REPORT

OF THE

BADGER STAKEHOLDER GROUP

25 FEBRUARY 2008

Context

1. The Badger Stakeholder Group has agreed to produce a short report to outline the background information in respect of badgers and bovine TB that is relevant to Northern Ireland and set out the actions they have agreed to progress.

2. It has been difficult to get an agreed position due to a divergence of opinion between the livestock sector and the environmental interests representatives and representatives of the group as to the best way forward. This is the report of the Group and is not intended to reflect the position of any particular individual or organisation represented on the Group.

3. The major reference points for the deliberations of this group have been scientific work arising in Great Britain (GB) and the Republic of Ireland (ROI).

4. This report follows from the recent conclusion of a major body of scientific work on bovine TB in badgers in Great Britain, namely the report of the Independent Scientific Group (ISG) that was published in June 2007, and consideration of the scientific work concluded in the ROI during the past 2 to 3 years.

5. The Group feels that it is an appropriate time to report, since it is unlikely that there will be further scientific research of this scale concluding in the foreseeable future.

Introduction - The Badger Stakeholder Group

6. Arising out of the 2002 Department of Agriculture and Rural Development (DARD) Review of the Control of Bovine Tuberculosis Policy the Department introduced a range of options designed to aid the reduction of bovine TB. The measures included tighter restrictions on overdue TB tests, changes to the valuation system, additional Veterinary Officer resource, a review of current TB testing arrangements, the use of Gamma Interferon blood testing and the establishment of a Badger Stakeholder Group. The measures that relate to preventing cattle – cattle spread of TB have been progressed outside the Badger Stakeholder Group and are not the subject of this report which deals with the badger issue only.

7. The Badger Stakeholder Group was established in 2004 to review all the available information relating to badgers and consider the potential need for a badger management strategy to help reduce bovine TB levels in Northern Ireland. The Terms of Reference and current membership of the Group are attached (Annex A and B). The Group is chaired by DARD and has representatives from the Environment and Heritage Service and a range of environmental, academic, veterinary and farmer interests.

8. During 2004 and 2005 the Badger Stakeholder Group met 7 times and reviewed much of the available evidence to date on work carried out on badgers in GB, ROI and Northern Ireland. However, it was unable to reach a consensus about a way forward as unequivocal evidence to support an agreed badger management strategy was not available. The Group then also learnt that Defra were preparing to consult on badger culling options during the summer of 2005, and it was clear that a decision could not be taken in NI until after the outcome of this consultation was known. The draft report that had been prepared in 2004/05 was therefore not finalised. Defra did not consult until December 2005 and the outcome was not published until July 2006. No policy decisions were taken by Defra at this time as they awaited the report of the Independent Scientific Group (ISG).

9. The Badger Stakeholder Group was reconvened on 31 January 2007. They considered new information relevant to NI and developments in GB/ROI research since the last meeting in early 2005. A bibliography of the information considered by the Group is provided at Annex C. Due to the fact that it was 2 years since the Group had met last and as no decision could be made before the likely return of Devolution in spring, nor before the ISG reported in June 2007, they agreed that the draft report from 2005 would be set aside for the time being. Instead effort and resource was focused on taking forward key actions which would help inform any future decision.

10. A further meeting of the Badger Stakeholder Group took place on 23 August 2007 when they considered an overview of the ISG work and agreed progress on the badger population survey. At this meeting the Group agreed to prepare a short report of actions proposed and agreed to date.

BACKGROUND

What is bovine Tuberculosis and why must it be controlled?

11. Bovine Tuberculosis (TB) due to *Mycobacterium bovis* is primarily a bovine respiratory disease but also a zoonosis. TB is an infectious disease, predominantly of the respiratory system, and transmission between cattle usually occurs through direct contact, although the dynamics are poorly understood. Clinical signs are normally seen only later in the disease. Epidemiological risk factors include those related to management (for example, movement between herds, herd size, stocking density, TB in neighbouring herds), and infected wildlife.

12. Bovine TB causes poor growth rates and low milk yields and if unchecked can result in heavy losses to the farming industry and constitute a serious risk to public health. Worldwide, treatment with antibiotics is not considered a viable option in bovines because of the extended period

over which it is necessary and because of the difficulty in ensuring complete killing of the organism to prevent introduction of disease resistant strains. Cattle vaccination is not currently an option because the efficacy is unknown and it may interfere with current diagnostic techniques.

13. Council Directive 64/432 prescribes the requirements and testing programmes that must be observed by Member States in relation to bovine TB and trade.

The current Northern Ireland TB control programme

14. The current DARD TB Control Programme involves regulation of cattle movements, compulsory annual testing of all cattle herds using the Single Intradermal Comparative Cervical Test (a skin test) in line with EU Directive 64/432, use of gamma interferon blood testing in some circumstances, removal of skin reactor bovines and testing of contacts. It also involves routine abattoir surveillance of all slaughtered bovines.

15. Cattle found positive to the test (reactors) are removed by government contracted hauliers to specified abattoirs where they are examined for evidence of TB infection. The herd is restricted pending satisfactory completion of further tuberculin testing.

16. Following a confirmed TB breakdown adjoining farmers are alerted and their herds may be allocated a contiguous risk herd test. All herds are restricted if a herd test is not completed on time. Cattle which have left a herd prior to infection being found are traced, placed under movement restriction and tested. If it is not possible to test the traced animal then a herd level test is considered. Where relevant, the herds from which a TB reactor has originated or moved through are tested.

Costs of the TB control programme to DARD

17. The control programme is funded by DARD and includes payment for all testing, laboratory costs, staff costs, compensation paid to farmers for the full value of the animals, and costs of removal and slaughter. The total programme costs including costs of compensation and fees to Private Veterinary Practices (PVPs), for the last 10 years, are shown in Annex B.

18. Compensation for both reactor and in-contact cattle is currently 100% of market value. Until 1998 compensation for reactor cattle was 75% but this was increased to bring DARD into line with Defra who changed it in recognition of the fact that cattle outside their badger culling trial areas could be more exposed to infection from wildlife.

Costs of the TB control programme to the Industry

19. An assessment by the Department of Agricultural and Food Economics at the University of Reading found that the main farm-level costs of a breakdown in GB were slaughter costs (of reactors, inconclusive reactors and contact cattle), which represented the main cost element, and costs associated with testing, isolation and movement restrictions. The survey found a large variation in the costs associated with a breakdown ranging from £229 per farm to £103,817 per farm depending on the number of reactors and their valuation, the length of breakdown, etc.

20. In Northern Ireland the main costs to farmers of a TB breakdown are costs associated with collecting stock for testing and consequential losses associated with the restriction of cattle movements in reactor herds. Costs in NI are not directly comparable to those of GB because the respective control programmes differ. Work to assess farm-herd costs of a breakdown in Northern Ireland has yet to be done.

Bovine TB in NI - TB incidence

21. The TB control programme with compulsory testing for TB was first introduced in 1960. The table below gives the overall disease incidence for the last 13 years under the NI TB programme.

22. The herd incidence information from the table below is plotted on a graph at Annex E.
    Graphs illustrating the disease statistics of the ROI and GB are also contained in Annex E. Caution must be exercised in making direct comparisons between these TB graphs. However, trends may be disclosed within each graph or data set.

TABLE 1: Disease incidence under the NI TB Programme.

Year	Herd incidence (%)	Reactors per 1,000 tests (APT)
1995	4.09	1.66
1996	4.07	1.84
1997	4.27	2.31
1998	5.47	3.10
1999	6.39	3.70
2000	6.84	4.14
2001	6.82	4.60
2002	9.92	6.19
2003	9.56	6.10
2004	9.17	4.86
2005	7.22	3.65
2006	6.23	3.49
2007	5.35	3.08

23. TB disease levels in cattle in NI have fallen considerably since 2002 when herd incidence was 9.93% due to herd testing being suspended because of FMD. In 2006, herd incidence stood at 6.23%, a decline of nearly 40% from 2002 levels. In 2007, the herd incidence was 5.35%, a reduction of nearly 50% from 2002 levels, which continues the encouraging trend.

24. This decrease has been achieved without any Government intervention in terms of wildlife controls beyond advice to herdkeepers to keep cattle and badgers apart. This reduction leaves us at a similar level of disease as in the mid/late 1990's but on a downward trend. This downward trend is encouraging but with over 9000 reactor cattle last year eradication remains a long way off.

25. These reductions in TB could be influenced by a range of factors from changes in farming practices (e.g. resulting from decoupling) to the effect of the enhanced measures introduced following the TB and Brucellosis Policy Reviews of 2002, such as tighter restrictions on overdue TB tests, changes to the valuation system, additional Veterinary Officer resource, and roll-out of the use of supplementary Gamma Interferon testing.

26. The Northern Ireland Executive Programme for Government has set a Public Service Agreement target to reduce herd incidence of TB by 27% in the period 2008 - 2011. This target is derived through veterinary epidemiological analysis of Northern Ireland disease trends and is based on the implementation of current policies without any additional intervention measures. It is likely to be met only if the current rate of TB decline continues.

THE TB RESERVOIR IN BADGERS IN THE UK AND THE REPUBLIC OF IRELAND

27. This section deals with the TB reservoir in badgers drawing on evidence from Northern Ireland, the Republic of Ireland and Great Britain.

28. To date in NI, the Department of Agriculture and Rural Development has focused largely on addressing the risk from cattle-cattle spread. However, between December 1993 and January 1995 a case control study[1] of risk factors for bovine TB in Northern Ireland concluded that the contribution of the badger was possibly one of several main reasons for the lack of significant progress in TB eradication despite strenuous efforts associated with all aspects of the scheme. In addition, epidemiological evidence suggests that the badger is a

[1] G.O. Denny and J.W.Wilesmith. Bovine tuberculosis in Northern Ireland: a case-control study of herd risk factors. Veterinary Record, March 20 1999, 144, 305-310.

wildlife reservoir for the disease and is a potential source of re-infection in domestic stock.

29. Post Mortem examination of farmed deer indicates that they too are susceptible to bovine TB. However deer in NI are not the subject of the current report and are not considered to be a significant source of TB in cattle in NI.

30. Surveys of badgers killed by cars (so-called RTAs) have been ongoing in Northern Ireland since the 1970s. Badgers killed on roads are reported by DARD staff or members of the public, collected, and examined in the Agri-Food and Bioscience Institute (AFBI, a DARD sponsored NDPB) laboratories. Tests include post mortem inspection, histology, bacteriological culture and molecular typing. In the 1980s 240 badgers were sampled, and TB was detected in 11.7%. An epidemiological study found that badgers located within two kilometres of a TB outbreak had a significantly higher risk of being infected with *M. Bovis* than those outside this zone. (Odds ratio 5.52, 95% confidence interval: 1.59-23.38, $p<0.005$). Since 2000, 618 badgers have been tested, with a TB prevalence of 17.8%. A study in 2003 found that herds within 3 km of an infected carcass were more likely to have experienced a breakdown in the previous 4 years than herds within 3km of a TB negative carcass (25.6% and 20.2% respectively; $\chi 2$ test; $p<0.001$). The results are consistent with a link between TB in cattle and TB in badgers, however they provide no information on the direction of transmission, or the relative importance of either species. (DARD, unpublished data)

31. However, the RTA study, due to the sampling methodology, may not support an accurate measure of disease prevalence in the whole badger population in NI.

32. *M. bovis* Strain Typing studies of some 100 *M. bovis* isolates recovered from road-kill badgers (N=~600) has identified the same range of *M. bovis* strains in both cattle and badgers. The study has also shown correlational evidence of links between infections in cattle and badgers, based on mapping the locations of *M. bovis* strains in both species. These observational data support the hypothesis that transmission occurs between the two host species. However, the data cannot conclusively demonstrate the direction of transmission. Hence these patterns could be generated by badger-to-cattle transmission, cattle-to-badger transmission, or some combination of the two. They cannot be used to evaluate the relative importance of badger-to-cattle and cattle-to-badger transmission. Preliminary statistical analysis suggests that these findings will be consistent with those from the GB trial i.e. that *M. bovis* infections in cattle and badgers are spatially associated, on a scale of 1-2km. There is evidence of a relationship, but there is not necessarily evidence that it is causal. Evidence of an *association* between *M. bovis* infection in badgers and in cattle is not the same as

evidence of *transmission* from badgers to cattle. (R Skuce, AFBI, unpublished data)

33. Studies in the Republic of Ireland and GB have also linked badgers to bovine TB in cattle. These will be explored more in the following paragraphs.

34. In the ROI report on "The Impact of Badger Removal on the Control of Tuberculosis in Cattle Herds in Ireland"[2], there were two key factors quoted as being instrumental in highlighting the potential role of wildlife in bovine TB. These are the limited observable progress towards disease eradication despite the implementation of intensive measures that have ''effectively eliminated cattle to cattle spread in other countries'' and the increasing evidence in support of wildlife as a reservoir of bovine tuberculosis. Specifically, the author cites that there has been building evidence of the role of infected badgers, including isolation of *the same* strains of *M bovis* in local cattle and badger populations and recognition that badgers were highly susceptible to the infection, and that tuberculosis infection was endemic in Ireland. However, the author also notes that this information on its own provides little direct evidence in support of a temporal relationship (providing evidence of badger to cattle transmission). The report considers that compelling evidence now exists between the linkage between proactive culling and tuberculosis in Ireland. He concludes that the relative importance of cattle to cattle and wildlife to cattle transmission depends on a range of circumstances, including the standard of animal husbandry, aspects of national disease control and badger ecology and notes therefore that extrapolation to other regions should be made with care.

35. It should be noted that in respect of the above report the methodology used, the analysis made and the conclusion drawn have been the subject of academic debate. These issues will be explored further later in this report.

36. In 1971, bovine TB was found in a dead badger in an area of GB where TB breakdowns were common. They then investigated the prevalence of TB in badgers and concluded that action was required. This led to several culling operations, including one at Thornbury, Gloucestershire, where intensive and repeated gassing of badger setts between 1975 and 1982 virtually eliminated the species from this area. This was followed by a period of 10 years with no confirmed infection found in the cattle population in the area. During the 1980's and early 1990's GB continued to operate badger culling policies believing that badgers represented a significant "reservoir" of *M bovis* infection, until 1996 when Professor Krebs was commissioned to review the issue. The Krebs report, declared that "the control of TB in cattle is a complex

[2] The impact of badger removal on the control of TB in cattle herds in Ireland, CVERA, UCD, More, S. et al. 2006

problem and there is no single solution". He also concluded that badgers were a significant source of infection but, importantly, noted that "most of the evidence is indirect, consisting of correlations rather than demonstrations of cause and effect". The report concluded that proper experimental assessment was required to test the effectiveness of different strategies. This led to the formation of the Independent Scientific Group on Cattle TB (ISG) and the Randomised Badger Culling Trial (RBCT or Krebs trial), which included the re-evaluation of the above reports as discussed below[3].

37. Badgers[4] are territorial. They live in setts in small family groups and use latrines. A main sett may have several entrances and outliers within the same territory. They favour woodland habitats, but in NI setts are often found along field margins, hedgerows, and in small areas of scrub. They are omnivores. Like many other wild or feral animals they range widely and feed and drink in an opportunistic manner. They will be found feeding in hedgerows and on pasture where they eat large quantities of berries, grains and pest grubs. During winter months, if biosecurity is lax, they may gain access to feed stores. Sett size generally is smaller than in GB. They tend to concentrate on certain food at different times of the year.

38. Badgers and their setts are protected by law in Northern Ireland. Under under Article 10 Schedules 5,6 &7.of the Wildlife (NI) Order 1985 it is illegal to disturb a badger sett, to take a badger captive, kill it or sell it. Also, listed as a species of conservation concern in the UK Biodiversity Action Plan and listed under Appendix III of the Bern Convention on Conservation of European Wildlife & Natural Habitats. The Northern Ireland Badger Survey in 1994 estimated the Eurasian badger -*Meles meles* population at around 38,000 (S. Feore, PhD Thesis). Eurasian badgers are found across Europe & Asia. The UK has 25% of the global population of the species (personal communication, Ulster Wildlife Trust).

MANAGEMENT OF BADGER POPULATIONS IN GREAT BRITAIN AND THE REPUBLIC OF IRELAND: IMPACT ON TB IN CATTLE

39. The scientific evidence from ROI and GB around the impact of the removal of badgers on TB in cattle is complex, and it is not certain from the available scientific evidence that removing badgers will necessarily result in a further decline in TB in cattle across NI. There is evidence from the ROI that proactive removal of badgers can produce a reduction in cattle TB in defined geographical areas. The ROI currently undertake targeted removal of badgers where badgers are implicated

[3] Bovine Tb: The Scientific evidence. A science base for a sustainable policy to control TB in cattle. An epidemiological investigation into bovine tuberculosis. Final report of the Independent Scientific Group on Cattle. 18 June 2007

[4] Information about badger in paragraphs 37 and 38 were provided by EHS unless otherwise stated.

in an outbreak of TB in cattle. However, there is also evidence from the work in GB that in some circumstances (i.e. reactive culling as performed in the Randomised Badger Culling Trial) intervention may in fact exacerbate the TB problem in cattle.

40. This section is about what has been done to date on the issue of badger management in Great Britain and the Republic of Ireland.

The control programme in GB and their response to the badger reservoir

41. The cornerstone of the GB TB control policy is the system of regular cattle testing, slaughter of cattle which react to the tuberculin test and herd movement restrictions laid down in EU legislation. Herds are tested at either one, two, three or four yearly intervals, according to the incidence of TB in the parish concerned. Gamma interferon is used in some instances as it is known that the skin test can miss up to 25% of animals with confirmed disease on farms. Pre-movement testing is undertaken for cattle moving out of 1 and 2 yearly tested herds. Cattle which have moved out of restricted herds are traced and tested for TB, to find and deal with any situations where TB has spread through the movement of cattle. In addition, all cattle submitted to abattoirs are examined post-mortem for signs of TB and where TB is found the originating herd is traced and tested. Essentially this control policy uses the same fundamental tools as in NI. Also, as in NI, the control programme is paid for by Government. In GB, industry pay for the TB pre-movement testing element.

42. Data on the disease levels in GB is provided is the following table and is plotted on a graph at Annex E. However, it should be noted that they are not directly comparable to ROI or NI data due to the longer herd test intervals in non-infected herds. However it is possible to establish a trend within each data set.

TABLE 2: Disease incidence under the GB TB Programme.

Year	Herd incidence (%)	Reactors per 1,000 tests (APT)
1995	-	-
1996	3.06	1.35
1997	3.66	1.44
1998	4.36	1.98
1999	4.31	2.05
2000	4.61	2.34
2001	-	-
2002	7.46	4.86
2003	6.82	4.42
2004	6.86	4.28
2005	7.92	5.31
2006	6.26	3.63
2007	7.40	4.40

(- unknown or as yet unconfirmed)

43. In November 1996, Professor Krebs began a scientific review on behalf of MAFF into the links between bovine tuberculosis and badgers. The Krebs report, which was published in 1997, recommended that MAFF should set up an experiment, in which farmers should play a role, to quantify the impact of culling badgers.

44. Following this report the Independent Scientific Group on Cattle TB (ISG), comprising of a group of independent scientists, was established. The ISG designed and oversaw the Randomised Badger Culling Trial (Krebs trial) to ascertain whether culling badgers is an effective or sustainable bovine TB control mechanism and to investigate how TB may be spread between cattle and badgers. In addition the ISG oversaw a programme of associated epidemiological research.

45. The trial, which is estimated to cost some £50 million, ran from 1998 until 2006 and covered 30 areas each of approximately 100km^2 that historically have had a large number of TB cases in cattle. The 30 areas were grouped into 10 sets of 'triplets' and within each triplet one of the following treatments was randomly allocated to each area:-

- **'Proactive' culling** where badgers were cage trapped and culled at the outset of the trial and at approximately annual intervals afterwards. Badger numbers were kept as low as possible.

- **'Reactive' culling** where badgers were trapped and culled once only from social groups associated with farms which had a confirmed incident of bovine TB during the course of the trial. The badgers elsewhere within the reactive culling area were not removed.

- **'Survey only'** areas where no trapping or culling took place. Setts were surveyed regularly for details of badger activity and to check for signs of unlawful removal of badgers. These areas acted as a scientific control against which the impact of the two culling strategies was measured.

46. Landowner participation in the trial was voluntary, no culling was permitted outside the trial areas, cage trapping and shooting was used and no trapping took place between February and April each year (the 'closed season') to protect female badgers with dependent cubs.

47. In 2003 Defra commissioned an independent review of the RBCT and associated research. This was chaired by Professor Godfray and reported in March 2004. The report broadly supported the work of the ISG.

48. The ISG published its final report in June 2007. Their ten year study reached two key conclusions. First, they reported that while badgers are clearly a source of cattle TB, they concluded that badger culling

would make no meaningful contribution to control of TB in cattle in Britain. Indeed, they reported that some badger intervention policies would be likely to make matters worse rather than better.

49. The ISG reported that reactive culling, in the form and time span implemented in the RBCT, did not offer a beneficial effect large enough to make it useful as a practical policy option and there was substantial evidence of an adverse effect of that reactive culling strategy.

50. Proactive culling was reported to indicate a reduction in cattle incidence within the culled area, but elevated incidence on unculled land up to 2km outside. The conclusion drawn was that while proactive culling reduced the incidence of cattle TB in the areas actually culled, these benefits were to some extent offset by detrimental effects on neighbouring land. As a result, the overall benefits and cost effectiveness of proactive culling were moderate, and realized only after culling had been implemented repeatedly.

51. Second, they believed that weaknesses in current cattle disease control programmes mean that cattle themselves contribute significantly to the persistence and spread of disease in all areas where TB occurs, and in some parts of GB would be likely to be the main source of infection. They further concluded that their findings indicated that the rising incidence of disease in GB could be reversed and geographical spread contained, by the rigid application of cattle-based control measures alone. They suggested that these measures could include restricting cattle movements, zoning, wider use of gamma interferon testing, and increased testing frequency. Herd contacts, housing, fertiliser usage, feeding practices and badger contact were found to be risk factors in the epidemiological studies.

52. The ISG also reported the overall prevalence of M bovis infection in road kill badgers was 15%, range 3-29%. This survey was concentrated in seven counties, chosen to represent either high, or historically low but increasing, TB risk to cattle, during 2002-2005. This was similar to that recorded in proactively culled badgers during the same time period (16.6%, range 6.3-37.2%). Note these proactively culled areas are within areas of high cattle incidence. However, in interpreting patterns of M bovis prevalence in badgers, it is important to note that the diagnostic methods used in the RBCT were not 100% sensitive. A sample of necropsies performed under less time constraints revealed substantially more (almost double) infected badgers than did standard necropsy of the same badgers. This indicates that the prevalence values above are likely to be under-estimates.

53. Defra ministers in England asked their Chief Scientific Adviser, Prof. Sir David King (at the time), for an assessment of the scientific evidence in the Independent Scientific Group on cattle TB (ISG) report and elsewhere that needs to be taken into account in reaching future policy

decisions on bovine TB. The King report was published on 22 October 2007 to help inform an inquiry by the Environment, Food and Rural Affairs (EFRA) Select Committee on bovine TB.

54. King concluded that that the removal of badgers could make a significant contribution to the control of cattle TB in those areas of England where there is a high and persistent incidence of TB in cattle, provided removal takes place alongside an effective programme of cattle controls. Whilst questioning the conclusion of the ISG report, he produced no new data and was not specific as to the scale.

55. Two reports were submitted to the EFRA Committee in November from the ISG and Prof. Denis Mollison. Both stated that there were fundamental scientific errors in how King interpreted the ISG results.

56. The question of whether badger culling has a role to play in controlling bovine TB in cattle in England is complex. At the time of writing, Defra Ministers are considering the evidence and holding discussions with stakeholders. They have made clear that they wish to take into account the views from the EFRA Select Committee, due to report in February 2008, following its inquiry into badgers and bovine TB. There is currently no specific timetable for a decision on the issue.

The control programme in the ROI and their response to the wildlife reservoir

57. The Department of Agriculture, Fisheries and Food (DAFF) TB control and eradication strategy is based on annual herd and individual animal testing; skin testing; 60 day reactor re-tests; contiguous herd tests; special check tests; epidemiology; veterinary meat inspection; hygiene control; depopulation (although this rarely used); backward and forward tracing; an epidemiology and research unit; gamma interferon testing, and reactive badger culling. Apart from the research unit and the wildlife measures, the above controls are similar to those in Northern Ireland. Different compensation arrangements exist between ROI and Northern Ireland. In the ROI compensation paid for reactors and in-contact bovines is based on the market value subject to ceilings and industry contribute to the cost of compensation through a levy. The general rule is that, except where reactors are disclosed, the herd keeper is required to pay one test per year which is usually for the annual routine herd test, whereas in NI the Department pay private vets to carry out this testing.

58. The following table gives the disease levels in ROI since 1995. This data is plotted on a graph at Annex E. It should be noted that the herd incidence data from the ROI is not directly comparable with the GB or NI herd incidence because of some differences in compilation of the data. However it is possible to establish a trend within each data set.

TABLE 3: Disease incidence under the ROI TB Programme.

Year	Herd Incidence %	Reactors per 1,000 tests (APT)
1995	6.20	3.30
1996	5.90	3.00
1997	5.60	2.90
1998	7.10	4.20
1999	7.70	4.20
2000	8.20	3.90
2001	7.00	3.60
2002	6.38	3.10
2003	6.37	3.10
2004	5.50	2.60
2005	5.54	2.86
2006	5.37	2.69
2007	6.02	3.03

69. Following an initial badger removal project in East Offaly which found that in the proactive badger removal area the reactor cattle per thousand bovine tests dropped from 3.72 in 1989 to 0.45 in 1995, the ROI designed a larger project called the Four Area Badger Project. This was conducted from 1997 to 2002 in Donegal, Cork, Kilkenny and Monaghan. The four removal areas were selected on the basis of being representative of different farming environments; having above average prevalence of TB in cattle; having badger proof boundaries; and the availability of trained staff. This cull was also proactive.

60. An initial survey of the badgers was carried out from November 1996 to assess the location of badger setts in the areas. A total of 3077 setts were discovered in the removal areas and 2448 in the reference areas.

61. The four area badger removal project started in September 1997. Removal, reference and buffer areas were set up. The buffer areas were set up where geographical boundaries were inadequate to prevent badger incursions, and in the buffer areas badgers were removed but cattle herds were not included in the comparison of TB incidence. In the removal area all badgers were removed. In the reference area badgers were only removed from the farm and adjacent land parcels following a severe outbreak (4 standard reactors or more).

62. A disease prevalence of 19.5% was found in the 2,310 badgers post mortemed during the study in the removal area. The prevalence of disease in badgers dropped during the study in three out of the four areas. The badger disease prevalence in the reference area was 26.1% on 218 badgers post mortemed. The report concluded that the prevalence of detected infection in the 2 populations was significantly different and that this may be the result of the selective manner of removal in the reference areas. Equally the reducing rate in the cull areas may be due to changes in disease transmission in a falling population.

63. The results from the study support the hypothesis that the badger is an important reservoir of *M.bovis* for cattle in Ireland and that a proactive cull policy may have value in reducing the levels of TB in cattle. However, cost effectiveness of proactive culling in the ROI was not measured.

64. The ISG also reported that culling profoundly altered the prevalence (and distribution) of M bovis infection in badgers. However, they note that there was a very clear difference between the RBCT, where badger disease prevalence rose and the Four Areas Trial where it fell. They hypothesise that this may reflect ecological differences between the two trials, but it is noted that comparison of badger disease prevalence cannot be easily made due to non-standardised diagnostic techniques.

65. Bovine tuberculosis has been an ongoing problem in ROI for many years, with eradication efforts starting in 1954. During the initial stages of this programme, progress was rapid leading to a considerable reduction in the prevalence of the disease by the mid-1960's. At this point progress stalled although disease prevalence has remained low. Until 2002, it was reported as difficult to breach a floor of 30000 reactors per annum[5].

66. The ROI currently operate a policy of badger removal in areas where TB infection in herds cannot be traced to cattle or other sources of infection.

Consideration of vaccination trial work in the ROI and GB.

67. Both the ROI and GB conclude that badger culling is not a sustainable long term measure for dealing with the contribution of the wildlife reservoir to TB in the cattle population. Both are therefore pursuing the option of developing a badger vaccine over the next 5 years approximately.

[5] Good, M., IVJ 59 (3) 2006, More & Good, Vet Microbiology 112, 2006, Sheehy & Christiansen, 1991.

68. Defra are conducting field trials to test the safety of BCG in badgers. In parallel with this field experiment, Defra are conducting experimental efficacy studies and is exploring oral formulations of vaccines suitable for delivery to wildlife. Experimental studies on BCG based cattle vaccines, including a natural transmission study are ongoing.

69. Defra is also continuing to pursue the development of new cattle vaccine candidates. By April 2008, Defra will have funded over £17.8 million of research into developing bovine TB vaccines and associated diagnostic tests since 1998. This includes over £5.5 million invested during 2007/08.

70. In the ROI there are the on-going experiments with a BCG vaccine in captive badgers. Current work is focusing on a field experiment for the use of a live vaccine based on *M.bovis* BCG which might persist in the host and continually prime the protective cellular immune response. The area chosen for the field experiment is in Co. Kilkenny.

71. The BCG vaccine is currently not licensed for use in NI.

POSITION OF THE BADGER STAKEHOLDER GROUP

72. The Badger Stakeholder Group has systematically considered over the past 4 years all the readily available evidence regarding bovine TB and the potential role of the badger in spread of this infectious disease within domestic cattle and badger populations. The presentations which were delivered to them and the literature copied to them is listed at Annex C. In addition, the Group members also visited a TB affected farm in NI where badgers were suspected of involvement to see first hand the impact of TB on the farm. The Group recognises the significant economic and practical impacts of Bovine TB both at farm level and on the wider farming community. The Group also recognises that this disease continues to be a huge drain on public resources.

73. The Badger Stakeholder Group recognizes that any recommendation to intervene with the badger population would require the agreement of the DARD minister, the Department of Environment Minister who is responsible for the badger protection legislation in NI, and the Executive. Any recommendation must also balance the interests of all stakeholders, the wider public interest, and the concerns of the citizens and taxpayers of NI. The Group recognises, therefore, that any recommendation to Ministers to intervene in badger populations in NI would need to take account of available evidence from all sources (scientific, practical experiences of farming) and economic justification. They recognise that more work is needed to determine first whether an intervention is justified, on scientific and economic grounds. They also recognise that more work may be required to guide the design and application in the field of any future intervention strategy or pilot scheme.

74. It is recognised that the interested parties on the Group have widely divergent opinions regarding badger intervention strategies and it is highly unlikely that a consensus position within the Group could ever ultimately be reached. However, having considered all of this information the Group have developed a range of proposed recommendations appropriate to Northern Ireland, some of which have already been acted upon.

75. The Group also acknowledges that TB incidence has fallen considerably in the past 5 years without any official intervention in badger populations and that there is, therefore, a need to be cautious in making any recommendation that may affect this trend until it becomes clearer how the situation is going to develop over the coming months. Bearing in mind the considerable progress that has been made in reducing TB incidence in cattle in NI since 2002 to the point where it is approaching but not yet below pre-1998 (pre-BSE) levels, it would be prudent to be cautious about introducing measures that have the potential to either be costly and ineffective or worse still exacerbate the TB problem in cattle.

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ACTION COMMENCED BY THE BADGER STAKEHOLDER GROUP

The survey of the badger population in NI

76. The Group recognised that, as the most recent available data are out of date, it is necessary to collect information about badger populations to inform any future decisions relating to badgers. They agreed that a survey of the badger population in Northern Ireland should be commissioned. The competition for this was run during the summer of 2007 and the contract was awarded to Quercus, School of Biological Sciences, Queen's University, Belfast, in partnership with the Central Sciences Laboratory, Defra, on 6 September 2007. The survey protocol is designed to collect data on badger social group numbers and their distribution in NI. Estimates of badger numbers will be derived from social group sizes and landclass. This will not involve any capture or removal of badgers. The survey work commenced in the autumn of 2007 and is to be completed and a report submitted to DARD by end May 2008.

PhD Studentship

77. The Environment and Heritage Service is funding a PhD student to consider the landscape ecology, density and physiological ecology of the Eurasian badger. This work will also complement the badger population survey work and validate the results of that survey. The

project started in January 2008 and will be completed by September 2010.

ADDITIONAL MEASURES THAT ARE ONGOING SUPPORTED BY DARD IN RELATION TO BADGERS

PhD Studentship

78. Complementing the above 'work' DARD is funding a PhD student to undertake a study of stress hormones and *Mycobacterium bovis* in badgers. The project is due to start in October 2007 and be completed by September 2010.

Molecular strain typing of *M. bovis*

79. The epidemiology of bovine TB in Northern Ireland is complex, involving inter-bovine transmission and potentially transmission to and/or from wildlife. The ability to discriminate *M. bovis* isolates and trace their transmission has the potential to clarify sources of infection and major routes of transmission. The Agri-Food and Bioscience Institute (AFBI, a DARD sponsored NDPB) has developed and validated methods for sub-typing *M. bovis* isolates by DNA analysis. *M. bovis* sub-typing is being applied to the systematic study of epidemiological factors such as movements of cattle, spread within herds, persistence and latency. The significance of interactions between cattle and wildlife is also being investigated. AFBI is also investigating whether there is any significant association between different sub-types and their biological properties, which might influence the ability to diagnose bovine TB. They are also examining whether current disease incidence is associated with the rapid expansion or contraction of particular sub-types. *M.bovis* sub-typing is now sufficiently discriminating to address detailed epidemiological questions and is being evaluated as a tool to inform TB outbreak investigation and surveillance. This work is on-going and it is intended that the result will be published in due course.

ADDITIONAL ACTION PROPOSED BY THE GROUP

80. The Badger Stakeholder Group have also proposed the following actions:

TB prevalence in badgers in NI

81. The Badger Stakeholder Group has requested that DARD officials work with EHS on developing an acceptable methodology to determine baseline data on the prevalence of TB in badgers in NI. EHS permission would be required before any intervention in badger

populations is undertaken, however limited. It is intended that DARD and EHS should be in a position to announce their agreed method of determining the prevalence of TB in badgers by Spring 2008 with a view to initiating action following the outcome of the badger population survey in May 2008, subject to availability of funding.

Assessment of the available evidence

82. A greater understanding of TB in badgers in NI is necessary to better quantify the benefits of badger management in NI. The Group suggests that the recent and significant body of scientific studies that have been published in the ROI and GB should be considered by DARD. This would be added to the previously assessed evidence and should be taken into account to help inform on an appropriate course of action in NI, for example whether it is appropriate to run a pilot badger management strategy (which may include the removal or vaccination of badgers) in NI. This analysis will look at gaps in the available evidence and identify areas for future scientific research e.g. investigation into TB in other species. It is anticipated that this work will be undertaken at the earliest opportunity and be made available to DARD by Spring 2008.

Partnership with the Industry

83. Farmers in NI have played and will continue to play a pivotal role in the reduction in cattle-to-cattle transmission of TB. It is also important that they take all reasonable precautions to protect their herds from possible infection by badgers. The Group recommends more positive engagement at Divisional Veterinary Office level with farmers and vets on the ground to examine the local factors contributing to disease spread and what practical cost effective measures can be taken to contain disease outbreaks. It is proposed that DARD, in partnership with the industry, further investigate ways that herdkeepers can be encouraged to take more practical steps to reduce badger and cattle contact, for instance by preventing the access of badgers to cattle sheds and feed stores.

Vaccination trial

85. The ROI and GB trials as currently designed do not include any field application in NI. However, DARD are keeping in close contact with both of these groups with a view to assessing what involvement might be appropriate for NI and will review the position again at the end of May 2008 when the outcome of the Badger population survey is known.

Cost benefits analysis / Economic Appraisal

86. The population and prevalence surveys and the assessment of available evidence will inform the next stages of the policy development process which is to undertake a cost benefit analysis (CBA) of the options. Even if removal (or eventually vaccination) of badgers is shown to reduce the level of TB in cattle, it is necessary to show that the economic benefit of such an intervention outweighs the cost of the intervention strategy. The Badger Stakeholder Group acknowledge that a full and positive cost benefit analysis will be required to support any proposed wildlife management strategy through the approval process for the relevant Ministers, Assembly Committees, and the Executive, and to support a bid for resource from the Department of Finance and Personnel (DFP). The costs to the industry must be evaluated as part of the overall costs, as well as those to the tax payer. DARD officials will work closely with EHS and farming representatives to develop a CBA. As the outcome of the population and prevalence surveys and review will inform this process, it will not be completed during 2008.

CONCLUSION

87. It is intended that the Badger Stakeholder Group will agree this report at a meeting in early 2008. Thereafter, the Department of Agriculture and Rural Development and the Environment and Heritage Service will jointly work in liaison with their stakeholders to progress the outstanding proposed actions of the Group to their conclusion and make recommendations to Ministers.

88. Upon publication of this report the role that the Badger Stakeholder Group will play in future will be reviewed, to ensure that appropriate mechanisms for engagement of all stakeholders are in place in relation to this sensitive but important area of TB control in NI.

ANNEX A

TERMS OF REFERENCE

BADGER STAKEHOLDER GROUP

1. Review all the available information relating to badgers and Bovine TB, including:
    - the work undertaken in the Republic of Ireland
    - the ongoing Randomised Badger Culling Trial in GB including the recent independent review report from Professor Godfray and the response to that from the group overseeing the RBCT
    - existing information and research work on badgers in Northern Ireland
    - the overall Bovine TB position in Northern Ireland and the existing control measures taken.

2. Consider the potential need for a badger management strategy as part of a range of initiatives to help reduce Bovine TB levels in Northern Ireland.

3. Develop an agreed Group report and recommendations.

Make recommendations to Ian Pearson, Minister for Agriculture and Rural Development by end of November 2004 for the policy to be adopted in Northern Ireland.

ANNEX B

Membership of the Stakeholder Badger Group (25 January 2008)

John Rankin OBE – dairy farmer, Newtownards.

Crosby Cleland – livestock farmer and contractor, Saintfield.

John Carson – beef farmer, Downpatrick.

Rosalind Woodside – Association of Veterinary Surgeons Practising in Northern Ireland.

Andrew Upton – Director of Programmes, Ulster Wildlife Trust.

Harold McBride – member of the Council for Nature, Conservation and the Countryside.

Ian Montgomery – Professor of Animal Ecology, QUB.

Angela Ross – Vertebrate Curator, Ulster Museum.

Liz Redmond – Director of Animal Health and Welfare Policy, DARD

Colette McMaster – Head of TB and Brucellosis Branch, DARD

Nigel Clarke – DVO, DARD

Roly Harwood – SPVO, DARD

Michael Meharg - Environment and Heritage Service.

Declan Looney - Environment and Heritage Service.

ANNEX C

PRESENTATIONS

No.	Title	Date	Name/author
1.	Bovine Tuberculosis	10.06.2004	P McGuckian
2.	Bovine Tuberculosis: Overview of research	10.06.2004	John Pollock
3.	Badgers – Policy and Ecology	10.06.2004	Mike Meharg
4.	NI Bovine TB Policy	10.06.2004	Colette McMaster
5.	Four Area Badger Study	09.09.2004	DAF presentation
6.	NI research on ecology of badgers	12.10.2004	Ian Montgomery
7.	Independent review of the RBCT and associated research	12.10.2004	Nick Coulson (Defra)
8.	Randomised Badger Culling Trial	12.10.2004	Alexia Flowerday (Defra)
9.	Review of the TB Strategy in GB	12.10.2004	Helen Ainsworth (Defra)
10.	Bovine Tuberculosis: Programme of statutory and supporting work at VSD	21.10.2004	VSD
11.	Cost Benefit Analysis of Badger Culling: Protocol	15.12.2004	Darrell Abernethy
12.	Wildlife Seminar	September 2006	Richard Healy
13.	NI Bovine TB Policy	31.01.2007	Alan McMullan
14.	Badger Stakeholder Group	31.01.2007	Sandra Dunbar
15.	GB badger culling trial	31.01.2007	Graham Smith
16.	Bovine Tuberculosis: Molecular sub-typing of Mycobacterium bovis	31.01.2007	Robin Skuce
17.	Description of medium term national strategy toward eradication of Tuberculosis in cattle in Ireland	31.01.2007	James O'Keefe
18.	TB incidence in NI and the ROI	23.8.2007	Nigel Clarke
19.	The final report of the Independent Scientific Group	23.8.2007	Nigel Clarke

PAPERS

No.	Title	Date	Name/author
1.	Bovine tuberculosis in Northern Ireland: a case-control study of herd risk factors	20.03.1999	G. O. Denny, J. W. Wilesmith Veterinary Record 1999
2.	Impact of badger removal on bovine tuberculosis in east County Offaly	April 1999	Irish Veterinary Journal
3.	Assessment of the economic impacts of TB and alternative control policies	01.05.01 – 31.01.04	Defra - Final project Report
4.	Use of cattle farm resources by badgers (Meles meles) and risk bovine tuberculosis (Mycobacterium bovis) transmission to cattle	27.06.2002	The Royal Society
5.	Animals by Breed 2003 & 1998	2004	DARD
6.	Analysis of Tuberculosis Reactors for years 1998 and 2003	2004	DARD
7.	Independent Scientific Review of the Randomised Badger Culling Trial and Associated Epidemiological Research (Report to Mr Ben Bradshaw MP)	04.03.2004	Profs. Godfray, Curnow, Dye, Pfeiffer, Sutherland, Woolhouse
8.	Completed TB investigation reports – source of infection for TB breakdowns during 2003	05.07.2004	Received from Fraser Menzies
9.	Bovine tuberculosis in Ireland - *(A critical review of research output from the Centre for Veterinary Epidemiology and Risk Analysis summary)*	July 2004	Simon More & Damien Barret
10.	Report by the Independent Scientific Review Group on TB in cattle and badgers	08.07.2004	Defra internet printout
11.	The four-area's trial paper	10.01.2005	DAF
12.	Diseases caused by bacteria - IV	Submitted to BSG 2004	Extract from textbook
13.	The DARD Biosecurity Code	27.9.2004	DARD
14.	The impact of badger removal on the control of tuberculosis in cattle herds in Ireland	15.10.2004	Preventative Veterinary Medicine Journal
15.	A review of the international evidence for an interrelationship between cattle and wildlife in the transmission of bovine tuberculosis	September 2005	Tony Wilsmore & Nick Taylor
16.	Positive and negative effects of widespread badger culling on tuberculosis in cattle	14.12.2005	Nature Publishing Group
17.	Effects of culling on badger Meles meles spatial organization: implications for the control of bovine tuberculosis	2006	Journal of Applied Ecology
18.	A review of the evidence for culling – induced social perturbation and disease transmission in badger (Meles meles) populations.	2005	Defra
19.	The impact of localised reactive badger culling versus no culling on TB incidence in British	2005	Defra

	cattle: a randomised trial		
20.	Review of the literature on the role of the badger in bovine tuberculosis and the effect of trial interventions in GB and Ireland	April 2006	Veterinary Epidemiology Unit DARDNI
21.	Update on the role of the badger in bovine TB and the effect of trial interventions in GB and Ireland	December 2006	Veterinary Epidemiology Unit DARDNI
22.	The Final report of the Independent Scientific Group on Cattle TB entitled – Bovine TB: The Scientific Evidence. A Science base for a sustainable policy to control TB in Cattle	June 2007	The Independent Scientific Group chaired by John Bourne

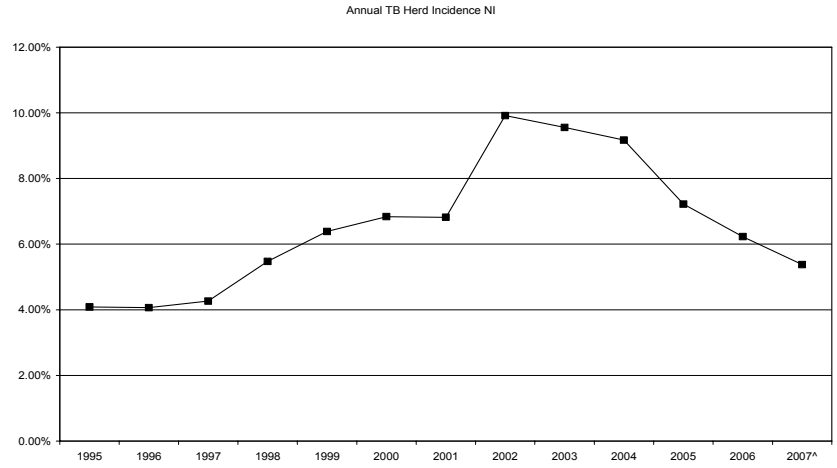
ANNEX D

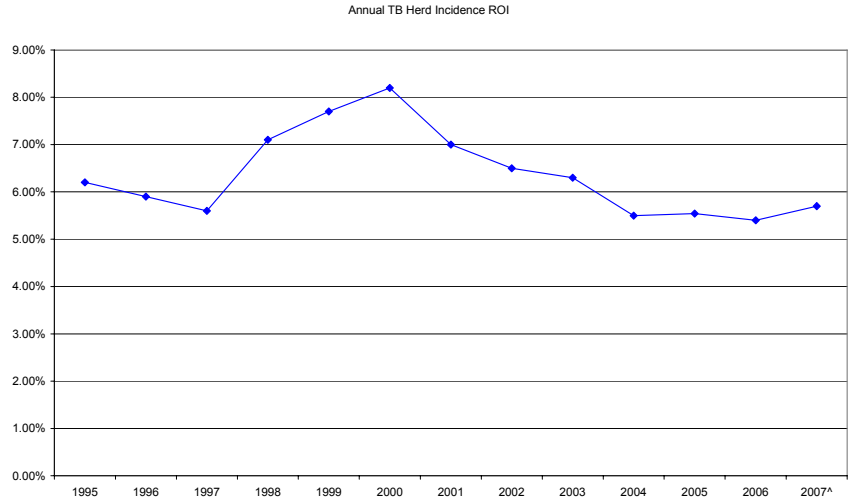
DARD TB Control Programme Income/Expenditure

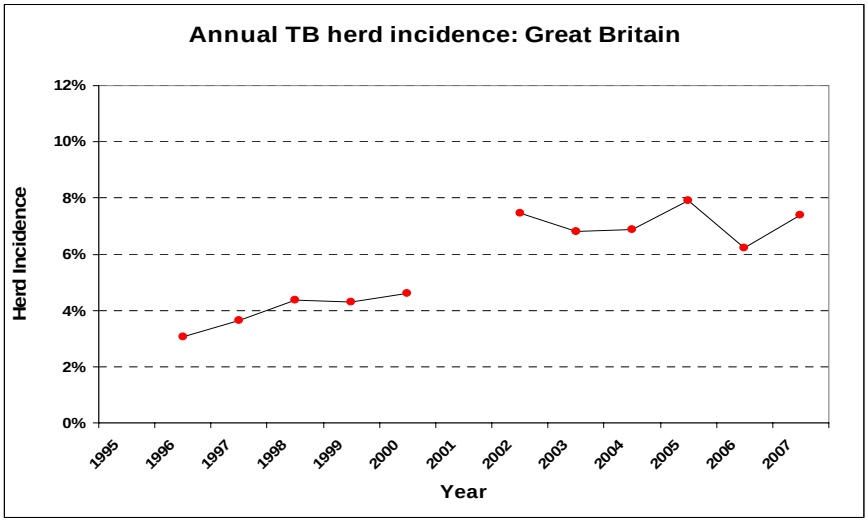
Year	AFBI Costs	PVP Costs	Compensation	DARD Staff Costs	DARD Funded Research	Haulier Costs	Misc	Tuberculin	Salvage	Total Expenditure
1996/97	135,928	3,922,112	2,262,142	4,207,662	331,181	82,643	15,513	318,827	-1,195,081	10,080,927
1997/98	178,950	4,042,605	2,920,205	4,258,372	432,080	111,014	4,319	322,079	-962,458	11,307,166
1998/99	195,677	4,733,137	4,895,826	4,491,549	465,768	145,017	15,613	439,458	-1,070,843	14,311,202
1999/00	193,992	4,865,775	5,776,774	4,983,310	436,845	180,587	84,675	464,063	-1,658,875	15,327,146
2000/01	219,441	5,333,056	7,921,489	4,107,182	376,229	208,927	185,105	439,249	-2,080,344	16,710,334
2001/02	206,417	4,879,726	8,587,921	3,501,933	368,929	211,388	193,065	363,889	-1,763,691	16,549,577
2002/03	260,210	5,876,873	16,255,611	3,474,625	325,957	282,565	579,463	609,754	-5,655,431	22,009,627
2003/04	367,728	6,517,861	15,408,521	4,174,111	405,431	255,414	203,380	698,229	-3,603,560	24,427,115
2004/05	564,899	7,514,183	12,586,405	4,167,069	965,388	242,492	214,122	836,074	-3,298,454	23,792,178
2005/06	845,012	6,285,277	9,225,891	5,424,182	566,196	199,020	231,718	862,766	-2,019,455	21,620,607
2006/07	Not yet available	6,806,600	7,887,123	6,451,488	Not yet available	169,578	204,310	989,315	-941,392	

Key:-
AFBI (Agri-food Bioscience Institute) Costs
PVP (Private Veterinary Practictioner) Costs

Annual Herd Incidence Graphs NI, ROI, GB ANNEX E

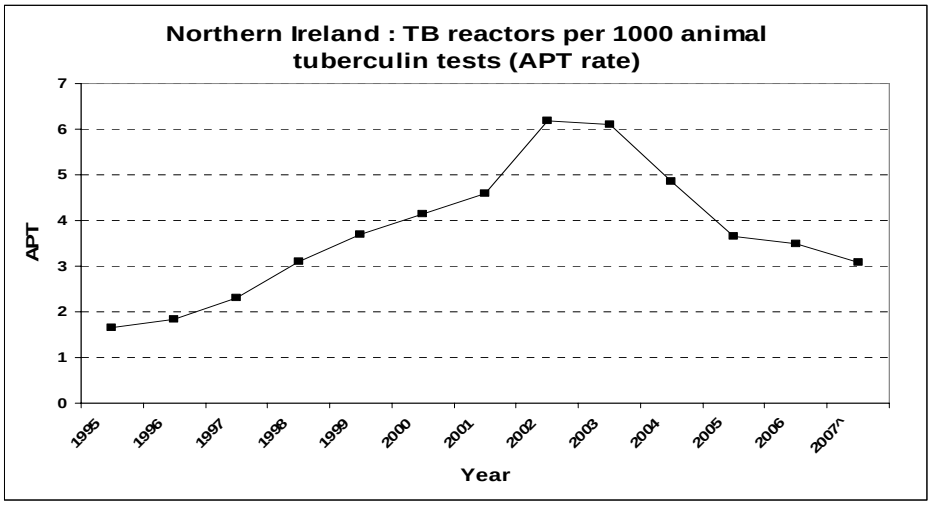


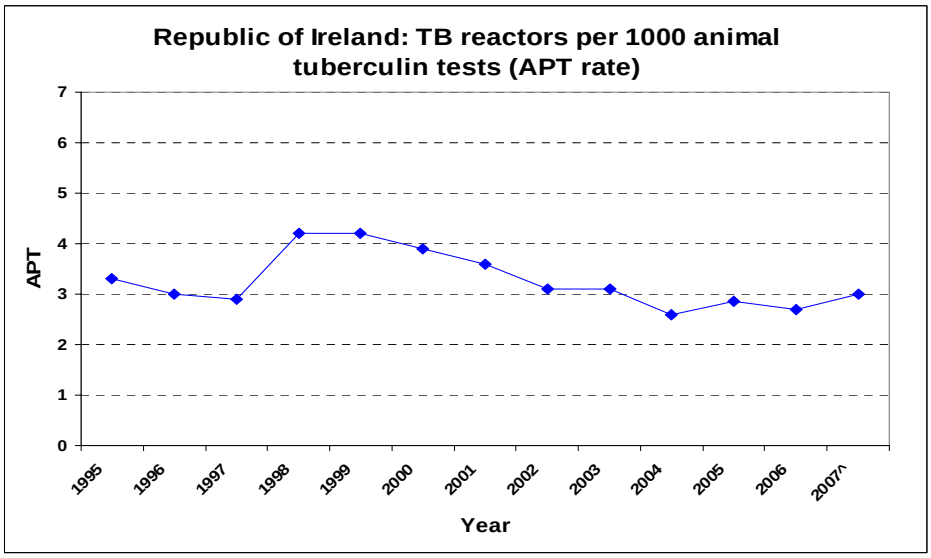


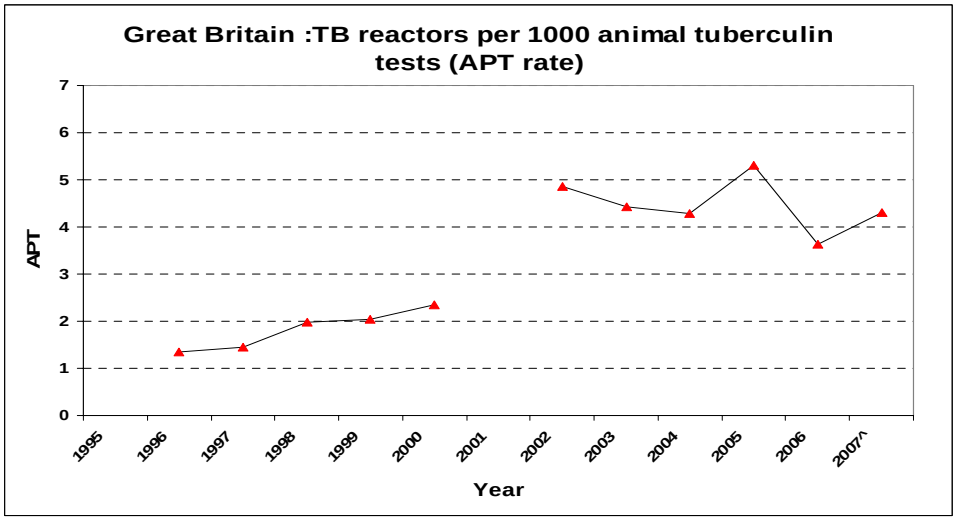


Note that these annual herd incidence charts cannot be directly compared as the data used to compile each may be different.
However, a trend within each graph may be relied upon.
* Figures for 1995 and 2001 unknown

Reactor Animals per One Thousand Tests (APT) NI, ROI, GB







These graphs are complied using highly defined parameters.
However, the APT rate is influenced by the details of each control programme