs.

DARD's Veterinary Service (VS) advises that the implementation of 'Class B and C' modifications in addition to 'Class A' modifications will facilitate the achievement of the policy's aim and intermediate objectives by three to four months earlier than implementing 'Class A' modifications (Option 3) alone.

1.7 Quantitative and Qualitative Analysis of Options

Table 1.1 below summarises the results of a qualitative and quantitative analysis of the shortlisted options over a seven-year period.

Table 1.1

Quantitative and Qualitative Results

	Description	**NPV (£s)***	**Weighted Score**
Option 1	Do Nothing	-76,419,458	0
Option 2	Do Minimum (64/432 compliant only)	-83,612,914	344
Option 3	Class A Modifications	-69,833,552	460
Option 4	Class A, B and C Modifications	-72,318,085	487

* Cumulative NPV over a seven year period

The preferred option is Option 3, as it achieves a lower NPC/higher NPV than the other options (base case and non base case) options, while delivering a level of qualitative benefit that is only surpassed by Option 4. Even though Option 4 has

additional qualitative benefit, this is at a marginal economic cost of £2.5 million. Taking everything into account, it is considered that Option 3 represents the most economic method of achieving the policy objectives.

Whilst the preferred option provides the "best fit" in terms of the quantitative and qualitative analysis, particular areas of uncertainty remain to be addressed. The main areas of uncertainty are:

- DARD's ability to secure legislative change;
- the ability of the revised policy to secure industry and political support;
- change in policy in ROI and/or GB;
- the ability to secure financial and human resources to implement the proposed policy changes;
- the underlying prevalence of BR in NI. The number of reactors identified in the first three months of 2002 is significantly higher than that identified in previous years. This may be a result of the postponement in testing in 2001 due to FMD, but it may also be related to a general increase in the underlying incidence of the disease. The extent to which the increase can be attributed to either of these factors cannot be assessed at present.

1.8 Recommendation

The policy Review Group recommends that DARD should proceed with development of Option 3 – the preferred option.

This option entails the following changes to the existing policy:

- introduction of EU 64/432 compliant annual testing and pre-movement testing;
- the use of market prices for valuation and introduction of compensation ceilings;
- enhancement/implementation of powers to enforce housing and movement restriction;
- augmentation of APHIS;
- enhancement/implementation of powers relating to depopulation, restocking and slurry treatment;
- re-evaluation of diagnostic tests;
- the creation of an industry forum; and
- an enhanced education and awareness campaign for herdowners.

In response to industry views, the Review Group also recommends that a BR Consultative Forum be established to contribute to the implementation and

development of the eradication policy. This group will be comprised of representatives of all key stakeholders and will provide a formal means of sharing and discussing issues relating to the control of BR. It is envisaged that this group would meet twice a year.

The Review Group also recommend that an animal health/disease prevention lifelong learning programme be implemented to improve bio-security and to help reduce the risk of spread of animal diseases between farms.

Also, while this review has considered the major options for dealing with BR, it has not been exhaustive and there are many other areas where further work should be done. These include:

- the use of Geographical Information Systems;
- bar coding of samples; and
- review and consolidation of BR related legislation.

Therefore, the Review Group recommends that all of the above issues be explored further.

Given the processes involved in obtaining ratification and funding for the identified proposals, it is envisaged that the revised policy will first impact on the 2003/04 financial year. However, the Review Group recommends that, where possible, implementation of the revised policy (or elements of the revised policy) be 'fast-tracked', given the worsening disease position.

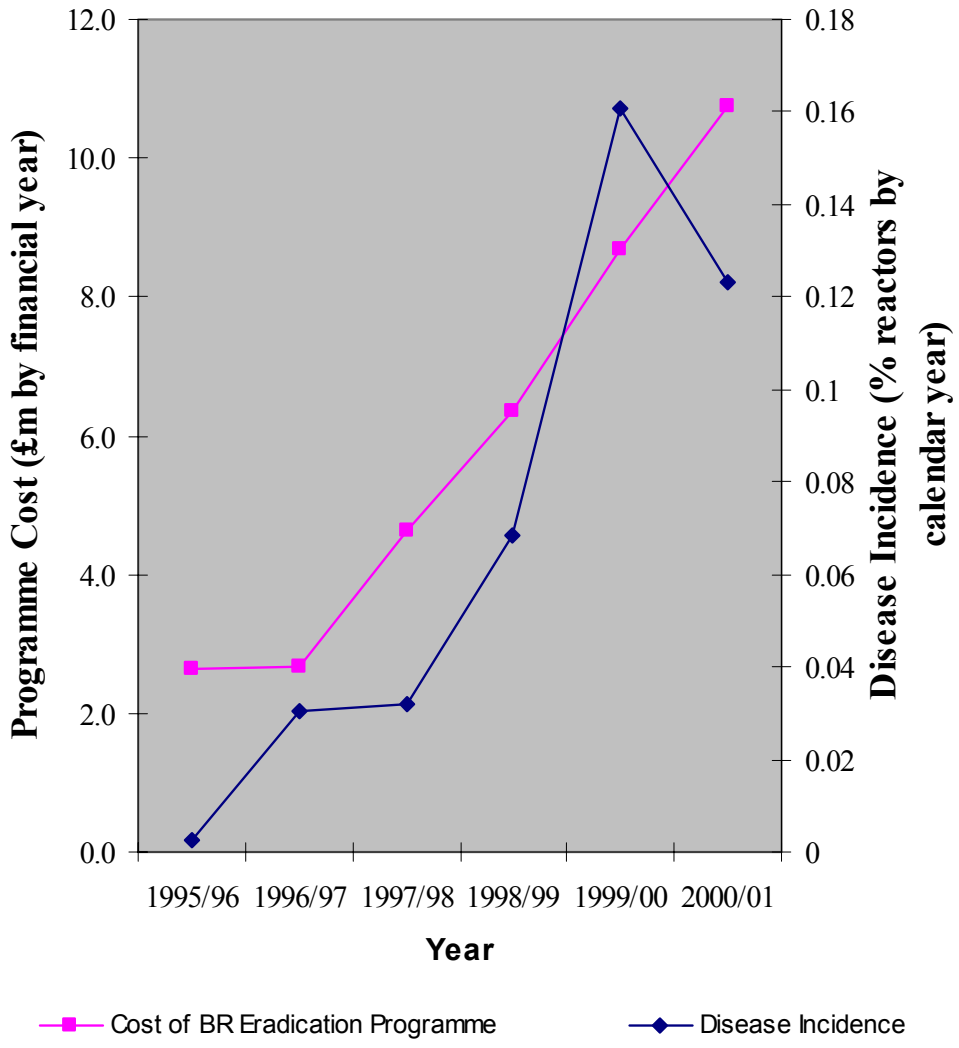
2. RATIONALE, SCOPE AND DESIGN OF THE POLICY REVIEW

2.1 Rationale for the Policy Review

Following a period of many years when the disease was entirely absent from Northern Ireland (NI) or present only in a sporadic sense, the past few years have seen a significant increase in the prevalence of Brucellosis (BR) within NI. In recent years the Republic of Ireland (ROI) has experienced a similar increase. Figure 2.1 identifies that the current control policies of the Department of Agriculture and Rural Development (DARD) have yet to show any sign of halting the increase in incidence.

Figure 2.1

DARD Cost of BR Control/BR incidence



Apart from the human and animal health risks posed by increasing levels of BR, it is of real economic significance to the agri-food industry as BR causes abortion in cows with the possible sequel of infection and infertility. In addition, the current testing and compensation arrangements associated with BR mean that it is becoming a serious drain on DARD manpower and financial resources. Also, European Commission (EC) legislation places constraints on how the disease is monitored and controlled.

Against this background, the purpose of this review is to assess how DARD has been tackling the issue and to examine how it might more effectively and efficiently do so in the future. The current approach to BR has not previously been subject to formal review by DARD.

2.2 Scope and Design of the Review

The scope of the policy review is detailed within its Terms of Reference (TOR), which is attached as Appendix I for reference. That document, which was agreed by the Department of Finance and Personnel (DFP), identifies the aim as being:

- To review the effectiveness of the Department's current approach to the eradication of bovine BR and evaluate in particular the value for money afforded by the present approach;
- To take account of scientific, veterinary and political developments since the policy was established, including:
  - any alternatives to the current policy of slaughter and compensation;
  - the scope for greater efficiency;
  - long-term disease trends in ROI, GB and in NI;
  - the controls aimed at preventing the disease spread from the ROI;
  - the changed political environment in NI and the potentially different approaches to compensation etc which arise in consequence;
  - scientific developments relating to alternatives and/or adjuncts to the present tests;
  - current research strategies within DARD; and
  - implications of genetic traceability in relation to fraud in the areas of movement control, identification and testing;
- To make recommendations to the Permanent Secretary and Minister for a policy to be adopted during the period until 2005 and the arrangements necessary for its effective delivery;
- particular attention will be given to:
  - establishing the rationale for the policy;

- identifying the policy's aims;
- specifying its objectives;
- factors involved in the current epidemic;
- the effectiveness of the current testing frequency;
- alternatives, if any, to existing testing methodologies;
- the current approach to compensation including valuation, rates of compensation and salvage;
- action being taken in the ROI;
- quantification of the costs and benefits of the present policy, including the identification of specific performance measures and indicators of impact and value for money;
- any assumptions underlying the policy and their continued appropriateness;
- any unintended side effects in terms, for example, of equality, of the present policy;
- the public expenditure implications of the future policy options and recommendations identified;
- the gaps in knowledge and the need for research and development; and
- the role of DARD's Animal Public Health Information System (APHIS) in control strategies;

■ the review will take account of any relevant conclusions reached in the parallel exercise relating to bovine TB.

2.3 Factors Constraining the Policy Review Process

Originally, this Review was to have been completed by 31 March 2001. However, the NI FMD outbreaks intervened and further work on both this exercise and the parallel one on TB was impossible until late in that year. At that stage, there were considerable political and other pressures to complete both this exercise and the TB policy review quickly. Moreover, it was apparent that while DARD had been preoccupied with dealing with FMD, both TB and BR had been spreading. For all those reasons, a revised target date of 31 March 2002 was set.

It was clear that completing two detailed policy reviews in parallel and within a period of some four months was not going to be possible. However, DARD judged it preferable to complete the exercises as fully as possible within a timeframe that facilitated completion by the end of March/ early April 2002, so as to produce tangible proposals capable of impacting upon the disease quickly. The option of taking longer to provide a more detailed report (e.g. the incorporation of an equality impact) was not thought to be acceptable, as the disease continued to spread.

The proposals contained in this document and to be taken forward will, of course, be subjected to full analysis covering both the financial and equality dimensions before being implemented.

Finally, while this document considers the major options for dealing with the disease, it cannot be exhaustive. There are many other areas where further work can and should be done. Examples relate to Geographical Information Systems, bar coding of samples and review and consolidation of legislation. To have explored all of these issues now would have further delayed the completion of this Review and such issues have not therefore been specifically addressed. The Group recommends that all of the above issues be explored further.

2.4 Memorandum of Reply from DFP on the Fifth Report from the Public Accounts Committee Session 2001/2002 (BR Outbreak at the Agricultural Research Institute, Northern Ireland (ARINI))

The Memorandum of Reply from DFP on the Fifth Report from the Public Accounts Committee Session 2001/2002 committed DARD to a number of actions in response to PAC criticisms of the way it handled a BR outbreak at ARINI, Hillsborough during 1999.

Many of those undertakings were free-standing and independent of the present Policy Review process. Examples include those relating to:-

- the restocking policies and procedures in DARD institutions;
- the dissemination of disease information to neighbouring herdowners;
- the timeliness of its tracing procedures;
- the handling and pursuit of prosecutions; and
- DARD employment equality issues.

Some undertakings did, however, require to be addressed in the Policy Review process itself. These were as follows:-

PAC Conclusion 5.35

"We find it particularly worrying that, within the Department itself, there was such a slow response to the Brucellosis threat, especially against a background of spiralling costs. Had the Department been more vigorous in its response in the early stages of the current outbreak, it is likely that it could have reduced the spread of the disease and thereby avoided at least part of the substantial cost to the taxpayer. It is wholly unacceptable given the many demands on scarce public funds, that the Department has to waste such large sums on unproductive compensation payments.

The Department accepts the Committee's view that it is wholly unacceptable to waste large sums on unproductive compensation payments. The Department is undertaking a review of its Brucellosis eradication policy which is due to be completed in March 2002. The Terms of Reference of the Review are appended. The

Review will cover all the areas of the Committee's concerns including compensation. Following the Review targets will be set in relation to eliminating the disease."

The Review has addressed all those areas of PAC concern that were appropriate and, in particular, the issues of compensation and disease reduction targets.

PAC Conclusion 36

"The annual cost of compensation for Brucellosis has risen from £200,000 in 1996/97 to £9.3m in 2000/01, with more than £22m have been paid out in the 5 years to March 2001. This appears to us to be illustrative of a worrying failure on the part of the Department to get to grips with the Brucellosis threat and suggests that it has lost control of the situation. The Accounting Officer accepted that the trend is very worrying. ***We note his assurance that the Department is doing all that it can to effect eradication of the disease. However, we would expect the Department to set targets and timescales to effect the*** **eradication** ***of this disease and report its performance back to this Committee. This should result in a progressive reduction in the overall sums of compensation being paid by the taxpayer and we see this as one of the main performance indicators for assessing the success of the eradication programme.***

The Department fully accepts the need to do all it can to effect the eradication of Brucellosis. The policy for doing so is currently being reviewed in the course of the policy review process. The Review will set targets and a timetable for achieving a reduction in the incidence of this disease, from which a reduction in compensation will flow. This exercise is due for completion by March 2002. The Department will then consider its recommendations and where appropriate consult the industry with a view to developing a comprehensive plan by 30 September 2002. The Department will be happy to report its performance back to the Committee."

The Review Report addresses these issues at Section 1.4 and Section 9.

PAC Conclusion 37

"One of the Department's main strategies to eradicate Brucellosis is its routine testing programme ……. However, it is clear that, despite this biennial testing programme the incidence of Brucellosis in Northern Ireland has been steadily increasing since 1996. In our view, this raises questions as to the cost-effectiveness of the testing scheme. The Accounting Officer said that the Department was currently reviewing its policy on eradication. ***We would ask the Department to include, as part of that Policy Review, a detailed assessment of the cost-effectiveness of its current testing programme.***

The Department accepts the Committee's comments and assures the Committee that the cost-effectiveness of the current Brucellosis testing programme is being addressed as part of the Policy Review referred to in the previous response, which is due for completion by March 2002."

The Review Report addresses these issues at Section 1.3 and Section 8.

PAC Conclusion 38

"We found it amazing that in the 3 years after August 1996, when the current Brucellosis epidemic started, the Department did not issue any general Press Releases on the disease. ***We are in no doubt that a greater level of publicity about Brucellosis and how to combat it, would have contributed significantly to tackling the problem and keeping down the cost to the taxpayer. We expect the Department to take every opportunity in the future to publicise the threat.***

The Department accepts the Committee's view and agrees that it could have done more to publicise the Brucellosis outbreak at a time when it was increasing in scale and impact. The Department will continue to take every opportunity to publicise the threat.

A new publicity initiative has been launched by the Minister aimed primarily at increasing Brucellosis awareness, prevention and recognition. This issue will also form part of the Policy Review."

The Policy Evaluation Group discussed the issue of publicity and the raising of public awareness at some considerable length. It was accepted that this was a crucial area and one in which the Department's performance needed to be improved, but it was not seen as an issue for decision or recommendation by the Policy Evaluation Group, given that the need to follow it through was self-evidently something that the Department could do at relatively modest cost. No further analysis of the issue was therefore considered necessary and the DARD Veterinary Service has therefore been charged with taking it forward and is doing so, as per the Department's response to PAC Conclusion 15 in the Memorandum of Reply, as detailed below.

PAC Conclusion 15

"…. the onus is on the Department to establish what information it can legally and correctly make public to herd owners. Accordingly, we would ask the Department to establish the scope for doing so and to begin disseminating this information at an early stage. We welcome the Accounting Officer's undertaking to pursue the setting up of a 'bulletin board', in the local agricultural press and the Department's website, as a means of doing so.

The Department accepts the Committee's recommendation and will establish with its legal advisers the scope for disseminating disease information to herd owners as early as possible.

The Department also accepts the need for effective publicity on Brucellosis. Press releases, press articles and advertisements supplying information and advice on disease prevention, recognition and reporting will be placed in the local agricultural press. The use of publicity opportunities such as the broadcast media, which have not previously been used, is planned. In addition, the recruitment of a full time webmaster to develop the Veterinary Service website is underway, which will allow this medium to be upgraded to provide up-to-date information and advice for farmers.

Furthermore, meetings have been arranged with farmers in the worst-affected regions. Letters have also been sent to 5,200 dairy farmers explaining the role of the Veterinary Service in helping them to detect disease.

The service offered to farmers includes the provision of information on brucellosis disease levels on a geographic basis, information on DARD's procedures for routine disease control activities and in relation to brucellosis breakdown herds. Additionally advice is provided on disease prevention, recognition, reporting of suspected disease and advice on public health aspects.

The Department's most recent action plan is as follows:-_

- *March 2002: article and advertisement in Northern Ireland Veterinary Today*
- *April 2002: major article and advertisements in farming and local press*
- *April 2002 : launch of website bulletin board*
- *May 2002 and monthly thereafter: follow-on articles and advertisements in farming and local press*
- *May and thereafter: advertisements in agriculture show and breed society catalogues*
- *Use of broadcast media to highlight food animal disease issues.*

There will be on-going assessment of these activities and development of other means of communicating the Department's messages on brucellosis disease eradication."

2.5 The Policy Review Group

The members of the DARD team responsible for overseeing the policy review process and for developing this report are detailed overleaf.

	Division
Mr Owen Denny	Veterinary Service
Mr Jim Ditchfield	Resource Control Division
Mr Johnston Given	Animal Health Division
Mr Stewart Johnston	Animal Health Division
Mr Stanley McBurney	Economics and Statistics Division
Dr Sam McCullough	Veterinary Science Division
Ms Cecilia McGarrigle	Animal Health Division
Dr George McIlroy	Veterinary Service
Mr Roy Watt	Veterinary Service

In addition to the above, Mr Darrell Abernethy (Veterinary Service), provided extensive epidemiological data contributing to the policy review.

2.6 The Purpose of This Report

This document has been developed for consideration by DARD's Departmental Management Board (DMB). It is envisaged that the DMB will consider the issues and policy options presented within this document to form the basis of a revised approach to BR eradication. Following DMB's decision on the course to be adopted, in principle, any necessary additional appraisal or assessment required to progress the proposals represented by the preferred option will be carried out.

3. STRATEGIC CONTEXT

3.1 Introduction

The following section documents the review of the policy context within which current DARD BR policy is developed. This analysis is aimed at ensuring that future policy development is consistent with relevant strategies, policy directives and pronouncements relating to BR control.

3.2 European Commission Directives

The following EC directives apply to DARD's BR disease control policy:

- Directive 64/432/EC deals with animal health problems affecting intra-Community trade in bovine animals and swine. The annexes to the Directive detail the testing programmes and the technical detail of the tests that may be carried out in order to fulfil the requirements of the Directive;
- Directive 64/432/EC has been amended by 97/12/EC (intra-Community trade) and 98/46/EC (testing programmes);
- Directive 98/46/EC consists of the amended Annexes A, D (Chapter 1) and F, which are the non-technical annexes of 64/432. These annexes describe the requirements and testing programmes that must be observed by the Member States (MS) in order to achieve and retain officially free status from:
  - TB;
  - BR; and
  - Enzootic Bovine Leucosis.

Bovine animals for breeding, production and slaughter must come from Officially Brucellosis Free (OBF) herds. Both intra community and third country trade in animal products rely on our ability to certify that the herds of origin are OBF etc. Milk must be heat treated unless it comes from an OBF herd.

Annex A II of the Directive lays down the guide lines for attaining and retaining OBF status on a regional basis. MSs must report all occurrences of BR to the Commission. If there is significant change, the Commission may suspend or revoke the OBF status until the requirements of the Directive have been met.

A herd is OBF if:

- no animals have been vaccinated in the last three years;
- all bovines over 12 months have had two blood tests within 12 months, or three milk and 1 blood test; and

- all bovines entering the herd come from an OBF herd and if those over one year old have had a clear 30 day pre- or post-movement test.

Males for fattening are exempt from BR tests so long as they come from an OBF herd and the competent authority guarantees that they will go directly from the farm to slaughter.

A herd will retain OBF status if:

- eligible cattle over 12 months of age are tested for BR every second year while prevalence of the disease remains below 0.2 per cent of herds;
- all bovines entering the herd come from OBF herds; and
- where the incidence is > 0.2 per cent animals must have clear 30 day pre- or post-movement tests.

Pre-or post movement testing is not required if the incidence of the disease remains below 0.2 per cent for at least two years.

The OBF status of a herd will be suspended if:

- the presence of the disease is suspected;
- non-OBF animals are moved into the herd;
- vaccinated animals are moved into the herd;
- the testing regimes are not adhered to; or
- a suspect animal is slaughtered or isolated.

If the suspected animal/s is slaughtered, the OBF status will be restored after two herd tests are carried out with results of less than 30 international units (i.u.) of agglutination per millilitre.

If the suspected animal/s has been isolated, it may be re-introduced into the herd and the OBF status of the herd restored if the animal has a clear test.

The OBF status of the herd will be withdrawn if brucella infection has been confirmed in the herd. The OBF status of the herd will not be restored until either:

- all the animals have been slaughtered; or
- the herd has had two clear herd tests and all the pregnant animals have calved.

A Member State or region of a Member State will be declared OBF if no case of BR has been recorded for at least three years and at least 99.8 per cent of herds have achieved OBF status for five calendar years.

3.3 DARD

The DARD Business Strategy (June 2000) identifies an aim to improve the economic performance of the agri-food, fishing and forestry sectors within NI and in doing so to maintain and improve NI's animal, fish and plant health status. The strategy identifies that the review of BR control policy and compensation arrangements and the control of BR outbreaks are key output measures that correspond to the identified 'key challenge'.

The Department's Veterinary Service (VS) identifies within its "Corporate Plan 2001/04 (Version 6 – November 2000)" to improve NI's animal health status and to lower human exposure to zoonotic disease in animals. In relation to BR, the VS identifies an objective to:

> *"...over the next three years to put into place measures to reduce the number of outbreaks of Brucellosis to less than 50 per annum".*

Since the above objective was set, NI experienced an outbreak of FMD in the Spring of 2001, which seriously hampered attempts to reduce BR levels. Recent statistics (January - March 2002) have confirmed, as expected, that BR has spread significantly and that the above objective is no longer realistic.

3.4 Department of the Environment, Food and Rural Affairs (DEFRA)

DEFRA's aim is sustainable development, which means a better quality of life for everyone, including:

- a better environment at home and internationally, and sustainable use of natural resources;
- economic prosperity through sustainable farming, fishing, food, water and other industries that meet consumers' requirements;
- thriving economies and communities in rural areas and a countryside for all to enjoy.

In order to achieve this aim DEFRA have formed a range of objectives that include:

- to promote a sustainable, competitive and safe food supply chain which meets consumers' requirements;
- to promote sustainable, diverse, modern and adaptable farming through domestic and international actions and further ambitious CAP reform; and
- to protect the public's interest in relation to environmental impacts and health, including in relation to diseases which can be transmitted through food, water and animals and to ensure high standards of animal health and welfare.

BR is present in negligible levels in GB so, unsurprisingly, a review of DEFRA's strategy/ business planning and public service agreement documents (2001-2004) does not identify any specific animal health/ disease control targets relating to BR.

3.5 Department of Agriculture, Food and Rural Development (DAFRD)

The third Statement of Strategy (2001-2004) published by DAFRD identifies the Department's mission as being:

> *"to lead the development of a competitive, sustainable and consumer-focused agri-food sector and a vibrant rural economy".*

In striving to achieve this vision, one of DAFRD's goals is to ensure the highest standards of food safety, animal health and welfare and plant health. The strategies that have been developed to achieve this goal include:

- development of animal/ product identification and trace-back systems;
- intensification of the BR eradication programme in order to make significant progress by 2004; and
- to promote the concept of farm bio-security and routine preventative approach to animal health and welfare problems at a farm level.

3.6 Summary

EC directive 64/432 and its amended annexes, describes the requirements and testing programmes that must be observed by the MS in order to achieve and retain OBF status. Therefore, the strategies and approaches undertaken by Member States are largely shaped by these requirements.

Strategic pronouncements by DARD, DEFRA and DAFRD all make reference to ensuring/ maintaining high standards of animal health. However, because BR is not an issue in GB at present, only DARD and DAFRD make explicit reference to the eradication/ control of BR.

As stated above the current formally stated DARD VS aim is no longer attainable.

4. BACKGROUND TO BOVINE BRUCELLOSIS AND ITS INCIDENCE WITHIN NORTHERN IRELAND

4.1 Introduction

The following section provides background information on BR, detailing its possible health implications for animals and humans and providing an insight into its prevalence and distribution within NI.

4.2 Brucellosis – Implications for Human Health

BR is a highly infectious disease that can cause acute and chronic infection in animals and man. The disease is most commonly associated with abortions in cattle. It has the potential for spread because of contamination of the environment from aborted calves. Farmers and veterinarians are most at risk, as they are likely to have contact with infected material.

Humans become infected with BR when the organism enters the body, through cuts, from splashes to the eyes, lips or face, by ingestion and by inhalation. Symptoms in humans include a flu like illness, headache, fatigue, sweating, chills, pains in the joints, general aches and pains, depression and weight loss. The illness can last days or months.

Figure 4.1 overleaf identifies that following a 12 year period from 1986 to 1997 when there had been no reports of human BR, the number of human cases of the disease has steadily increased, with fourteen cases being reported for the year 2000 (as at 30 November 2000). This was the highest annual total since 1978.

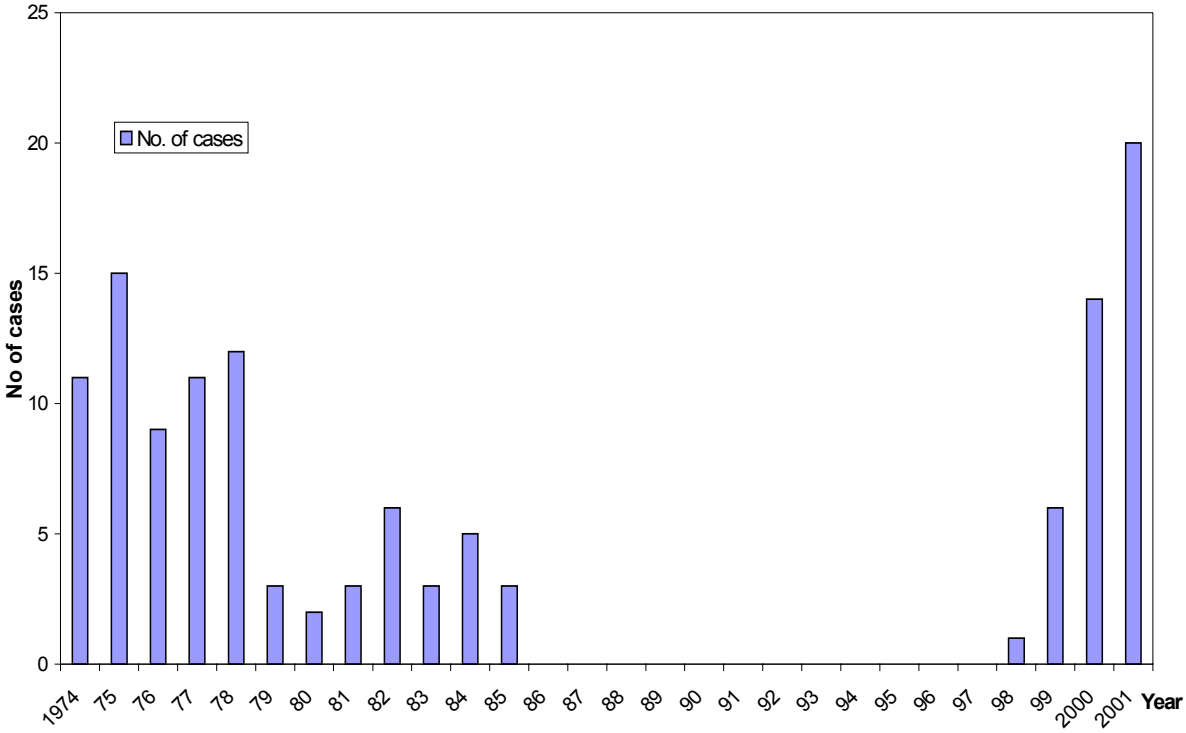
The Communicable Diseases Surveillance Centre (NI) identifies that all 14 human cases of BR reported in 2000 acquired their infection occupationally. Ten were farmers and four worked at meat plants where brucella reactor cattle were slaughtered. (N.B. a 'reactor' is an animal that has shown a positive result from a recognised BR test).

Nine of the farmers were from the Southern Health Board area with four being reported during October and November. This coincides with the peak calving period.

The rise in reported cases of human BR among the NI population continued in 2001 with a total of twenty cases being reported. The previous highest annual total of fifteen cases was recorded in 1975. Information available at present indicates that at least eight cases are occupationally related, with the occupational status of the remainder of the cases not reported at present. All eight cases whose occupational status has been reported were farmers.

Figure 4.1

Annual Totals of Human BR in NI (1974 -2001)



Source: Communicable Diseases Surveillance Centre (NI)

4.3 Bovine Brucellosis in NI (January 1996 to October 2001)

Prior to 1996 BR had effectively been eradicated in NI as a result of considerable joint efforts by the industry and the Department of Agriculture. However, mid 1996 marked the re-emergence of the disease and the start of a steady increase in its incidence. Appendix II provides further details. The following is a summary of the key issues highlighted within Appendix II.

4.3.1 BR Incidence and Distribution

23,500 herds were tested for BR in the two-year period ending 31 October 2001. The number of herds ranged from 954 in Londonderry to 3,652 in Newry division. The average herd-size, base on cattle tested at herd tests between 1990 and 2001, was 39 with an increase from 32 in 1990 to 45 in 2001.

Approximately 581,000 BR tests are performed annually, representing half a test-cycle. The number of tests was largely constant from 1991 to 1997, with a sharp increase thereafter which coincided with a significant increase in risk testing.

The herd incidence, based on confirmed outbreaks, was 0.40 in 2000 while the animal incidence (serological reactors) was 0.12 per cent. These represent

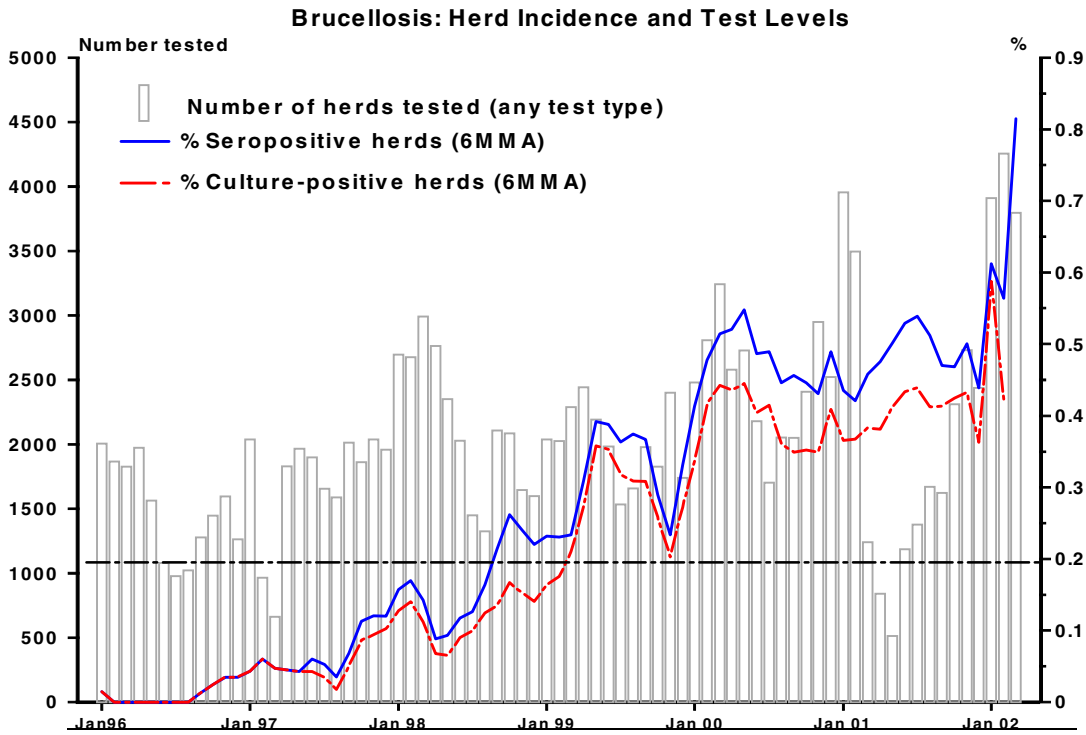
a five fold increase in herd incidence and four-fold increase in animal incidence compared to 1997.

Outbreaks are largely clustered in the south-western part of DARD's Armagh and Newry and in the Enniskillen division. Following an absence of BR from the province for some years, three clusters occurred in 1996/97: in Londonderry, Coleraine and Armagh Divisional Veterinary Office (DVO) areas, linked to cross-border contact or cattle movement. Recent infection has spread to Newry DVO and has also occurred in Enniskillen DVO. 80.6 per cent of all confirmed outbreaks during the period January 1998 to October 2001 occurred in these divisions.

Figure 4.2 below shows the herd incidence of BR for the period January 1996 to January 2002.

Figure 4.2

Herd Incidence



Source: DARD

The following should be noted with respect to this chart:

- the difference between the two lines represents the proportion of herds that were serologically positive but from which the *Brucella* organism could not be cultured. As to be expected, the lines diverge during periods of increasing or high incidence, possibly due to increased severity in interpretation;

- the bar chart is provided to illustrate that the sharp rise in incidence in mid-2001 is due principally to testing being restricted to high-risk herds. Almost all testing was stopped at this time due to the FMD epidemic and only herds with a high suspicion e.g. multiple abortions or known case of disease were tested. Thus the rise in incidence in this period is not a true indicator of the epidemic trend; and
- the horizontal dotted line indicates the threshold at which annual testing should be instigated, subject to interpretation of the EC legislation. The culture-positive line ("confirmed" infection) reached this point in March 1999.

4.3.2 Size and Nature of Breakdowns

Table 4.1 shows the number and percentage of serological reactors when infection was first disclosed at a herd test e.g. 42 breakdown herds presented between 31 and 50 cattle at the herd test and that the median number of reactors at these tests was 4.

Table 4.1

Number and Percentage of Serological Reactors when Infection was Disclosed at Herd Test

Cattle Tested	Number of Herds	Median (No.)
1 to 10	29	1
11 to 30	58	3
31 to 50	42	4
51 to 100	61	3
101 to 300	51	5
>300	11	4

Source: DARD

Table 4.1 suggests that intra-herd spread at first disclosure of infection is relatively limited and does not appear to be overly affected by herd size: the median number of reactors remains relatively constant (three to five) despite changes in the number of cattle tested.

4.3.3 Factors Contributing to the Current Epidemic

Illegal Movement of Cattle

There is little doubt that unauthorised movement of cattle within NI and across the border, together with associated illegal activities e.g. tag-switching, have played a significant role in spreading BR. Although it is not possible to prove or accurately quantify, there is anecdotal evidence that this was responsible for introducing infection into border areas of NI. A 1999 study found that five primary outbreaks across the province in these years caused infection to spread to more than 60 other herds; illegal activity was strongly suspected in four of these index cases while (legal) cross-border movement was involved in the fifth. However, despite the investigation of each of the suspect cases, it was not possible to obtain evidence that was sufficient to secure prosecution.

Compensation Arrangements

Again, there are suspicions that a small but significant proportion of breakdowns are caused by the deliberate infection of cattle to benefit from the compensation associated with herd depopulation. Although the actual number of herd keepers who engage in this activity is thought to be small, their activities may lead to significant spread within their neighbourhood and certain herd characteristics (often large and/or pedigree herds) result in expensive compensation payments.

Failure to Report Abortions

Abortions are the cardinal sign of BR infection and this is reflected in the proportion of breakdowns (under 20 per cent) where a check test following an abortion first identifies the disease. Prompt reporting of abortions is thus critical in aiding rapid screening but the pattern appears to be that it is only after the third or fourth case that DARD is notified.

Insufficient Resources

Effective management of a BR outbreak necessitates rapid identification of the source, evaluation of the spread of disease and removal of infected cattle or material. A 1997[3] study found that delays in testing led to increased outbreaks and that up to 10 per cent of neighbouring herd infections may have arisen due to this. Given the increased preponderance of breakdowns at Lateral Check Tests (LCTs) it is likely that this effect will be stronger now. Past resource difficulties within VS have curtailed rapid testing, mapping of contiguous farms and investigation of breakdowns.

[3] DARD Epidemiologist (1997)

Herd Management Factors

Poor herd segregation and fragmented grazing were shown to be significant factors in the spread of disease in south Armagh in 1998 and are likely to be the cause of the high proportion of outbreaks that occur at testing of contiguous herds. High intra-herd movement has also led to increase in the spread of disease although resource constraints have prevented adequate assessment of its significance.

4.4 Summary and Key Issues

The information presented within this section identifies that mid-1996 marked an upsurge in the incidence of bovine BR within NI, the peak of which appears to have occurred during March 2000. (The picture thereafter has been obscured by the 2001 FMD outbreak, though the incidence of BR is thought to have continued to increase). Pockets of disease appear to be concentrated in border areas particularly in the Newry and the Enniskillen DVO areas. The key factors that are thought to have contributed to a resurgence of BR include:

- illegal movement of cattle within border county areas;
- existing compensation arrangements;
- the failure of farmers to report abortions;
- insufficient resources within DARD to carry out rapid testing, mapping of contiguous farms and investigation of breakdowns etc.; and
- poor herd segregation and fragmented grazing.

As stated above, BR testing was severely curtailed during 2001 due to the FMD crisis and while the effect of this reduction in testing will only be known for certain when the backlog of testing has been resolved, it was becoming clear as this Report was being finalised and as would be expected, that the disease incidence had increased.

The upsurge in bovine BR has also been accompanied by a significant increase in human cases of BR. Following a 12-year period from 1986 to 1997 when there had been no reports of human BR, the number of human cases of the disease has steadily increased, with twenty cases being reported in 2001. All cases in 2001, whose occupational status has been reported, were farmers. The previous highest annual total of fifteen cases was recorded in 1975.

5. DARD'S CURRENT APPROACH TO CONTROLLING BR

5.1 Introduction

The following section identifies the current policy and approach employed by DARD in tackling bovine BR. Where possible it also examines the effectiveness of differing elements of its approach.

5.2 Current DARD Policy/Approach

The current monitoring programme used by DARD consists of:

- biennial testing of eligible herds and annual testing in three DVO areas where BR is at a higher level (i.e. relative to the other seven DVO areas);
- checks on aborted animals;
- re-testing of inconclusive reactors (those giving a doubtful reaction to the initial testing);
- the use of forward/backward and contiguous herd testing;
- bulk milk tank testing; and
- sampling, at slaughter, of cattle older than 30 months.

Following confirmation of BR in a herd, all or some of the breeding and pre-breeding cattle may be culled to eliminate the risk of residual infection i.e. BR may persist in infected cattle that initially test negative but develop clinical disease some time later. Herds that are not depopulated are subjected to extensive testing and control procedures for a protracted period.

A description of differing elements of the monitoring programme are attached as Appendix III for reference.

Table 5.1 overleaf identifies the number of BR tests carried out over the period 1995 to 2000 and identifies a significant increase in the number of tests carried out post 1996/7.

Table 5.1

Number of BR Tests

Financial Year	No. of Animals Tested	% Increase
1995/96	Approx. 550,000	---
1996/97	Approx. 550,000	---
1997/98	580,000	5
1998/99	638,747	10
1999/00	683,512	7
2000/01	746,051	9

Source: DARD

5.3 Current Approach Compared to Legislative Requirements

The main local legislation relevant to the control of BR is:

- the Diseases of Animals (NI) Order 1981;
- the Brucellosis Control Order (NI) 1972 (No 94) (as amended); and
- the relevant European Directive is 64/432/EC (as amended by 98/46/EC and 97/12/EC).

EC Directive 64/432 is the only legislation which places minimum requirements on DARD's approach to BR control. Compliance with 64/432 is required to maintain exports of cattle and beef products to other EU states[4].

Table 5.2 overleaf compares the 64/432 'do-minimum' requirements (i.e. those conforming strictly to the Directive) with DARD's current BR control policy. It will be noted that in several areas DARD's control policies do not comply strictly with the Directive, and these are discussed elsewhere in this document. However, certain strategic measures have been introduced to address the rising incidence and these exceed legislative requirements. The value of these measures is discussed more fully in the following chapter.

[4] Export of cattle and beef products is currently prohibited by the export ban introduced in response to BSE. It is generally considered that this ban will remain only in the short/mid term.

Table 5.2

64/432 Requirements Compared to DARD's Current Approach

Minimum required by 64/432	DARD current policy
Annual serological testing of all herds (only animals over 12 months old & excluding males for fattening) where less than 99.8% of herds are OBF for at least 4 years or 2 milk Enzyme Linked Immunofluorescent Assays (ELISAs) at an interval of at least 3 months.	Biennial serological testing of all herds (only animals over 12 months old & excluding males for fattening) except those in Armagh, Newry and Enniskillen where annual testing of all herds is carried out
30 day pre or post movement testing of all animals over 12 months old which move into the herd	Nil
Nil	Contiguous herd testing
Nil	Forward and backward testing
Nil	Monthly Bulk milk sampling
Nil	Sampling of all cull cows

Source: DARD

BR had been eradicated in NI Herds by 1982 with the herds attaining OBF status and biennial herd testing was introduced in 1988. As detailed in Section 4.3, BR incidence started to rise in mid 1996 and by March 1999 the threshold at which annual testing should arguably have been instigated (i.e. where less than 99.8 per cent of herds are considered OBF) was breached.

Over the last four years, the disease has been largely localised in three DVO areas. Additional measures were introduced to curtail the spread, including the following:

- annual testing was introduced in three DVOs;
- high risk areas have been declared in the worst affected areas with associated frequent testing;
- additional surveillance measures were introduced such as bulk milk tank testing and the testing of cows at slaughter. The former commenced in January 2001 and now includes all dairy herds across the province. The latter started at the same time and all cows over thirty months are sampled;
- an extensive publicity campaign was launched to increase awareness among farmers and to emphasise the importance of reporting abortions. Initiatives included: issue of letters to all herd keepers with BR-eligible stock, leafleting and an associated press release, display of information posters at DVOs, livestock markets and meatplants, inclusion of a related article in 'Northern Ireland Veterinary Today' etc;

- additional training and awareness programmes were introduced for all grades of VS staff and private veterinary practitioners;
- staff instructions were revised and updated;
- the VS Divisional Veterinary Officer resource was increased at DARD headquarters;
- a BR disease management database was constructed; and
- a new epidemiological questionnaire was developed for completion by VOs investigating a BR breakdown.

As stated previously, the FMD epidemic in 2001 has had a serious impact on the control programme and appears to have resulted in a marked rise in disease levels. This was due to the backlog of tests created due to the suspension of routine BR testing during the outbreaks, and due to increased work in other areas in VS. This is being currently addressed partly through increased effort and partly via recruitment of additional staff.

Regardless of the impact of the FMD epidemic, the level of BR since 1999 has meant that DARD is not meeting the Directive requirements in respect of annual and pre-movement testing. As the 99.8 per cent threshold has been breached for at least two years, in the Review Group's opinion serious consideration must given to extending annual herd testing to the remaining Divisions and to introducing pre or post movement testing to NI (as required by 64/432). Failure to do so could result in EC infraction proceedings against DARD for non-compliance. Additionally, should the disease prevalence exceed one per cent (i.e. less than 99 per cent of NI herds considered as OBF) then the level of herd testing would have to be even more frequent.

5.4 DARD Actions Beyond 64/432's Testing Requirements

Although not required by 64/432, contiguous herd testing, forward/backward testing, bulk milk tank testing and over thirty-month scheme (OTMS) serology sampling form key elements of DARD's current approach to BR. They are viewed as essential in ensuring the effectiveness of the eradication programme.

These tests are described in Chapter 7(b) Appendix II and the following summarises their value.

5.4.1 Contiguous Testing

Contiguous testing refers to the testing of cattle around an infected farm. This may include the immediate neighbours, two concentric "rings" of farms ("inner" and "outer" ring) or all herds in a prescribed area.

Such testing is a strategic measure in response to the manner in which BR spreads between herds. It is clear from Chapter 7(b) Appendix II that such testing, although only accounting for 10 to 30 per cent of all testing, is a valuable method of disease detection:

More outbreaks are identified by this test category than any other. During the years 1990 to 2001, 50 per cent of all outbreaks were first identified at contiguous testing. When allowance is made for tests following abortions in these herds, the proportion rises to almost 65 per cent.

The reactor incidence rate in contiguous testing is 25 times higher than in routine testing. This is consistent with the manner of spread of the disease and emphasises the value of this type of testing.

What would occur if the *de minimis* approach were adopted? As noted in Chapter 7(b) Appendix II, 60 per cent of breakdowns that were first identified at contiguous testing were tested more than 3 months before or after the usual month in which they had their previous routine testing. Thus, if testing were restricted to an annual cycle, it is likely that infection might have persisted for a significant period until the next test. Given the significance of lateral spread in BR to date, this would severely exacerbate the epidemic and lead to many herds becoming infected.

5.4.2 Forward and Backward Tracing

Tracing tests (i.e. Forward Check Tests (FCTs) and Backward Check Tests (BCTs)) are essential to detect cattle linked to outbreaks, either through locating the source herd if infected cattle were recently acquired or locating animals that may have moved out prior to infection being disclosed. The value of such tests will not be negated by the introduction of pre-movement testing as there remains a risk that infected cattle may become clinical cases some time after leaving the vendor's herd.

DARD's APHIS allows the rapid location of cattle or herds that may be linked to breakdowns; the system also provides an appraisal of the risk herd's testing schedule and whether the tracing test is warranted. Some modifications to the system are required to maximise its use in this area.

5.4.3 Bulk Milk Tank Testing

The implementation and value of this test type is discussed in Chapter 7(b) Appendix II. Suffice it to say at this point that it allows frequent surveillance of dairy herds across the province with minimal field resource implications.

5.4.4 Over Thirty Month Scheme (OTMS) Serology Sampling

Again, this testing is described in Chapter 7 (b) Appendix II. It is noted that it is too early in the sampling programme to be able to draw any firm conclusions about the cost-benefit. Nevertheless, no additional infected herds were identified by the 50,000 samples submitted in the first 8 months of the programme, consistent with the disease being largely clustered in certain areas. Sampling occurs province-wide, providing valuable surveillance of all older slaughter stock and, as it includes cattle from non-dairy herds, is a valuable and strategic complement to the bulk milk tank sampling.

In addition to the above-named schemes, DARD are currently in the process of implementing a process whereby progeny from reactor cattle are purchased. It is anticipated that this will assist the control of spread of BR infection. This action is based on the evidence that approximately 2.5 - 9 per cent of calves born to reactor dams may be latently infected. Although these animals are traced, in a similar fashion to other cattle moved from the infected herd and subjected to individual animal testing, they may not react to the test or may not show any clinical signs of infection until they are sexually mature. Pregnant animals that are infected with BR may spread the disease if they abort.

To counter this, any eligible progeny of reactor cattle born in the two years prior to their dam being declared a reactor will be purchased as a 'negative in contact', and removed from the cattle population at the earliest opportunity. N.B. a 'negative in contact/in-contact' is an animal that produces a negative test result, but has been at risk to exposure to the brucella organism.

5.5 Compensation Rates and Valuation Procedures

5.5.1 Compensation Rates

The amount of compensation varies depending on whether the animal is a reactor or an 'in-contact'. Article 9(1) and Schedule 5 of the BR Control Order (NI) 1972 (as amended) permits compensation for reactor animals to be paid at 75 per cent of the animal's market value or 75 per cent of the average price whichever is less. The average price (ceiling rate) is calculated on a monthly basis using average prices paid at selected markets throughout NI in the preceding four weeks. The limit for a pedigree reactor is £300 greater than for a non-pedigree. In the case of in-contact animals 100 per cent of the valuation is paid.

Under Article 9(3), the market value is determined before slaughter by agreement between an authorised officer and the owner of the animal or his agent; or if they fail to agree, by an independent valuer. The latter is paid by the Department and selected by the owner from a list of at least three such valuers presented by the Department. If the owner refuses to select an independent valuer the Department will make the selection.

5.5.2 Independent Valuations Compared to DARD Valuations

Table 5.3 overleaf details the results of an analysis of valuations made by independent valuers and those provided by DARD staff. Of the 113 animals subjected to independent valuation in 2000/01, DARD has information on approximately 14 per cent of these (i.e. 16 cases), whereby a comparison against the initial DARD valuation can be made.

Table 5.3 identifies that in 2000/01 the total value placed by independent valuers (for the identified 113 cases) was 79 per cent higher than the total

DARD valuation (representing a difference of £16,250), which is 23 per cent higher than the variance recorded in 1999/00.

N.B. the 1999/00 comparison was based on available information that related to only nine cases. Additional information was made available in 2000/01 due a change in DARD's procedures for obtaining/recording information on valuations.

Table 5.3

BR Animal Valuations

Year	No. of Animals Valued by Independent Valuers	Comparisons Available with DARD Valuers		Independent Valuations (£)	DARD Valuation (£)	Difference (£)	Variance
		Nos	%				
2000/01[5]	113	16	14	36,750	20,500	16,250	79 % higher
1999/00	1,294	9	1	10,900	6,990	3,910	56 % higher
1998/99	1	0	0	0	0	0	0
1995/6 - 1997/98	Information Not Available						

Source: DARD

5.6 DARD Expenditure on Brucellosis Disease Control

Table 5.4 overleaf identifies the total expenditure incurred by DARD over the period 1995/6 to 2000/1 in monitoring and tackling BR within NI.

[5] Compensation in one case where independent valuation was invoked has not yet been agreed and has not been included in the figures presented.

Table 5.4

BR Programme Costs

Year	Admin. & VS Staff Costs	Compensation	VSD Lab Costs	Salvage	Annual Total
1995/96	2,619,642	17,989	n/a*	-4,244	2,633,387
1996/97	2,585,653	216,714	247,782	-108,643	2,667,520
1997/98	2,751,972	2,333,633	322,992	-763,329	4,645,268
1998/99	2,933,320	3,742,635	476,394	-808,596	6,343,753
1999/00	3,658,805	6,511,220	398,232	-1,885,250	8,683,007
2000/01	3,130,098	8,921,139	850,663	-2,165,256	10,736,644
Total	**17,679,490**	**21,743,330**	**2,296,063**	**-5,735,318**	**35,983,565**

* n/a = not available.

Source: DARD

Table 5.4 highlights that a total of £36 million has been spent on BR monitoring and control by DARD over the identified period and that the annual amount spent has increased by 308 per cent from 1995/6 to 2000/1. This amount includes approximately £6 million that DARD receives as payment for 'salvaged' meat.

The majority of expenditure over the period relates to compensation (52 per cent), followed by administration and veterinary staff costs (42 per cent).

Table 5.4 also identifies that the levels of compensation paid for animals and herds that are bought out have increased by 496 per cent over the 6-year period (i.e. an average of 83 per cent per annum).

Table 5.5 overleaf identifies that although the compensation paid per reactor has decreased by 13 per cent over the period 1996 to 2001, the compensation paid per in-contact has increased by 43 per cent over this period. (Compensation per in-contact peaking in 1999 at a figure that was over 80 per cent greater than in 1996).

Table 5.5

Breakdown of BR Compensation

Year	No. of Herds	No. of Reactors	Compen-sation Per Reactor (£s)	No. of In-Contacts	Compensati-on per In-Contact (£s)	Total Compen-sation (£s)
1996	4	134	642	106	630	152,849
1997	29	91	729	2,133	757	1,681,020
1998	62	357	528	2,800	616	1,913,296
1999	153	607	449	6,520	1,142	7,718,383
2000	206	587	549	9,273	842	8,131,256
2001	186	726	559	7,172	898	6,845,967

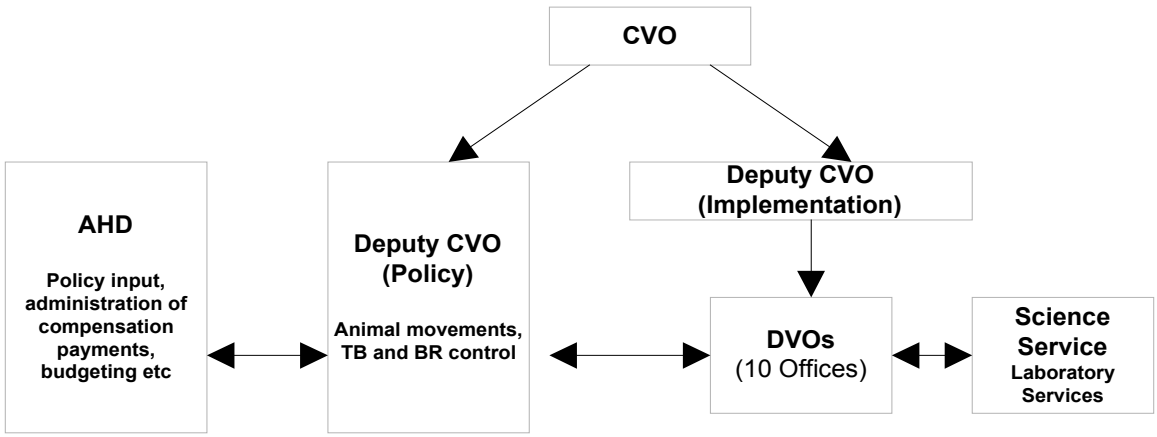
Source: DARD

5.7 Management of the BR Eradication Programme

Figure 5.1 identifies that the Chief Veterinary Officer (CVO) and DARD's VS is primarily responsible for the management of the BR eradication programme. DARD's Animal Health Division (AHD) and Veterinary Science Division (VSD) also have roles to play. AHD provides policy and administrative input and VSD provides laboratory services (i.e. for test analysis).

Figure 5.1

BR Eradication Programme - Management Structure



In addition to the above internal structures, DARD is actively involved in cross-border activities relating to the control of BR at both a formal and informal level. Appendix IV provides details of the nature of this co-operation.

It is very clear that the BR situation in either jurisdiction on either side of the Border has the capacity to adversely affect the other. It is axiomatic that both administrations must co-operate as closely as possible in dealing with this disease. The formal machinery for ensuring that, has been put in place under the North/South Ministerial Council (Agriculture Sector). BR, along with TB, is the subject of a dedicated Working Group, which meets regularly and reports ultimately to Ministers. It is responsible for seeing that a co-ordinated approach is taken to dealing with the disease in both jurisdictions and that the capacity for one to impact adversely on the other is minimised in the future.

In November 2000, the North/South Ministerial Council (NSMC) formalised much of the cross border work in this area by:

- approving the establishment of a Strategic Steering Group to co-ordinate animal health policy on the island and make regular reports to the NSMC on co-operation on animal health matters together with recommendations for policy and/or operational decisions;
- agreeing the establishment of Policy Working Groups which will consider policy issues on animal health which apply to the whole island; and
- agreeing to continued co-operation in operational aspects of schemes.

The Steering Group has been tasked with producing a report on the findings of the Working Groups by the end of December 2002. The Working Group on TB and BR has been established and the initial meeting was held on 17 January 2002. The following issues were agreed for more detailed consideration within the group:

- cross border co-operation and communication including disease tracing mechanisms;
- detailed comparison of respective policies and operational procedures for these two eradication programmes – to include review of surveillance at both farm and factory levels;
- review of compensation measures and quality control issues relating to identification and validation of reactors. This would also include the subject of atypical breakdown herds;
- review by DARD and DAFRD epidemiologists to devise common standards of disease measurement and sharing of disease data; and
- review of supporting research programmes and identification of collaborative/complimentary projects.

5.8 Summary

A total of £36 million has been spent on BR monitoring and control by DARD over the identified period and the annual amount spent has increased by 308 per cent from 1995/6 to 2000/1. The majority of expenditure over the period relates to

compensation (52 per cent), followed by administration and veterinary staff costs (42 per cent).

The existence of significant differences between valuations carried out by DARD staff and those carried out by independent valuers, has contributed to increasing levels of compensation.

The current DARD policy is deficient when compared to the do-minimum requirements stipulated by 64/432, as it does not carry out annual herd testing nor does it use pre or post movement testing. Also, events relating to FMD resulted in serological herd testing being postponed for a period in 2001.

Although not required by 64/432, contiguous herd testing, FCT/BCT, bulk milk tank testing and OTMS Serology Sampling also form key elements of DARD's current approach to BR. Contiguous testing is regarded as being of significant value as it identifies more breakdowns than any other test type. FCT/BCT, bulk milk tank testing are also considered to be valuable tests. It is considered too early in the OTMS serology sampling programme to be able to draw any firm conclusions about its benefits. However, it is noted that the programme provides valuable province-wide surveillance of all older slaughter stock, including non-dairy herds, and the sampling represents less than nine per cent of annual (July-June) testing.

6. REVIEW OF OTHER COMPARABLE REGIONAL/NATIONAL ERADICATION PROGRAMMES

6.1 Introduction

GB is an OBF region and Brucella abortus has not been isolated since October 1993. Table 6.1 shows the total number of animals slaughtered between 1995 and 2000 and although there has been a rise in recent years, it is likely that these are false positive reactors.

Table 6.1

Stock Slaughtered, Compensation Paid and Salvage Received (1995 – 2000)

Year	No. of Serological Reactors Slaughtered	No. of Dangerous Contacts Slaughtered	Total Animals Slaughtered	% variance	Comp. Paid (£s)	Salvage (£s)
1995	24	1	25	---	12,750	4,699
1996	27	2	29	+ 16	13,359	3,177
1997	13	3	16	- 45	7,598	1,191
1998	47	4	51	+219	17,606	3,202
1999	60	7	67	+31	33,354	14,261
2000	n/a	n/a	25	-63	10,726	n/a

Source: MAFF Reports of the Chief Veterinary Officer (1995 – 2000)

n/a - not available (i.e. not published) within the 2000 report
(N.B. the 2001 DEFRA Report of the Chief Veterinary Officer was not published when this report was being developed).

As the level of BR within GB remains at negligible levels, this section will focus on BR within the ROI and the steps that have been taken to reduce its incidence. This section also compares the approaches currently implemented by DAFRD and DARD and highlights aspects of the DAFRD approach that may be considered within the context of NI.

6.2 Background to Bovine BR in the ROI

Despite being declared as OBF in the late 1980's, BR has not been eradicated from the ROI. DAFRD state that up to mid 1996, BR reactors were being found at a reasonably consistent and low level under Milk Ring and strategic blood testing.

Information provided by the ROI authorities indicates a substantial decrease in the number of restricted herds in recent years, although the number of depopulated herds

has increased. Similarly, there has been a significant decrease in the reactor rates over the last four years. It is DARD's intention to carry out a detailed direct comparison of disease trends within NI and ROI and this will be an agreed action point under the auspices of the NSMC BR Sub Group.

Discussions with DAFRD staff have identified that they consider that the positive trends achieved in recent years can be built upon, leading to total eradication of the disease.

6.3 Background to DAFRD's Approach In Tackling the Disease

In August 1997 DAFRD announced a number of interim measures to address the increasing prevalence of BR in cattle. These were:

- the continuation of monthly Milk Ring testing, the intensive contiguous blood testing regime, the depopulation programme and early removal of reactors;
- a requirement that, as a minimum, all eligible animals being sold through marts and from farm to farm must have been blood tested within the preceding 12 months;
- an awareness/education programme directed at farmers, specifically promoting effective herd management and health protection practices;
- detailed epidemiological investigations by Departmental veterinary inspectors into BR breakdowns; and
- major change to the compensation regime aimed at encouraging farmers to purchase eligible cattle from reliable sources, to confine purchases to cattle which have passed BR tests within the previous 60 days in the herds from which they were bought and to test such cattle within 30 days of purchase; compensation payments for any reactors being at nominal levels where bought in cattle do not meet these requirements.

In February 1998 DAFRD announced that with effect from 23 February 1998:

- all eligible animals being moved into or out of holdings (other than direct to a slaughter premises) must have passed a blood test within 30 days preceding the date of movement;
- that bulls over 12 months and female cattle over 18 months may not be sold more than once, whether by pubic or private sale without a BR test and such cattle being sold must be moved from the holding where tests are undertaken direct to either the purchaser's holding or direct to a mart and from there direct to the purchasers holding;
- a full round of blood testing for all eligible cattle in 1998 would be carried out to augment and complement existing arrangements including monthly milk ring testing;

- further enhancement of the eradication measures applying in certain areas, in particular the completion of a full round of blood testing of all eligible animals in these areas over the next two months;
- the revamping of administrative procedures in the Department's local offices to deal more effectively with BR reactors and those contiguous to such herds;
- new arrangements to speed up the completion of blood tests and improve the notification of results;
- early removal of reactors and steps to improve detection of irregularities;
- increased epidemiology work by Departmental veterinary staff and a review of the epidemiology of BR over recent years;
- an on-going and intensive awareness/advisory campaign to update farmers and others on farm husbandry and management practices to curtail the spread of BR;
- early introduction of further legislation on aspects relating to trading and tracing of cattle movements and on registration of all those engaged in trading cattle; and
- a restructured and re-vamped compensation regime.

In addition to the above measures, which have been retained, DAFRD also implemented the following initiatives in 2000:

- screening with indirect ELISA (I-EIA);
- whey ELISA replacing MRT;
- cow monitoring for BR at factories;
- comparative trial of Serological assay for BR;
- field trial of Brucellin skin test;
- risk analysis of all infected herds;
- rapid depopulation policy (21 days) – high risk herds;
- housing of all animals more than 140 days pregnant and/or more than six months calved in herds with confirmed infection (changed legislation);
- development of new epidemiological investigation procedures;
- investigation of the role of slurry in the spread of BR and development of treatment methods;
- computerised mapping system for the contiguous programme; and
- new compensation regime.

6.4 DAFRD and DARD Approaches Compared

Detailed analysis of the approach adopted by DAFRD in tackling BR, identifies a wide range of areas where the approach adopted by DAFRD is different from that adopted by DARD. The differences can be classified into:

- differences in the implementation of Directive 64/432; and
- differences in policy that are not specifically mentioned in Directive 64/432.

As a result of this analysis, it is the Review Group's opinion that the following areas, which currently form part of DAFRD's approach, should be considered during the policy review:

(a) annual herd serological testing and pre or post movement testing (in order to fulfil 64/432 requirements);

(b) a process of independent arbitration during valuation;

(c) adoption of ceilings on compensation for in-contact animals;

(d) deductions in compensation for breaches of the rules; and

(e) specific developments relating to high risk groups (e.g. housing of 'high risk' cattle in isolation from other cattle).

N.B. in order to implement (b), (c), (d) and (e) in NI, legislative change will be required.

It is impossible, without a detailed epidemiological analysis, to assess accurately if many of the other differences between DARD's and DAFRD's approach contribute to differences in their effectiveness in controlling BR. Such an analysis is not possible within the timescales of this policy review but it will be carried out as soon as resources permit.

6.5 Summary

Although the ROI has experienced an improvement in the incidence of BR in recent years, the extent to which specific DAFRD activities contributed to this improvement cannot be determined without detailed epidemiological analysis including the direct comparison of disease trends referred to in Section 6.2. This level of analysis cannot be carried out in the short-mid term.

It is recognised within DARD that compliance with 64/432 is required (i.e. carrying out annual herd serological testing and pre or post movement testing), that changes to the valuation/compensation process may encourage farmers to be more vigilant in their disease control activities and that specific developments relating to high risk groups are worthy of consideration. However, it is also noted that these adjustments to policy will require legislative change.

7. OTHER ISSUES IMPACTING ON FUTURE POLICY DEVELOPMENT

7.1 Introduction

The following section identifies issues that DARD must bear in mind while considering future policy options.

7.2 Scientific Developments

Appendix V details recent scientific developments relating to the study of BR in cattle and how these might have a beneficial impact on the control of BR in NI. The following provides a summary of the salient issues discussed in Appendix V.

7.2.1 Serology

Much of the research effort on bovine BR in recent years has been on the improvement of existing methods of detection of antibody or the development of new methods. While we might expect advances in relation to improved sensitivity and specificity of serological tests in future, it is less likely that the problem of identification of infected animals before abortion can be overcome through the use of serological tests.

There are many different serological tests for BR in cattle and there is controversy over what is the "right" test or test combination to use. None of the available tests is a clear leader in performance in all situations, and because BR schemes involve testing huge numbers of samples, cost is an important factor. Also, the optimal balance between sensitivity and specificity will depend on the incidence of infection.

More recently developed tests include:

- **enzyme linked immunofluorescent assay (ELISA) -** the most common serological test format used today, which means that it is easily automated using generic equipment. ELISAs are reported to have better sensitivity and specificity than the older tests compared individually, but there are still problems with cross-reactions. Competitive ELISA formats using monoclonal antibodies have improved specificity, but at the expense of sensitivity. Variants of the ELISA include the particle concentration fluorescence immunoassay (PCFIA) which is widely used in the USA, and the Delfia test. These tests use different technologies to detect positive reactions;
- **fluorescent polarisation assay** - reported to give better sensitivity and specificity than the ELISA, but there is insufficient data to confirm this. The test is not yet commercially available, but is likely to be expensive.

There is scope for a research project in NI aimed at ensuring that we apply the optimal test or test combination in our serological surveillance programme.

Other immunological tests include:

- **brucellin intradermal test** - highly specific, but low sensitivity. Technically difficult, as the change in skin thickness can be very small. Expensive to carry out as it involves two farm visits. Could be useful for resolution of inconclusive serological results; and
- **interferon assay -** similar to that used in bovine TB, but the test as applied to bovine BR has not been well characterised.

7.2.2 Detection and Characterisation of the Organism.

The task of sequencing the brucella genome has recently been completed and this may give rise to further advances in characterisation, diagnostic test and vaccine development in due course.

7.2.3 Vaccination

Current EU brucella abortus vaccines have been available for many years, but are not considered appropriate within the DARD BR eradication programme. The traditional reason for this has been that vaccines, in general, interfere with tests used to identify infected animals. As such, vaccines are often used as a preliminary stage to test and slaughter programmes and are considered inappropriate where disease is at low levels. However, recent advances in vaccine technology have produced vaccines that may be effective and not interfere with all tests. The potential use of additional control procedures is constantly under review by DARD.

7.2.4 Epidemiology

Epidemiological models have been developed to predict and compare the impact of test and eradication strategies. This type of approach could be usefully applied in NI.

7.2.5 Genetic Tracing of Cattle

Technology exists to facilitate genotyping of cattle and to provide a DNA fingerprint for individual animals and their products. A complete system for genotyping can be envisaged.

Genotyping of cattle is being considered for applications in relation to backing-up and quality assurance/quality control of existing paper and/or computerised animal movement and traceability systems. These methods are also used as a forensic tool for fraud investigation in some countries (including NI).

7.3 Operational Developments

The following provides details of operational issues that DARD had identified as being appropriate for consideration during the policy review. In some cases these overlap with issues identified within previous sections. These suggestions include:

- extension of annual testing to all divisions;
- use of pre or post movement testing;
- substitution of serological testing by bulk milk ELISA in Dairy Herds;
- Recording of Bulk Milk ELISA (BrBME) testing results on APHIS or other database;
- review of laboratory tests currently being used;
- review of DNA technology as a possible anti fraud measure;
- review of the legislation;
- review of compensation arrangements;
- investigation of herd calving patterns using APHIS;
- control of intra-herd movement;
- amend current "ring-testing" to three kilometre zone;
- partial herd depopulation;
- targeted sampling of UTMS cattle;
- use of GIS to manage outbreaks;
- increased frequency of testing for "sentinel" groups; and
- computerised recording of OTMS samples that test negative for BR.

7.4 Industry Opinion

As part of the policy review process, DARD wrote to key organisations within NI agriculture sector in January 2001 asking for written submissions detailing the key issues that should be considered. The results are summarised in Appendix VI. The written request and its enclosures were also made available on the DARD web site.

The suggestions resulting from this consultation process included:

- the initiation of a consultative forum or a public/private project management group to oversee programme management;
- use of the milk ELISA test/ wider emphasis on testing of bulk milk samples;
- encouragement to producers to submit aborted foetal material (e.g. by providing a free testing service for producers providing this material);

- allowing/compensating vets attending abortion events to submit blood samples;
- pre/post movement testing in selected areas;
- continued investment in APHIS to further improve traceability and to allow increased transparency and access to animal health data;
- the publishing of disease trends information;
- testing of adult slaughter animals;
- introduction of post-importation tests;
- introduction of post-movement testing in areas to assist in the detection of latent infections;
- review/evaluation of all advances in technology (e.g. ELISAs);
- research into the development of more effective tests;
- use of epidemiological modelling to assess alternative/ cost effective control strategies and devise most-effective cost regimes;
- provision of 100 per cent compensation for BR reactor animals;
- provision of a sufficient level of manpower and resources being made available to reduce delay in testing;
- improvement in communication and provision of information to producers whenever herd restrictions are imposed, particularly with herds restricted but not depopulated as a result of an inconclusive BR tested animal;
- provision of other information e.g. availability of schemes when herds are restricted (e.g. 0.8 co-efficient to be applied to stocking rates);
- provision of practical advice and assistance to producers of depopulated herds; and
- the use of vaccinations as a basis for a damage limitation.

Clearly, a number of the above suggestions relate to implementation issues (e.g. the use of consultative forum/stakeholder liaison). Although these issues will not form part of the appraisal of policy options, they will be addressed during the implementation of the revised policy.

8. VALUE FOR MONEY AFFORDED BY DARD'S CURRENT APPROACH

8.1 Introduction

The TOR for this review (Appendix I) identifies that it must:

> *" Review the effectiveness of the Department's current approach to the eradication of bovine Brucellosis and evaluate in particular the value for money afforded by the present approach". (TOR I)*

In addition the TOR identifies that the review should:

- assess the potential for greater efficiency (TOR 2e);
- establish the effectiveness of the present testing frequency (TOR 4e);
- quantify the costs and benefits of the present policy, including the identification of specific performance measures and indicators of impact and value for money (TOR 4i).

During the period 1998 to date, DARD has undertaken various epidemiological assessments of its BR policy and implementation in the field, with a view to improving the efficiency and effectiveness of the control programme. The assessments included a review of:

- test methodologies - including the type and frequency of testing as well as reactor thresholds;
- field management and investigation of breakdowns, and associated testing;
- disease trends and contributing factors; and
- best practice from other national programmes (incorporating consultations with relevant international experts).

Many of the recommendations resulting from these reports have been implemented. Section 5.3 (pages 29 and 30) detail a number of these. This section will provide a broad assessment of the factors contributing to the value for money offered by the current approach. Subsequent sections will identify and discuss areas offering greater efficiency, effectiveness and economy.

A caveat should also be noted about the term "value for money". This is that it is not clear from reports such as the NIAO publication 'Report on Value for Money' (1993) whether the concept is applied at the level of the overall economic system or simply in public expenditure terms. The approach taken here is to concentrate on public expenditure as this is the simpler of the methods. It should be recognised, however, that this approach might disguise the economic picture. For example, in the extreme all costs could be transferred to the industry, as in New Zealand, to achieve maximum value for "public money", however the actual control costs may remain

unchanged and value for "public and private" money remain unchanged. Where such differences arise in analysis they will be highlighted.

8.2 Value for Money of the Current Approach

8.2.1 Economy

Table 5.4 identifies that the key areas of expenditure associated with the BR programme are:

- DARD administrative and veterinary staff costs (42 per cent of total costs over the period 1995/96 to 2000/01);
- compensation for reactors and in-contacts (52 per cent of total costs over the period 1995/96 to 2000/01); and
- DARD VSD laboratory costs (6 per cent of total costs over the period 1995/96 to 2000/01).

Where possible, the following sections assess the extent to which 'economy' has been achieved under each of these headings and where applicable, this assessment involves an analysis of costs per unit of output. However, the level of analysis in this area is constrained as DAFRD (in the ROI) do not collect or analyse TB and BR cost information separately and therefore a comparison between DARD and DAFRD costs is not possible.

Staff Costs

During the period 1996/7 to 2000/01 staff costs increased by 19 per cent to over £ 3 million. This increase reflects the increasing workload associated with an increase in disease incidence.

It has been noted within the review process that there have been insufficient staff resources in the past (Appendix II page10) and that there has been a recent bid for additional resources. However, as the use of staff is critical to the implementation of an efficient policy, this area of expenditure should be subject to ongoing monitoring during the implementation of the revised policy.

Compensation

Table 5.4 identifies that compensation paid in relation to BR reactors and in-contacts has increased by a factor of 495 over the period 1995/6 to 2000/01, up to a level of approximately £9 million.

Section 5.5.2 identifies that in 2000/01 the total value placed by independent valuers was 235 per cent higher than the total DARD valuations, representing a significant difference of £1,075,641.

Comparison with the ROI scheme suggests that a cap should be placed on compensation payments. Farmers who wish to insure for stock which they value more highly than the imposed cap could seek commercial insurance.

DARD VSD laboratory costs

Table 5.4 (Section 5.6) identifies that VSD laboratory costs increased by 243 per cent over the period 1996/7 to 2000/01, up to a level of approximately £0.8 million. (N.B. the expenditure figures presented within Table 5.4 incorporate capital items at full cost during the year they were incurred). The identified increase in cost is largely attributed to:

- an increase in the number of samples submitted;
- the added workload associated with development of improved quality assurance measures;
- the increased number of positive test results being found, which leads to further laboratory testing; and
- the cost of tests by culture of specimens, which was practically zero before 1996 and has increased dramatically in the intervening years.

8.2.2 Efficiency

The assessment of efficiency of the BR programme is constrained by the unavailability of relevant data to support a detailed analysis of DARD's disease control activities. It has been recognised within DARD that this is an area that requires urgent attention and DARD's VS is currently developing proposals to implement a time/task recording system that will produce data that will assist this type of analysis in the future. It is envisaged that such a system would provide data that would allow measurement of:

- total cost of taking a sample;
- total cost of carrying out sample analysis; and
- VS administration cost per test.

Using data that was available to the Review Group within the time constraints of the review process (refer to Table 5.1 and Table 5.4), the following efficiency measures are considered worthy of further comment:

Total Costs (less compensation)/Number of Tests Carried Out

This measure identifies the per test cost of VSD laboratory input, AHD administrative input and VS administrative and field staff input, thereby providing a broad indicator of the efficiency achieved in delivering a key output (i.e. disease surveillance).

Table 8.1 overleaf identifies that the cost of VS, AHD and VSD input by test has remained relatively constant over the four-year period shown, with a slight increase in the 1999/00 year.

Table 8.1

Cost of VS, AHD and VSD input by test

Year	AHD/VS and VSD cost per test (£s)
1997/98	5.30
1998/99	5.34
1999/00	5.93
2000/01	5.33

Source: DARD

Veterinary and Admin Costs/ Number of Tests Carried Out

Table 8.2 identifies that, apart from an increase in 1999/00, DARD's veterinary and administration staff costs have decreased over the period shown, which suggests improving efficiency.

Table 8.2

Cost of VS and AHD input by test

Year	AHD/VS staff cost by test (£s)
1997/98	4.74
1998/99	4.59
1999/00	5.35
2000/01	4.20

Source: DARD

Veterinary Service Costs/ Number of Tests Carried Out

This is a useful measure of efficiency as the output under consideration (i.e. number of tests carried out) is directly related to input by VS staff. Table 8.3 identifies the costs per test of VS field staff (i.e. those directly responsible for carrying out tests) and all VS staff costs (i.e. veterinary and administrative staff costs).

Table 8.3 overleaf highlights that apart from an increase in 1999/00, the total cost of VS staff per test has decreased over the period shown. Similarly, the cost of field staff per test has also decreased over the period 1997/98 apart from an increase in 1999/00.

Table 8.3

Cost of VS staff by test

Year	VS Admin Staff Costs (£s)	VS Field Staff Costs (£s)	VS Total Staff Costs (£s)	VS Total Staff Cost (£s)/Test Numbers	VS Field Staff Costs (£s)/Test Numbers
1997/98	735,233	1,974,655	2,709,888	4.67	3.40
1998/99	760,253	2,119,398	2,879,651	4.51	3.32
1999/00	892,243	2,717,221	3,609,464	5.28	3.98
2000/01	579,428	2,497,872	3,077,300	4.12	3.35

Source: DARD

VSD Laboratory Costs Per Sample

VSD identify that it is difficult to compare year by year cost of testing per sample unless fluctuations in capital and building expenditure are excluded. In addition, the cost per test of brucella culture is much greater than that of a serological test.

In order to provide a basis for analysis Table 8.4 provides the cost and number of samples tested by serology.

Table 8.4

BR Test and related VSD costs (1996/7 - 2000/01)

Year	VSD laboratory cost (£s)*	Number of samples (tested by serology)	Cost per sample (£s)*
1996/97	225,440	550,000	0.41
1997/98	288,987	580,000	0.50
1998/99	333,576	638,747	0.52
1999/00	350,153	683,512	0.51
2000/01	580,370	746,051	0.78

***** excluding costs relating to capital and building works

Source: DARD VSD

Table 8.4 identifies that the cost per sample has increased from £0.41 to £0.78 over the period 1996/7 to 2000/01 i.e. an increase of £0.37 per sample. Over the period 1996/97 to 1999/00 the cost per sample was relatively constant, which suggests that efficiency was being maintained. The significant increase in the cost per sample in

the year 2000/2001 is largely due to the initial purchase of ELISA kits during that year, and the cost of training of additional staff taken on as a consequence of the increased numbers of samples submitted.

8.2.3 Effectiveness

Effectiveness is concerned with the relationship between the intended result and the actual results of the programme. In the case of the current programme it can be stated simply that the policy has not been effective, as the incidence of BR has continued to rise in recent years and that the eradication of BR can only be considered as a long-term goal.

Despite this, as detailed in section 5.3, DARD has introduced a number of measures to curtail the spread of the disease, including the use of a range of valuable risk tests that are in addition to the minimum level of testing prescribed by 64/432 (refer to section 5.4.1). In doing so, DARD has maximised the discovery of reactors within current resource constraints and has therefore contributed significantly to the effectiveness of the programme.

During the review process questions have been raised as to the ability of the Serum Agglutination Test (SAT) to identify BR outbreaks at an early stage. A 1999 study[6] found that up to 30 per cent of infected contiguous herds might be missed at the first herd check test, and this raised concern as to the sensitivity of the test. Conversely, a data analysis the following year found little difference between the SAT and CFT (the confirmatory test, with a good sensitivity) when they were used in parallel for a large number of samples. The SAT was used previously to eradicate BR from NI and has been used worldwide. However, other tests have since been developed and a trial is required to assess if any of these offer greater sensitivity or specificity than those currently in use. It is the opinion of the Review Group that, as the effectiveness of the test being used to detect BR is key to the effectiveness of the programme, that future efforts should include an analysis of the relative pros and cons of available tests.

Subsequent sections of this report discuss measures that may improve the overall effectiveness of DARD's approach to BR eradication.

8.3 Cost and Benefits

The 1993 NIAO report identifies the following potential benefits from the Department's disease control programme objectives, which have, in essence, not changed:

i) protecting a valuable live animal trade;

ii) maintaining an important "health status" for exports;

[6] DARD Epidemiologist (1999)

iii) avoiding trade restrictions prohibiting export of animals or meat from infected herd;

iv) avoiding the economic losses associated with the disease;

v) reducing risk to human health; and

vi) producing animal welfare benefits.

Almost a decade on, it is possible to re-examine this list and identify the changes that have occurred, particular since the emergence of Bovine Spongiform Encephalopathy (BSE). Following the same ordering as above:

i) an important change is that live animal trade with other Member States is currently prohibited because of BSE restrictions, but it is expected that the obstacles to re-opening these export markets will be removed;

ii) the main economic impact before the BSE crisis may have been in terms of a "health status" perception in export markets. However, current perceptions of health status are dominated by BSE and FMD considerations;

iii) item iii is no longer a current benefit in so far as trade with other Member States is concerned, for the same reasons as i);

iv) the economic losses associated with BR are not easily quantified as the disease causes abortions and may contribute to a lessening of the output from cattle in the long term (i.e. weight loss, reduced milk yield, reduction in fertility). However, the disease does not have long-term health implications and the animal is likely to fully recover from the disease in the short to mid term;

v) the risk to human health. Section 4.2 identifies an upsurge in occupationally linked cases of humans with BR and therefore the human health benefits are likely to be significant; and

vi) if the disease has only short term animal health impacts the animal welfare benefits are likely to be limited.

For illustration purposes, the following details the level of impact required by the BR eradication programme to achieve a breakeven (in terms of economic costs and benefits), in relation to human health and cattle output.

Human Health

The United Kingdom's (UK's) Department of Environment Transport and the Regions (1997)[7] provided a cost of a 'slight' casualty to a human (representing loss of earnings, welfare costs etc). When this is adjusted to reflect 2000/01 prices it equates to approximately £8,000. If the 2000/01 cost of the BR eradication

[7] Highway Economic Note #1, DETR (1997) identifies the economic cost of a slight injury to a human as £7,480.

programme were measured solely against this indicator, the programme would have to prevent over 1,340 people from becoming infected by BR through contact with cattle (i.e. four per cent of the number of those working on farms[8]) to be judged cost effective in purely economic terms.

Output - Cattle

The DARD Statistical Review of NI Agriculture (2001) identifies the total value of output of finished cattle and calves and milk in 2001 as £683.7 million. The 2000/01 cost of the BR eradication programme represents 1.6 per cent of this level of output. Therefore, for the BR eradication programme to be cost effective, should protect its equivalent amount in cattle output.

Although the above broad-brush analysis has its limitations, it demonstrates that the BR programme requires a relatively low level of economic benefit (1.6 per cent of the sectors output) to justify its existence. However, this level of benefit produced by the programme cannot be accurately quantified, as it is difficult to predict the value of costs that would occur in the absence of such a programme.

8.4 An Indicator of Value for Money

Other ways in which the overall value for money of the scheme can be illustrated is through the use of an indicator. An indicator is designed to show changes in a variable or group of related variables with respect to time, geographical location or other characteristics.

In research a common indicator is the R/C ratio, where R is the research spend on a commodity and C the value of the output of the commodity. By analogy we can calculate D/C, the ratio of disease control expenditure for a sector D and the value of the output of the commodity, C. This is an indicator of the intensity of control efforts.

The unit of measurement is £ of control expenditure per £ of gross output value, expressed as a percentage. It is important to note that the greater this value the lower the value for money. Another way to look at the indicator is that it identifies the premium that would have to be received on output values for the programme to be justified.

It will be evident that the changes in the denominator will affect the value for money of the scheme, yet this may be independent of the disease control cost numerator. Although this is a disadvantage, it can be justified on the grounds that the costs of the scheme would be expected to bear some relationship to the output of the sector that supports it. Thus although this is not a perfect indicator, it does illuminate the relationship between output and control expenditure.

---

[8] Source: DARD Statistical Review of NI Agriculture (2001). N.B this figure does not include veterinary surgeons and abattoir workers who may also come in contact with BR

Figure 8.1 presents data for the cost of TB and BR programmes as a percentage of milk and beef output value. In Figure 8.1 it is evident that the value for money indicator is increasing over time highlighting the fact that both programmes are costing a higher proportion of the sectors output.

Figure 8.1

The ratio of control programme costs to output value of milk and beef for BR in NI

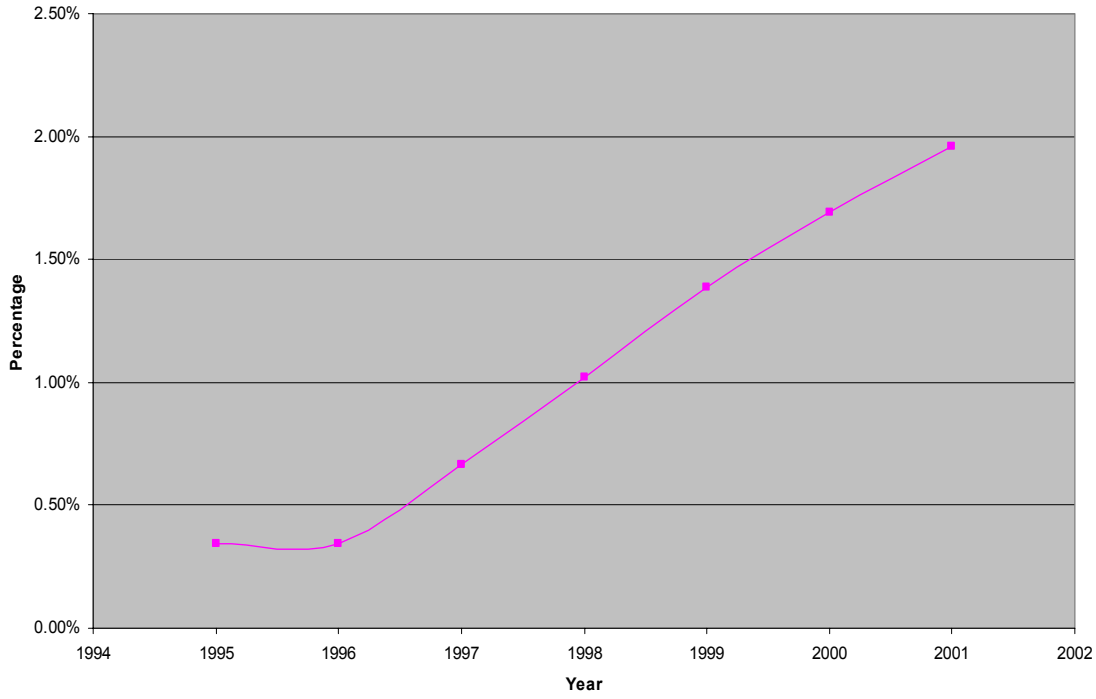


Figure 8.2 overleaf has been constructed using the combined cost[9] of the TB and BR programmes to allow a comparison with the net costs of the combined TB and BR programme in the ROI (i.e. DARD's counterparts in the ROI are unable to provide programme cost information on TB and BR separately due to the nature of their cost recording system).

In broad terms the data suggest that a higher proportion of the value of the agriculture sectors output is incurred in NI. However, the ROI programme benefits from receipts in terms of animal disease levies and from 1996 onwards, the costs of the annual herd test were excluded as this cost was transferred to farmers.

Since 1999, there has been a strong downturn in the ROI indicator, which may reflect the ROI's success in reducing BR levels. However, as this measure combines both

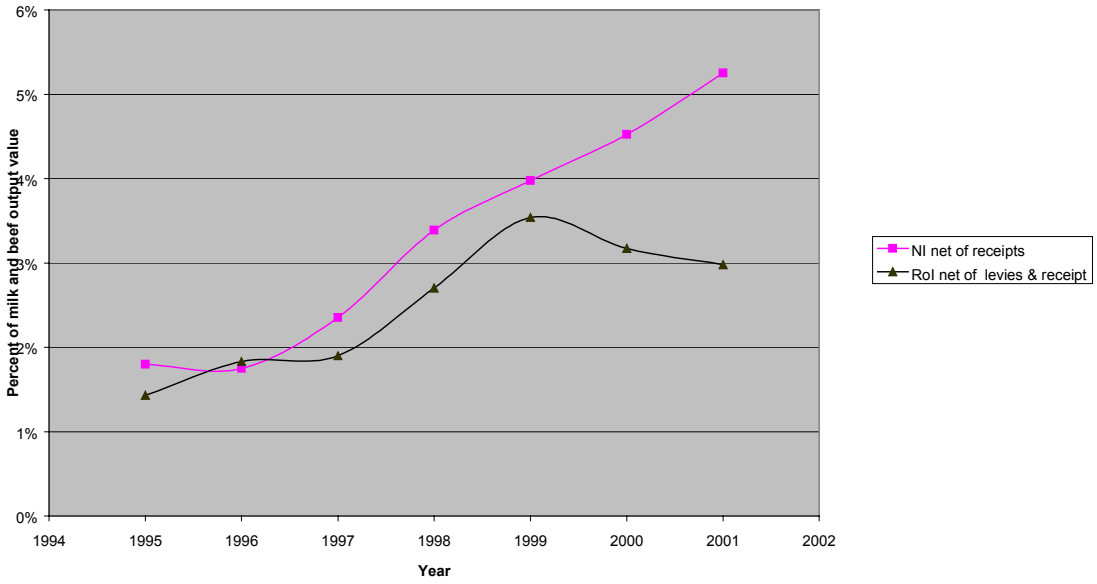
[9] DARD costs include: administrative staff costs; veterinary administration and field staff costs; compensation paid; laboratory costs; less salvage value of animals.

DAFRD costs include: compensation paid: testing fees; staff costs; supplies/services and equipment; less disease levies and other receipts.

TB and BR costs, it is impossible to be definitive about the impact of the ROI's success in reducing BR incidence upon programme costs.

Figure 8.2

The ratio of control programme costs (TB and Br combined) to output value of milk and beef



NB 2001 = forecast figures

8.5 Conclusions

An assessment of the efficiency of the BR eradication programme highlights that efficiency measures based on staff costs suggests that efficiency has been maintained or improved over the period profiled, except for the year 1999/2000. It is tentatively suggested that the apparent reduction in efficiency in 1999/2000 may be attributed to a significant upsurge in the disease, which resulted in a requirement for additional staff who were less familiar with DARD processes/procedures, and, changes in the VS computer systems.

An analysis of VSD input/outputs identifies that efficiency was largely being maintained over the period 1996/97 to 1999/00. However, costs relating to the initial purchase of ELISA kits and the cost of training of additional staff taken on as a consequence of the increased numbers of samples submitted, led to a significant increase in the cost per sample in the year 2000/2001.

When the effectiveness of the BR eradication programme is assessed in terms of its actual results compared to its intended, it is clear that it has not been 'effective'. However, it should be noted that DARD has utilised risk tests that are in addition to

the minimum level of testing prescribed by 64/432 (refer to section 5.4.1), which have added to the effectiveness of the programme.

Consideration of costs and benefits associated with the BR eradication programme indicates that it requires a relatively low level of economic benefit (as a proportion of the sectors output) to justify the cost of the programme. However, the level of benefit produced by the programme cannot be accurately quantified, as it is difficult to predict the costs that would occur in the absence of such a programme.

The evidence presented in Figure 8.1 shows that the cost of the eradication scheme accounted for a higher proportion of economic output in 2001 than in previous years. However, for the 1995-1999 period, a comparison of BR and TB programme costs combined divided by output value suggest that NI costs have been broadly in line with DAFRD costs up until the most recent years.

The reduction in DAFRD's TB/BR programme costs coincides with a period of lower levels of BR incidence within ROI (as detailed in Section 6.2), which suggests that DAFRD may have improved both the effectiveness and efficiency (in terms of public money) of its BR control/eradication programme. However, the apparent gains in 'efficiency' may also be attributed to a transfer of the cost of BR control to the private sector and/or efficiency gains/transfer of costs achieved in relation to TB control. The impact of these other factors on the ROI's control costs/ output value ratio cannot be readily assessed because of the lack of detailed information.

Nevertheless, the reduction in BR incidence achieved by the ROI suggests that there are aspects of the DAFRD programme that, if applied to DARD's programme, might facilitate an improvement of effectiveness of DARD's BR eradication programme.

9. FUTURE POLICY OBJECTIVES

9.1 Introduction

As stated earlier, DARD's present formally stated objective in relation to BR is no longer acheivable. The following sections therefore suggest more realistic policy objectives relating to the BR eradication programme.

9.2 Overall Aim

To eradicate[10] BR from NI within seven years of implementation of the revised programme.

9.3 Intermediate Objectives

- to reverse the trend in BR outbreaks, so that it is reduced to less than 150 outbreaks per annum within three years of implementing the revised programme; and
- to reduce the 2000/01 level of BR compensation payments by at least £1.5 million within three years of implementing the revised approach.

9.4 Immediate Objectives

- to ensure compliance with EU Directive 64/432.

9.5 Constraints

The constraints impacting upon option development and ultimately the achievement of the above objectives are:

Financial Resources - resources available to DARD are finite and therefore a future disease control programme must operate within the financial resources available.

Complimentary action in the ROI - as NI shares a land border with the ROI, an effective control programme is dependent upon a system within NI that complements that in the ROI and vice-versa. It is essential that a revised programme promotes effective cross border work relating to BR control.

[10] for the purposes of this document 'eradication' is defined as five or less breakdowns per annum

Legislation - it is anticipated that changes to the current approach will require legislative change at a local level. Therefore the ability to achieve this legislative change and the time required to effect it will impact on the programme's ability to achieve its aim and objectives. Also, the minimum level of action that DARD takes in response to BR is determined by the EU 64/432 directive and therefore, any policy option that does not meet the requirements of 64/432 is untenable in the long term.

Industry Buy-in - the impact of a revised programme on disease trends will be dependent on the level of support obtained within the industry for the proposed changes. Therefore, maximisation of industry acceptance of the proposed changes is essential.

Changes in BR Control Policy in GB - as part of the UK, NI agriculture policy is traditionally developed from that devised within GB. Consequently, future changes to GB policy may impact upon that developed within NI.

9.6 Key Performance Indicators

The performance of the revised DARD BR eradication programme will be measured in the future using the following key performance indicators:

- total cost of the BR control programme;
- compensation paid per year;
- compensation paid per reactor/'in-contact';
- number of breakdowns, reactors and 'in-contacts' per year;
- total cost of taking a sample;
- total cost of carrying out sample analysis; and
- VS administration cost per test.

10. OPTION IDENTIFICATION AND SHORTLISTING

10.1 Introduction

Sections 4 and 5 of this report identify that there has been increasing levels of expenditure by DARD due to increased levels of BR incidence within NI.

Taking into account DARD's assessment of the cause of increase in the disease, issues raised in relation to DAFRD's (apparently successful) approach and other factors informing the review process, the following section aims to identify areas of the current policy that can be revised to improve its economy, efficiency and effectiveness.

10.2 Policy Options Excluded From Detailed Analysis

Previous sections identify that industry feedback from consultations carried out in conjunction with this review highlighted that it was considered that epidemiological modelling should be carried out to assess alternative/ cost effective control strategies and devise most-effective cost regimes.

To date there has been a significant shortfall in the resources applied to epidemiological assessment and investigations, which has led to the postponement of field studies or data analyses that would assist in the eradication measures. Additional staffing resources have recently been allocated to epidemiology, which should provide substantial improvement in this area of activity, once staff are in place and appropriately trained.

Also, in addition to the above, the 'theoretical do nothing' is excluded, i.e. whereby DARD terminates its current policy and no public sector intervention is made to attempt to control BR. This option is excluded due to the following reasons:

- it is likely that such an action would result in an escalation of the disease, which would result in significant costs in relation to loss of animals/market value of animals and human health;
- the resulting impact on the agricultural industry and society in general would provide the potential for legal action to be taken against DARD for failure to perform its statutory duties; and
- as this option would comprehensively fail to meet the requirements of EC Directive 64/432, DARD would be left open to a legal challenge by the EC.

10.3 Policy Areas Shortlisted for Revision

The policy areas that have been identified by the review group as offering the potential for improved performance are:

- Annual testing;

- Valuation and compensation;
- Increased testing at meat plants;
- Pre and post movement testing;
- Powers to enforce housing and movement restriction;
- Powers relating to depopulation, restocking and slurry treatment;
- Further research;
- Enhancement of APHIS; and
- Re-evaluation of diagnostic tests.

Proposals relating to annual and pre/post movement testing address statutory requirements detailed within 64/432, which DARD is currently not fulfilling. All other proposals offer the potential for improved performance economy, efficiency and/or effectiveness.

Upon identification of the areas highlighted above, relevant members of the policy Review Group considered the following in relation to each area of modification:

- revisions required to current activities that would offer potential improvements;
- differing options that may be developed to achieve the envisaged improvements; and
- the envisaged costs and benefits associated with each option.

10.4 Proposed Areas of Policy Modification

Appendix VII contains abbreviated papers resulting from the above process detailing, where possible, the rationale/area of need to be addressed, options for addressing needs, indicative costs/benefits associated with each option and identification of a preferred option for development.

The recommendations emanating from the Review Group's consideration of the shortlisted policy review areas are summarised below. Appendix VII provides further details on each of the proposed changes to the current policy.

1. 64/432 Compliant Testing

DARD currently carries out annual testing in the three divisions with the highest BR incidence and carries out biennial testing for herds in the other seven DVOs. It is proposed that DARD maintains biennial testing for dairy herds in the other seven DVOs, utilising monthly bulk milk sampling, and introduces annual testing for non-dairy herds in these areas. This would provide compliance with 64/432.

2. Use market prices for valuation and introduce compensation ceilings

Valuation of animals is currently carried out by DARD staff except where an independent valuer is requested by a herd owner. Valuations are carried out on a

subjective basis. Compensation is currently capped for BR reactors at 75 per cent of its valuation subject to a ceiling. No limits are in force in relation to BR in-contacts.

It is proposed that:

- initial valuations be carried out by strict reference to a list of market prices produced by DARD on a weekly basis;
- the herdowner be given two working days to accept the valuation or to request an independent valuation;
- independent valuations be carried out at the herdowner's expense by reference to a list of independent valuers, which will be maintained by DARD,
- where valuations are considered unacceptable to either the herdowner or DARD, the matter will be referred to an arbitration panel consisting of a professional arbitrator, an industry representative and a DARD representative;
- a ceiling of £1,500 for compensation on all in contact animals, including pedigrees be introduced; and
- DARD seeks powers to deduct compensation where a herdowner has been proved to be negligent.

3. Introduce a targeted programme of testing under 30 month cattle at abattoirs

The review group proposes that a targeted programme of sampling of cattle aged less than 30 months takes place at slaughter. This will provide an additional level of surveillance of cattle in herds that neighbour a breakdown.

4. 64/432 compliant pre movement testing

It is proposed that the BR eradication programme incorporates pre-movement testing to ensure 64/432 compliance.

5. Enhance/implement powers to enforce housing and movement restriction

It is proposed that DARD clarifies, obtains and/or implements powers to enforce:

- the restriction of cattle to specific farm locations (e.g. the home farm); and
- the restriction of cattle within farm locations to particular areas of the premises (e.g. specific fields/buildings).

6. Enhance/implement powers relating to depopulation, restocking and slurry treatment

It is proposed that DARD enforces the current powers and/or obtains powers to enforce:

- six-month break between depopulation and restocking with breeding cattle, following a breakdown; and
- treatment of slurry of infected herds with Thick Lime Milk to minimise the risk of any potential spread of infection via this route.

7. Evaluation/ implementation of biometric identification of cattle

It is proposed that the feasibility of DNA/Biometric identification of cattle using current genotyping technologies be determined, including the evaluation of appropriate new developments on sampling, DNA analysis and eye-imaging.

8. Augmentation of APHIS

It is recommended that a working group be established to review TB and BR functionality on APHIS and make comprehensive and specific recommendations for modifications and improvements. It is suggested that the recommendations emanating from the working group be funded as a priority issue, either under the umbrella of APHIS Phase II or otherwise, and that modifications to APHIS start before September 2002.

9. Re-evaluation of Diagnostic Tests

Whilst the existing test methodologies have proved successful in the past, DARD believes that the time is appropriate to examine some of the new evolving technologies (serological, microbiological and molecular biological) in order to determine their potential benefit in terms of diagnostic efficiency and effectiveness in delivering a successful Brucellosis Eradication Programme.

DARD propose therefore to embark on a programme of laboratory experimentation and comparative field testing including parallel testing in order to provide a platform for future decision making on how the current testing regime could be modified or enhanced, to deliver value for money.

Specifically, it is proposed that DARD screens higher risk cattle with two tests, the traditional SAT and a serological ELISA. This would be carried out in a pilot study in the worst affected area in Northern Ireland and involve approximately 5,000 cattle. The prime purpose of the study is to identify infected herds as early as possible and thus reduce the likelihood of spread especially during the grazing period.

DARD also propose to produce a protocol for an extensive parallel trial, nested within the BR programme, whereby the sensitivity and specificity of the SAT relative to a range of other tests is assessed. It is envisaged that a pilot study will be progressed separately and ahead of the trial protocol being agreed. This approach is to be adopted as the theoretical risk of leaving infected cattle, which are negative to the first test, is too great to wait for the outcome of an extensive trial (possibly up to 2 years).

DARD recognises that it will be important to evaluate the various test regimes at different stages in the reproductive cycle, including the latent period, where existing tests are known to be insensitive.

10.5 Rating of Proposed Areas of Policy Modification

In order to determine the relative merit of each of the above proposals, they were subjected to a weighting, scoring and rating process, whereby the basis for each recommendation was assessed against the following criteria:

- **impact upon the achievement of policy aim/objectives;**
- **robustness of information** i.e. the extent to which the information used to produce the recommendation can be relied upon and will stand up to more detailed scrutiny;
- **consensus among Review Group** i.e. the extent to which the Review Group agrees that the identified recommendation offers the best approach in contributing to the proposed objectives; and
- **sustainability of net benefits at an aggregate level** i.e. the extent to which the net benefit of the proposed recommendation will be realised over the mid to long term.

This subjective weighting and scoring process was carried out by senior AHD and VS members of the policy Review Group.

In order to provide a concise framework for the analysis of a range of different policy options, each recommendation was allocated a score out of 10 against each criterion. As it was considered that each criterion was equally important, they were not allocated differential weightings.

Upon calculation of the total score allocated to each recommendation, a rating was allocated on the following basis:

- options scoring between 30 - 40 points received an 'A' rating;
- options scoring between 20 - 29 points received a 'B' rating; and
- options scoring between 10 - 19 points received a 'C' rating.

The rating of options provides a basis for future option generation.

Each recommendation, its score against the identified criteria and its subsequent rating are detailed within Table 10.1 overleaf.

10.6 Option Generation

In identifying options for the future BR eradication programme the Review Group has considered a range of differing mixes of the rated areas of policy change.

Option 1 - Do Nothing (actual) - the do-nothing option is the base case against which all other options are measured. In this case it reflects the current nature and level of activities carried out by DARD in relation to BR. The financial year 2000/01 has been used to form the base case, as it is more representative of DARD's activities than 2001/02, as 2001/02 was dominated by the FMD crises. 2001/02

Table 10.1

Rating of Recommended BR Policy Revision Areas

		Option Score Against Criteria				Total Score	Rating
	Recommended Option	a	b	c	d		
1	64/432 compliant testing	9	9	9	9	36	A
2	Use market prices for valuation and introduce compensation ceilings	9	9	9	9	36	A
3	Introduce a targeted programme of testing under 30 month cattle at abattoirs	4	3	5	3	15	C
4	64/432 compliant pre movement testing	9	9	9	9	36	A
5	Enhance/implement powers to enforce housing and movement restriction	9	5	7	9	30	A
6	Enhance/implement powers relating to depopulation, restocking and slurry treatment	7	7	9	8	31	A
7	Further areas of research - Evaluation/ implementation of biometric identification of cattle	5	5	5	5	20	B
8	Augmentation of APHIS	9	5	9	9	32	A
9	Re-evaluation of diagnostic tests	9	7	8	7	31	A

expenditure levels have been adjusted to reflect recent bids for the 2002/03 financial year.

N.B. It is assumed that the level of expenditure profiled within the base case will allow the level of BR breakdowns to be restricted to current levels. However, if the number of breakdowns increase or decrease during 2002/03, expenditure levels will vary accordingly, primarily as a result of increased or decreased levels of compensation payments. In the first quarter of 2002, a higher level of BR outbreaks was observed when compared to previous years. Consequently, DARD's VS forecast that approximately 225 outbreaks will occur in 2002, an increase of 39 outbreaks when compared to base case (i.e. 186 outbreaks were recorded in 2000/01). If this increase is maintained over the five year appraisal period, this would result in higher levels of expenditure. However, the extent to which the observed increase in outbreaks can be attributed to the postponement in testing in 2001 (due to FMD), or to a general increase in the underlying incidence of the disease, cannot be determined.

Option 2 - Do Minimum - this option reflects an eradication programme that is fully resourced as reflected in bids for the 2002/03 financial year, plus changes to the current policy that ensures compliance with the EU 64/432 Directive i.e. introducing annual testing for non-dairy herds in seven DVOs, in addition to the three DVOs where annual testing currently takes place and introducing pre-movement testing.

Option 3 - Option 'Class A' Modifications Only - whereby, in addition to the changes associated with Option 2, the current policy is modified to incorporate:

- the use market prices for valuation and introduce compensation ceilings;
- enhancement/implementation of powers to enforce housing and movement restriction;
- augmentation of APHIS;
- enhancement/implementation of powers relating to depopulation and restocking; and
- re-evaluation of diagnostic tests.

DARD has used this policy review to re-affirm its commitment to the control and ultimate eradication of BR, by enhancing existing policy and by developing new initiatives to form a revised policy. However, DARD cannot hope to eradicate this disease without the full co-operation of the agriculture industry, especially in areas such as effective bio-security procedures.

Therefore, in addition to the identified areas of policy change, this option also provides for an enhanced level of awareness and education activities targeted at the agriculture industry.

DARD is aware that many farmers have a limited understanding/awareness of best practice procedures for reducing the risk of spreading animal diseases between farms. Traditionally farmers have purchased animals from marts or other farms, and immediately introduced them into their herds. They seldom would have considered isolation or checking when the last BR or TB test had been carried out on such animals. The provision of an animal health/disease prevention lifelong learning

programme by DARD Colleges will assist farmers improve bio-security practices on their own farms. It is envisaged that this education programme will be developed by DARD Colleges in conjunction with DARDs VS and that it will be made available to all livestock producers through the normal DARD College provision.

A best practice protocol on the prevention of animal disease transmission between farms will also be developed and effectively communicated to all farmers annually. It is essential that farmers take responsibility to ensure the risk of spreading animal diseases between farms is minimised. This protocol will be agreed with Local Stakeholders.

The policy Review Group considers that the package of measures provided by this option provides the minimum level of change required to achieve the identified policy aim and objectives.

Option 4 - Class A, B and C Modifications - whereby the current policy is modified to reflect those incorporated under Option 3 plus:

- evaluation/ implementation of biometric identification of cattle; and
- introduction of a targeted programme of testing under 30 month cattle at abattoirs.

DARD's VS advises that the implementation of 'Class B and C' modifications in addition to 'Class A' modifications will facilitate the achievement of the policy's aim and intermediate objectives by three to four months earlier than implementing 'Class A' modifications (Option 3) alone.

10.7 Summary of Option Elements/Performance Against Objectives

Table 10.2 below provides a summary of the differing elements that comprise each of the above options. Option 1, i.e. the "do-nothing' base-case, does not contribute to the achievement of any of the policy objectives. Option 2, the do-minimum option, only contributes to compliance with the EU 64/432 directive (re annual and pre-movement testing) and Options 3 and 4 offer the potential to achieve all of the identified objectives. Option 4 offers the potential for achievement of the aim and intermediate objective within a marginally shorter timeframe.

Table 10.2

Summary of Each Options' Proposed Areas of Policy Change

	Option			
Recommended area of policy change	**1**	**2**	**3**	**4**
64/432 compliant testing	✖	✔	✔	✔
Valuation/compensation ceilings	✖	✖	✔	✔
Introduce targeted UTMS testing	✖	✖	✖	✔
Introduce pre movement testing	✖	✔	✔	✔
Enhance/implement powers to enforce housing and movement restriction	✖	✖	✔	✔
Enhance/implement powers relating to depopulation and restocking	✖	✖	✔	✔
Evaluation/ implementation of biometric identification of cattle	✖	✖	✖	✔
Augmentation of APHIS	✖	✖	✔	✔
Re-evaluation of diagnostic tests	✖	✖	✔	✔
✔ indicates that the recommended modification is included in option ✖ indicates that the recommended modification is not included in option				

10.8 Changes in the Allocation of Costs and Benefits

Table 10.3 overleaf identifies (in qualitative terms) the changes envisaged in the allocation of the type of costs and benefits between the public (DARD) and private sector, resulting from adoption of each of the shortlisted non-base case options. N.B. only changes from the current policy (i.e. additional costs) are identified.

Table 10.3 highlights that options involving the following initiatives will involve the transfer or imposition of costs to the agriculture industry:

- conformance to 64/432 requirements (i.e. introduction of annual testing for non-dairy herds);
- adoption of the use of compensation ceiling;
- pre-movement testing;
- implementation of powers to enforce housing and movement restriction; and

- implementation of powers relating to depopulation and restocking.

Table 10.3

Proposed Options - Changes in Allocation of (Monetary and Non Monetary) Costs and Benefits

Option	Costs		Benefits	
	Public	**Private**	**Public**	**Private**
Option 2	Cost of test/analysis required to comply with 64/432	Cost of pre-movement tests Costs associated with farmer time associated with increased level of testing and pre-movement tests.	Minor reduction in disease incidence	
Option 3	As Option 2 plus: - implementing powers to enforce housing and movement restriction ; - augmentation of APHIS; - costs of revised valuation system; - costs of implementing depopulation and restocking proposals; and - cost of re-evaluation of diagnostic tests.	As Option 2 plus: - replacement of higher valued cattle not covered by compensation limits; - holding costs incurred by farmer due to housing/ movement restriction; and - loss of business earnings over six months in relation to restocking period	Reduction in compensation paid	Reduction in disease incidence
Option 4	As Option 3 plus: - costs of evaluating/ implementing biometric identification; and - costs of implementing <30 months scheme		Reduction in compensation paid	Reduction in disease incidence

11. QUANTITATIVE ANALYSIS OF INDICATIVE COSTS AND BENEFITS

11.1 Introduction

We have considered the economic implications of the shortlisted options identified in the previous section. In this section we identify the Net Present Value (NPV) of each option. NPV calculations and their supporting assumptions are provided in Appendix VIII.

11.2 Net Present Value

The NPV for each option is calculated on the basis of costs directly attributable to BR eradication. This analysis is limited to the identification of costs that are attributable to DARD only, as this review is primarily concerned with the development of a policy that offers best value for money from the perspective of the public 'purse'.

Identified costs are indicative and are based on current best estimates. They have been discounted at six per cent in accordance with the Treasury Green Book, over a period of seven years. A seven-year appraisal period has been chosen as it is considered that the costs and benefits associated with option 3 and 4 will cease upon eradication of the disease in year seven. Option 1 and 2 will incur additional costs on an ongoing basis beyond year seven.

Due to time constraints associated with the review process and, in some cases, the absence of baseline data, it has not been possible to quantify the incremental benefit of all of the proposed policy modifications. Table 11.1 overleaf identifies those proposals where indicative monetary costs and benefits have been estimated and the net cost/benefit (as accrued by DARD) over the seven-year appraisal period.

Within the NPV analysis, the benefits of each option are reflected by the level and timing of costs generated by the anticipated achievement of objectives. Cost savings stem from:

- reduced levels of compensation being paid; and
- reduced levels of breakdowns, resulting in lower levels of risk tests being carried out.

Table 11.1
Summary of Additional Monetary Costs and Benefits of Option Dimensions (Not discounted)

					Option Dimensions			
Recommended area of policy change	**Capital Costs (£m) Year 0**	**Revenue costs (£ m) Year 1-7**	**Estimated Savings (£ m) Year 1-7**	**Benefits less Costs (£ m) Year 1-7**	**1**	**2**	**3**	**4**
64/432 compliant testing	0	4.8	n/q	n/q	✖	✔	✔	✔
Valuation/compensation ceilings	0	1.9	20*	18.1	✖	✖	✔	✔
Introduce targeted UTMS testing	0	1.2	n/q	n/q	✖	✖	✖	✔
Introduce pre movement testing	0	4.2	n/q	n/q	✖	✔	✔	✔
Enhance/implement powers to enforce housing and movement restriction	0	2.1	2.73	0.63	✖	✖	✔	✔
Enhance/implement powers relating to depopulation and restocking	0	1.4	2.73	1.33	✖	✖	✔	✔
Evaluation/ implementation of biometric identification of cattle	0.25	1.8	n/q	n/q	✖	✖	✖	✔
Augmentation of APHIS	0.02	0	n/q	n/q	✖	✖	✔	✔
Re-evaluation of diagnostic tests	0	1.4	n/q	n/q	✖	✖	✔	✔

✔ indicates that the recommended modification is included in option ✖ indicates that the recommended modification is not included in option

n/q - not quantifiable

* assuming policy objectives are achieved

Table 11.2 details the NPV of each option, as calculated in the spreadsheets included as Appendix VIII. Each option presents a negative NPV i.e. a Net Present Cost.

Table 11.2
Net Present Value of Options

Option	Description	NPV (£s)*
Option 1	Do Nothing	-76,419,458**
Option 2	Do Minimum	-83,612,914**
Option 3	'Class A' modifications	-69,833,552
Option 4	'Class A, B and C' modifications	-72,318,085

* Cumulative NPV over a seven year period

** Option 1 and 2 will incur additional costs on an ongoing basis beyond year seven at a level of £13.69 million and £14.98 million per annum (before discounting), respectively.

11.3 Additionality

Additionality may be defined as the amount of output from a policy or project as compared with what would have occurred without public sector intervention. Without such intervention, it is highly unlikely that BR would be brought under control as there are no co-ordinated initiatives actively tackling the issue of bovine BR within the private sector.

11.4 Ranking of Options

On the basis of the quantitative analysis, the rank order for each option is outlined in Table 11.3, rank number "1" indicating the option exhibiting the highest NPV.

Table 11.3

NPV Analysis of Options

Option	NPV (£s)*	Increment from Do Nothing (£s)	Rank
1	-76,419,458	---	3
2	-83,612,914	-7,193,457	4
3	-69,833,552	6,585,906	1
4	-72,318,085	4,101,373	2

** Cumulative NPV over a seven year period*

Table 11.3 identifies that Option 3 scores the highest ranking, with Option 2 (the 'do-minimum' option) scoring the lowest ranking with the highest Net Present Cost (NPC). Both Option 3 and Option 4 are more preferable than the 'do-nothing' option, as they generate cost savings over the appraisal period.

11.5 Sensitivity Analysis

The issue of risk is assessed by the application of a sensitivity analysis to each of the project options. In this case, sensitivity analysis has been applied to those areas that are regarded as being most open to variation i.e. the costs of implementing proposed changes in policy, the reduction in outbreaks achieved by the revised policy and the ceilings applied to compensation payments.

The following variations are applied:

- +10 per cent and -10 per cent in the costs of implementing each proposed policy modification;
- +10 per cent and -10 per cent in the number of outbreaks;
- +£500 and -£500 on the compensation ceiling introduced in relation to BR in-contacts.

The levels of variation used have been selected in an arbitrary manner to illustrate their resulting impact, as there is no data available to inform the selection of more appropriate levels of variation.

Table 11.4 identifies the effect of the introduction of the variations to the NPV of each option. The NPV resulting from the introduction of the above variations seen in Appendix VIII.

Table 11.4

Sensitivity Analysis

	Option 1	**Option 2**	**Option 3**	**Option 4**
Original NPV over seven years (£000s)	-76,419	-83,613	-69,834	-72,318
Variation Introduced	**Option 1**	**Option 2**	**Option 3**	**Option 4**
	% Change from original Option NPV			
+/-10 per cent in costs of implementing proposed policy modification	n/a	+/- 0.86%	+/- 1.82%	+/- 2.13%
+/-10 per cent in the number of outbreaks	n/a	n/a	+/- 5.54%	+/- 5.35%
compensation ceiling raised to £2,000	n/a	n/a	- 0.28%	- 0.27%
compensation ceiling lowered to £1,000	n/a	n/a	+ 1.55%	+ 1.50%

Table 11.4 identifies that the variable with the largest impact of the NPV of shortlisted options is the number of BR outbreaks. Option 4 is marginally less susceptible to this area of variation, and to the lowering of compensation, than Option 3. Option 4's NPV is marginally more susceptible to an increase in costs associated with the proposed changes in policy.

When NPVs resulting from the sensitivity analysis are compared, the rankings (where applicable) remain unchanged.

12. EVALUATION OF OPTIONS - QUALITATIVE ANALYSIS

12.1 Weighting and Scoring

The following section involves an assessment of the non-monetary/qualitative costs and benefits. Taking account of the inherent difficulties associated with the evaluation of the qualitative factors, we have adopted a weighting and scoring approach. We have defined the qualitative criteria and have assigned weighting to each depending on its relative importance in terms of meeting the specific objectives set out in Section 4. The higher the weighting the higher its perceived importance. Weightings total 100. Each option is then scored out of 10 according to the degree to which it matches the criteria that have been identified.

The qualitative criteria that are to be applied are detailed below.

12.2 Qualitative Criteria

Local Stakeholder Acceptance - i.e. the extent to which NI based stakeholders will accept and support the revised policy. Local stakeholders include those representing the agricultural industry, DARD, the NI Assembly, other political and public bodies (e.g. the ARDC, PAC and NIAO) and the wider public. Options that involve a transfer of costs to the private sector are likely to receive an unfavourable response from the agriculture sector and those options that are predicted to produce DARD cost savings are likely to produce a favourable response from some quarters within the public sector. However, on balance, it is considered that those options that increase farmer costs will receive a significant level of adverse reaction and therefore they will receive a lower scoring than those that do not increase farmer costs.

Public Health and Consumer Reaction - inter-relating issues concerning animal health and human health have been prevalent within society in recent years due to the impact of BSE, FMD etc. The revised BR control policy should contribute to minimising potential human health risks from BR and generate a favourable reaction from the general public. Options involving the targeted under 30 month cattle testing scheme will score higher than options that do not include this as this initiative will increase the level of surveillance of the BR status on beef entering the human food chain.

Compatibility with DAFRD approach - i.e. the extent to which the policy maximises compatibility between the approach adopted by DARD and DAFRD, encourages effective co-operation between the two Departments and reduces the potential for illegal cross border movement of animals. Options incorporating changes to valuation and compensation in line with DAFRD, the 64/432 compliant approach to testing and the implementation of powers relating to housing/movement restriction and depopulation/restocking, will score higher than those that do not include these elements, as these activities are congruent with DAFRD's approach.

Acceptance from the EU - the disease control measures adopted by DARD are subject to scrutiny and comment by the EU (e.g. the EU Task Force for monitoring disease in Member States). The range of this scrutiny exceeds the requirements of 64/432. Subsequently, it is desirable that the revised policy adopted by DARD

addresses previous recommendations made by relevant EU bodies. Therefore, options incorporating recent EU TB task force recommendations (i.e. the use of pre-movement tests) will receive higher scorings in relation to this criterion.

The weighting applied to each of the identified criteria is detailed in Table 12.1 below.

Table 12.1

Weighting of Objectives

Factor*	Weighting	Explanation
Local Stakeholder Acceptance	34	This factor has been awarded the highest rating, as stakeholder acceptance is essential in order to allow the revised policy to be progressed at speed and for benefits to be realised at the earliest possible date.
Public Health and Consumer Reaction	27	Protection of human health is a key public responsibility. The creation of a positive consumer reaction to the consumption of NI beef is essential in maintaining/developing the beef sector. Therefore, this factor has been awarded the second highest weighting.
Compatibility with DAFRD approach	21	Effective disease control requires the development of a compatible approach between NI and ROI. Therefore, this factor has been awarded the third highest weighting.
Acceptance from EU	18	Maintaining EU support of disease control activities is desirable but not essential. Consequently, this factor has been awarded the lowest rating weighting.
Total	100	

* within the TB Review report an additional criterion of 'Compatibility with the DEFRA approach' was included. As BR is not a significant problem in GB and as it was considered that the options presented would not impact on this criterion, it was omitted from this analysis.

12.2.1 Results

Table 12.2 overleaf illustrates the weighted score for each option and identifies that Option 3 is the preferred option when non-monetary criteria are considered.

Table 12.2

Weighted Scores

		Option							
Criteria	**Weight**	**1**		**2**		**3**		**4**	
		Score	*Weighted Score*	Score	*Weighted Score*	Score	*Weighted Score*	Score	*Weighted Score*
Local Stakeholder Acceptance	34	0	*0*	5	*170*	4	*136*	4	*136*
Public Health and Consumer Reaction	27	0	*0*	2	*54*	4	*108*	5	*135*
Compatibility with DAFRD approach	21	0	*0*	4	*84*	6	*126*	6	*126*
Acceptance from EU	18	0	*0*	2	*36*	5	*90*	5	*90*
Total Weight/Score*	100		***0***		***344***		***460***		***487***
Rank		**4**		**3**		**2**		**1**	

13. CONCLUSIONS AND RECOMMENDATIONS

13.1 Introduction

In this section we have set out our conclusions and recommendations arising from the appraisal of the proposed options for the control of BR by DARD.

13.2 Results

Table 13.1 below summarises the results of our qualitative and quantitative analysis.

Table 13.1

Quantitative and Qualitative Results

	Description	NPV (£s)*	Weighted Score
Option 1	Do Nothing	-76,419,458	0
Option 2	Do Minimum (64/432 compliant only)	-83,612,914	344
Option 3	Class A Modifications	-69,833,552	460
Option 4	Class A, B and C Modifications	-72,318,085	487

* Cumulative NPV over a seven year period

13.3 Preferred Option

The preferred option is Option 3, as it achieves a lower NPC/higher NPV than the other (base case and non base case) options, while delivering a level of qualitative benefit that is only surpassed by Option 4. Even though Option 4 has additional qualitative benefit, this is at a marginal economic cost of £2.5 million. Taking everything into account, it is considered that Option 3 represents the most economic method of achieving the policy objectives.

13.4 Critical Success Factors and Uncertainties to be Addressed

The critical success factors of the revised policy are:

- securing legislative change (re compensation);
- securing industry and political support for the policy changes proposed by the preferred option; and
- obtaining appropriate financial and human resources.

Whilst the preferred option provides the "best fit" in terms of the quantitative and qualitative analysis, particular areas of uncertainty remain to be addressed. The main areas of uncertainty relate to those factors that are deemed critical to the success of the policy, as highlighted above, plus:

- change in BR policy in ROI and/or GB; and

- the underlying prevalence of BR in NI. The number of reactors identified in the first three months of 2002 is significantly higher than that identified in previous years. This may be a result of the postponement in testing in 2001 due to FMD, but it may also be related a general increase in the underlying incidence of the disease. The extent to which the increase can be attributed to each of these cannot be assessed at present.

Figure 13.1 allocates identified areas of project risk and uncertainty (i.e. both quantifiable and unquantifiable) against the probability and impact of each element of risk occurring. Each area of risk is categorised as high, medium and low against each variable.

Figure 13.1

Risk Probability/Impact Matrix

		Impact Severity		
Risk Probability		**Low**	**Medium**	**High**
	High			Achieving industry and political support Securing of financial and human resources
	Medium		Change in GB/ROI policy	Underlying prevalence of BR Achieving legislative change
	Low			

Risks allocated within the shaded area denote those factors that are categorised as being of medium/high probability and high impact. These factors constitute potential areas of high levels of exposure of risk.

In minimising the probability of these risks occurring and/or the extent of their impact it is suggested that DARD adopts the following measures:

Achieving Industry and Political Support/Achieving Legislative Change

Some aspects of these proposals, such as those relating to animal disease compensation, will be unpopular with the agricultural industry. The risk is that political lobbying will lead to Assembly veto on those changes that require legislative amendments. It is impossible to remove that risk entirely and all that DARD can do is to pursue the consultation process sensitively. At political level, it will be important for Members of the Legislative Assembly (MLAs) to be reminded that there are wider issues than those relating to farmers in this and that expenditure

on animal disease compensation has implications for other NI spending programmes. This will require careful lobbying of MLAs by both the Minister and officials.

Finance and Human Resources

It is axiomatic that any additional resources – whether human or financial – required to implement these proposals will, if not provided, undermine the desired outcomes. It is obvious that if DARD has insufficient resources to employ staff to carry out the necessary testing programme, the disease will tend to spread. However, even if finances are available, it will be crucial that the relevant staff are made available when needed. Long recruitment delays, for example, will undermine the Department's efforts. To counter this, as soon as any additional funding has been secured, the Department will liaise with the Civil Service Commission to initiate the recruitment process. There is no reason to believe that there will be any difficulty as far as the availability of recruits is concerned but, should that emerge as a problem, DARD would explore all other practical alternatives (e.g. recruitment of private veterinary practitioners on short-term contracts).

13.5 Equality, Human Rights and Targeting Social Need

Section 75 of the NI Act 1998 requires public bodies in carrying out their functions to have due regard to the need to promote equality of opportunity between the nine Section 75 categories:

- persons of different religious belief, political opinion, racial group, age, martial status or sexual orientation;
- men and women generally; and
- persons with a disability and persons without; and persons with dependants and persons without.

Targeting Social Need is complementary to Equality but focuses more narrowly on reducing unfair social and economic differentials.

It is not possible to carry out an equality impact assessment of the options proposed within this document, within the timescales of the review. However, it is recommended that this assessment is carried out at the earliest possible opportunity and that it incorporates the following:

- consideration of available data and research - guidance on what information is available and how it can be accessed;
- assessment of impacts - meaning of differential/adverse impact;
- consideration of mitigation and alternative policies;
- consultation - good practice guidance;
- decision making; and
- publication of results - good practice to ensure accessibility.

The resulting policy will require monitoring of adverse impact and publication of monitoring results should take place.

13.6 Recommendation

We recommend that, subject to the identified key risk issues of uncertainty being addressed, that the DARD should proceed with development of Option 3 – the preferred option.

Also while this review has considered the major options for dealing with the BR, it has not been exhaustive and there are many other areas where further work should be done. These include:

- the use of Geographical Information Systems;
- bar coding of samples; and
- review and consolidation of legislation.

Therefore, the Review Group recommends that all of the above issues be explored further. Additional details on each of the above are detailed in Appendix IX for reference.

14. PROGRAMME FUNDING, MANAGEMENT, MONITORING AND EVALUATION

In order to appraise the outcome of the project it will be necessary to carry out a post implementation evaluation. This should comprise examining the extent to which the programme succeeds in meeting its original objectives and ensuring that a number of key monitoring and management structures are in place.

14.1 Programme Funding

To date, because of the difficulties of predicting BR expenditure, DARD has agreed with DFP an arrangement whereby in-year bids are used in the event that the budgets proved to be inadequate.

It is envisaged that this arrangement will continue until annual programme expenditure can be predicted more accurately. This can be achieved through halting the upward trend in the disease and capping compensation. It is envisaged that the preferred option will facilitate this and will allow a return to conventional budgeting and financial control arrangements in the next two to three years.

The total cost of implementing the preferred option over an initial seven-year period is £84 million, reflecting an incremental saving (when compared to the base case) of £6.6 million over the seven year period.

It is envisaged that the process of agreeing the funding of the preferred option will incorporate the following:

- consideration and agreement by DMB, on which recommendations are to be put to the Minister of Agriculture and Rural Development;
- upon ratification by the Minister, DARD will carry out a process of industry consultation;
- upon conclusion of the consultation phase, development of administrative arrangements to deliver the new policy (e.g. initiating legislative change, 'green book' appraisal and equality impact assessment of proposed changes);
- revision of budgets and running cost provisions; and
- development of bids for additional resources (if required).

Therefore, it is envisaged that the revised policies will first impact on the 2003/04 financial year. However, the Review Group recommends that, where possible, implementation of the revised policy (or elements of the revised policy) be 'fast-tracked', given the worsening disease position.

It is also imperative that the funding requirements of the BR eradication programme be closely monitored and reviewed on an ongoing basis, as programme costs are particularly susceptible to variations in the number of BR outbreaks. Sensitivity analysis identifies that a 10 per cent increase in the number of BR outbreaks will increase the preferred option's programme costs (over the seven appraisal period) from £84.2 million to £88.7 million, an increase of over five per cent. This is particularly pertinent as the underlying prevalence of BR is identified as a key area

of uncertainty that cannot be addressed in the short-term by risk minimisation strategies.

14.2 Programme Management

Management arrangements for implementation of the preferred option will not differ significantly from current arrangements, with the management of the programme being the responsibility of DARD's CVO, with policy input being provided by DARD's AHD.

However, in response to industry views (see paragraph 7.5), it is envisaged that a BR Consultative Forum will be established to contribute to the eradication policy. This group will be comprised of representatives of all key stakeholders and will provide a formal means of sharing and discussing issues relating to the control of BR. It is envisaged that this group would meet twice a year.

14.3 Monitoring and Evaluation

Table 14.1 overleaf provides details of the project's arrangements for monitoring and evaluation. Within Table 14.1 the following monitoring and evaluation requirements are detailed against each of its objectives (where applicable):

- baseline information required;
- monitoring and evaluation methods;
- the frequency of monitoring and evaluation activity; and
- the individual responsible for ensuring that monitoring and evaluation is carried out at the appropriate time(s) and to an appropriate level of detail.

Table 14.1

Post Implementation Evaluation

Objective	Baseline Information	Evaluation Method	Frequency of Data Collection	Individual(s) Responsible for Monitoring and Evaluation
to reverse the trend in BR outbreaks, so that it is reduced to less than 150 outbreaks per annum within three years of implementing the revised programme.	Disease monitoring data	Desk analysis	Monthly	CVO
to reduce the 2000/01 level of BR compensation payments by at least £1.5 million within three years of implementing the revised approach	Compensation payments/ disease monitoring data	Desk analysis	Quarterly	Head of Farm Policy, Animal Health, Welfare and BSE
to ensure compliance with EU Directive 64/432.	64/432 (as amended) requirements	Desk analysis	Annually	CVO
Other Performance Indicators				
- total time expended to control a breakdown; - total cost of taking a sample; - total cost of carrying out sample analysis; and - VS administration cost per test.	None at present	Desk analysis of time/task data	Quarterly	CVO

APPENDIX I

Review of the DARD Policy on the Control of Brucellosis in Cattle: Terms of Reference

1. Review the effectiveness of the Department's current approach to the eradication of bovine Brucellosis and evaluate in particular the value for money afforded by the present approach.

2. Take account of scientific, veterinary and political developments since the policy was established, including:-

   (a) any alternatives to the current policy of slaughter and compensation;

   (b) the scope for greater efficiency;

   (c) long-term disease trends in ROI, GB and in NI;

   (d) the controls aimed at preventing the disease spread from the ROI;

   (e) the changed political environment in NI and the potentially different approaches to compensation etc which arise in consequence;

   (f) scientific developments relating to alternatives and/or adjuncts to the present tests;

   (g) current research strategies within DARD, and

   (h) implications of genetic traceability in relation to fraud in the areas of movement control, identification and testing.

3. Make recommendations to the Permanent Secretary and Minister for a policy to be adopted during the period until 2005 and the arrangements necessary for its effective delivery.

4. Particular attention will be given to:-

   (a) establishing the rationale for the policy;

   (b) identifying the policy's aims;

   (c) specifying its objectives;

   (d) factors involved in the current epidemic;

   (e) the effectiveness of the current testing frequency;

   (f) alternatives, if any, to existing testing methodologies;

(g) the current approach to compensation including valuation, rates of compensation and salvage;

(h) action being taken in the ROI;

(i) quantification of the costs and benefits of the present policy, including the identification of specific performance measures and indicators of impact and value for money;

(j) any assumptions underlying the policy and their continued appropriateness;

(k) any unintended side effects in terms, for example, of equality, of the present policy;

(l) the public expenditure implications of the future policy options and recommendations identified;

(m) the gaps in knowledge and the need for research and development; and

(n) the role of APHIS in control strategies.

5. The review will take account of any relevant conclusions reached in the parallel exercise relating to bovine TB.

APPENDIX II
Veterinary Service Epidemiological Overview of Brucellosis 1990 - 2001

(1) Introduction

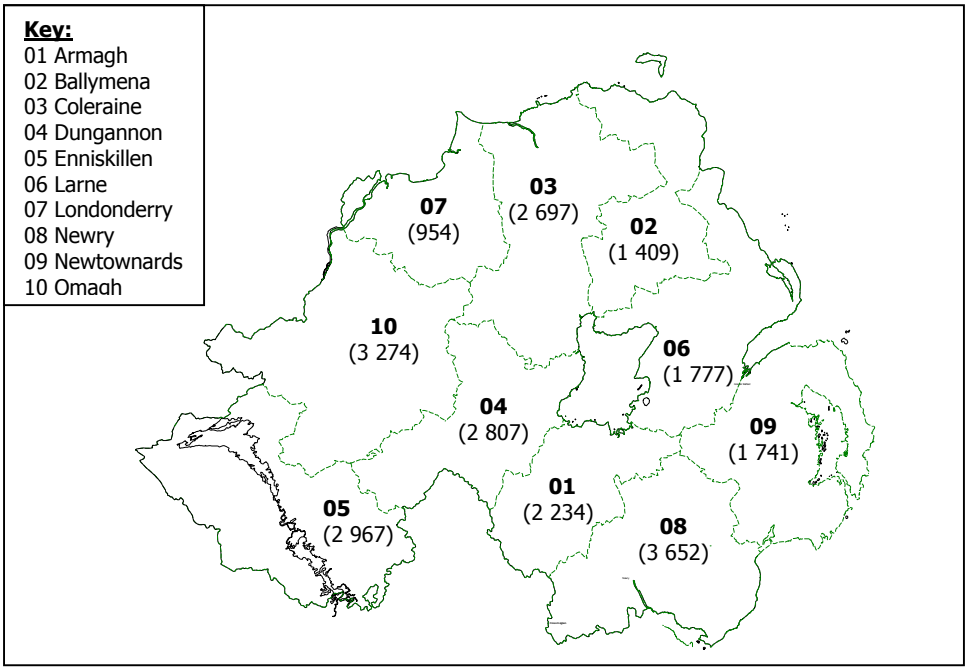
The purpose of this section is to provide an overview and some background information regarding bovine brucellosis. Time, information and resource constraints have prevented an in-depth analysis and thus this document is restricted to providing a series of descriptive charts or maps with some explanatory comments.

(2) Herd Distribution and Size

(a) Number of Herds

32 700 herds presented cattle for Brucella testing in the 10 years ending 31 October 2000 while 23 500 had cattle tested in the last 2 years of this period. Figure 1 shows the number of herds per division (DVO) which had a Brucellosis test during the latter time.

Figure 1:



(b) Size and Age of Herds

The average number of cattle tested at herd tests between 1990 and 2001 was 39 with an increase from 32 in 1990 to 45 in 2001 i.e. 71%.

Figure 2 shows the herd-level changes for each division. Note the following with respect to these charts:

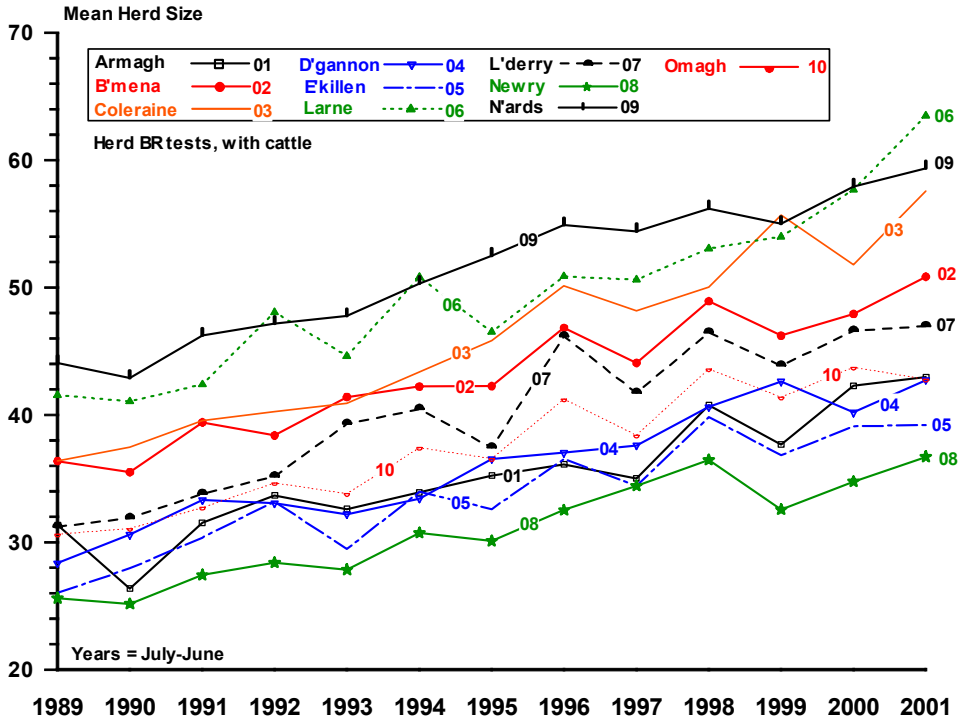
- Only female cattle older than 9 months and bulls older than 6 months are tested for Brucellosis, so these data cannot be used as estimates of herd size.

- Herds in the north/east of the province test larger numbers of Brucellosis-eligible cattle than those in the west and south and the difference is statistically significant ($p < 0001$). The mean 10-year average for the former DVOs (07, 03, 02, 06, 09) is 47 while it is 32 for the other 5 divisions.

- The increase in the number of Brucellosis-tested cattle corresponds to the increase in the number of cattle tested for TB, both across the province and between divisions, although the increase is less for TB.

- The 10-year increase in the number of cattle tested for Brucellosis is consistent across divisions.

Figure 2:



To assess if the national herd has increased in age i.e. if farmers are retaining cattle for longer, I compared the mean age of 50 herds that presented more than 30 cattle for routine Brucellosis testing in 1994 and 2000. Although only a crude measure it did allow the comparison of ages within stable herds over a lengthy period. However, as the analysis only included cattle tested, the result was not a measure of the whole herd.

The mean age of herds tested in 1994 was 73 days older than when tested in 2000 and there was no significant difference ($p>0.05$) between the 2 samples.

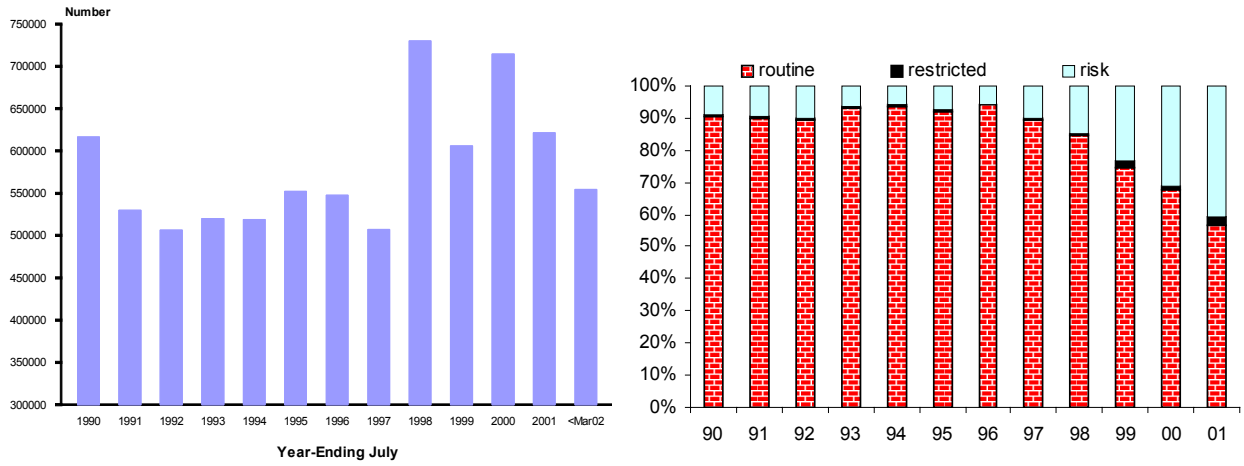
(3) Brucella Testing

On average, 581 000 Brucellosis animal tests per annum were performed during the period July 1990 to June 2001. As routine herd testing is biennial, with some recent exceptions, the annual total represents half a test cycle.

Figure 3 indicates the annual test levels for the period in question. The chart on the left shows the total number of animal tests while the right hand figure shows the proportion of testing by risk status. "Routine" testing refers to biennial or private tests, "restricted" to those that followed disclosure of infection, and "risk" testing to other test types. The latter is largely comprised of testing herds that neighbour breakdowns ("contiguous" herds), considered as additional to the agreed "de minimis" i.e. beyond what EC Directives dictate.

Test levels in 1997 were low due to the impact of the Newcastle Disease epidemic on testing resources. The sharp increase in testing after this corresponds to a significant increase in the proportion of risk testing. This is discussed later.

Figure 3:



(4) Brucellosis Incidence

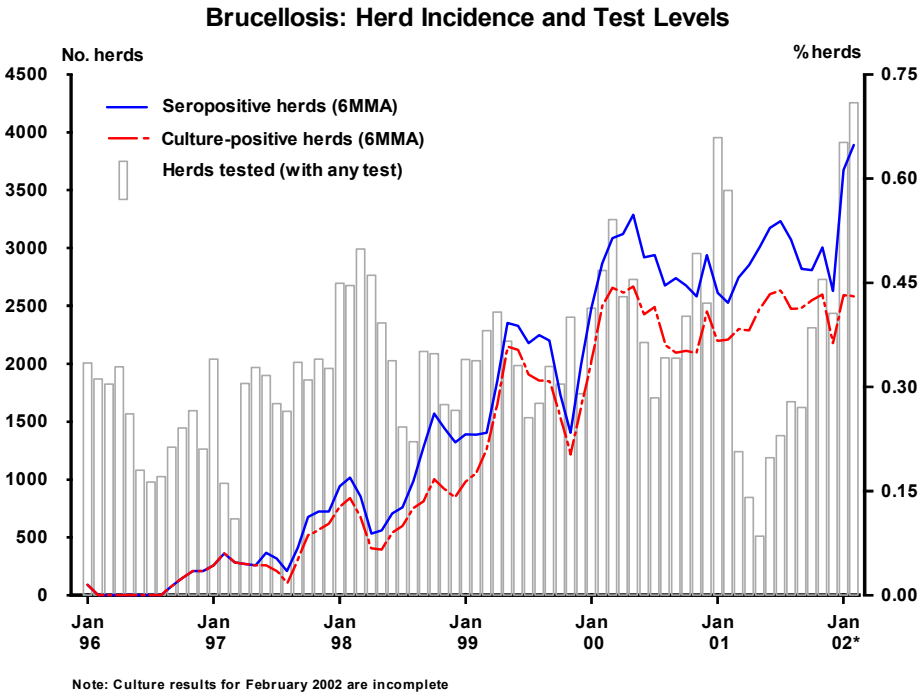
(a) Herd Incidence

Figure 4 shows the herd incidence of Brucellosis for the period January 1996 to February 2002. Note the following with respect to this chart:

- The difference between the 2 lines represents the proportion of herds that were serologically positive but from which the *Brucella* organism could not be cultured. As to be expected, the lines diverge during periods of increasing or high incidence, possibly due to increased severity in interpretation.

- The bar chart is provided to illustrate that the sharp rise in incidence in mid-2001 is due principally to testing being restricted to high-risk herds. Almost all testing was stopped at this time due to the Foot and Mouth epidemic and only herds with a high suspicion e.g. multiple abortions or known case of disease were tested. Thus the rise in incidence in this period is not a true indicator of the epidemic trend.

Figure 4:



The annual incidence, as a percentage of herds tested within a calendar year, is as follows:

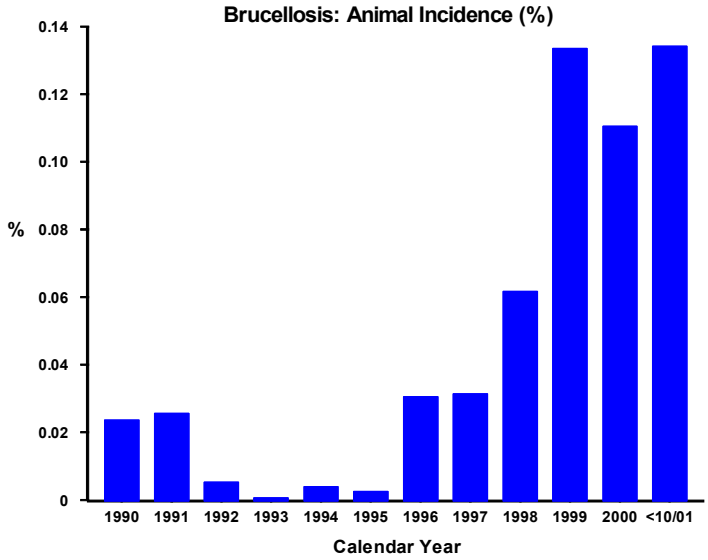
Table 1

Year	% Sero-positive	% Culture-positive
1995	0.01	0.01
1996	0.02	0.02
1997	0.10	0.08
1998	0.16	0.10
1999	0.36	0.32
2000	0.48	0.40
<10/01	0.46	0.38

(b) Animal Incidence

Figure 5 shows the annual animal incidence of Brucellosis serological reactors from 1990 to Oct 2001 by calendar year:

Figure 5:



Note the following with respect to this chart:

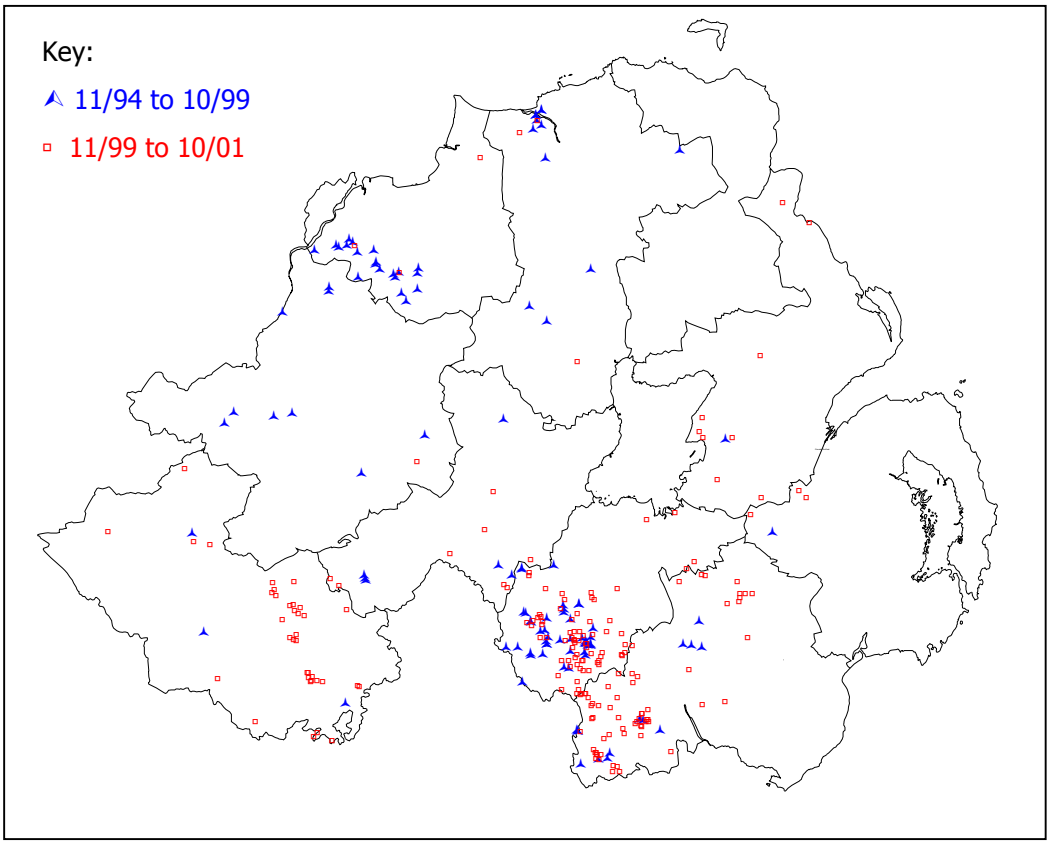
- The rise from 1996 is obvious with a 3-year mean (1999 to 2001) of 0.15%.
- The data for 2001 overestimate the true incidence due to testing constraints described under herd incidence.
- The overall data slightly underestimate the incidence from 1998 onwards due to a re-interpretation feature on APHIS (so-called "ATI" tests).
- The data are presented by calendar year; this causes the Oct-Mar test cycle, the bulk of the testing each year, to fall into 2 different years. This has little impact if the incidence is constant but tends to "flatten" the curve during periods of rising or falling levels of disease.

(5) Breakdown Features

(a) Distribution of Breakdowns

The following map shows the distribution of confirmed breakdowns for the period November 1994 to October 2001:

Figure 6



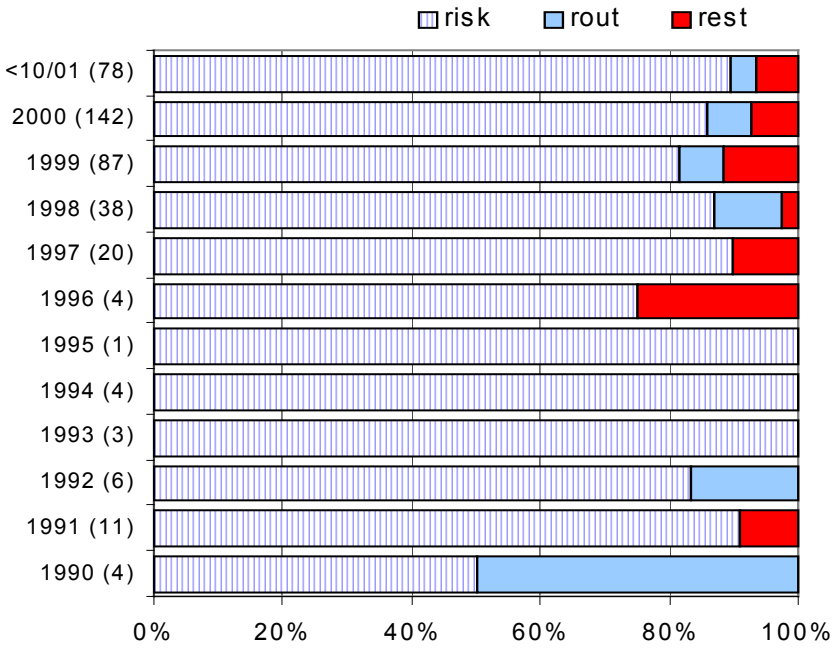
Following an absence of Brucellosis from the province for some years, 3 clusters occurred in 1996/1997: in Londonderry, Coleraine and Armagh DVOs, linked to cross-border contact or cattle movement. From the map it can be seen that the problem has been largely resolved in the former 2 DVOs but recent infection has spread to Newry DVO and has also occurred in Enniskillen DVO. 80.6% of all confirmed outbreaks during the period January 1998 to October 2001 occurred in these divisions.

(b) Test Types

How are Brucellosis-infected herds identified and how is infection acquired? A detailed epidemiological investigation report form is completed for each breakdown but the data from these is not currently available. However, some information can be obtained from APHIS regarding the circumstances in which Brucellosis is first disclosed.

Figure 7 shows the relative proportion of herd breakdowns by the status of the test at which reactors were first identified (see Section 4 for an explanation of the status labels). The annual number of breakdowns is given in parentheses to the right of the year-label.

Figure 7:



Note the following:

- The majority of breakdowns are identified when the herd is tested due to some identified risk of disease i.e. because of proximity to, contact with, or movement of animals between 2 herds one of which is infected. In the years 1997 to (Oct) 2001 i.e. when there were a significant number of breakdowns, 86% of all infected herds were identified within this test category.

- Restricting the data to confirmed breakdowns i.e. where disease was confirmed by laboratory culture, has little impact on the relative proportions. In other words, the risk status of the breakdown has little impact on the final culture status of the herd.

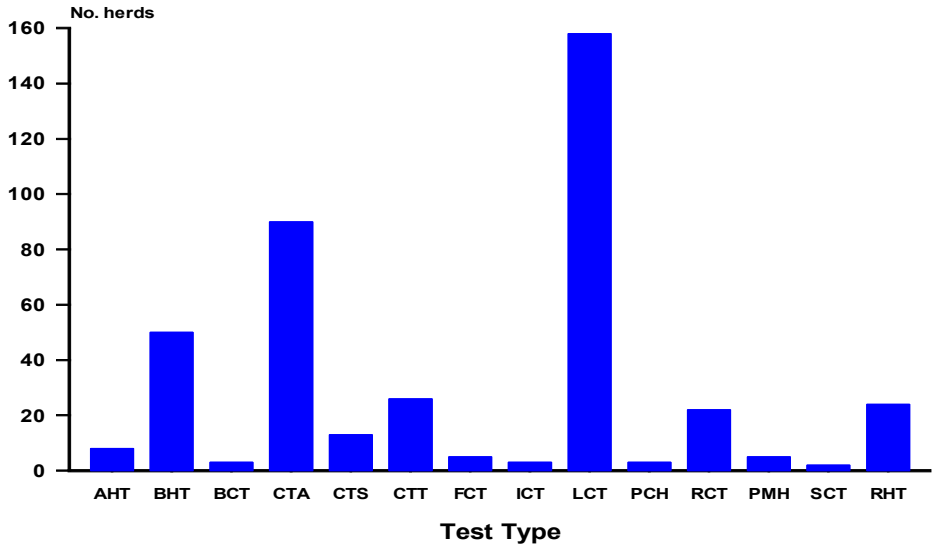
To assess this further, the following chart (Figure 8) shows the distribution of breakdowns by the test at which reactors were first disclosed. In the instance where infection was first identified through retesting of inconclusive reactors (30% of breakdowns), the original test of the reactor was included. Note the following with respect to this chart:

- The 2 left-hand bars show the number of breakdowns identified at routine testing. AHT = "Annual Herd Test" and BHT = "Biennial Herd Test". These comprise 14% of all outbreaks and are discussed later.

- The right-hand bar labelled "RHT" (Restricted Herd Tests; 7% of all outbreaks) shows those herds where infection was identified once the herd had already been placed under restriction e.g. following disclosure of infection in a linked/associated herd.

- The remainder of the chart details the "risk" tests, which comprise 79% of all tests. The most significant test type within this category is the LCT (lateral check test), a test of herds that are contiguous to infected herds. This accounts for 48% of all test types but this underestimates the true level as other test types pertain to this type of herd. For example, most RCT breakdowns ("Risk Check Test") could have been labelled LCT, and 39 of the 89 CTA (Check Test following an Abortion) herds had a LCT test in the previous year. When allowance is made for these other test types, the LCT category accounts for 69% of all tests.

Figure 8



(c) Size and Nature of Breakdowns

The following table shows the number and percentage of serological reactors when infection was first disclosed at a herd test:

Table 2

Cattle Tested	Number of Herds	Median (No.)
1 to 10	29	1
11 to 30	58	3
31 to 50	42	4
51 to 100	61	3
101 to 300	51	5
>300	11	4

Thus, 42 breakdown herds presented between 31 and 50 cattle at the herd test and the median number of reactors at these tests was 4.

Intra-herd spread at first disclosure of infection is relatively limited and does not appear to be overly affected by herd size: the median number of reactors remains relatively constant (3 to 5) despite changes in the number of cattle tested. Of the 252 herds included in the analysis, 86 had 1 reactor at the disclosure test (34%) while 139 (55%) had 3 or fewer.

To assess if the number of reactors was affected by test type, the analysis was repeated but stratified by particular test types. The number of herds is indicated in parentheses.

Table 3:

Cattle Tested	BHT/AHT	LCT/RCT	RHT
1 to 10	2.5 (4)	1 (12)	2 (4)
11 to 50	2 (9)	4 (45)	4 (41)
51 to 100	6 (9)	4 (28)	2 (17)
>101	12 (4)	3 (25)	11.5 (26)
All sizes	3	3	4

The first column indicates routine testing where the duration between tests is greatest and where awareness of the disease might be lower. One might therefore expect greater intra-herd spread in such tests compared to the risk or restricted tests. This does not appear to be the case except possibly for very high risk herds (RHTs) with large numbers of cattle. Across all herd sizes there is little difference in the median number of reactors at the first test.

However, further analysis is required to assess this in more detail as various factors may be masking a true association:

- Some of the BHT and AHT herds occur in high-prevalence areas and may thus have necessitated LCTs rather than routine test status.
- Some work-around solutions on APHIS e.g. the re-interpretation (ATI) code masks the test status of the herd and require individual checking to ascertain the original test status.
- The analysis does not include what happens at subsequent tests, does take account of buy-out decisions, or any changes over time in the nature of the epidemic.
- Infected herds that are linked or "associated" on APHIS may represent single outbreaks. This is not taken into account in the analysis as the data is not readily available, and the effect of this may be to reduce the number of reactors.

277 of 375 herds (74%) with Brucellosis from January 1995 onwards had at least 1 restricted test following disclosure of infection in the herd or in an associated herd:

- In 91 (33%) of these herds reactors were disclosed at these RHTs
- In 46 of the 91 herds the previous test was a (positive) herd test, thus reactors were disclosed at 2 consecutive tests of all eligible cattle in the herd.
- In 6 herds (2%) reactors were identified in at least 2 RHTs.

This means that infection is not disclosed fully at the first test in up to one third of infected herds. In many cases this is because the initial test is that of individual cattle e.g. check- testing of aborted cattle, but it is not resolved at the first test in a significant proportion (46/277 = 17%) when there are 2 herd tests. Failure to identify infection at the first (herd) test may be due to early infection in the cattle (which the test may not detect), exposure to Brucellosis between the tests or a lack of sensitivity in the screening test used. This aspect requires further investigation as it may play a significant role in prolonging the epidemic.

(6) Factors/Issues in the Current Epidemic

Time constraints preclude a detailed description of the factors that may have contributed to the current prevalence of Brucellosis in the province. I have therefore merely provided a list of some of the more salient factors, with a few comments, for information of the group and as a basis for further discussion. I have not listed the remedial or follow-up actions taken by the Department but can provide this information separately if required.

(i) Illegal movement of cattle

A 1999 study suggested that unauthorised movement of cattle within Northern Ireland and across the border, together with associated illegal activities, have played a significant role in spreading Brucellosis. Although it is not possible to prove or accurately quantify, there is anecdotal evidence that this was responsible for introducing infection in 1997/1998 to south Armagh. A 1999 study found that 5 primary outbreaks across the province in these years caused infection to spread to more than 60 other herds; illegal activity was strongly suspected in 4 of these index cases while (legal) cross-border movement was involved in the fifth.

(ii) Compensation arrangements

Again, there is evidence that a small but significant proportion of breakdowns are caused by the deliberate infection of cattle to benefit from the generous compensation associated with herd depopulation. Although the actual number of herd keepers who engage in this activity is small, their activities lead to significant spread within their neighbourhood and their herd characteristics (often big and/or pedigree herds?) result in expensive compensation payments.

(iii) Failure to report abortions

Abortions are the cardinal sign of Brucellosis infection and this is reflected in the proportion of breakdowns (>20%) where a CTA test first identifies the disease. Prompt reporting of abortions is thus critical in aiding rapid screening but the pattern appears to be that it is only after the 3 or 4th case that the Department is notified.

(iv) Insufficient resources

Effective management of a Brucellosis outbreak necessitates rapid identification of the source, evaluation of the spread of disease and removal of infected cattle or material. A 1999 study found that delays in testing, arising from insufficient resources, led to increased outbreaks; up to 10% of neighbouring herd infections may have arisen due to this. Given the increased preponderance of breakdowns at LCTs it is likely that this effect will be stronger now. Resource difficulties within Veterinary Service have curtailed rapid testing, mapping of contiguous farms and investigation of breakdowns, and it is likely that this will significantly compromise efforts to eradicate the disease.

(v) Herd management factors

Poor herd segregation and fragmented grazing were shown to be significant factors in the spread of disease in south Armagh in 1998 and are likely to be the cause of the high proportion of outbreaks that occur at testing of contiguous herds. High intra-herd movement has also led to increase in spread of disease although resource constraints have prevented adequate assessment of its significance.

(vii) Foot and Mouth Disease

Brucellosis testing was severely curtailed during mid-2001 due to the FMD crisis. Almost one third of testing during the 2001/2002 financial year was not carried out as a direct result of the epidemic. Subsequent FMD-related activities exacerbated the backlog of testing with the result that significant shortfall still exists. The effect of non-testing will only be truly known once the backlog of testing has been resolved, initial indications are that disease has spread extensively in the interim. This can be seen in Figure 4 as a sharp rise in incidence in early 2002.

(7) Assessment of the *De Minimis*

The control measures stipulated by EC Directive 64/432 are considered to be the minimum required of the Department. The following differences have been identified:

- Directive requirements not being met at present:
  - Annual testing across the province; this is only happening in 3 of 10 divisions.
  - Testing of cattle 30 days before or after movement between herds.

- Current practices not demanded by 64/432:
  - Contiguous testing
  - Forward and backward tracing/testing
  - Monthly Bulk Milk sampling of herds
  - Cull cow survey

(a) Directive requirements not being met at present

(i) Annual testing across the province.

Annual testing was introduced in 1999 to 3 divisions with the highest Brucellosis incidence: Armagh, Enniskillen and Newry. The remaining divisions retained their biennial testing regime.

To evaluate the merits and/or costs of full compliance with the Directive, 2 questions need to be addressed:

- What additional testing will be required?
- What value is there in annual testing, in terms of disease diagnosis?

Based on herds tested in 1997 to 1999, introducing annual testing across N.I. will result in an additional 10 000 herds and 350 000 animals to be tested per annum. This does not take account of follow-up testing of inconclusive reactors (rate approximately 8 per 1 000) or herds with increased frequency of testing.

Time constraints preclude a substantial risk-benefit analysis, but note the following with regard to the value of annual testing:

- In the years 1990 to October 2001, 14% of breakdowns were first identified at routine testing. This is not an insignificant amount and increasing the frequency of routine testing should improve the detection of disease.

- However, 14% over-estimates the benefit of annual testing for the following reasons:

  - The proportion of breakdowns detected at routine testing has decreased from 1990 to the present. The proportion of LCT-detected herds has increased (see Figure 11).

  - In some herds that neighboured infected farms, the test type was not altered to a risk test (i.e. LCT) if the herd was coincidentally due a routine test at that time. This leads to an over-estimate of the proportion of BHT-herds.

  - In herds with confirmed infection, almost 60% of those identified at routine testing are located in the divisions already subject to annual testing. A further 20% occur within 15km of these 3 divisions. This can be seen in Figure 9, which is a replica of Figure 6 but with herds identified that had infection detected at routine testing. Note too, the lack of "clustering" around many of the "routine" herds in divisions away from Newry, Enniskillen and Armagh. This indicates that, at the very least, there was little, if any spread from these herds to their neighbours.

- A herd identified at BHT in Londonderry was one of 2 associated herds responsible for spreading infection (directly or indirectly) to 14 other herds. It is not possible to say if a test one year earlier

would have prevented this but the other associated herd (with many reactors at the BHT) tested clear 15 months earlier.

- Of the 16 herds outside the 3 affected divisions and with confirmed infection at BHT:

  - 10 had infection first identified through inconclusive reactors i.e. the herds were only identified as breakdowns at a RI test

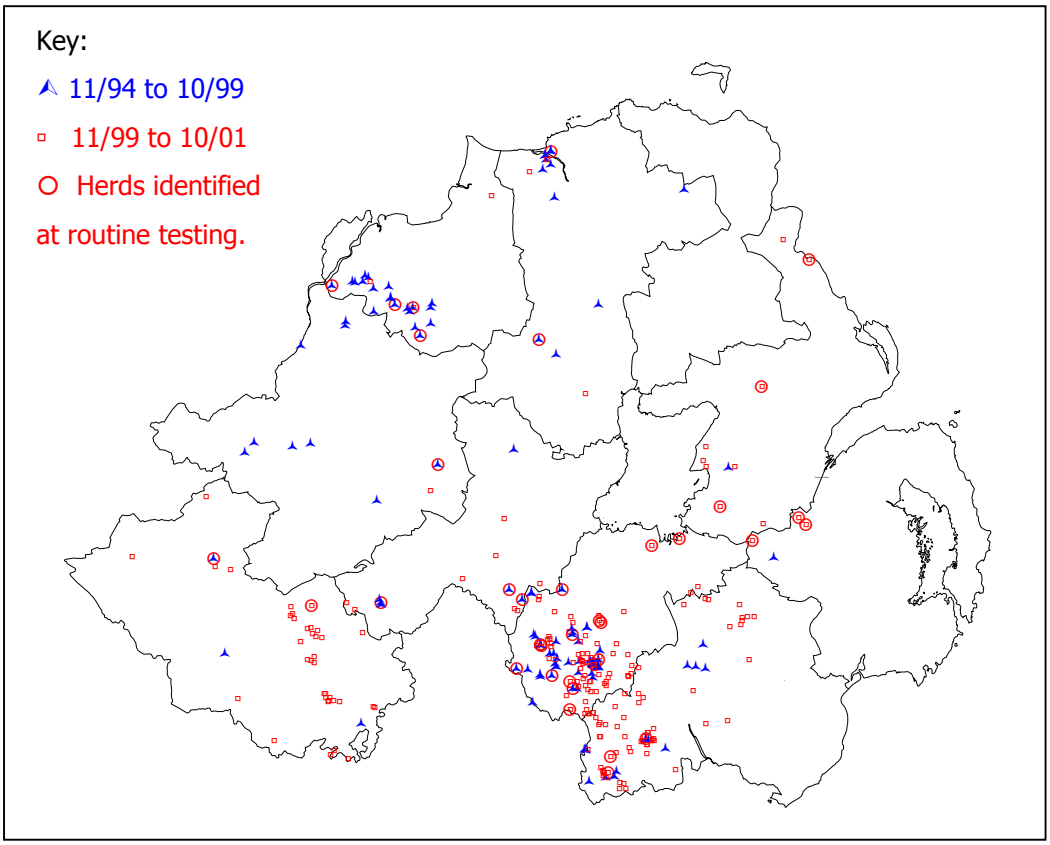
  - 2 had singleton reactors at the BHT while 1 had 2 reactors

  - 2 herds (the Londonderry herds mentioned earlier) had multiple reactors

  - 1 herd had 4 reactors but was noted at risk to another breakdown 2 months before the BHT.

Thus, it must be noted that little significant infection has been detected to date at routine testing and, where it did occur (Londonderry), it is likely that annual testing would not have prevented the outbreak or reduced the extent of infection. Nevertheless, historical data is not always a reliable indicator of future trends and the sharp rise in incidence, together with statutory requirements, makes the introduction of annual testing an urgent necessity. The advantages and implications of this testing type are provided later.

Figure 9



(ii) Pre/Post-movement testing

It has not been possible to assess this in the time available. 7% of all outbreaks from 1990 to 2001 were identified through tracing/testing of cattle that moved from herds before infection was detected. However, the proportion decreases to 4% if the period is limited to the last 4 years i.e. such movement of cattle appears to have played a less important role as the epidemic has progressed. The data though, do not indicate the number of infected, clinically negative cattle that might have moved and were not sufficiently linked to breakdown herds to be detected through tracing tests. It is likely that a significant proportion of these cattle will be detected through such testing.

Pre-movement testing is a statutory requirement given the current prevalence of disease, thus a strong epidemiological case for this testing might not be necessary. Instead, the implications, advantages and disadvantages of this are described later in this document.

(b) Departmental actions beyond the requirements

(i) Contiguous testing

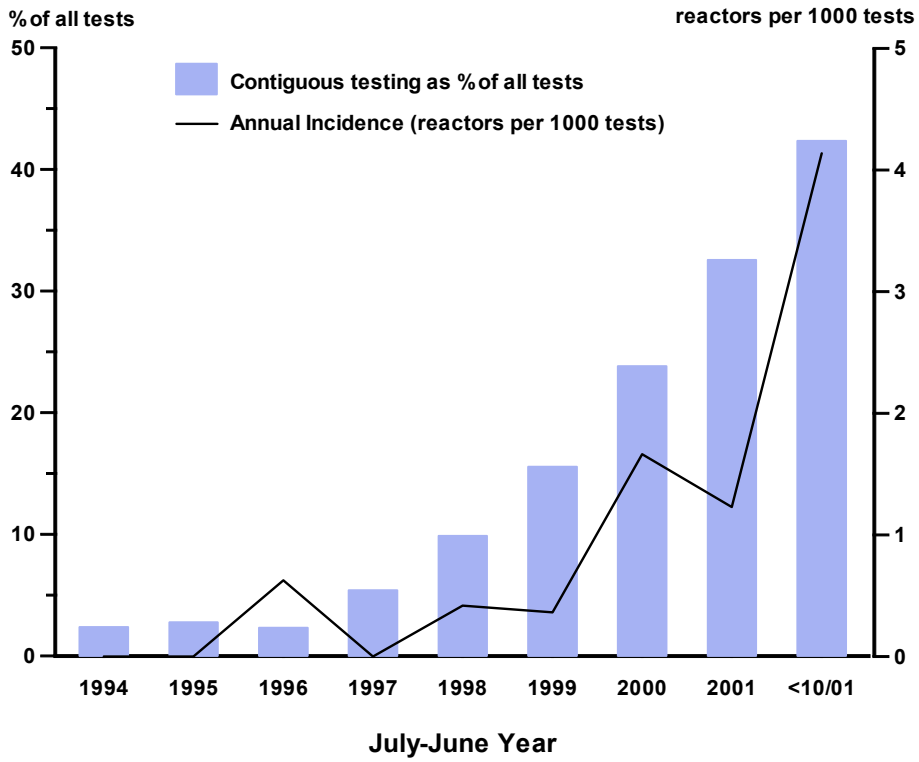
Contiguous testing refers to the testing of cattle around an infected farm. This may include the immediate neighbours, two concentric "rings" of farms ("inner" and "outer" ring) or all herds in a prescribed area. As this is not a requirement of 64/432 the following questions need to be addressed:

What proportion of testing does this test type comprise?
What is the value of this testing in terms of disease diagnosis?
What would happen if this type of testing were to stop?

During the period January 1990 to October 2001, contiguous testing has accounted for 10% of all Brucellosis tests conducted by the Department. However, this proportion has increased significantly in recent years due to the increase in disease incidence and increased awareness of the value of contiguous testing.

Figure 10 shows this for the years 1994 to Oct 2001. Note the increased proportion of contiguous testing, from just over 2% in 1994 to over 30% in 2001 (2001 data is skewed because of the FMD epidemic as mentioned earlier). However, note the increased incidence in reactors within this test category over the same period. This indicates that, in terms of disease diagnosis, contiguous testing is detecting an increased number of reactors per volume of testing.

Figure 10



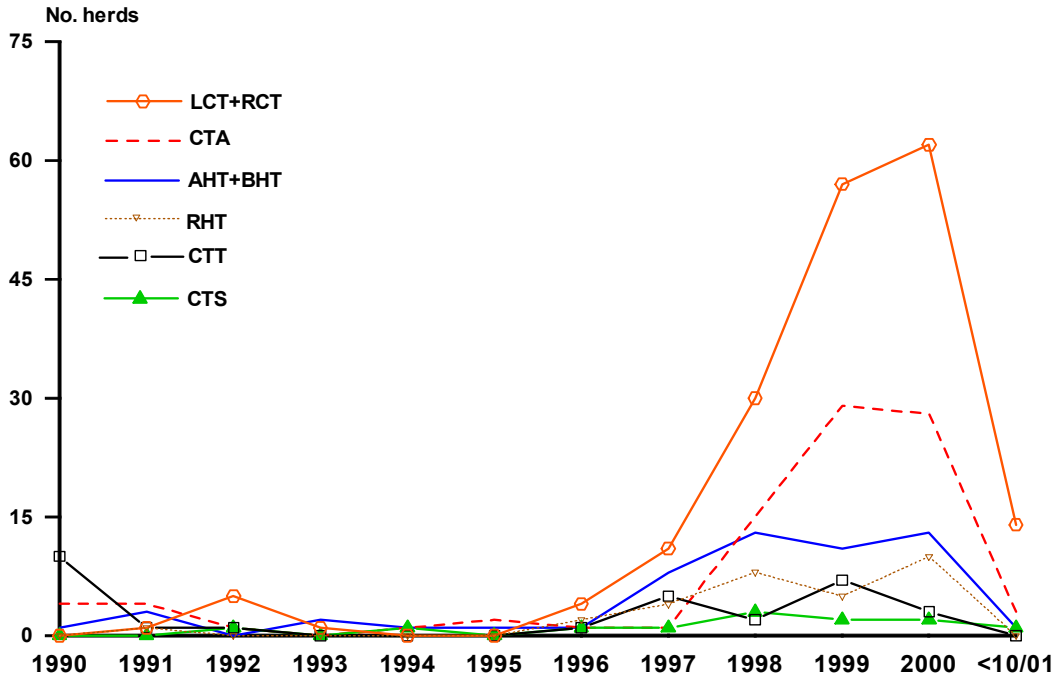
How does this compare to other test types? The following table and chart address this question. Table 4 shows the incidence rate for the period 1995 to 2001 by certain test types:

Table 4

Test-Type	Reactors per 1000 tests
Herd tests:	
Routine	0.04
Contiguous	1.02
Forward tracing (FCT)	1.15
Backward tracing (BCT)	0.00
Individual tests:	
Post-abortion (CTA)	10.02
Forward tracing (CTT)	1.47
Retest of Inconclusive (RI)	3.95

Figure 11 shows the distribution of Brucellosis breakdowns by year and test type when serological reactors were first identified:

Figure 11



Note the following with respect to Table 4 and Figure 11:

- The value of contiguous testing (LCT and RCT) is clear from the reactor rate which is more than 25 times that of routine testing (1.02 v 0.04) and from the number of breakdowns in which infection was first disclosed by this method of testing.

- From Figure 11 it can be seen that contiguous testing identifies more breakdowns than any other test type and has become increasingly significant as the epidemic has progressed – the slope of the (LCT+RCT) curve is greater and the area is larger than any of the other curves.

What would happen if contiguous testing were discarded and the *de minimis* adopted? A substantial analysis is required to address this question, which is not possible given current time and information constraints. However, it is significant to note that 60% of the herds identified at contiguous testing were tested more than 3 months before or after the usual month in which they had their previous routine testing. In other words, for the majority of herds tested because they were at risk from a neighbour, infection might have persisted for more than 3 months had their testing been delayed until their next routine test schedule. Given the significance of lateral spread in Brucellosis to date, this would severely exacerbate the epidemic and lead to many herds becoming infected.

(ii) Forward and backward tracing

When infection is disclosed in a herd, all cattle that were moved out within a prescribed period before the outbreak are traced and tested. This test category is known as CTT ("check test tracing"). If the animal cannot be tested e.g. because it was slaughtered, the herd(s) that received the animal are tested (FCT – "forward check test"). If the reactors were recently purchased, the herd(s) from which the animals came are tested to ensure they were not the source of the current outbreak (BCT – "backward check test").

These tests are essential for the tracing of potentially infected herds and cattle. Examples exist to show that infected cattle have moved out of herds prior to the outbreak being identified and movement restrictions applied: in 1997 a herd sold infected bulls to more than 13 herds; in November of that year, cattle moved

from an Armagh herd to 3 herds in the Dungannon division, all of which were subsequently restricted for Brucellosis.

In the years 1995 to 2001, FCT tests accounted for 1.4% of all testing and BCTs for 0.59%, so the resource used for this test type is small. The incidence rates are provided in Table 4 but these are unreliable due to possible APHIS anomalies and questions as to how the tests were applied. Further work is required to assess these factors and the issue has been raised with senior APHIS administrators.

(iii) Bulk Milk Tank Testing

The sampling of dairy farm bulk milk tanks commenced in January 2001. Dairies collect a milk sample during the routine monthly sampling of a herd and forward it to Veterinary Science Division who perform an ELISA test. Positive or inconclusive results are reported to the Veterinary Service who then blood-sample the herd.

The major advantage of the test is the frequency of sampling – herds may be tested on a monthly basis. Disadvantages include its limitation to dairy herds and possible low sensitivity in large herds. Herd details are only recorded for positive results, so it is currently not possible to assess the performance of the test (sensitivity/specificity) or use the test fully as a disease eradication tool.

From data provided by Ms McKillop at VSD and Mr Irwin DVO, the following was noted:

- 35 000 samples have been submitted to date, with an average of 3 100 per month.
- 50 herds have shown positive or inconclusive results to the test, 25 of which tested positive on more than one subsequent occasion (median: 2, range 2 – 6).
- In 27 of the 50 herds, Brucellosis had already been confirmed or suspected. 23 of these had some serological test subsequently and reactors were disclosed in 10.
- Of the remaining 23 herds, 17 had a subsequent serological herd test, with an average duration of 51 days. 2 of these contained serological reactors and both herds were culture-positive. One had a risk test 6 months previous to the positive milk test and was due another that should have identified the infection. In the other, a herd test was due 6 months (based on test history) after the milk sampling and, with no discernible risk factors, Brucellosis may have escaped detection for that period.

Thus, although it is not possible to assess the test in a comprehensive manner, its value has already been demonstrated. Nevertheless, the system should be modified to maximise its use and recommendations have been forwarded to this effect.

(iv) OTMS Serology Sampling

This survey commenced in early 2001 as a surveillance of older cattle at slaughter. Blood samples are collected shortly after slaughter and submitted to VSD for normal serological testing:

- 50 000 samples were submitted to VSD during 2001, comprising 63% of all cattle slaughtered at abattoirs during the period. The sampling proportion for the last 5 months of 2001 was 85%.
- 30 samples from 23 herds provided inconclusive or positive results. In 7 herds this was the first suspicion of infection but no reactors were detected at subsequent testing of the cattle on the farm.
- It is too early in the sampling programme to be able to draw any firm conclusions about the cost-benefit. On the one hand, no additional infected herds were identified by the 50 000 samples. Conversely, province-wide coverage of all older slaughter stock provides valuable surveillance, which includes non-dairy herds, and the sampling represents less than 9% of annual (July-June) testing.

- Value may be added to the programme by better targeting of samples (e.g. excluding reactor herds), including younger cattle (24% of reactors were less than 30 months old) and capturing results for cattle that test negative (thus improving use of the results for field managers).

(8) Summary

(1) 23 500 herds were tested for Brucellosis in the 2-year period ending 31 October 2001. The number of herds ranged from 954 in Londonderry to 3 652 in Newry division.

(2) The average herd-size, based on cattle tested at herd tests between 1990 and 2001, was 39 with an increase from 32 in 1990 to 45 in 2001.

(3) There was no significant difference in the mean age of cattle tested in 2000 compared to 1994, based on a random sample of 50 herds with more than 30 cattle.

(4) Approximately 581 000 Brucellosis tests are performed annually, representing half a test-cycle. The number of tests was largely constant from 1991 to 1997, with a sharp increase thereafter which coincided with a significant increase in risk testing.

(5) The herd incidence, based on confirmed outbreaks, was 0.40 in 2000 while the animal incidence (serological reactors) was 0.12%. These represent a 5-fold increase in herd incidence and 4-fold increase in animal incidence compared to 1997.

(6) Outbreaks are largely clustered in the south-western part of Armagh and Newry divisions and Enniskillen division. Over 80% of all confirmed breakdowns since January 1998 occurred in these areas.

(7) 86% of outbreaks was identified at risk testing and 69% through testing of herds that neighbour infected farms.

(8) In breakdowns identified at a herd test, 34% have 1 reactor while 55% have 3 or fewer. In these herds the test type did not appear to be a significant factor.

(9) Following disclosure of infection in a herd, 33% of breakdowns experience reactors at the first restricted test while 2% had reactors at 2 consecutive restricted tests.

(10) Introduction of annual testing across all divisions will necessitate an additional 350 000 samples from 10 000 herds per annum.

(11) Contiguous testing is a key aspect of current eradication efforts, even though such testing is not obligatory under EC legislation. Although the benefit from other non-obligatory measures such as bulk milk testing and testing of cattle at slaughter is less obvious, they are considered to play an important role.

APPENDIX III

Description of Key Elements of DARD's BR Monitoring Process

Testing

Blood sampling is carried out by DARD. A BR test allocation is generated by the APHIS computer system to the relevant Animal Health and Welfare Inspector (AHWI). There is a customer service requirement to synchronise TB and BR testing where the herd has greater than 20 eligible animals. The AHWI to whom the test is allocated arranges a suitable time and date with the herd owner. Test sheets are printed giving a list of animals that the computer system believes should be presented by that herd owner for test. The AHWI arrives at the farm at the appointed time, carries out routine cleansing and disinfecting and proceeds to blood sample the cattle presented to him. The cattle eligible for test are as follows:-

- all females over 12 months old;
- all bulls over 12 months old (an exception has been made for beef bulls providing they go direct to slaughter).

The blood tubes are noted and numbered with the animals identification number. The test sheets are also noted with the tube number. The AHWI will attempt to resolve any discrepancies that arise while still on the premises. Examples include:

- a variation in animal descriptions;
- the absence of an animal that is on the computer generated test sheet;
- the appearance of an animal not noted on the test sheets.

The AHWI will repeat the cleansing and disinfecting (C&D) of his protective clothing before leaving the farm. On returning to the office, the bottle numbers are recorded against the correct animal identification on computer and sheets generated to accompany the samples to the VSD for serological testing.

Laboratory testing of samples.

The VSD carry out an serum agglutination test (SAT) as the screening test on all submitted blood samples. Some samples fall into the criteria for further testing and these are subject to a complement fixation test (CFT). Staff at VSD record the test results on the APHIS computer system. The system then queues the test results back to the relevant patch Veterinary Officer for interpretation.

Interpretation of results.

The computer system automatically interprets routine herd test results that fall within pre-set criteria which determine that the test is negative. The date for the next routine test is set by the system at this time. All other results are queued to the patch VO for interpretation. Using set guidelines plus knowledge of the disease in the patch area, the VO will interpret the test,

taking the necessary follow-up actions relevant to the test results. Follow-up actions may include any of the following:

- set next herd test date;
- set any individual animal tests required ;
- add or remove any relevant herd and/or animal restrictions;
- notify HQ of high titre results; and
- queue instructions to admin section.

Non-negative results.

Where non-negative results (SAT > 30iu/ml) are obtained there are set guidelines given in the Brucellosis Staff instructions. These range from retest of the animal concerned to declaring a reactor.

Reactor herds.

When one or more serological reactors are found in a herd, the herd is immediately restricted with a BT40 restriction notice which prohibits movement of animals onto or off the farm except under a licence granted by the Department. The reactor animal/s are valued, slaughtered and tissue samples taken at point of slaughter. The samples are cultured at VSD and if the causative organism, *brucella abortus*, is isolated, the herd is usually depopulated. Where the culture is negative, the herd is restricted for at least 6 months and tested at monthly intervals until clear non-pregnant tests are obtained for all breeding animals in the herd.

APPENDIX IV

Cross Border Co-operation

1. At its meeting in Greenmount College, Antrim on 17 November 2000, the NSMC considered and endorsed proposals for the formalisation of liaison arrangements on animal health policy and operations.

2. In particular the Council
   (i) approved the establishment of a Strategic Steering Group to co-ordinate animal health policy on the island and make regular reports to the NSMC on co-operation on animal health matters together with recommendations for policy and/or operational decisions;
   (ii) agreed the establishment of Policy Working Groups which will consider policy issues on animal health which apply to the whole island; and
   (iii) agreed to continued co-operation in operational aspects of schemes.

3. The Steering Group has been tasked with producing a report on the findings of the Working Groups by the end of December 2002.

4. The Working Group on Tuberculosis and Brucellosis has been established and the initial meeting was held on 17 January 2002. The following issues were agreed for more detailed consideration within the group:
   (a) Cross border co-operation and communication including disease tracing mechanisms.
   (b) Detailed comparison of respective policies and operational procedures for these two eradication programmes – to include review of surveillance at both farm and factory levels.
   (c) Specific review of compensation measures and quality control issues relating to identification and validation of reactors. This would also include the subject of atypical breakdown herds.
   (d) Specific review by our epidemiologists with a view to devising common standards of disease measurement and sharing of disease data.
   (e) Specific review of our supporting research programmes and identification of collaborative/complimentary projects.
   (f) Specific review of wildlife disease component for tuberculosis and the associated badger policy of DAFRD.

5. DARD and DAFRD are involved on a continuous basis in disease surveillance through a combination of compulsory testing, routine inspections and investigations, mandatory and voluntary reporting and codes of practice. There are informal contacts between HQ Veterinary Staff and their ROI counterparts on an ongoing basis. Due to rise in Brucellosis infection in last few years there have been several informal meetings between DARD and DAFRD Veterinary HQ staff. Border field DVOs have ongoing contact with their counterparts in the ROI relating to current issues pertinent to disease control e.g. herdkeepers who have land on both sides of the border, illegal movements, etc. Informal meetings between the DVO and their counterparts occur

on a regular basis e.g. several times per year. In addition border field VOs are encouraged to meet with their counterparts on the ROI side.

6. Existing good co-operation between the Departments in Belfast and Dublin was maintained by formal meetings on major animal health issues. These meetings have been taking place for a number of years and were held both at Grade 7 level and at Grade 5 level with appropriate VS support.

7. R & D. There are currently no BR research projects at VSD. Cross border contacts are informal. VSD are in contact with the Cork Laboratory quite frequently and are aware of the work done there on BR test methods. VSD researchers working on bovine tuberculosis have always had close collaborative links with various research groups in the Republic of Ireland. These contacts take the form of defined collaborative projects and ongoing informal links. In recent times, the major defined collaborative projects (many of which have brought significant funding to the VSD research effort via the QUB link) have been:

Years	Programme	Collaborator and subject matter
1991-94	EU AIR3	University College Dublin and Dept of Agriculture - Diagnosis of bovine TB
1992	Interreg	Dept of Agriculture and UCD - Vaccines for bovine TB in badgers
1994-98	EU SMT	Univeristy College Galway, UCD, Abbotstown - Strain typing of M. bovis
1998-present	EU FAIR CA	University College Dublin and Dept of Agriculture - Concerted action on mycobacterial diseases

Other currently active research collaborations include

- Applications of IFN-gamma testing and novel antigens
  - in collaboration with UCD

- Development of novel skin test applications
  - in collaboration with UCD and Dept of Agriculture

- Current discussions ongoing relating to formal collaboration with UCD through PRTLI Programme in Republic of Ireland.

APPENDIX V

Bovine Brucellosis: Recent Scientific developments.

The purpose of this paper is to review recent scientific developments relating to the study of brucellosis in cattle and, in particular, how these might have a beneficial impact on the control of brucellosis in Northern Ireland.

There have been no research projects on bovine brucellosis at DARD Veterinary Sciences Division for many years. The disease had been eradicated from Northern Ireland by the early 1990s and similarly successful programmes had been run by many other countries across Europe and further afield. When the disease reappeared in the late 1990s, it was considered that the science required to support control measures was already available. There were more pressing needs for research dealing with issues such as bovine tuberculosis, food safety and BSE.

Research on bovine brucellosis has been of low priority worldwide for the same reason and has not had the momentum of, for example, bovine tuberculosis research.

Diagnostic methods.

The most important means of surveillance for bovine brucellosis are (i) through the reporting and laboratory investigation of abortions and (ii) through testing of blood samples for the presence of specific *B. abortus* antibody (serology). The same general principles apply, whether the objective is to monitor freedom from infection, or to eradicate the disease. In both cases, there must be surveillance by serology of the entire susceptible population. However, in the latter case, the frequency of testing is higher and there will be additional testing of targeted, at-risk groups, such as those on farms neighbouring known outbreaks and those on farms known to have contacts with infected farms. Eradication is effected through culling on farms where the organism has been cultured from aborted animals or where serology is positive, or both.

Serology

Much of the research effort on bovine brucellosis in recent years has been on the improvement of existing methods of detection of antibody or the development of new methods. The impetus for this work has been the cost of the huge number of tests carried out worldwide. National authorities are keen to minimise the cost, particularly when monitoring for freedom from infection. Commercial brucellosis tests represent one of the biggest sectors of the animal health diagnostic test kit market.

Despite this effort, bovine brucellosis serology tests suffer two major shortfalls from the ideal. Firstly, all give rise to false positive results to a greater or lesser extent through cross reactions with antibody to other common organisms. A great deal of work has gone into minimising this problem, but none of the available tests have overcome it completely. In addition, as new tests have become more specific, i.e. give rise to fewer false positives, they have tended to lose sensitivity and will not detect animals with low antibody titres. This inverse relationship between sensitivity and specificity is common to most serology tests. The second problem arises from the pathogenesis of the disease as it relates to the development of antibody responses. In most situations where serology is used to identify infected animals, we would expect to be able to detect positive responses within one or two

weeks of the initial challenge. In the case of brucellosis, the full response is only evident after calving or abortion, though infection may have occurred some months earlier.

While we might expect advances in relation to improved sensitivity and specificity of serological tests in future, it is less likely that the problem of identification of infected animals before abortion can be overcome through the use of serological tests.

It is around the time of abortion that the organism is excreted in the greatest quantity, therefore the risk of onward transmission is highest at this time. Unfortunately, our two main means of detection (culture of the organism and/or positive serology) will only pick up infection after the abortion event when there is a good chance that other animals have already become infected.

Infection of the pregnant animal does not always result in abortion. Affected calves may be stillborn at full term, born weak at full term, or clinically normal at full term. Those which survive will become carriers. Existing serological tests are limited in their ability to detect carriers. However, this should not be a significant problem, given the culling policies applied in Northern Ireland.

There are many different serological tests for brucellosis in cattle and there is controversy over what is the "right" test or test combination to use. None of the available tests is a clear leader in performance in all situations, and because brucellosis schemes involve testing huge numbers of samples, cost is an important factor. Also, the optimal balance between sensitivity and specificity will depend on the incidence of infection. For instance, in our position, infection is present, but the incidence is low and, in order to eradicate, we should apply a precautionary principle through enhancing sensitivity. Inevitably, this means that specificity will suffer and we must carry an overhead in the investigation of false positives. On the other hand, in GB, eradication has been achieved, and the chances of a finding a true positive in the serological surveillance programme are low. In such a situation, sensitivity can be sacrificed for specificity. Hence, much of the surveillance of GB dairy herds is carried out through ELISA testing of bulk milk samples, which is much cheaper than surveillance through individual blood sampling.

The older serological tests used in the original eradication programme were the tube agglutination test, the complement fixation test and the Rose Bengal test. For milk samples, the milk ring test was used. All of these are cheap to carry out and were proven effective. However, there are problems, for example, the agglutination test and the complement fixation test detect different classes of antibody which appear at different stages in the development of the antibody response. This can be partially overcome by applying combinations of tests.

More recently developed tests include:-

- ELISA. The most common serological test format used today, which means that it is easily automated using generic equipment. ELISAs are reported to have better sensitivity and specificity than the older tests compared individually, but there are still problems with cross-reactions. Competitive ELISA formats using monoclonal antibodies have improved specificity, but at the expense of sensitivity. ELISAs are more expensive than the older test formats. To overcome this, some commercial companies recommend pooling of samples, but this reduces sensitivity. The tests can be applied to serum or milk samples and are being used widely in the testing of bulk milk as described above. In the case of bulk milk samples the limitation in sensitivity through pooling is partially offset through it being practical to test more frequently. The ELISA

is clearly superior to the milk ring test, both in sensitivity and specificity. Variants of the ELISA include the particle concentration fluorescence immunoassay (PCFIA) which is widely used in the USA, and the Delfia test. These tests use different technologies to detect positive reactions.

- Fluorescent polarisation assay. Reported to give better sensitivity and specificity than the ELISA, but there is insufficient data to confirm this. The test is not yet commercially available, but is likely to be expensive.

There is scope for a research project in Northern Ireland aimed at ensuring that we apply the optimal test or test combination in our serological surveillance programme.

Other immunological tests.

- Brucellin intradermal test. Highly specific, but low sensitivity. Technically difficult, as the change in skin thickness can be very small. Expensive to carry out as it involves two farm visits. Could be useful for resolution of inconclusive serological results.
- Interferon assay. Similar to that used in bovine tuberculosis, but the test as applied to bovine brucellosis has not been well characterised.

Detection and characterisation of the organism.

There have been no major advances in methods of culture of *B. abortus* from clinical samples within recent years. Almost all of the cultures from Northern Ireland have been characterised as of biotype 1 and are of similar phenotype. Efforts to differentiate isolates using the techniques of molecular biology have met with little success. The prospects for use of these techniques as an aid to studying patterns of spread of infection are poor. However, the task of sequencing the brucella genome has recently been completed and this may give rise to further advances in characterisation, diagnostic test and vaccine development in due course.

Methods of detection of brucella DNA in clinical samples by PCR (polymerase chain reaction) are available, though sensitivity is often similar to that achievable using conventional culture.

Vaccination.

Brucella vaccines have been available for many years, but are not permitted within our eradication programme. Recent work on the RB-51 strain has shown it to be possible to vaccinate cattle such that the vaccine response is reasonably effective, yet available tests can be used to differentiate the immune response from that resulting from field challenge. This approach has potential use where conventional test and cull procedures are impractical, or have failed.

Epidemiology

Epidemiological models have been developed to predict and compare the impact of test and eradication strategies. This type of approach could be usefully applied here.

Genetic Tracing of Cattle

- Technology exists to facilitate genotyping of cattle and to provide a DNA fingerprint for individual animals and their products. A complete system for genotyping can be envisaged.
- Genotyping of cattle is being considered for applications in relation to backing-up and QA/QC of existing paper and/or computerised animal movement and traceability systems. These methods are also used as a forensic tool for fraud investigation in some countries (including NI).

APPENDIX VI

Summary of Responses from TB and Brucellosis Policy Evaluation Consultations

1 (a). Tuberculosis

	Livestock and Meat Commission	**Association of Veterinary Surgeons Practising in Northern Ireland**	**North of Ireland Veterinary Association**	**Ulster Farmers Union**	**General Consumer Council**	**Ms Eileen Walker (Veterinary Student)**
Form/ date of response	Letter (07/02/01)	Letter (05/02/01)	Letter (05/02/01)	Letter (16/02/01)	Letter (01/02/01)	E-Mail (31/01/01)
Key issues identified re current /past policy	- Recognition of failure of policies to control disease	- limited consultation period/rushed review - continued involvement of vets in carrying out tests. Use of lay staff would drastically reduce disease surveillance for important but non notifiable diseases - inadequate DARD staffing levels and bureaucracy leading to TB reactors not being removed rapidly enough	- no formal review since 1992/limited consultation period - unavailability of detailed statistics on the DARD web site - no specific guidelines as how the industry can contribute to the control of both TB and Br - lack of ongoing consultation - TB reactors not being removed rapidly enough - Continued involvement of vets in carrying out tests	- Limited consultation period - policy objectives must continue to strive for eradication - reactors not being valued/removed rapidly enough - herd re-tests following closure not being carried out within an acceptable timeframe - lack of communication and information provision to producers whenever herd restrictions are imposed	- consideration of food safety and public health issues re entry of slaughtered cattle into human food chain	N/A

1 (b). Tuberculosis

	LMC	AVSPNI	NIVA	UFU	NIGCC	Ms E Walker
Suggested areas for future consideration/development	- in the event of the continuation of annual testing, the inclusion of the surveillance of other compliance issues (e.g. herd and flock records and medicine records)	- future ongoing consultation via a consultative forum (involving all bodies with a constructive role to play) - better use of the practising vet (to counterbalance time pressures on DARD staff) and their qualifications - accelerated development of the DARD/PVP extranet link - Maintenance of current compensation levels for TB reactors to maintain support from the agricultural industry - Review of the policy allowing reactor carcasses into the food chain - continued investment in APHIS to further improve traceability and to allow increased transparency and access to animal health data	- Initiation of a stakeholder liaison group /consultative forum - use of gamma interferon test to supplement tuberculin test in reactor herds - maintenance of TB research at VSD - TB reactors remain on farms too long after detection - Publishing and publicising of guidelines on prevention of TB spread (cattle to cattle and badger to cattle) - additional resources for the development of APHIS (it currently doesn't highlight reactor herds or inconclusive animals) - TB testing to remain a veterinary role and the development of an enhanced role for vets e.g. carrying out inspections to fulfil Milk Hygiene Directives, sampling for active veterinary surveillance, routine BR testing. - Publishing of information re disease trend, costs, targets and performance indicators - Maintenance of current compensation levels to maintain support from the agricultural industry	- Comprehensive cross-border approach (including the co-ordination of action plans on animal health via North/South Ministerial Council working groups - a sufficient level of manpower and resources being made available to reduce delay in herd re-tests - it is important that TB testing of herds that are closed up for a period of years takes place on their holdings and at least annually - provision of practical advice and assistance to producers of depopulated herds - further R&D of a TB blood test - DNA testing of blood samples to determine genetic traceability (the data could be held on APHIS) - Development of TB vaccination programmes (if incidence doesn't reduce with testing and herd restriction) - extension of 'Krebs' badger trials to NI - TB and BR can be controlled/ eradicated given the right policies, if practical implementation is adhered to and adequate resources are made available	That the Terms of Reference be extended to explicitly consider food safety and human health implications of TB and BR.	N/A

2 (a). Brucellosis

Respondent	**LMC**	**AVSPNI**	**NIVA**	**UFU**	**NIGCC**	**Ms E Walker**
Form/date of response	Letter (07/02/01	Letter (05/02/01)	Letter (05/02/01)	Letter (16/02/01)	Letter (01/02/01)	E-Mail (31/01/01)
Key issues identified re current/ past policy	As above	As above	As above	- As above	As above	the traditional SAT test is not 100% reliable and appears to pick up cases in the early stages of the disease frequency of testing based on a herd basis – therefore individual animals/group of animals can avoid testing by moving herds insufficient DARD staff available to carry out required volume of testing

2 (b) Brucellosis (continued)

Respondent	LMC	AVSPNI	NIVA	UFU	NIGCC	Ms E Walker
Suggested areas for future consideration/develop-ment	As above	- initiation of a consultative forum - biennial testing frequency - use of the milk ELISA test - encouragement of greater submissions of aborted foetuses - allow/compensate vets attending abortion events to submit blood samples - pre/post movement testing in selected areas - continued investment in APHIS to further improve traceability and to allow increased transparency and access to animal health data	- initiation of a public/private project management group to oversee programme management - publishing of information as identified re TB - use of the milk ELISA test in dairy herds (used in GB) - testing of adult slaughter animals - encouragement of greater submissions of aborted foetuses - allow/compensate vets attending abortion events to submit blood samples - introduction of post-importation tests Re BR outbreaks - introduction of pre and post movement testing for certain areas - introduction of post-movement test in areas to assist in the detection of latent infections - review/evaluation of all advances in technology (e.g. ELISAs) - research into the development of more effective tests - use of epidemiological modelling to asses alternative/ cost effective control strategies and devise most-effective cost regimes	- 100% compensation for BR reactor animals (fair and honest compensation) - a sufficient level of manpower and resources being made available to reduce delay in testing - more encouragement should be given to producers to submit aborted foetal material e.g. by providing a free testing service for producers providing this material - lack of communication and information provision to producers whenever herd restrictions are imposed, particularly with herds restricted but not depopulated as a result of an inconclusive BR tested animal. - Other information e.g. availability of schemes when herds are restricted (e.g. 0.8 co-efficient to be applied to stocking rates) - Provision of practical advice and assistance to producers of depopulated herds - Wider emphasis on testing of bulk milk samples. If frequent milk testing provides an indication of BR at early stages then blood testing could be used more efficiently for high risk herds	As above	use of vaccinations as a basis for a damage limitation

APPENDIX VII

Proposed Areas of Policy Modification
(Consideration of Type/Level of Need, Options and Costs/Benefits)

1. ANNUAL TESTING

Annual Testing is currently applied in the 3 divisions with the highest BR incidence: Newry, Armagh and Enniskillen. It was introduced in 1999, in accordance with EC rules, to increase the frequency of testing and thus provide earlier detection of infection. Under EC legislation, MS with a herd incidence of greater than 0.2% should implement annual testing, either serological or bulk milk testing.

The following options regarding the introduction of annual testing have been considered:

(a) Maintain biennial testing in the other 7 divisions and utilise monthly bulk milk samples for screening instead of annual serological testing.

- Advantages/benefits:
  - No additional resource is required for collection or testing of samples i.e. compliance with the requirement for annual testing of dairy herds is met by the milk ELISA test programme.
- Disadvantages/costs:
  - Milk testing does not provide surveillance of non-dairy herds and thus will not ensure full compliance with EC legislation. Dairy herds make up approx. 25% to 30% of BR-eligible herds, thus the majority are not included in this scheme.
  - A system is required to record negative test results (currently underway).
  - The sensitivity of the milk ELISA in large herds needs to be resolved. If shedding of the organism is low, the dilution effect in large herds may prevent diagnostic levels being reached at an early stage. Annual testing in herds with greater than 100 cattle may thus be required. Approximately 1800 herds with more than 100 cattle are tested each test cycle, with an average of 170 cattle per test.
  - Although few breakdowns have been detected at routine testing to date, this may not continue to be the case if the incidence continues to rise. If this occurs, the test interval in biennial serological testing may be too long to provide adequate surveillance, especially in areas with many non-dairy herds.

(b) Discard biennial testing in dairy herds in the other 7 divisions, relying on monthly bulk milk samples as the sole screening test.

- Advantages/benefits:
  - Discarding serology will save staff resources and these can be diverted to testing in the high-risk areas.
- Disadvantages/costs:

- The ELISA screening programme has not been validated for NI and, given the rising incidence, a replacement of the current scheme will be premature. This option should only be considered once the 2 schemes (serology and milk testing) have been used in parallel for at least 2 years and properly evaluated.

- Serology will still be required for non-dairy herds, which comprise two-thirds of all eligible herds, and to follow up ELISA-positive results.

- The long interval in biennial testing may increase the risk of breakdowns as mentioned above.

(c) Maintain biennial testing for dairy herds in the other 7 DVOs, utilising monthly bulk milk sampling, but introduce annual testing for non-dairy herds in these areas

- Advantages/benefits:

  - Maintains current testing regime for dairy herds and increases potential for detecting disease in non-dairy herds.

  - Ensures full compliance with EC directives.

- Disadvantages/costs:

  - Will necessitate the testing of an additional 6 000 herds with 220 000 cattle per year.

(d) Introduce annual testing in the 7 DVOs that currently test every 2 years.

- Advantages/benefits:

  - Increases ability to detect disease as have annual serological and monthly milk screening from all eligible herds across province

  - Good presentational value: proper response to rising incidence

- Disadvantages/costs:

  - Will require additional testing of approx. 10,000 herds (350,000 animals) per annum.

The Review Group recommends that Option (c) should be implemented as soon as possible given the current incidence of BR in the province. This will cost approximately £690,000, comprised of the following:

- Sampling costs = £330,000 (220,000 samples @ £1.50 per sample)

- Testing costs = £360,000 (220,000 samples @ £1.63 per sample)

2. INCREASED TESTING AT MEAT PLANTS

Sampling of cattle older than 30 months, at slaughter, commenced in early 2001. It serves as a surveillance measure, particularly of herds in non-infected areas, and to detect infected cows that may be slipped into the cull in an attempt to avoid restrictions.

No similar surveillance is conducted on cattle younger than 30 months (so-called UTMS cattle), raising the question as to whether this should be considered as a measure to eradicate BR. To address this, the following issues are addressed:

(a) Benefit of extending testing to include cattle less than 30 months.

365 herds, positive for BR, were assessed with respect to the age of reactors:

- 20% of test-positive cattle were less than 30 months when slaughtered.
- In 72 herds (20%), the first positive test was that of a single animal under 30 months.
- In 51 herds (14%), this was the only reactor in the herd.

Younger cattle form therefore, a small but significant part of the infected population and in 14% of herds were the only indication of infection. However, surveillance of the OTMS cattle, which comprise most of the remaining 80% of reactors, did not detect infection in non-restricted herds. This probably reflects the low herd prevalence of the disease and strong clustering of breakdowns in affected areas. Given the low proportion of herds with solely young reactors, the probability is low that general surveillance of younger animals will provide a positive cost-benefit ratio.

The value of monitoring UTMS cattle will depend on the extent to which herds in infected areas slaughter such animals, and whether serology may provide an early indication of disease. A study is therefore recommended to assess the number and age of cattle slaughtered from infected herds 6 to 12 months prior to BR being detected. If this number is significant and a substantial proportion is younger than 30 months, i.e. that are unlikely to be detected through the OTMS, then a targeted survey may be worthwhile. All cattle in herds that neighbour a breakdown can be marked on APHIS and an alarm generated in the abattoir when the animal is presented for slaughter, thus identifying it for sampling.

(b) Implications of extending testing

OTMS cattle are slaughtered at only 2 abattoirs, thus facilitating the sampling programme. Testing of UTMS cattle will necessitate sampling at 9 abattoirs in the province, which will increase significantly the staffing resource required.

Approximately 13 000 heifers are slaughtered monthly with a range of 8,000 to 18,000. The cost of testing this number of cattle will be approximately £370,000 per annum, comprised of the following:

- Sampling costs: £120,000 (utilising 4.5 meat inspectors)
- Testing costs: £253,000 (155,000 samples at £1.63 per sample)

A targeted programme will cost £170,000 per annum, comprised of the following:

- Amendment to APHIS: £20,000
- Sampling costs: £72,000 (assuming 80 breakdowns and 600 “marked” cattle in the area).
- Testing costs: £78,000

The costs for the latter will vary according to the number and clustering of breakdowns, and type of neighbouring herd.

3. PRE- AND POST MOVEMENT TESTING

Pre- or post-movement testing is obligatory under EC legislation when the national herd incidence reaches a specified threshold (greater than 0.2%). Post-movement testing provides reassurance to the purchaser of cattle regarding the health status of purchased cattle and farmers are advised, by DARD, to isolate and test such animals. For the purposes of the BR eradication programme however, pre-movement testing facilitates identification of infected animals before they leave the vendor's herd. For this reason it is preferred as the statutory test and is the option considered here.

Advantages:

- Infected cattle are identified before they leave the herd, thus reducing the potential for spread of BR.
- It provides an additional surveillance measure when applied across the province.
- It should decrease the total amount of cattle movement and/or concentrate movement shortly after the herd test. Cattle movement is considered to be a risk factor for both BR and TB.
- It will ensure compliance with EC legislation, thus avoiding criticism or sanction from the Commission.
- It should impact positively on movement control measures as it will force cattle owners to move their animals shortly after the proposed date (the test date), thus reducing the alleged free movement of cattle with back-dating of MC2 permits.

Disadvantages

- It may increase illegal movement due to the additional cost and trouble involved in moving cattle.
- It will impose additional costs on farmers.

Implications

To assess the potential impact and cost of such testing, the movement patterns of 2,500 randomly selected herds were assessed during the period July 1998 to June 2000:

- On average, 10 female cattle older than 12 months were moved to other farms from each herd per year. Extrapolating this to all herds in the province during a similar period, results in 360,000 moves per annum across the province. The average number of occasions cattle were moved was 4.
- 195 herds (8% of the sample) did not move female cattle older than 12 months to other herds, despite presenting female cattle for BR testing. Unless this proportion increases significantly when/if charging for pre-movement testing is introduced, it can be assumed that almost all herds will require such testing at some time during each year.

- Less than 5% of the animal moves occurred within 30 days of the BR herd test. Should charging be introduced, it is anticipated that this will rise markedly, as farmers are likely to move cattle during this period to avoid this cost.

- The annual number of female cattle over 12 months moved *into* herds is 315,000 i.e. slightly less (12.5% less) than the number of moves out. This implies that post-movement testing is likely to have a similar test cost than pre-movement testing, although the associated costs will be higher with the former for the reasons mentioned before.

- The cost associated with introduction of pre-movement testing is likely to be:

    - £1.8 million paid by the farmer for testing. This assumes 360,000 moves at 4 occasions per year and £20 PVP charge per occasion. However, the estimate is likely to over-estimate the cost, as farmers are likely to bias cattle movement to within 30 days of a herd test to avoid the cost of private testing.

    - £0.6 million for DARD costs associated with testing of samples and sampling of inconclusive reactors.

4. APHIS DEVELOPMENT

APHIS replaced the Animal Health Computer in November 1998. This was regarded as an important step forward and several potential advantages were apparent from the outset: - APHIS was pc based, it functioned in a Microsoft Windows environment and it provided the opportunity for additional future functionality.

However, the change to APHIS has coincided with significant changes in relation to diseases, animal identification and traceability. All of which have made significantly increased demands on the computer system. For example, in recent years TB has increased from approximately 3,000 reactor cattle per year to 10,000 and BR has increased from negligible levels to over 200 breakdowns per year. Therefore when APHIS was designed, BR was not a significant consideration, but it now makes considerable demands across the whole of VS.

Increased expectations regarding statistical returns, electronic databases, computerised disease management and investigation has also put additional pressure on the system.

The VS response to increasing BR levels has also included a number of new initiatives that require new and detailed data recording and management systems on APHIS, i.e. monthly bulk milk sampling of all dairy herds in NI, and blood sampling of all over thirty month cattle at slaughter.

Clearly there is a need to co-ordinate the increasing and new demands of the TB and BR schemes in relation to APHIS.
A number of improvements in relation to TB and BR have already been identified and submitted to the APHIS Project Board. There is some provision for inclusion of these in APHIS Phase II.

However, the list is not comprehensive and was not generated as a result of a strategic review of TB and BR functionality on APHIS. They have not yet been given a clear start date and the budget for their implementation has not been ring-fenced.

It is therefore recommended that:

a) A working group is immediately established to review TB and BR functionality on APHIS and make comprehensive and specific recommendations for modifications and improvements.

   The areas covered would include:

   - The new bulk milk testing programme;
   - The recently developed blood sampling programme for over thirty month cattle at slaughter;
   - Recording of BR laboratory culture information on APHIS;
   - APHIS Field procedures – including animal tracing;
   - Data quality and recording issues;
   - Extraction tools and statistical reports for new format EU disease returns;
   - Management information reports for Field and HQ SPVOs and DVOs.;
   - Disease management databases for TB and BR;
   - New requirements in relation to TB and Directive 64\432; and
   - Geographical Information System (GIS) requirements and DARD GIS developments.

   This group would include Field, HQ and APHIS staff and would report within 3-4 months.

b) The recommendations are fully funded as a priority issue. Either under the umbrella of APHIS Phase II or otherwise.

c) The modifications to APHIS start as soon as possible and certainly before September 2002.

5. HOUSING AND MOVEMENT RESTRICTIONS

(i) DARD's Existing Powers

Article 14 of the BR Control Order (NI) 1972 provides powers to restrict cattle in breakdown herds to specific premises or parts of premises. Currently, DARD has not challenged the full extent of these powers.

(ii) The Proposed Changes to be developed.

As infection occurs in many instances in clusters or on an area basis it would be extremely useful for DARD to review the use of the above powers and to extend them to include, among other things, 'at risk' herds (i.e. herds within a designated area of the breakdown). The powers to be developed should include:

a) restriction of cattle to areas away from perimeter fences etc. thus hopefully reducing the risk of spread of infection from a particular breakdown;

b) housing of cattle posing high disease risks e.g. pregnant females thus reducing the risk of these cattle spreading infection should they abort. This power hopefully would assist in preventing the spread of infection to other cattle on the premises and neighbouring premises.

c) Restriction of herds and control of the actual movement of cattle into and out of a defined/ designated area. Some form of a movement licence may permit movement. As BR has appeared in some areas in clusters recently this power would allow DARD to put a standstill on movement of all cattle for designated periods thus reducing the risk of spread of infection out of these areas. This appeared to be used successfully during the Foot and Mouth outbreaks during 2001.

(iii) Benefits / Costs

The main **Benefits** of such powers would be

- Control of the infected and potentially infected animals on breakdown premises in general.
- Control of particular risk group cattle on a breakdown premises
- Control of cattle in neighbouring herds to minimise the risk of these cattle acquiring infection (assuming that they are not already infected)
- Allow control of disease on an area basis.

  All of the above benefits would allow DARD to control the breakdown premises, the neighbouring premises and the area in a more co-ordinated fashion.
- The benefits of having such powers in general could be significant and if they saved even 10 breakdowns per year this could save compensation of approximately £390,000 per annum (10 x £39,000 average cost of compensation per breakdown during March 2001- February 2002).

The main **Costs** of such powers would be

- Financial cost to DARD to enforce/ police such a system particularly the policing on an area basis. If we assume that this will require 1.5 AHWIs per DVO to police then 1.5 x 10 DVOs x £19,700 (cost of AHWI per annum) equals £295,000 per annum cost.
- Farmer's goodwill / co-operation may be tested by such stringent measures.
- Farming lobby may resist.

6. DEPOPULATION, RESTOCKING AND THE TREATMENT OF SLURRY

(i) Current Powers/Policy

a) DARD's current policy is to allow restocking with breeding stock 2 months after a satisfactory cleansing and disinfection has been completed. It may be more prudent to insist on a 6-month break between depopulation and restocking with

breeding cattle, and allow the herdkeeper the option to purchase steers only during the intervening period to obtain an income.

b) DAFRD (ROI) currently pay for the thick lime milk and pay the herdkeeper to mix this material with the slurry to achieve treatment and hopefully inactivation of any Brucella organism within the slurry. DARD does not have a policy relating to the treatment of slurry.

(ii) The Proposed Changes to be developed.

These proposed changes relate to (i) above.

a) Enforce a 6-month break between depopulation and restocking with breeding cattle - this would be useful to prevent herds restocking quickly in an infected area and reacquiring infection (leading possibly to another buyout);

b) DARD adopt a similar approach to DAFRD re the treatment of slurry. Treatment hopefully would minimise the risk of any potential spread of infection via this route.

(iii) Benefits / Costs

The main **Benefits** a)

- This would simplify the whole derestriction process i.e. currently DARD permit a limited number of breeding stock to be purchased 2 months after completion of a satisfactory cleansing and disinfection. This creates problems in that the herd cannot be derestricted until all of these cattle have been tested in a post calving state; thus if the herdkeeper purchases more stock it may be several months before the herd is derestricted. This proposal would mean that all herds would have to be derestricted before any breeding stock could be purchased.
- This would allow a much longer break between depopulation and restocking with the hope that in an infected area fewer herds would be restocking while new breakdowns are being disclosed.

The main **Costs** a)

- Farmer's goodwill / cooperation may be tested by such stringent measures especially as there will be no income for these herdkeepers for a 6 month period.
- Farming lobby may resist or seek compensation for this period of not having stock and hence no income.

The main **Benefits** b)

- Treatment of slurry would allow disposal of this material in a "safer" state.
- The potential infectivity of the slurry could be reduced quickly following treatment rather than allowing this material to stay in slurry tanks for long periods of time.
- If this treatment saved 10 new breakdowns per annum this measure could potentially save £390,000 per annum (10 x £39,000)

The main **Costs** b)

- The main costs for the treatment of slurry would be the obvious financial cost of the thick lime milk and the cost to mix with slurry on farm. This cost could approximate to £200000 per annum (200 breakdowns @ £1,000 per treatment – approximate average cost of treatment DAFRD). If these costs were borne by DARD there may be no other issues.
- There may be a Health and Safety Cost as the thick lime milk is a high pH substance and may require special handling.

7. BR VALUATION AND COMPENSATION

Proposed Process

- DARD staff should carry out the initial valuation by reference to a list of market prices produced by the Department on a weekly basis. The value of the animal will be no greater than the average price on the current list, and will be subject to any ceiling (see below).
- The herdowner will have 2 working days to accept the valuation or to request that an independent valuation be carried out. Such independent valuations will be carried out by reference to a list of independent valuers that will be maintained by DARD. The resulting valuation will be carried out at the herdowner's expense, the cost being deducted from the compensation payment.
- Should that valuation be unacceptable to either the herdowner or the Department, the matter will be referred to an arbitration panel consisting of a professional arbitrator, an industry representative and one from DARD. The panel's decision will be final and binding on all parties and the panel will decide who meets the cost of the arbitration process.
- DARD will deduct compensation where a herdowner has been proved to be negligent. For example: in relation to failure to test on time, failure to report abortions, failure to properly dispose of abortions, failure to isolate the aborting animal, failure to cleanse and disinfect etc.

Amounts

- Introduce ceiling of £1,500 for compensation on all in contact animals, including pedigrees. A review of the amounts paid for the period 1 April 2001 to 31 January 2002 show that a saving of £386,984 on TB and £400,000 on BR would have been made if a ceiling of £1,500 had been applied.
- Pay 100% compensation (subject to the ceiling) for BR in-contacts. A 75% limit remains on BR reactors.

Costs

- Obtaining/maintaining value lists. An estimate of £397,340 per year which represents 10 DARD valuers at £39,734 (includes travelling and subsistence) to attend markets and produce valuation lists on an ongoing basis. This is based on the average number of markets throughout the week – 46 markets over 5 days.

- Employing internal valuers for all valuations - estimated at 250,000.
- Employing external valuers for second valuations only. The cost is £10,000 approx.
- Arbitration panel.

Savings

- Cost of DARD valuation officers' salaries etc. Cost of six valuers currently employed £238,404.
- Total compensation bill at existing levels. £8.3 m for TB and £7.5 for BR.
- Future compensation bill, as disease incidence recedes due to lower levels of compensation being paid.

A review of one large herd's compensation payment using the market prices reported for the same week as the valuation showed a reduction in the overall payment from £302,195 to £162,976 a saving of £139,219.

However such a comparison is lacking on a number of counts:

(i) The original valuation was made by DARD valuers and would have represented a fair assessment of the animals actual values at the time;

(ii) the information available on market reports contains averages only and it was therefore difficult to assess the correct price;

(iii) the market report did not cover some of the categories involved i.e. maiden heifers and young bulls as such animals do not normally go through markets until they are much older.

(iv) The list of prices was not detailed enough and it was therefore difficult to match the animals correctly with their price e.g. no weight available on valuation form, little idea of category of animal. The valuation for compensation was made by sight of the animal.

Split of costs and savings between TB & BR

Costs

- Obtaining/maintaining value lists £397,340. Split*£222,510 for TB and £174,830 for BR. (56%/44% split TB/BR).
- Employing external valuers for all valuations £250,000. Split is £135,500 for TB and £114,500 for BR. (56%TB/44%BR £134,400/£105,600 split of £240,000 for DARD valuations and 11%TB/89%BR £1,100/£8,900 split of £10,000 for independent valuations).
- Employing external valuers for second valuations only. £10,000 split as above £1,100TB/£8,900BR.
- Arbitration panel. Based on panel of three members one DARD employee – other two paid at £222 per day. Take independent valuations during 2001 as base for number of arbitration panel hearings and assume one day per case. 4 independent

valuations for Br during 2001 - 4 x £222 x 2 =£1776. 15 independent Valuations for TB during 2001 – 15 x £222 x 2 =6,660.

Savings

Refer to Appendix VIII (Assumptions to NPV Calculations).

8. RE-EVALUATION OF DIAGNOSTIC TESTS

Rationale

Whilst the existing BR test methodologies have proved successful in the past, DARD believes that the time is appropriate to examine some of the new evolving technologies (serological, microbiological and molecular biological) in order to determine their potential benefit in terms of diagnostic efficiency and effectiveness in delivering a successful BR Eradication Programme.

DARD propose therefore to embark on a programme of laboratory experimentation and comparative field testing including parallel testing in order to provide a platform for future decision making on how the current testing regime could be modified or enhanced, to deliver value for money.

DARD also recognises that it will be important to evaluate the various test regimes at different stages in the reproductive cycle, including the latent period, where existing tests are known to be insensitive.

The "sensitivity" of a test is a measure of its ability to detect infected cattle. A test with perfect sensitivity will detect all infected animals in a population and not provide a negative result in a diseased animal (so-called "false negative"). "Specificity" is a measure of a test's ability to correctly identify non-diseased animals; a test with perfect specificity will have no "false positives" i.e. non-diseased animals that yielded a positive result to the test. No test has perfect sensitivity and specificity, and there is often an inverse relationship between the 2 in any application of the test.

There is currently no test that correctly identifies all cattle infected with BR. In other words, all available tests have an imperfect sensitivity and may thus result in infected cattle being retained within the herd. This is a key reason for depopulating herds following significant infection. Sensitivity may be increased by repeatedly testing the same animal or by testing the same sample with a variety of tests. The latter, which provides a more reliable result and requires less sampling, is known as parallel testing.

To maximise the sensitivity of the current screening programme, DARD propose to screen higher risk cattle with 2 tests, the traditional SAT and a serological ELISA. This would be carried out in a pilot study in the worst affected area in NI and involve approximately 5,000 cattle. The prime purpose of the study is to identify infected herds as early as possible and thus reduce the likelihood of spread especially during the grazing period.

DARD also propose to produce a protocol for an extensive parallel trial, nested within the BR programme. The purpose of this trial will be to assess the sensitivity and specificity of the SAT relative to a range of other tests. Such a trial is considered necessary to provide continued assurance that the SAT remains the most appropriate screening test in support of DARD's BR Eradication Programme. Within this trial, additional tests will be employed, including bacteriology, to determine the status of test positive cattle. The pilot study will be progressed separately and ahead of the trial protocol being agreed, because the theoretical risk of leaving infected cattle which are negative to the first test is too great to wait for the outcome of such an extensive trial (possibly up to 2 years).

The following tests will be used within the programme and/or trial:

- SAT – screening test in all herds
- ELISA – screening test in all herds
- EDTA – screening test in the nested sample; follow-up in non-negative samples
- CFT – screening test in the nested sample; follow-up in non-negative samples
- Brucellin Skin test – screening test in nested sample and some contiguous herds; follow-up test in some herds
- Bacteriology – confirmatory test in all non-negative animals in nested sample; confirmatory test in (some) reactors in all herds

Advantages

- The parallel test pilot study will increase the sensitivity of screening and thus assist in removal of infected cattle earlier than when the single test is used.

- The proposed nested trial will provide an assessment of the SAT against a range of other tests.

Implications

- Additional number of ELISA tests: 150,000. Note: this will not include additional sampling if sufficient blood is sampled for the current test (SAT).

- Additional number of brucellin tests: 10,000

- Additional number of CFT tests: 10,000

- The additional number of bacteriology tests is unknown as it will depend on the results of SAT/ELISA sampling and size of nested trial sample.

- The ELISA and SAT will identify different but overlapping populations of test-positive cattle, many of which will be false-positive. These will require follow-up testing which has implications for field staff.

Sampling/Testing Costs

Approximately £200,000 per annum depending on the extent of bacteriology follow-up.

9. BIOMETRIC IDENTIFICATION/GENETIC TRACING

Strengths and Weaknesses of DNA Identification

DNA markers are unique to the individual animal. This makes them an accurate means of ensuring that an animal is the individual it is supposed to be. In this respect they are better than ear-tags since these and other artificial means of identification may be moved between animals at will. However they are not ideal as the exclusive means of cattle identification, since DNA markers cannot be seen, unlike an ear-tag. Their value is limited as the identity of the animal will take time to be checked. The ideal identifier is one in which an external marker, an ear-tag, say, is truly tamper-proof. Failing that, an effective compromise solution is an ear-tag system sufficiently audited (and thereby validated) by the tamper-proof, if cryptic, DNA marker system. A DNA database would be the foundation of such a system.

Proposals

DNA analysis currently falls into two broad categories:

1 *Investigation of specific suspected criminal offences*. This is currently used with effect by both VS and Fraud Investigation Unit staff. A current prosecution is based upon DNA evidence that a BR infected animal reappeared "after slaughter" in a second herd.

2. *The establishment of a database of all NI cattle*. This is the main subject under discussion. In essence it requires that a biological sample (say, hair) is lodged with and retained by VS at the time of a calf registration and is available to be compared with a sample taken at any stage later in the animal's life or indeed after its death.

What a DNA Database Could and Could Not Provide

It should:

1. *Provide audit of traceability of meat*.
2. *Provide audit of cattle traceability.*
3. *Render tag-switched animals ineligible for payment of Beef Special Premium/Suckler Cow Premium etc*. (The wrong person, an innocent purchaser, may be penalised rather than the culprit).

It is unlikely to:

4. *Render tag-switchers more prosecutable*. It would rarely do this because of one or more of:
    - The questionable evidential value of the original sample.
    - The mis-identified animal may not be detected in the malefactor's herd
    - Movement of the animal through several herds in any of which its tag may have been switched.

5. *Significantly deter tag-switching.* At the level of audit-testing which could currently be considered, tag-switching is unlikely to be deterred.

   - The guilty party would be unlucky to be detected.
   - Movement of a tag-switched animal into a 2nd herd would render the malefactor safe from both prosecution and loss of premium payment.

The Future: Recommendations for Progress

It is proposed that feasibility of DNA/Biometric identification of cattle using current genotyping technologies be determined and that a core facility is established to deliver this. It is envisaged that initial research will determine the ability of technologies to consistently identify animals on multiple occasions at any time throughout their lives and ultimately provide baseline data against which, appropriate new developments on sampling, DNA analysis and eye-imaging will be investigated, evaluated and integrated.

A recent VSD 2002/2003 bid for a 'Traceability and Regulation of Animals by Confirmatory Evidence (TRACE)' identified the following costs in relation to implementation of the above research project:

	2003/04 (£K)	2004/05 (£K)	2005/06 (£K)
Capital			
Building	416.00	0	0
Equipment	75.00	0	0
Current	124.39	225.06	190.06
TOTAL PROGRAMME	615.39	225.06	190.06
DRC Total	257.06	264.77	272.71

DARD - BR Eradication Programme - Appendix VIII

A Assumptions to Costs (Refer to Appendix VII for description and breakdown of proposal costs)

1 2002/03 Programme Budget (Baseline)

Year	VSD Costs	Compensation	Staff Costs	Salvage	Total Expenditure
2000/01 (actual)	850,663	8,921,139	3,130,098	2,165,256	10,736,644
2002/03 (budgeted)	**1,076,000**	**10,753,000**	**3,224,001**	**1,363,600**	**13,689,401**
			Uplift between years		2952757

2 Annual Testing

Sampling Costs	=	220,000	samples	X	1.5	per sample	=	330,000
Testing Costs	=	220,000	samples	X	1.63	per sample	=	358,600
								688,600 per annum

3 Compensation - valuation and ceiling

Additional Annual costs:							
Obtaining/maintaining value lists	=	397,340	x	0.44	=	174830	
Employing external vauers	=	238,404	x	0.44	=	104898	
Arbitration panel fees	=				=	1176	
					Total	**280903**	

4 Increased Testing at Meat Plants = **170,000** per annum

5 Pre Movement Test = **600,000** per annum

6 Housing and Movement Restriction = **295,000**

7 Depopulation and Restocking = **200,000**

8 Evaluation/ implementation of biometric identification of cattle (representing 50% of total cost - 50% also allocated to TB)

Additional Capital Costs (Year 0)								
VSD Capital	:	**208,000 equipment replaced every 7 years**	**+**	**37,500 building occupying 50 sq.m. of land**				
Replacement of equipment every 5 years							(with an economic life of 20 years)	
Opportunity cost of land	:	50	x	16.4 per sq.m.	=	**820**		
Additional Annual Revenue Costs		Programme Current Expenditure		Additional DRC		Total		
	:	Year 1	62,195	128,530		**190,725**		
	:	Year 2	112,530	132,385		**244,915**		
	:	Year 3	95,030	136,355		**231,385**		
	:	Year 4	95,030	136,355		**231,385**		
		Year 5	95,030	136,355		**231,385**		

9 APHIS

Cost of development **250,000** (Indicative total cost of development (£500,000) is allocated equally to the BR and TB programme)

10 Education and Awareness

Additional Annual Spend: **10,000**

11 Evaluation of Diagnostic Tests **200,000** **(Annual Cost of Implementation)**

12 Residual Values

Evaluation/ implementation of biometric identification of cattle

Equipment	0	(reflecting remaining 0 years out of an economic life of seven)
Building	37,500	(at original cost)
Land	820	(at original cost)
	38,320	

APHIS **Software development** **0 (I.e. zero value)**

B Assumptions To Cost Savings (Option 3*)

		2000/01 Base Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
1	Number of oubreaks at present:								
	No. Seropos herds in Cal. Year 2000	n/a	155	n/a	n/a	n/a	n/a	n/a	n/a
	No. Seropos herds in Cal. Year 2001 < 31/10/01	n/a	84	n/a	n/a	n/a	n/a	n/a	n/a
	No. Seropos herds 01/11/01 to 28/02/02	n/a	89	n/a	n/a	n/a	n/a	n/a	n/a
	Sub total	**0**	**173**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
	Adjustment for Assoc herds that will trigger testing (30% herds)	0	51.9	n/a	n/a	n/a	n/a	n/a	n/a
	Total	**186**	**225**	**188**	**150**	**113**	**77**	**41**	**5**
2	Number cattle per herd	40	42	44	45	46	47	47	48
3	**IR herds**								
	Number/breakdown	15	15	15	15	15	15	15	15
	Number of herd tests/ herd (adjusted for annual test)	3	3	3	3	3	3	3	3
4	**OR herds**								
	Number/breakdown	25	25	25	25	25	25	25	25
	Number of herd tests/herd	2	2	2	2	2	2	2	2
5	**Cost of test (£)**								
	Sampling Cost (Field)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Testing Cost (Lab)	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63
	Cost at present = No breakdowns x	186	225	188	150	113	77	41	5
	[(No IR herds x No. Tests x No animals x Cost of test/sample)+	3,834	4,026	4,217	4,313	4,409	4,505	4,505	4,601
	[(No OR herds x No. Tests x No animals x Cost of test/sample)]	4,260	4,473	4,686	4,793	4,899	5,006	5,006	5,112
	Total cost of testing	**1,505,484**	**1,911,358**	**1,673,839**	**1,365,863**	**1,051,815**	**732,305**	**389,928**	**48,564**
	Cost of testing compared to base year	---	405,874	168,355	-139,622	-453,669	-773,179	-1,115,556	-1,456,920
6	Average cost of compensation/breakdown	47,963	47,531	47,531	47,531	47,531	47,531	47,531	47,531
	Total cost of compensation	**8,921,118**	**10,689,797**	**8,935,891**	**7,129,700**	**5,371,041**	**3,659,913**	**1,948,785**	**237,657**
	Cost of compensation compared to base case	---	1,768,679	14,773	-1,791,418	-3,550,077	-5,261,205	-6,972,333	-8,683,461
	Total variance with base case (compensation and testing)	**0**	**2,174,552**	**183,128**	**-1,931,040**	**-4,003,746**	**-6,034,385**	**-8,087,889**	**-10,140,381**

1-5 Based on DARD VS/VSD data

6 Reduction in compensation is based on analysis of impact of compensation ceilings (overleaf). The % reduction relating to a ceiling of £1,500 is applied to the base case level.

* Although it is envisaged that Option 4 will achieve the stated policy objectives 3-4 months earlier than Option 3, the level and timing of benefits profiled for Option 4 is the same as Option 3, as differences in the accrual of benefits within years cannot be distinguished.

Analysis of Impact of Compensation Ceilings (using payment data from 17 randomly selected herds, representing a range of animals at differing values)

Herd #		No. of animals	amount paid	ceiling at £1,000	saving	ceiling at £1,500	saving	ceiling at £2,000	saving
1		40	24,150	24,150	0	24,150	0	24,150	0
2		43	27,100	24,100	3,000	25,100	2,000	26,100	1,000
3		1	700	700	0	700	0	700	0
4		41	22,830	22,830	0	22,830	0	22,830	0
5		28	27,850	25,950	1,900	27,850	0	27,850	0
6		12	6,410	6,410	0	6,410	0	6,410	0
7		2	400	400	0	400	0	400	0
8		17	18,700	17,000	1,700	18,700	0	18,700	0
9		98	75,790	70,840	4,950	75,790	0	75,790	0
10		69	37,830	36,830	1,000	37,330	500	37,830	0
11		8	4,050	4,050	0	4,050	0	4,050	0
12		42	24,550	24,550	0	24,550	0	24,550	0
13		10	7,350	6,550	800	7,050	300	7,350	0
14		53	30,780	29,880	900	30,380	400	30,780	0
15		58	31,850	31,850	0	31,850	0	31,850	0
16		14	6,910	6,710	200	6,910	0	6,910	0
17		1	550	550	0	550	0	550	0
	Total	**537**	**347,800**	**333,350**	**14,450**	**344,600**	**3,200**	**346,800**	**1,000**
	average per herd*		**20,459**	**19,609**	**850**	**20,271**	**188**	**20,400**	**59**
	% variance with base case				**4.2**		**0.9**		**0.3**

Limitations of analysis:
- based on historic market prices
- based on a limited sample of total payments

* the variation between the average compensation per herd in this analysis and that presented in the previous page is considered to be due to the limitations of the sample size

Sensitivity Analysis (Outbreak Numbers +10%) **NEGATIVE VARIATION**

Assumptions To Cost Savings

	2000/01 Base Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Number of oubreaks at present:								
No. Seropos herds in Cal. Year 2000	n/a	155	n/a	n/a	n/a	n/a	n/a	n/a
No. Seropos herds in Cal. Year 2001 < 31/10/01	n/a	84	n/a	n/a	n/a	n/a	n/a	n/a
No. Seropos herds 01/11/01 to 28/02/02	n/a	89	n/a	n/a	n/a	n/a	n/a	n/a
Sub total	**0**	**173**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Adjustment for Assoc herds that will trigger testing (30% herds)	0	51.9	n/a	n/a	n/a	n/a	n/a	n/a
Total	**186**	**247**	**207**	**165**	**124**	**85**	**45**	**6**
Number cattle per herd	40	42	44	45	46	47	47	48
IR herds								
Number/breakdown	15	15	15	15	15	15	15	15
Number of herd tests/ herd (adjusted for annual test)	3	3	3	3	3	3	3	3
OR herds								
Number/breakdown	25	25	25	25	25	25	25	25
Number of herd tests/herd	2	2	2	2	2	2	2	2
Cost of test (£)								
Sampling Cost (Field)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Testing Cost (Lab)	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63
Cost at present = No breakdowns x	186	247	207	165	124	85	45	6
[(No IR herds x No. Tests x No animals x Cost of test/sample)+	3,834	4,026	4,217	4,313	4,409	4,505	4,505	4,601
[(No OR herds x No. Tests x No animals x Cost of test/sample)]	4,260	4,473	4,686	4,793	4,899	5,006	5,006	5,112
Total cost of testing	**1,505,484**	**2,102,493**	**1,841,223**	**1,502,449**	**1,156,997**	**805,535**	**428,921**	**53,420**
Cost of testing compared to base year	---	597,009	335,739	-3,035	-348,487	-699,949	-1,076,563	-1,452,064
Cost of Compensation/breakdown	47,963	47,531	47,531	47,531	47,531	47,531	47,531	47,531
Total cost of compensation	**8,921,118**	**11,758,776**	**9,829,480**	**7,842,670**	**5,908,145**	**4,025,904**	**2,143,663**	**261,422**
Cost of compensation compared to base case	---	2,837,658	908,362	-1,078,448	-3,012,973	-4,895,214	-6,777,455	-8,659,696
Total variance with base case (compensation and testing)	**0**	**3,434,668**	**1,244,101**	**-1,081,483**	**-3,361,460**	**-5,595,163**	**-7,854,018**	**-10,111,759**

Sensitivity Analysis (Outbreak Number -10%) **POSITIVE VARIATION**

Assumptions To Cost Savings

	2000/01 Base Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Number of oubreaks at present:								
No. Seropos herds in Cal. Year 2000	n/a	155	n/a	n/a	n/a	n/a	n/a	n/a
No. Seropos herds in Cal. Year 2001 < 31/10/01	n/a	84	n/a	n/a	n/a	n/a	n/a	n/a
No. Seropos herds 01/11/01 to 28/02/02	n/a	89	n/a	n/a	n/a	n/a	n/a	n/a
Sub total	**0**	**173**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Adjustment for Assoc herds that will trigger testing (30% herds)	0	51.9	n/a	n/a	n/a	n/a	n/a	n/a
Total	**186**	**202**	**169**	**135**	**102**	**69**	**37**	**5**
Number cattle per herd	40	42	44	45	46	47	47	48
IR herds								
Number/breakdown	15	15	15	15	15	15	15	15
Number of herd tests/ herd (adjusted for annual test)	3	3	3	3	3	3	3	3
OR herds								
Number/breakdown	25	25	25	25	25	25	25	25
Number of herd tests/herd	2	2	2	2	2	2	2	2
Cost of test (£)								
Sampling Cost (Field)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Testing Cost (Lab)	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63
Cost at present = No breakdowns x	186	202	169	135	102	69	37	5
[(No IR herds x No. Tests x No animals x Cost of test/sample)+	3,834	4,026	4,217	4,313	4,409	4,505	4,505	4,601
[(No OR herds x No. Tests x No animals x Cost of test/sample)]	4,260	4,473	4,686	4,793	4,899	5,006	5,006	5,112
Total cost of testing	**1,505,484**	**1,720,222**	**1,506,455**	**1,229,276**	**946,634**	**659,074**	**350,936**	**43,708**
Cost of testing compared to base year	---	214,738	971	-276,208	-558,850	-846,410	-1,154,548	-1,461,776
Cost of Compensation/breakdown	47,963	47,531	47,531	47,531	47,531	47,531	47,531	47,531
Total cost of compensation	**8,921,118**	**9,620,817**	**8,042,302**	**6,416,730**	**4,833,937**	**3,293,921**	**1,753,906**	**213,891**
Cost of compensation compared to base case	---	699,699	-878,816	-2,504,388	-4,087,181	-5,627,197	-7,167,212	-8,707,227
Total variance with base case (compensation and testing)	**0**	**914,437**	**-877,845**	**-2,780,596**	**-4,646,032**	**-6,473,606**	**-8,321,760**	**-10,169,003**

Sensitivity Analysis (Compensation ceiling increased to £2,000) **NEGATIVE VARIATION**

Assumptions To Cost Savings

	2000/01 Base Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Number of oubreaks at present:								
No. Seropos herds in Cal. Year 2000	n/a	155	n/a	n/a	n/a	n/a	n/a	n/a
No. Seropos herds in Cal. Year 2001 < 31/10/01	n/a	84	n/a	n/a	n/a	n/a	n/a	n/a
No. Seropos herds 01/11/01 to 28/02/02	n/a	89	n/a	n/a	n/a	n/a	n/a	n/a
Sub total	**0**	**173**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Adjustment for Assoc herds that will trigger testing (30% herds)	0	51.9	n/a	n/a	n/a	n/a	n/a	n/a
Total	**186**	**225**	**188**	**150**	**113**	**77**	**41**	**5**
Number cattle per herd	40	42	44	45	46	47	47	48
IR herds								
Number/breakdown	15	15	15	15	15	15	15	15
Number of herd tests/ herd (adjusted for annual test)	3	3	3	3	3	3	3	3
OR herds								
Number/breakdown	25	25	25	25	25	25	25	25
Number of herd tests/herd	2	2	2	2	2	2	2	2
Cost of test (£)								
Sampling Cost (Field)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Testing Cost (Lab)	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63
Cost at present = No breakdowns x	186	225	188	150	113	77	41	5
[(No IR herds x No. Tests x No animals x Cost of test/sample)+	3,834	4,026	4,217	4,313	4,409	4,505	4,505	4,601
[(No OR herds x No. Tests x No animals x Cost of test/sample)]	4,260	4,473	4,686	4,793	4,899	5,006	5,006	5,112
Total cost of testing	**1,505,484**	**1,911,358**	**1,673,839**	**1,365,863**	**1,051,815**	**732,305**	**389,928**	**48,564**
Cost of testing compared to base year	---	405,874	168,355	-139,622	-453,669	-773,179	-1,115,556	-1,456,920
Cost of Compensation/breakdown	47,963	47,819	47,819	47,819	47,819	47,819	47,819	47,819
Total cost of compensation	**8,921,118**	**10,754,518**	**8,989,993**	**7,172,867**	**5,403,560**	**3,682,072**	**1,960,584**	**239,096**
Cost of compensation compared to base case	---	1,833,400	68,875	-1,748,251	-3,517,558	-5,239,046	-6,960,534	-8,682,022
Total variance with base case (compensation and testing)	**0**	**2,239,274**	**237,230**	**-1,887,873**	**-3,971,227**	**-6,012,226**	**-8,076,090**	**-10,138,942**

Sensitivity Analysis (Compensation ceiling lowered to £1,000) POSITIVE VARIATION

Assumptions To Cost Savings

	2000/01 Base Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Number of oubreaks at present:								
No. Seropos herds in Cal. Year 2000	n/a	155	n/a	n/a	n/a	n/a	n/a	n/a
No. Seropos herds in Cal. Year 2001 < 31/10/01	n/a	84	n/a	n/a	n/a	n/a	n/a	n/a
No. Seropos herds 01/11/01 to 28/02/02	n/a	89	n/a	n/a	n/a	n/a	n/a	n/a
Sub total	0	173	n/a	n/a	n/a	n/a	n/a	n/a
Adjustment for Assoc herds that will trigger testing (30% herds)	0	51.9	n/a	n/a	n/a	n/a	n/a	n/a
Total	**186**	**225**	**188**	**150**	**113**	**77**	**41**	**5**
Number cattle per herd	40	42	44	45	46	47	47	48
IR herds								
Number/breakdown	15	15	15	15	15	15	15	15
Number of herd tests/ herd (adjusted for annual test)	3	3	3	3	3	3	3	3
OR herds								
Number/breakdown	25	25	25	25	25	25	25	25
Number of herd tests/herd	2	2	2	2	2	2	2	2
Cost of test (£)								
Sampling Cost (Field)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Testing Cost (Lab)	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63
Cost at present = No breakdowns x	186	225	188	150	113	77	41	5
[(No IR herds x No. Tests x No animals x Cost of test/sample)+	3,834	4,026	4,217	4,313	4,409	4,505	4,505	4,601
[(No OR herds x No. Tests x No animals x Cost of test/sample)]	4,260	4,473	4,686	4,793	4,899	5,006	5,006	5112
Total cost of testing	**1,505,484**	**1,911,358**	**1,673,839**	**1,365,863**	**1,051,815**	**732,305**	**389,928**	**48,564**
Cost of testing compared to base year	---	405,874	168,355	-139,622	-453,669	-773,179	-1,115,556	-1,456,920
Cost of Compensation/breakdown	47,963	45,949	45,949	45,949	45,949	45,949	45,949	45,949
Total cost of compensation	**8,921,118**	**10,333,830**	**8,638,328**	**6,892,283**	**5,192,187**	**3,538,039**	**1,883,891**	**229,743**
Cost of compensation compared to base case	---	1,412,712	-282,790	-2,028,835	-3,728,931	-5,383,079	-7,037,227	-8,691,375
Total variance with base case (compensation and testing)	**0**	**1,818,585**	**-114,435**	**-2,168,456**	**-4,182,600**	**-6,156,259**	**-8,152,783**	**-10,148,295**

Summary of Costs and NPVs

Option	Benefits less Costs	Incremental Cost	NPV	Incremental NPV
1	-95,825,807	---	-76,419,458	---
2	-104,846,007	-9,020,200	-83,612,914	-7,193,457
3	-84,157,570	11,668,237	-69,833,552	6,585,906
4	-87,185,635	8,640,172	-72,318,085	4,101,373

Option	NPV	NPV after costs of implementation increased by 10%	% change	NPV after costs of implementation decreased by 10%	% change	NPV after number of outbreaks increased by 10%	% change	NPV after number of outbreaks decreased by 10%	% change	NPV after compensation ceiling is increased to £2000	% change	NPV after compensation ceiling is decreased to £1000	% change
1	-76,419,458	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2	-83,612,914	-84,332,260	0.86	-82,893,569	-0.86	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	-69,833,552	-71,103,267	1.82	-68,563,838	-1.82	-73,700,774	5.54	-65,966,330	-5.54	-70,030,596	0.28	-68,749,814	-1.55
4	-72,318,085	-73,861,252	2.13	-70,774,917	-2.13	-76,185,306	5.35	-68,450,863	-5.35	-72,515,128	0.27	-71,234,346	-1.50

DARD - BR Eradication Programme - Appendix VIII

Option 1 **Do Nothing**

Monetary Benefits	**Year 0** **£**	**Year 1** **£**	**Year 2** **£**	**Year 3** **£**	**Year 4** **£**	**Year 5** **£**	**Year 6** **£**	**Year 7** **£**	**Total** **£**
Salvage (2000/01)		2,165,256	2,165,256	2,165,256	2,165,256	2,165,256	2,165,256	2,165,256	15,156,792
Total Benefits	**0**	**2,165,256**	**2,165,256**	**2,165,256**	**2,165,256**	**2,165,256**	**2,165,256**	**2,165,256**	**15,156,792**
Expenditure									
Admin. & Veterinary Staff Costs (2000/01)		3,130,098	3,130,098	3,130,098	3,130,098	3,130,098	3,130,098	3,130,098	21,910,686
Compensation (2000/01)		8,921,139	8,921,139	8,921,139	8,921,139	8,921,139	8,921,139	8,921,139	62,447,973
VSD Lab Costs (2000/01)		850,663	850,663	850,663	850,663	850,663	850,663	850,663	5,954,641
2002/03 budget uplift		2,952,757	2,952,757	2,952,757	2,952,757	2,952,757	2,952,757	2,952,757	2,952,757
Total Costs	**0**	**15,854,657**	**15,854,657**	**15,854,657**	**15,854,657**	**15,854,657**	**15,854,657**	**15,854,657**	**110,982,599**
Net Cost/Benefit	**0**	**-13,689,401**	**-13,689,401**	**-13,689,401**	**-13,689,401**	**-13,689,401**	**-13,689,401**	**-13,689,401**	**-95,825,807**
Opportunity Costs									
Residual Value									
Discount factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPC	**0**	**-12,914,529**	**-12,183,518**	**-11,493,885**	**-10,843,288**	**-10,229,517**	**-9,650,487**	**-9,104,233**	**-76,419,458**
Cumulative NPC	**0**	**-12,914,529**	**-25,098,047**	**-36,591,932**	**-47,435,220**	**-57,664,737**	**-67,315,224**	**-76,419,458**	

DARD - BR Eradication Programme - Appendix VIII

Option 2 **Do Minimum**

Monetary Benefits	**Year 0** **£**	**Year 1** **£**	**Year 2** **£**	**Year 3** **£**	**Year 4** **£**	**Year 5** **£**	**Year 6** **£**	**Year 7** **£**	**Total** **£**
Cost Savings									0
Sub Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Capital Costs									
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Annual Testing	0	688,600	688,600	688,600	688,600	688,600	688,600	688,600	4,820,200
Compensation - valuation and ceiling	0	0	0	0	0	0	0	0	0
Increased Testing at Meat Plants	0	0	0	0	0	0	0	0	0
Pre Movement Test	0	600,000	600,000	600,000	600,000	600,000	600,000	600,000	4,200,000
Housing and Movement Restriction	0	0	0	0	0	0	0	0	0
Depopulation and Restocking	0	0	0	0	0	0	0	0	0
Evaluation/ implementation of biometric identification of cattle	0	0	0	0	0	0	0	0	0
APHIS	0	0	0	0	0	0	0	0	0
Education and Awareness	0	0	0	0	0	0	0	0	0
Evaluation of Diagnostic Tests	0	0	0	0	0	0	0	0	0
Sub Total	0	14,978,001	14,978,001	14,978,001	14,978,001	14,978,001	14,978,001	14,978,001	104,846,007
Net Cost/Benefit	**0**	**-14,978,001**	**-14,978,001**	**-14,978,001**	**-14,978,001**	**-14,978,001**	**-14,978,001**	**-14,978,001**	**-104,846,007**
Opportunity Costs	0	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	0	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**0**	**-14,130,190**	**-13,330,368**	**-12,575,818**	**-11,863,980**	**-11,192,434**	**-10,558,900**	**-9,961,226**	**-83,612,914**
Cumulative NPC	**0**	**-14,130,190**	**-27,460,557**	**-40,036,375**	**-51,900,355**	**-63,092,789**	**-73,651,688**	**-83,612,914**	

DARD - BR Eradication Programme - Appendix VIII

Option 2 **Do Minimum (Cost of Proposal Implementation up 10%)**

Monetary Benefits	**Year 0** **£**	**Year 1** **£**	**Year 2** **£**	**Year 3** **£**	**Year 4** **£**	**Year 5** **£**	**Year 6** **£**	**Year 7** **£**	**Total** **£**
Cost Savings									0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Annual Testing	0	757,460	757,460	757,460	757,460	757,460	757,460	757,460	5,302,220
Compensation - valuation and ceiling	0	0	0	0	0	0	0	0	0
Increased Testing at Meat Plants	0	0	0	0	0	0	0	0	0
Pre Movement Test	0	660,000	660,000	660,000	660,000	660,000	660,000	660,000	4,620,000
Housing and Movement Restriction	0	0	0	0	0	0	0	0	0
Depopulation and Restocking	0	0	0	0	0	0	0	0	0
Evaluation/ implementation of biometric identification of cattle	0	0	0	0	0	0	0	0	0
APHIS	0	0	0	0	0	0	0	0	0
Education and Awareness	0	0	0	0	0	0	0	0	0
Evaluation of Diagnostic Tests	0	0	0	0	0	0	0	0	0
Sub Total	0	15,106,861	15,106,861	15,106,861	15,106,861	15,106,861	15,106,861	15,106,861	105,748,027
Net Cost/Benefit	**0**	**-15,106,861**	**-15,106,861**	**-15,106,861**	**-15,106,861**	**-15,106,861**	**-15,106,861**	**-15,106,861**	**-105,748,027**
Opportunity Costs	0	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	0	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**0**	**-14,251,756**	**-13,445,052**	**-12,684,012**	**-11,966,049**	**-11,288,725**	**-10,649,741**	**-10,046,925**	**-84,332,260**
Cumulative NPC	**0**	**-14,251,756**	**-27,696,808**	**-40,380,820**	**-52,346,869**	**-63,635,594**	**-74,285,335**	**-84,332,260**	

DARD - BR Eradication Programme - Appendix VIII

Option 2 **Do Minimum (Cost of Proposal Implementation down 10%)**

Monetary Benefits	**Year 0** **£**	**Year 1** **£**	**Year 2** **£**	**Year 3** **£**	**Year 4** **£**	**Year 5** **£**	**Year 6** **£**	**Year 7** **£**	**Total** **£**
Cost Savings									0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Annual Testing	0	619,740	619,740	619,740	619,740	619,740	619,740	619,740	4,338,180
Compensation - valuation and ceiling	0	0	0	0	0	0	0	0	0
Increased Testing at Meat Plants	0	0	0	0	0	0	0	0	0
Pre Movement Test	0	540,000	540,000	540,000	540,000	540,000	540,000	540,000	3,780,000
Housing and Movement Restriction	0	0	0	0	0	0	0	0	0
Depopulation and Restocking	0	0	0	0	0	0	0	0	0
Evaluation/ implementation of biometric identification of cattle	0	0	0	0	0	0	0	0	0
APHIS	0	0	0	0	0	0	0	0	0
Education and Awareness	0	0	0	0	0	0	0	0	0
Evaluation of Diagnostic Tests	0	0	0	0	0	0	0	0	0
Sub Total	0	14,849,141	14,849,141	14,849,141	14,849,141	14,849,141	14,849,141	14,849,141	103,943,987
Net Cost/Benefit	**0**	**-14,849,141**	**-14,849,141**	**-14,849,141**	**-14,849,141**	**-14,849,141**	**-14,849,141**	**-14,849,141**	**-103,943,987**
Opportunity Costs	0	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	0	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**0**	**-14,008,624**	**-13,215,683**	**-12,467,625**	**-11,761,910**	**-11,096,142**	**-10,468,058**	**-9,875,527**	**-82,893,569**
Cumulative NPC	**0**	**-14,008,624**	**-27,224,306**	**-39,691,931**	**-51,453,842**	**-62,549,984**	**-73,018,042**	**-82,893,569**	

DARD - BR Eradication Programme - Appendix VIII **'Class A' modifications Only**

Monetary Benefits	**Year 0** **£**	**Year 1** **£**	**Year 2** **£**	**Year 3** **£**	**Year 4** **£**	**Year 5** **£**	**Year 6** **£**	**Year 7** **£**	**Total** **£**
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
APHIS	250,000	0	0	0	0	0	0	0	250,000
	0	0	0	0	0	0	0	0	0
Sub Total	250,000	0	0	0	0	0	0	0	250,000
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	2,174,552	183,128	-1,931,040	-4,003,746	-6,034,385	-8,087,889	-10,140,381	-27,839,760
Annual Testing	0	688,600	688,600	688,600	688,600	688,600	688,600	688,600	4,820,200
Compensation - valuation and ceiling	0	280,903	280,903	280,903	280,903	280,903	280,903	280,903	1,966,324
Increased Testing at Meat Plants	0	0	0	0	0	0	0	0	0
Pre Movement Test	0	600,000	600,000	600,000	600,000	600,000	600,000	600,000	4,200,000
Housing and Movement Restriction	0	295,000	295,000	295,000	295,000	295,000	295,000	295,000	2,065,000
Depopulation and Restocking	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Evaluation/ implementation of biometric identification of cattle	0	0	0	0	0	0	0	0	0
Education and Awareness	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	70,000
Evaluation of Diagnostic Tests	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Sub Total	0	18,138,457	16,147,032	14,032,865	11,960,158	9,929,520	7,876,015	5,823,523	83,907,570
Net Cost/Benefit	**- 250,000**	**-18,138,457**	**-16,147,032**	**-14,032,865**	**-11,960,158**	**-9,929,520**	**-7,876,015**	**-5,823,523**	**-84,157,570**
Opportunity Costs	0	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	0	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**- 250,000**	**-17,111,752**	**-14,370,801**	**-11,782,264**	**-9,473,566**	**-7,419,915**	**-5,552,280**	**-3,872,975**	**-69,833,552**
Cumulative NPC	**- 250,000**	**-17,361,752**	**-31,732,553**	**-43,514,817**	**-52,988,382**	**-60,408,297**	**-65,960,577**	**-69,833,552**	

DARD - BR Eradication Programme - Appendix VIII

Option 3 **Class A' modifications Only (Cost of Proposal Implementation up 10%)**

Monetary Benefits	**Year 0 £**	**Year 1 £**	**Year 2 £**	**Year 3 £**	**Year 4 £**	**Year 5 £**	**Year 6 £**	**Year 7 £**	**Total £**
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
APHIS	250,000	0	0	0	0	0	0	0	250,000
	0	0	0	0	0	0	0	0	0
Sub Total	250,000	0	0	0	0	0	0	0	250,000
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	2,174,552	183,128	-1,931,040	-4,003,746	-6,034,385	-8,087,889	-10,140,381	-27,839,760
Annual Testing	0	757,460	757,460	757,460	757,460	757,460	757,460	757,460	5,302,220
Compensation - valuation and ceiling	0	308,994	308,994	308,994	308,994	308,994	308,994	308,994	2,162,956
Increased Testing at Meat Plants	0	0	0	0	0	0	0	0	0
Pre Movement Test	0	660,000	660,000	660,000	660,000	660,000	660,000	660,000	4,620,000
Housing and Movement Restriction	0	324,500	324,500	324,500	324,500	324,500	324,500	324,500	2,271,500
Depopulation and Restocking	0	220,000	220,000	220,000	220,000	220,000	220,000	220,000	1,540,000
identification of cattle	0	0	0	0	0	0	0	0	0
Education and Awareness	0	11,000	11,000	11,000	11,000	11,000	11,000	11,000	77,000
Evaluation of Diagnostic Tests	0	220,000	220,000	220,000	220,000	220,000	220,000	220,000	1,540,000
Sub Total	0	18,365,907	16,374,482	14,260,315	12,187,609	10,156,970	8,103,466	6,050,973	85,499,722
Net Cost/Benefit	**-250000**	**-18,365,907**	**-16,374,482**	**-14,260,315**	**-12,187,609**	**-10,156,970**	**-8,103,466**	**-6,050,973**	**-85,749,722**
Opportunity Costs	0	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	0	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-250000**	**-17,326,327**	**-14,573,231**	**-11,973,236**	**-9,653,728**	**-7,589,879**	**-5,712,624**	**-4,024,243**	**-71,103,267**
Cumulative NPC	**-250000**	**-17,576,327**	**-32,149,558**	**-44,122,794**	**-53,776,522**	**-61,366,400**	**-67,079,024**	**-71,103,267**	

DARD - BR Eradication Programme - Appendix VIII

Option 3 **Class A' modifications Only (Cost of Proposal Implementation down 10%)**

Monetary Benefits	**Year 0** **£**	**Year 1** **£**	**Year 2** **£**	**Year 3** **£**	**Year 4** **£**	**Year 5** **£**	**Year 6** **£**	**Year 7** **£**	**Total** **£**
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
APHIS	250,000	0	0	0	0	0	0	0	250,000
	0	0	0	0	0	0	0	0	0
Sub Total	250,000	0	0	0	0	0	0	0	250,000
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	2,174,552	183,128	-1,931,040	-4,003,746	-6,034,385	-8,087,889	-10,140,381	-27,839,760
Annual Testing	0	619,740	619,740	619,740	619,740	619,740	619,740	619,740	4,338,180
Compensation - valuation and ceiling	0	252,813	252,813	252,813	252,813	252,813	252,813	252,813	1,769,691
Increased Testing at Meat Plants	0	0	0	0	0	0	0	0	0
Pre Movement Test	0	540,000	540,000	540,000	540,000	540,000	540,000	540,000	3,780,000
Housing and Movement Restriction	0	265,500	265,500	265,500	265,500	265,500	265,500	265,500	1,858,500
Depopulation and Restocking	0	180,000	180,000	180,000	180,000	180,000	180,000	180,000	1,260,000
Evaluation/ implementation of biometric identification of cattle	0	0	0	0	0	0	0	0	0
Education and Awareness	0	9,000	9,000	9,000	9,000	9,000	9,000	9,000	63,000
Evaluation of Diagnostic Tests	0	180,000	180,000	180,000	180,000	180,000	180,000	180,000	1,260,000
Sub Total	0	17,911,006	15,919,582	13,805,414	11,732,708	9,702,069	7,648,565	5,596,073	82,315,417
Net Cost/Benefit	**-250000**	**-17,911,006**	**-15,919,582**	**-13,805,414**	**-11,732,708**	**-9,702,069**	**-7,648,565**	**-5,596,073**	**-82,565,417**
Opportunity Costs	0	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	0	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-250000**	**-16,897,176**	**-14,168,371**	**-11,591,292**	**-9,293,404**	**-7,249,951**	**-5,391,937**	**-3,721,708**	**-68,563,838**
Cumulative NPC	**-250000**	**-17,147,176**	**-31,315,547**	**-42,906,839**	**-52,200,243**	**-59,450,193**	**-64,842,130**	**-68,563,838**	

DARD - BR Eradication Programme - Appendix VIII

Option 3 **Class A' modifications Only (Number of outbreaks up 10%)**

Monetary Benefits	**Year 0 £**	**Year 1 £**	**Year 2 £**	**Year 3 £**	**Year 4 £**	**Year 5 £**	**Year 6 £**	**Year 7 £**	**Total £**
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
APHIS	250,000	0	0	0	0	0	0	0	250,000
	0	0	0	0	0	0	0	0	0
Sub Total	250,000	0	0	0	0	0	0	0	250,000
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	3,434,668	1,244,101	-1,081,483	-3,361,460	-5,595,163	-7,854,018	-10,111,759	-23,325,115
Annual Testing	0	688,600	688,600	688,600	688,600	688,600	688,600	688,600	4,820,200
Compensation - valuation and ceiling	0	280,903	280,903	280,903	280,903	280,903	280,903	280,903	1,966,324
Increased Testing at Meat Plants	0	0	0	0	0	0	0	0	0
Pre Movement Test	0	600,000	600,000	600,000	600,000	600,000	600,000	600,000	4,200,000
Housing and Movement Restriction	0	295,000	295,000	295,000	295,000	295,000	295,000	295,000	2,065,000
Depopulation and Restocking	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Evaluation/ implementation of biometric identification of cattle	0	0	0	0	0	0	0	0	0
Education and Awareness	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	70,000
Evaluation of Diagnostic Tests	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Sub Total	0	19,398,572	17,208,005	14,882,421	12,602,444	10,368,741	8,109,887	5,852,145	88,422,215
Net Cost/Benefit	**-250000**	**-19,398,572**	**-17,208,005**	**-14,882,421**	**-12,602,444**	**-10,368,741**	**-8,109,887**	**-5,852,145**	**-88,672,215**
Opportunity Costs	0	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	0	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-250,000**	**-18,300,540**	**-15,315,063**	**-12,495,568**	**-9,982,316**	**-7,748,127**	**-5,717,150**	**-3,892,011**	**-73,700,774**
Cumulative NPC	**-250,000**	**-18,550,540**	**-33,865,603**	**-46,361,171**	**-56,343,487**	**-64,091,613**	**-69,808,763**	**-73,700,774**	

DARD - BR Eradication Programme - Appendix VIII

Option 3 **Class A' modifications Only (Number of outbreaks down 10%)**

Monetary Benefits	**Year 0 £**	**Year 1 £**	**Year 2 £**	**Year 3 £**	**Year 4 £**	**Year 5 £**	**Year 6 £**	**Year 7 £**	**Total £**
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
APHIS	250,000	0	0	0	0	0	0	0	250,000
	0	0	0	0	0	0	0	0	0
Sub Total	250,000	0	0	0	0	0	0	0	250,000
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	914,437	-877,845	-2,780,596	-4,646,032	-6,473,606	-8,321,760	-10,169,003	-32,354,406
Annual Testing	0	688,600	688,600	688,600	688,600	688,600	688,600	688,600	4,820,200
Compensation - valuation and ceiling	0	280,903	280,903	280,903	280,903	280,903	280,903	280,903	1,966,324
Increased Testing at Meat Plants	0	0	0	0	0	0	0	0	0
Pre Movement Test	0	600,000	600,000	600,000	600,000	600,000	600,000	600,000	4,200,000
Housing and Movement Restriction	0	295,000	295,000	295,000	295,000	295,000	295,000	295,000	2,065,000
Depopulation and Restocking	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Evaluation/ implementation of biometric identification of cattle	0	0	0	0	0	0	0	0	0
Education and Awareness	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	70,000
Evaluation of Diagnostic Tests	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Sub Total	**0**	**16,878,341**	**15,086,059**	**13,183,309**	**11,317,873**	**9,490,298**	**7,642,144**	**5,794,901**	**79,392,924**
Net Cost/Benefit	-250000	-16,878,341	-15,086,059	-13,183,309	-11,317,873	-9,490,298	-7,642,144	-5,794,901	-79,642,924
Opportunity Costs	0	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	0	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-250000**	**-15,922,963**	**-13,426,539**	**-11,068,960**	**-8,964,815**	**-7,091,703**	**-5,387,410**	**-3,853,940**	**-65,966,330**
Cumulative NPC	**-250000**	**-16,172,963**	**-29,599,502**	**-40,668,462**	**-49,633,278**	**-56,724,980**	**-62,112,390**	**-65,966,330**	

DARD - BR Eradication Programme - Appendix VIII

Option 3 **Class A' modifications Only (Compensation ceiling increased to £2,000)**

Monetary Benefits	**Year 0** **£**	**Year 1** **£**	**Year 2** **£**	**Year 3** **£**	**Year 4** **£**	**Year 5** **£**	**Year 6** **£**	**Year 7** **£**	**Total** **£**
Cost Savings	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
APHIS	250,000	0	0	0	0	0	0	0	250,000
	0	0	0	0	0	0	0	0	0
Sub Total	250,000	0	0	0	0	0	0	0	250,000
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	2,239,274	237,230	-1,887,873	-3,971,227	-6,012,226	-8,076,090	-10,138,942	-27,609,854
Annual Testing	0	688,600	688,600	688,600	688,600	688,600	688,600	688,600	4,820,200
Compensation - valuation and ceiling	0	280,903	280,903	280,903	280,903	280,903	280,903	280,903	1,966,324
Increased Testing at Meat Plants	0	0	0	0	0	0	0	0	0
Pre Movement Test	0	600,000	600,000	600,000	600,000	600,000	600,000	600,000	4,200,000
Housing and Movement Restriction	0	295,000	295,000	295,000	295,000	295,000	295,000	295,000	2,065,000
Depopulation and Restocking	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Evaluation/ implementation of biometric identification of cattle	0	0	0	0	0	0	0	0	0
Education and Awareness	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	70,000
Evaluation of Diagnostic Tests	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Sub Total	0	18,203,178	16,201,134	14,076,031	11,992,677	9,951,678	7,887,814	5,824,962	84,137,476
Net Cost/Benefit	**-250,000**	**-18,203,178**	**-16,201,134**	**-14,076,031**	**-11,992,677**	**-9,951,678**	**-7,887,814**	**-5,824,962**	**-84,387,476**
Opportunity Costs	0	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	0	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-250,000**	**-17,172,809**	**-14,418,952**	**-11,818,507**	**-9,499,324**	**-7,436,473**	**-5,560,598**	**-3,873,932**	**-70,030,596**
Cumulative NPC	**-250,000**	**-17,422,809**	**-31,841,761**	**-43,660,269**	**-53,159,592**	**-60,596,065**	**-66,156,663**	**-70,030,596**	

DARD - BR Eradication Programme - Appendix VIII

Option 3 **Class A' modifications Only (Compensation ceiling lowered to £1,000)**

Monetary Benefits	**Year 0 £**	**Year 1 £**	**Year 2 £**	**Year 3 £**	**Year 4 £**	**Year 5 £**	**Year 6 £**	**Year 7 £**	**Total £**
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
APHIS	250,000	0	0	0	0	0	0	0	250,000
	0	0	0	0	0	0	0	0	0
Sub Total	250,000	0	0	0	0	0	0	0	250,000
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	1,818,585	-114,435	-2,168,456	-4,182,600	-6,156,259	-8,152,783	-10,148,295	-29,104,242
Annual Testing	0	688,600	688,600	688,600	688,600	688,600	688,600	688,600	4,820,200
Compensation - valuation and ceiling	0	280,903	280,903	280,903	280,903	280,903	280,903	280,903	1,966,324
Increased Testing at Meat Plants	0	0	0	0	0	0	0	0	0
Pre Movement Test	0	600,000	600,000	600,000	600,000	600,000	600,000	600,000	4,200,000
Housing and Movement Restriction	0	295,000	295,000	295,000	295,000	295,000	295,000	295,000	2,065,000
Depopulation and Restocking	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Evaluation/ implementation of biometric identification of cattle	0	0	0	0	0	0	0	0	0
Education and Awareness	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	70,000
Evaluation of Diagnostic Tests	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Sub Total	0	17,782,490	15,849,470	13,795,448	11,781,304	9,807,646	7,811,121	5,815,609	82,643,088
Net Cost/Benefit	**-250000**	**-17,782,490**	**-15,849,470**	**-13,795,448**	**-11,781,304**	**-9,807,646**	**-7,811,121**	**-5,815,609**	**-82,893,088**
Opportunity Costs	0	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	0	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-250000**	**-16,775,934**	**-14,105,972**	**-11,582,924**	**-9,331,896**	**-7,328,843**	**-5,506,532**	**-3,867,712**	**-68,749,814**
Cumulative NPC	**-250000**	**-17,025,934**	**-31,131,905**	**-42,714,829**	**-52,046,726**	**-59,375,569**	**-64,882,101**	**-68,749,814**	

DARD - BR Eradication Programme - Appendix VIII 'Class A, B and C' modifications
Option 4

Monetary Benefits	**Year 0 £**	**Year 1 £**	**Year 2 £**	**Year 3 £**	**Year 4 £**	**Year 5 £**	**Year 6 £**	**Year 7 £**	**Total £**
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
Evaluation/ implementation of biometric identification of cattle	245,500	0	0	0	0	0	0	0	245,500
APHIS	250,000	0	0	0	0	0	0	0	250,000
Sub Total	495,500	0	0	0	0	0	0	0	495,500
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	2,174,552	183,128	-1,931,040	-4,003,746	-6,034,385	-8,087,889	-10,140,381	-27,839,760
Annual Testing	0	688,600	688,600	688,600	688,600	688,600	688,600	688,600	4,820,200
Compensation - valuation and ceiling	0	280,903	280,903	280,903	280,903	280,903	280,903	280,903	1,966,324
Increased Testing at Meat Plants	0	170,000	170,000	170,000	170,000	170,000	170,000	170,000	1,190,000
Pre Movement Test	0	600,000	600,000	600,000	600,000	600,000	600,000	600,000	4,200,000
Housing and Movement Restriction	0	295,000	295,000	295,000	295,000	295,000	295,000	295,000	2,065,000
Depopulation and Restocking	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Evaluation/ implementation of biometric identification of cattle	0	190,725	244,915	231,385	231,385	231,385	231,385	231,385	1,592,565
Education and Awareness	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	70,000
Evaluation of Diagnostic Tests	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Sub Total	0	18,499,182	16,561,947	14,434,250	12,361,543	10,330,905	8,277,400	6,224,908	86,690,135
Net Cost/Benefit	**-495,500**	**-18,499,182**	**-16,561,947**	**-14,434,250**	**-12,361,543**	**-10,330,905**	**-8,277,400**	**-6,224,908**	**-87,185,635**
Opportunity Costs	820	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	38,320	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-494,680**	**-17,452,058**	**-14,740,074**	**-12,119,274**	**-9,791,500**	**-7,719,853**	**-5,835,241**	**-4,165,404**	**-72,318,085**
Cumulative NPC	**-494,680**	**-17,946,738**	**-32,686,812**	**-44,806,087**	**-54,597,587**	**-62,317,440**	**-68,152,680**	**-72,318,085**	

DARD - BR Eradication Programme - Appendix VIII 'Class A, B and C' modifications (Cost of proposal implementation up 10%)
Option 4

Monetary Benefits	**Year 0 £**	**Year 1 £**	**Year 2 £**	**Year 3 £**	**Year 4 £**	**Year 5 £**	**Year 6 £**	**Year 7 £**	**Total £**
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
Evaluation/ implementation of biometric identification of cattle	270,050	0	0	0	0	0	0	0	270,050
APHIS	275,000	0	0	0	0	0	0	0	275,000
Sub Total	545,050	0	0	0	0	0	0	0	545,050
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	2,174,552	183,128	-1,931,040	-4,003,746	-6,034,385	-8,087,889	-10,140,381	-27,839,760
Annual Testing	0	757,460	757,460	757,460	757,460	757,460	757,460	757,460	5,302,220
Compensation - valuation and ceiling	0	308,994	308,994	308,994	308,994	308,994	308,994	308,994	2,162,956
Increased Testing at Meat Plants	0	187,000	187,000	187,000	187,000	187,000	187,000	187,000	1,309,000
Pre Movement Test	0	660,000	660,000	660,000	660,000	660,000	660,000	660,000	4,620,000
Housing and Movement Restriction	0	324,500	324,500	324,500	324,500	324,500	324,500	324,500	2,271,500
Depopulation and Restocking	0	220,000	220,000	220,000	220,000	220,000	220,000	220,000	1,540,000
Evaluation/ implementation of biometric identification of cattle	0	209,798	269,407	254,524	254,524	254,524	254,524	254,524	1,751,822
Education and Awareness	0	11,000	11,000	11,000	11,000	11,000	11,000	11,000	77,000
Evaluation of Diagnostic Tests	0	220,000	220,000	220,000	220,000	220,000	220,000	220,000	1,540,000
Sub Total	0	18,762,705	16,830,889	14,701,839	12,629,132	10,598,493	8,544,989	6,492,497	88,560,544
Net Cost/Benefit	**-545050**	**-18,762,705**	**-16,830,889**	**-14,701,839**	**-12,629,132**	**-10,598,493**	**-8,544,989**	**-6,492,497**	**-89,105,594**
Opportunity Costs	902	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	42,152	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-544,148**	**-17,700,665**	**-14,979,431**	**-12,343,947**	**-10,003,455**	**-7,919,811**	**-6,023,880**	**-4,345,915**	**-73,861,252**
Cumulative NPC	**-544,148**	**-18,244,813**	**-33,224,244**	**-45,568,191**	**-55,571,647**	**-63,491,457**	**-69,515,338**	**-73,861,252**	

DARD - BR Eradication Programme - Appendix VIII 'Class A, B and C' modifications (Cost of proposal implementation down 10%)
Option 4

Monetary Benefits	**Year 0 £**	**Year 1 £**	**Year 2 £**	**Year 3 £**	**Year 4 £**	**Year 5 £**	**Year 6 £**	**Year 7 £**	**Total £**
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
Evaluation/ implementation of biometric identification of cattle	220,950	0	0	0	0	0	0	0	220,950
APHIS	225,000	0	0	0	0	0	0	0	225,000
Sub Total	445,950	0	0	0	0	0	0	0	445,950
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	2,174,552	183,128	-1,931,040	-4,003,746	-6,034,385	-8,087,889	-10,140,381	-27,839,760
Annual Testing	0	619,740	619,740	619,740	619,740	619,740	619,740	619,740	4,338,180
Compensation - valuation and ceiling	0	252,813	252,813	252,813	252,813	252,813	252,813	252,813	1,769,691
Increased Testing at Meat Plants	0	153,000	153,000	153,000	153,000	153,000	153,000	153,000	1,071,000
Pre Movement Test	0	540,000	540,000	540,000	540,000	540,000	540,000	540,000	3,780,000
Housing and Movement Restriction	0	265,500	265,500	265,500	265,500	265,500	265,500	265,500	1,858,500
Depopulation and Restocking	0	180,000	180,000	180,000	180,000	180,000	180,000	180,000	1,260,000
Evaluation/ implementation of biometric identification of cattle	0	171,653	220,424	208,247	208,247	208,247	208,247	208,247	1,433,309
Education and Awareness	0	9,000	9,000	9,000	9,000	9,000	9,000	9,000	63,000
Evaluation of Diagnostic Tests	0	180,000	180,000	180,000	180,000	180,000	180,000	180,000	1,260,000
Sub Total	0	18,235,659	16,293,005	14,166,661	12,093,954	10,063,316	8,009,812	5,957,319	84,819,726
Net Cost/Benefit	**-445950**	**-18,235,659**	**-16,293,005**	**-14,166,661**	**-12,093,954**	**-10,063,316**	**-8,009,812**	**-5,957,319**	**-85,265,676**
Opportunity Costs	738	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	34,488	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-445212**	**-17,203,452**	**-14,500,717**	**-11,894,602**	**-9,579,545**	**-7,519,895**	**-5,646,601**	**-3,984,894**	**-70,774,917**
Cumulative NPC	**-445212**	**-17,648,664**	**-32,149,380**	**-44,043,982**	**-53,623,527**	**-61,143,422**	**-66,790,023**	**-70,774,917**	

DARD - BR Eradication Programme - Appendix VIII 'Class A, B and C' modifications (Number of outbreaks up 10%)
Option 4

Monetary Benefits	**Year 0 £**	**Year 1 £**	**Year 2 £**	**Year 3 £**	**Year 4 £**	**Year 5 £**	**Year 6 £**	**Year 7 £**	**Total £**
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
Evaluation/ implementation of biometric identification of cattle	245,500	0	0	0	0	0	0	0	245,500
APHIS	250,000	0	0	0	0	0	0	0	250,000
Sub Total	495,500	0	0	0	0	0	0	0	495,500
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	3,434,668	1,244,101	-1,081,483	-3,361,460	-5,595,163	-7,854,018	-10,111,759	-23,325,115
Annual Testing	0	688,600	688,600	688,600	688,600	688,600	688,600	688,600	4,820,200
Compensation - valuation and ceiling	0	280,903	280,903	280,903	280,903	280,903	280,903	280,903	1,966,324
Increased Testing at Meat Plants	0	170,000	170,000	170,000	170,000	170,000	170,000	170,000	1,190,000
Pre Movement Test	0	600,000	600,000	600,000	600,000	600,000	600,000	600,000	4,200,000
Housing and Movement Restriction	0	295,000	295,000	295,000	295,000	295,000	295,000	295,000	2,065,000
Depopulation and Restocking	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Evaluation/ implementation of biometric identification of cattle	0	190,725	244,915	231,385	231,385	231,385	231,385	231,385	1,592,565
Education and Awareness	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	70,000
Evaluation of Diagnostic Tests	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Sub Total	0	19,759,297	17,622,920	15,283,806	13,003,829	10,770,126	8,511,272	6,253,530	91,204,780
Net Cost/Benefit	**-495500**	**-19,759,297**	**-17,622,920**	**-15,283,806**	**-13,003,829**	**-10,770,126**	**-8,511,272**	**-6,253,530**	**-91,700,280**
Opportunity Costs	820	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	38,320	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-494680**	**-18,640,846**	**-15,684,336**	**-12,832,578**	**-10,300,250**	**-8,048,065**	**-6,000,111**	**-4,184,440**	**-76,185,306**
Cumulative NPC	**-494680**	**-19,135,526**	**-34,819,863**	**-47,652,441**	**-57,952,691**	**-66,000,756**	**-72,000,867**	**-76,185,306**	

DARD - BR Eradication Programme - Appendix VIII 'Class A, B and C' modifications (Number of outbreaks down 10%)
Option 4

Monetary Benefits	**Year 0 £**	**Year 1 £**	**Year 2 £**	**Year 3 £**	**Year 4 £**	**Year 5 £**	**Year 6 £**	**Year 7 £**	**Total £**
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
Evaluation/ implementation of biometric identification of cattle	245,500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	245,500.0
APHIS	250,000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	250,000.0
Sub Total	495,500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	495,500.0
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	914,437	-877,845	-2,780,596	-4,646,032	-6,473,606	-8,321,760	-10,169,003	-32,354,406
Annual Testing	0	688,600	688,600	688,600	688,600	688,600	688,600	688,600	4,820,200
Compensation - valuation and ceiling	0	280,903	280,903	280,903	280,903	280,903	280,903	280,903	1,966,324
Increased Testing at Meat Plants	0	170,000	170,000	170,000	170,000	170,000	170,000	170,000	1,190,000
Pre Movement Test	0	600,000	600,000	600,000	600,000	600,000	600,000	600,000	4,200,000
Housing and Movement Restriction	0	295,000	295,000	295,000	295,000	295,000	295,000	295,000	2,065,000
Depopulation and Restocking	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Evaluation/ implementation of biometric identification of cattle	0	190,725	244,915	231,385	231,385	231,385	231,385	231,385	1,592,565
Education and Awareness	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	70,000
Evaluation of Diagnostic Tests	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Sub Total	0	17,239,066	15,500,974	13,584,694	11,719,258	9,891,683	8,043,529	6,196,286	82,175,489
Net Cost/Benefit	**-495500**	**-17,239,066**	**-15,500,974**	**-13,584,694**	**-11,719,258**	**-9,891,683**	**-8,043,529**	**-6,196,286**	**-82,670,989**
Opportunity Costs	820	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	38,320	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-494680**	**-16,263,270**	**-13,795,812**	**-11,405,971**	**-9,282,750**	**-7,391,641**	**-5,670,371**	**-4,146,369**	**-68,450,863**
Cumulative NPC	**-494680**	**-16,757,950**	**-30,553,762**	**-41,959,732**	**-51,242,482**	**-58,634,123**	**-64,304,494**	**-68,450,863**	

DARD - BR Eradication Programme - Appendix VIII 'Class A, B and C' modifications (Compensation ceiling increased to £2,000)
Option 4

Monetary Benefits	**Year 0 £**	**Year 1 £**	**Year 2 £**	**Year 3 £**	**Year 4 £**	**Year 5 £**	**Year 6 £**	**Year 7 £**	**Total £**
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
Evaluation/ implementation of biometric identification of cattle	245,500	0	0	0	0	0	0	0	245,500
APHIS	250,000	0	0	0	0	0	0	0	250,000
Sub Total	495,500	0	0	0	0	0	0	0	495,500
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	2,239,274	237,230	-1,887,873	-3,971,227	-6,012,226	-8,076,090	-10,138,942	-27,609,854
Annual Testing	0	688,600	688,600	688,600	688,600	688,600	688,600	688,600	4,820,200
Compensation - valuation and ceiling	0	280,903	280,903	280,903	280,903	280,903	280,903	280,903	1,966,324
Increased Testing at Meat Plants	0	170,000	170,000	170,000	170,000	170,000	170,000	170,000	1,190,000
Pre Movement Test	0	600,000	600,000	600,000	600,000	600,000	600,000	600,000	4,200,000
Housing and Movement Restriction	0	295,000	295,000	295,000	295,000	295,000	295,000	295,000	2,065,000
Depopulation and Restocking	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Evaluation/ implementation of biometric identification of cattle	0	190,725	244,915	231,385	231,385	231,385	231,385	231,385	1,592,565
Education and Awareness	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	70,000
Evaluation of Diagnostic Tests	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Sub Total	0	18,563,903	16,616,049	14,477,416	12,394,062	10,353,063	8,289,199	6,226,347	86,920,041
Net Cost/Benefit	**-495500**	**-18,563,903**	**-16,616,049**	**-14,477,416**	**-12,394,062**	**-10,353,063**	**-8,289,199**	**-6,226,347**	**-87,415,541**
Opportunity Costs	820	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	38,320	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-494680**	**-17,513,116**	**-14,788,225**	**-12,155,518**	**-9,817,258**	**-7,736,411**	**-5,843,558**	**-4,166,361**	**-72,515,128**
Cumulative NPC	**-494680**	**-18,007,796**	**-32,796,021**	**-44,951,539**	**-54,768,797**	**-62,505,208**	**-68,348,767**	**-72,515,128**	

DARD - BR Eradication Programme - Appendix VIII 'Class A, B and C' modifications (Compensation ceiling lowered to £1,000)
Option 4

Monetary Benefits	**Year 0 £**	**Year 1 £**	**Year 2 £**	**Year 3 £**	**Year 4 £**	**Year 5 £**	**Year 6 £**	**Year 7 £**	**Total £**
	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0	0	0
Capital Costs									
Evaluation/ implementation of biometric identification of cattle	245,500	0	0	0	0	0	0	0	245,500
APHIS	250,000	0	0	0	0	0	0	0	250,000
Sub Total	495,500	0	0	0	0	0	0	0	495,500
Revenue Costs									
Base Case Deficit	0	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	13,689,401	95,825,807
Adjustment to base case to reflect compensation/testing cost savings	0	1,818,585	-114,435	-2,168,456	-4,182,600	-6,156,259	-8,152,783	-10,148,295	-29,104,242
Annual Testing	0	688,600	688,600	688,600	688,600	688,600	688,600	688,600	4,820,200
Compensation - valuation and ceiling	0	280,903	280,903	280,903	280,903	280,903	280,903	280,903	1,966,324
Increased Testing at Meat Plants	0	170,000	170,000	170,000	170,000	170,000	170,000	170,000	1,190,000
Pre Movement Test	0	600,000	600,000	600,000	600,000	600,000	600,000	600,000	4,200,000
Housing and Movement Restriction	0	295,000	295,000	295,000	295,000	295,000	295,000	295,000	2,065,000
Depopulation and Restocking	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Evaluation/ implementation of biometric identification of cattle	0	190,725	244,915	231,385	231,385	231,385	231,385	231,385	1,592,565
Education and Awareness	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	70,000
Evaluation of Diagnostic Tests	0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	1,400,000
Sub Total	0	18,143,215	16,264,385	14,196,833	12,182,689	10,209,031	8,212,506	6,216,994	85,425,653
Net Cost/Benefit	**-495500**	**-18,143,215**	**-16,264,385**	**-14,196,833**	**-12,182,689**	**-10,209,031**	**-8,212,506**	**-6,216,994**	**-85,921,153**
Opportunity Costs	820	0	0	0	0	0	0	0	
Residual Values	0	0	0	0	0	0	0	38,320	
Discount Factor	1	0.94	0.89	0.84	0.79	0.75	0.70	0.67	
NPV	**-494680**	**-17,116,240**	**-14,475,244**	**-11,919,935**	**-9,649,831**	**-7,628,782**	**-5,789,493**	**-4,160,141**	**-71,234,346**
Cumulative NPC	**-494680**	**-17,610,920**	**-32,086,165**	**-44,006,099**	**-53,655,930**	**-61,284,712**	**-67,074,205**	**-71,234,346**	

APPENDIX IX

Additional Areas Requiring Further Consideration

1. GIS

Geographical Information Systems (GIS) refer to a range of software tools that allows the retrieval and manipulation of data from farm details held within a computer-mapping programme. Such a system provides the following:

(a) Assessment of the spatial arrangement of farms relative to a specific herd. The programme's output is in the form of a map, showing farm boundaries and other features (roads, towns, distance measures, geographical features), therefore it is relatively easy to select herds in the proximity of a particular farm.

(b) If the system is linked to Grants and Subsidies (G & S) data, herds may be selected to field level (including rented ground) based on subsidy claims. This assumes that G & S have all such farms computer mapped and the information is updated annually. Such information allows the rapid identification of risk herds, before field mapping has commenced, and provides recent information on the location, number and type of cattle. This will reduce the response time for testing risk herds and increase efficiency in use of limited resources.

(c) Depending on the underlying data, farms within the mapping programme can be selected according to specified parameters e.g. those with a certain number of cattle, with a particular test result or with a certain number of locations distant from the home farm. This information can be used to prioritise testing and/or complete risk assessments.

(d) The data allows for the future modelling of outbreaks to assist in risk analyses and thus provide field managers with information that will allow them to better manage their areas, particularly those with disease outbreaks.

For these reasons, the Group recommends that a feasibility study be undertaken to determine the potential use of GIS within DARD. Subject to the outcome of this study, GIS tools and expertise should be provided in all divisional offices to assist in the TB and BR programmes.

2. REVIEW OF BR RELATED LEGISLATION

A review of the legislation relating to Brucellosis should be carried out for the following reasons.

1) The Brucellosis Order is dated 1972; there have been some changes in farming practice since 1972 and the legislation should be amended to include e.g. legislation re disposal of slurry etc.;

2) The Order has been amended several times since 1972; these amendments make the Order difficult to read and interpret in the current format; and

3) The Order has several fundamental areas where simple definitions could help DARD to enforce the legislation e.g. an abortion is not defined - Scottish legislation defines abortion "any calf born before 270 days of gestation". This type of definition could help in possible prosecution cases where there is suspicion of non-reporting of abortions. Other areas of the legislation could be reviewed at the same time. For example:

   - powers to force prompt testing where DARD considers there to be a disease risk; and
   - powers to reduce grants/subsidies in the event of delayed testing.

The above examples are for illustration purposes only. There is a range of other areas that could be strengthened as part of a review of existing legislation.

3. BARCODING OF SAMPLES

Implementation of barcoding of test samples would speed turnaround between sampling and results, and enhance the accuracy and perceptions of the accuracy of sample tracking and identification.