

Inquiry into
Foot and Mouth Disease
in Scotland

July 2002



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of **Edinburgh**

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Foreword

The Foot and Mouth outbreak which first occurred in Scotland in early 2001 had widespread and far-reaching consequences. Scotland was not, of course, the only part of the UK to suffer, but the course of the epidemic in Scotland, the way in which it was tackled and the effects on the wider economy were in a number of ways different to elsewhere in the UK. The Council of the Royal Society of Edinburgh (RSE), therefore, took the view that there would be value in setting up an Inquiry which would address the particular happenings in Scotland and to set up a Committee to address the situation. As Scotland's National Academy and without financial support from Government, the RSE set up a Committee under Professor Ian Cunningham.

It would have been impossible to carry out our task without the support of individuals and the private sector, who donated cash or made a contribution in kind. A full list of those who made the work possible in this way is shown opposite. The response to the Committee's request for evidence met with an equally generous response from the public as well as Government officials and written evidence was forthcoming from a very wide range of bodies and individuals. That input was absolutely essential to the work of the Committee and we are most grateful to all who made this basic contribution.

The Committee was chaired by Professor Ian Cunningham; Professor Gavin McCrone was Vice-Chairman; and the Secretary of the Committee was Loudon Hamilton, supported by Dr Marc Rands and Miss Beth Owens. This executive team worked extremely hard to accommodate the widespread views put to it and the Committee generally are to be congratulated on producing a valuable and well researched report which rightly focuses on the lessons to be learned, rather than recriminations on the past.

I commend the broadly based report and the recommendations to Government and to all other agencies concerned. The report and recommendation deserves their closest attention. The threat from Foot and Mouth disease remains a serious one and must be treated as such by all who have any responsibility in the relevant areas.

Sir William Stewart
President, Royal Society of Edinburgh

Report Summary

1. Foot and Mouth is a highly infectious disease and the 2001 outbreak was the worst ever in Britain. The consequences for agriculture were serious and the measures taken to bring the outbreak under control had consequences no less serious for many other industries, particularly those operating in the countryside and most notably tourism. This report, commissioned by the RSE, investigates the outbreak in Scotland and, drawing on the evidence presented to it, concentrates on the lessons which can be learned to avoid some of the costs and much of the trauma in fighting any future outbreak.
2. The report discusses the **cost to agriculture** in Scotland from the loss of livestock slaughtered in pursuit of the stamping out policy; compensation for this stock came to £171m. This did not however meet loss of income while farms were without stock nor did it extend to farms which were not culled but where farming was disrupted by movement restrictions; these additional losses are estimated at £60m. We go on to consider the **costs to the wider economy** in Scotland and look at the effect on tourism, accounting as it does for 5% of Gross Domestic Product (GDP)-compared with 1.4% for agriculture. The effects for tourism were not evenly felt and there were even some gains for urban tourism. But overall there were losses and VisitScotland estimates a loss in gross revenue of £200m- £250m for Scotland as a whole.
3. The conclusion which the report draws from these foregoing figures is that in formulating policy to deal with a livestock epidemic it is **inadequate to treat it as purely an agricultural problem**. A somewhat similar point is made in commenting on the serious **social and psychological effects** of coping with large-scale slaughter of susceptible animals in the countryside. Whole communities, not least children, were affected and contingency planning must take account of these consequences.
4. The **disease** and its **diagnosis** are discussed. The Enzyme-Linked Immunosorbent Assay (ELISA) (a test which takes 4 hours) was the laboratory assay used for detecting the virus; where that produced a negative result, a virus isolation test was used, taking up to 4 days, for a negative result to be assured. In the early days of the outbreak, diagnostic capacity at Pirbright Laboratory of the Institute of Animal Health was overloaded, with consequential delays in obtaining results in Scotland. The Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) technology, which can be used in laboratory tests where a different level of biosecurity is acceptable, has, however, been available for some years. We therefore make two important recommendations: 1) that there should be a **regional laboratory in Scotland** to carry out Foot and Mouth Disease (FMD) testing; and 2) that a high priority should be given to further **development of the RT-PCR test** for FMD as well as to the development of other on-farm tests for FMD.
5. In controlling the outbreak the first action should be a **ban on all movement** as soon as an FMD case is confirmed. In 2001 this was not done until the third day after confirmation and evidence to the Inquiry suggests that an immediate ban could have saved from a third to a half of subsequent slaughterings.
6. The use of **modelling techniques** in decision-making is questioned. In particular, the transparency of the process was lacking and only a fraction of the considerable relevant scientific expertise in Scotland was called on to aid in the process.
7. **Vaccination** is discussed and major advances in research and development described. Although it was considered, vaccination was not called upon during the 2001 outbreak, since animals would have had to be slaughtered to ensure rapid resumption of exports. Recent experience of vaccination in Uruguay and in the

Netherlands is described. The progress in developing serological tests to discriminate between vaccinated and naturally infected animals is described; with modern purified vaccines, tests can now discriminate between vaccinated animals and those with the disease. This powerfully supports **the case for emergency protective vaccination** without subsequent slaughter, except for infected animals. The report notes the case for **prophylactic vaccination** in a world where the global threat of FMD is a continuing one, but concludes that such vaccination is not an immediate priority. It does however recommend that future contingency plans should incorporate **emergency barrier or ring vaccination as an adjunct to slaughter** of clinical cases, as this would lead to a considerable reduction in the number of animals requiring to be slaughtered.

8. The report considers that any reservations there may be about the **consumption of meat and milk from vaccinated animals** are unjustified and recommends that the Food Standards Agency take early steps to reassure the public. It is noted that the OIE have **reduced to 6 months the period required to regain FMD free status after vaccination** and recommends that the Government should press the EU to clarify its policy on the export of vaccinated meat between member states.

9. FMD only breaks out in the UK because it is brought in from other countries. The report makes recommendations about **import controls** which need EU wide support to be effective. The importance of **surveillance** is stressed and particularly the need for it on entry to the UK and at markets, abattoirs and farms. **Biosecurity** is an important issue at all times, not just at the time of an outbreak, and one where the responsibility lies throughout the agricultural industry. We think that SEERAD should take a lead in establishing the standards to be applied at the start of an outbreak as well as in normal times.

10. The report recognises that there were many dedicated people who worked extremely long hours in very difficult conditions and undertook tasks well beyond their normal responsibilities and who contributed very significantly in bringing the outbreak in Scotland under control. However, it also recognises that there are lessons to be learned for the future **management of a disease outbreak** and has suggested ways in which improvement may be brought about.

11. We believe that the role of the **Scottish Minister** responsible for animal health should be integral to GB decision making and further recommend that the post of **Chief Veterinary Officer (Scotland)** should be created with direct responsibility for all aspects of veterinary matters. To assist him at times of crisis we propose that there should be a **“Territorial Veterinary Army”** drawn from veterinarians in private practice and others qualified, who would be available to be called on when needed.

12. The **disposal of carcasses** resulting from a slaughter policy raises practical difficulties. There are three options: rendering, burning or burial. Initial advice in 2001 was that after rendering where possible, burning was to be preferred because of the threat burial presented to aquifers in Dumfries and Galloway. This advice was later amended to relegate burning to the third option because of the toxic threat from dioxins released into the air as well as the growing public revulsion to the sight and smell of burning pyres. The report accepts that burial should be preferred over burning unless there are risks to the water supply. The role of **SEPA** is discussed with the recommendation that they should have a clear role in contingency planning and in management of any future emergency.

13. The large scale killing of livestock in field conditions and the restriction on animal movements both raise **Animal Welfare** concerns. We support the Farm Animal Welfare Council recommendation for operational guidelines for slaughtermen and for the need to take account of the dispersed nature of many holdings in formulating movement restriction.

14. **Compensation** for slaughtered animals was an issue of some controversy during and after the outbreak. The rules changed several times and charges of inconsistency were made. We recommend that there should be a clear strategy for dealing with valuation and the strategy should be adhered to throughout any outbreak.

15. The main problem in dealing with **access** was that it was easy enough – and we agree necessary – to close the countryside down at the beginning of the outbreak but much more difficult in practice to reopen it. In our view this could be avoided by closing the country down initially for no more than three weeks and reopening in non-affected areas as soon as the threat receded.

16. Finally we attach great importance to **Contingency Planning** to meet future challenges from FMD and any other animal diseases. We make our own detailed suggestions as to what should be covered but in particular stress the need for regular exercises to test the plans and back that up with the recommendation for the setting up of an **independent standing committee** to monitor the maintenance of effective planning.

List of Recommendations

Economic and Social Impact

1. In considering the options for controlling FMD, the Scottish Executive must take account of the effects on the wider interests of the rural economy and involve the appropriate stakeholders. *(paragraph 43)*

Biology and Disease Control

2. SEERAD should identify a regional laboratory in Scotland to undertake diagnosis of FMD using tests where live virus is not required. The latter should remain the responsibility of Pirbright. *(paragraph 61)*

3. In view of the clear advantages they offer, SEERAD in consultation with DEFRA, Pirbright and interested commercial organisations should as a matter of the highest priority make resources available for the development of improved tests for the detection of FMD, especially RT-PCR; and that they should give similar priority to support the development and evaluation of on-farm tests for the detection of virus or viral components. *(paragraph 62)*

4. SEERAD should, in consultation with DEFRA, press for early adoption of tests that can discriminate FMD vaccinated from FMD infected animal to facilitate emergency vaccination in dealing with future outbreaks of FMD. A regional laboratory in Scotland could carry out those tests which do not involve the use of live virus. *(paragraph 66)*

5. A complete ban on movement of susceptible animals throughout the country must be imposed immediately an FMD case is confirmed. This may be speedily relaxed in consultation with the relevant stakeholders, including rural businesses, once the source of the disease is traced. *(paragraph 74)*

6. An appropriate GIS system should be established detailing land use, livestock numbers and other information relevant to disease control. Furthermore uniform standards in database design and data handling protocols should be established. *(paragraph 94)*

7. The Food Standards Agency should give public reassurance on the consumption of milk products and meat from vaccinated animals and should do so at a time, not of crisis, but when it is able to be dealt with as a routine issue in relation to imported meat already consumed in Europe. *(paragraph 109)*

8. The following recommendations relate to vaccination:-

- That UK contingency planning for future outbreaks of FMD incorporates emergency protective vaccination (ring or barrier) as an adjunct to slaughter of clinical cases and dangerous contacts.
- That Government ensures that vaccine manufacturers are involved in developing a national strategy for adequate production of emergency vaccine.
- That the Government presses the European Commission to clarify its policy on the tests and evidence required before exports of livestock and livestock products from a member state that has had the disease can be resumed to other member states. These rules should be no stricter than those applied to other countries.
- That the Government urges the OIE to validate tests that distinguish animals vaccinated against FMD from those that have been exposed to infection. *(paragraph 122)*

9. Further analysis of the role of sheep, cattle and pigs in the 2001 outbreak should be undertaken and the results published. Further studies on factors influencing the spread and survival of FMDV virus strains are also required. (*paragraph 125*)
10. SEERAD should foster and co-ordinate the available expertise in prevention and control of animal disease in Scotland in conjunction with SHEFC and the NHS. A good starting point would be an audit of available high containment facilities where FMD research could safely be undertaken. (*paragraph 128*)
11. The UK Government should press the EU to end the concession on the personal import of cooked meat into any member state from countries outside the Single Market and the European Economic Area and to impose stringent methods of inspection. (*paragraph 131*)
12. The Government should carry out up-to-date assessments of risks in the light of the international situation; and high priority be given to surveillance at points of entry to the UK, at markets, abattoirs and on farms. (*paragraph 137*)
13. SEERAD should prepare and keep in readiness up-to-date factsheets on biosecurity to be issued to all concerned at the start of an outbreak. Every effort should also be made to ensure that standards of biosecurity, even in normal times, are raised so as to minimise the risk of any infection spreading. (*paragraph 143*)

Managing the Disease Outbreak

14. The role of the Scottish Minister should be integral to UK decision-making and he should have access to advice in accordance with his specific accountability to the Scottish Parliament for animal health and disease control. (*paragraph 150*)
15. The post of Chief Veterinary Officer (Scotland) should be created with direct responsibility for all aspects of veterinary matters, including the eradication of FMD; and nationally-agreed control measures (including relevant protocols) should be devolved within the context of a Scottish Contingency Plan with responsibility being invested in the Chief Veterinary Officer (Scotland). (*paragraph 153*)
16. Funding for the State Veterinary Service in Scotland should become the responsibility of SEERAD with an appropriate transfer of funding from DEFRA. (*paragraph 154*)
17. The SVS and SEERAD should establish a body of contracted veterinary surgeons, RVIs external to the SVS, that would be on standby for the control of any future FMD outbreaks or any other major disease outbreak. All those participating as RVIs should be paid a retainer on the understanding that they would be immediately available in the event of an emergency. (*paragraph 163*)
18. The following priorities should be followed for disposal of carcasses:
 - Rendering plants should be considered as the first option but only where the transfer of carcasses can be guaranteed to be within sealed containers to minimise the risk of transferring infection to other premises and stringent disinfecting regimes applied to the transport used.
 - Burial on site should be used where there is inadequate rendering capacity provided there are no risks to water resources.
 - Burning should be used only as a last resort. (*paragraph 170*)
19. SEPA's role in protecting the environment should be properly incorporated into the contingency planning and the management of the emergency at the highest level. (*paragraph 173*)
20. The Scottish Executive, in consultation with relevant bodies, should give priority to identifying large burial sites throughout Scotland. (*paragraph 175*)

21. A clear strategy for dealing with the valuation process should be in place and a current list of competent valuers held by SEERAD. An annual review should also be considered to establish stock values and those values should be adhered to throughout any future outbreak. (*paragraph 191*)

22. In the event of an outbreak, unless its origins and spread are immediately apparent, the countryside should be closed for a limited period of three weeks at the same time as the animal movement ban is announced; but as soon as the extent of the disease is determined, the closure should be lifted in non-affected areas. (*paragraph 198*)

Contingency Planning

23. At least once a year a practice exercise should be undertaken at which there is a mock outbreak at a site not revealed until the start of the exercise. This would require all those involved to act as they would in a real outbreak as a means of testing their effectiveness and the suitability of the organisational structure. (*paragraph 216*)

24. SEERAD, in association with other stakeholders, such as local authorities, health boards and, where appropriate, the local enterprise companies (LECs), should establish a responsive system to assist members of the rural community to cope with stress during and following an FMD outbreak. (*paragraph 219*)

25. A comprehensive review should be undertaken into the most effective means of communication to those concerned in the event of an outbreak and the appropriate mechanisms incorporated in the Scottish contingency plan. (*paragraph 221*)

26. The Scottish Executive should review the emergency plans of all Scottish Councils to ensure that they adequately cover the action required in the event of an FMD outbreak; and all Councils should up-date their plans if that has not already been done. Such plans should be reviewed annually in the light of developments in science and consequential changes in policy. (*paragraph 224*)

27. To ensure that contingency planning at all levels is kept up-to-date and takes account of the latest developments, the Minister in the Scottish Executive with responsibility for animal health should establish an independent standing committee to monitor this work and to assess the effectiveness of mock exercises. (*paragraph 225*)

Glossary

Term	Meaning
Antigen	Usually a protein or carbohydrate substance (as a toxin or enzyme) capable of stimulating an immune response.
Antibody	A type of protein made by certain white blood cells in response to, and to bind with, a foreign substance (antigen). The purpose of this binding is to help destroy the antigen.
Epidemiology	A branch of medical science that deals with the incidence, distribution, and control of disease in populations.
Nucleic acid	Any of a group of complex compounds found in all living cells and viruses, composed of purines, pyrimidines, sugars, and phosphate. Nucleic acids in the form of DNA and RNA control cellular function and heredity.
Pharyngeal	Relating to the throat.
Serological	Blood study-related.
Serotype	A group of intimately related microorganisms distinguished by a common set of antigens.
Topotypes	A specimen of an organism taken from the type locality of that species.

Abbreviations

ACVO	Assistant Chief Veterinary officer	HVS	Head of Veterinary Services
ATB	Area Tourist Boards	IP	Infected Premise
BCMS	British Cattle Movement Scheme	IT	Information Technology
BGS	British Geological Survey	LVI	Local Veterinary Inspector
BSE	Bovine Spongiform Encephalopathy	MAFF	Ministry of Agriculture, Fisheries and Food
CAP	Common Agricultural Policy	NFUS	National Farmers Union Scotland
COSLA	Convention of Scottish Local Authorities	NSP	Non-structural protein
CP	Contiguous Premise	OIE	Office International des Epizooties
CSF	Classical Swine Fever	PEPFAA	Prevention of Environmental Pollution From Agricultural Activity
CVO	Chief Veterinary Officer	PRIMO	Pigs (Records, Identification and Movement) Order
D&G	Dumfries and Galloway	RSABI	Royal Scottish Agricultural Benevolent Institution
DECC	Disease Emergency Control Centre	RSE	Royal Society of Edinburgh
DEFRA	Department for Environment, Food and Rural Affairs	RT-PCR	Reverse Transcriptase-Polymerase Chain Reaction
DEL	Departmental Expenditure Limit	RVI	Reserve Veterinary Inspector
DRVO	Deputy Regional Veterinary Officer	RVO	Regional Veterinary Officer
DVM	Divisional Veterinary Manager	SABRI	Scottish Agricultural and Biological Research Institute
DVO	Divisional Veterinary Officer	SBC	Scottish Borders Council
ELISA	Enzyme-Linked Immunosorbent Assay	SEERAD	Scottish Executive Environment and Rural Affairs Department
EU	European Union	SEPA	Scottish Environmental Protection Agency
FAO	Food and Agriculture Organisation of the United Nations	SLF	Scottish Landowners Federation
FAWC	Farm Animal Welfare Council	SVS	State Veterinary Service
FMD	Foot and Mouth Disease	TIFF	Total income from farming
FMDV	Foot and Mouth Disease Virus	TVI	Temporary Veterinary Inspector
FSA	Food Standards Agency	WTO	World Trade Organisation
GATT	General Agreement on Tariffs and Trade		
GDP	Gross Domestic Product		
GIS	Geographic Information System		

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I Introduction

1. Foot and Mouth Disease (FMD) is widespread across the world, it is endemic in some countries and there remains a real risk of further outbreaks in Britain. It is one of the most infectious diseases known; and the ever increasing movement of people, livestock and goods across frontiers inevitably enhances the risk of it spreading to areas free of the disease. The nation must therefore be alert to this danger and have plans ready to deal with any future outbreak involving the best veterinary, epidemiological, scientific and organisational skills available.

2. The FMD outbreak of 2001 was the worst ever experienced in the UK. The extent of its spread and the number of animals slaughtered were both on a far greater scale than in the 1967/68 epidemic, the worst epidemic of the 20th century. The experience has raised widespread concern among the public to ensure that such an event should never be allowed to happen again. The damage to agriculture, especially in the affected areas, to tourism and to countless small and medium sized businesses in rural areas will take time to repair. And not only those directly affected but the wider communities of which they formed a part suffered serious distress and trauma.

3. It was clear that lessons could be learnt from the 2001 outbreak in Scotland and, accordingly, in December 2001, the Royal Society of Edinburgh (RSE) set up an independent expert committee with the following remit:

'to investigate the outbreak, spread and organism causing the disease with particular regard to its control, the impact on the economy, particularly that of tourism and rural areas generally; and to draw lessons for the future.'

4. Details of the membership of the Committee and of the oral and written evidence received by the Inquiry are provided in Appendices 1 and 2.

The Disease and the International Context

5. Foot and mouth disease (FMD) in cloven hoofed farm and wild animals is caused by a highly infectious virus, which can be extremely virulent. From 1953 to 1967 there were outbreaks each year in the UK, apart from 1963 and 1964(1). The serious epidemic of 1967/68 involved 2,364 outbreaks, but apart from the single small outbreak in the Isle of Wight in 1981, there had been a long period when the country was free of the disease before the major epidemic of 2001. There are seven virus serotypes: O, A, C, Asia 1, SAT 1, 2 and 3, each containing several subtypes, which have been classified into topotypes. The virus which was responsible for the 2001 epidemic in the UK was the PanAsia strain of the O serotype.

6. The UK is a member of the Office International Epizooties (OIE), which has a membership of 158 countries. The OIE advises on disease control measures and sets standards for international trade. Member states are required to notify to OIE the occurrence of FMD and other highly infectious diseases, which are reported rapidly to member states leading to international trade restrictions on the country affected. Conferment by OIE of FMD free status is normally required before importing countries lift these restrictions. At the time of the 2001 epidemic the PanAsia strain of the O virus of FMD had spread from India across other countries both to east and west and could therefore have been seen as a potential threat.

7. The European Union also imposes its own control measures. Council Directive 85/511/EEC introduced in 1985 stipulates that the policy for eradication of FMD should be stamping out, that is destruction of all susceptible animals on infected premises. Subsequent legislation banned the use of routine prophylactic vaccination, hitherto practised in EU countries with the exception of the UK, Ireland and Scandinavia; but emergency vaccination is permitted with EU Commission approval. Such approval can be rapidly given in an emergency. The above regulations are ratified within UK legislation (see Appendices 3 and 9)(2).

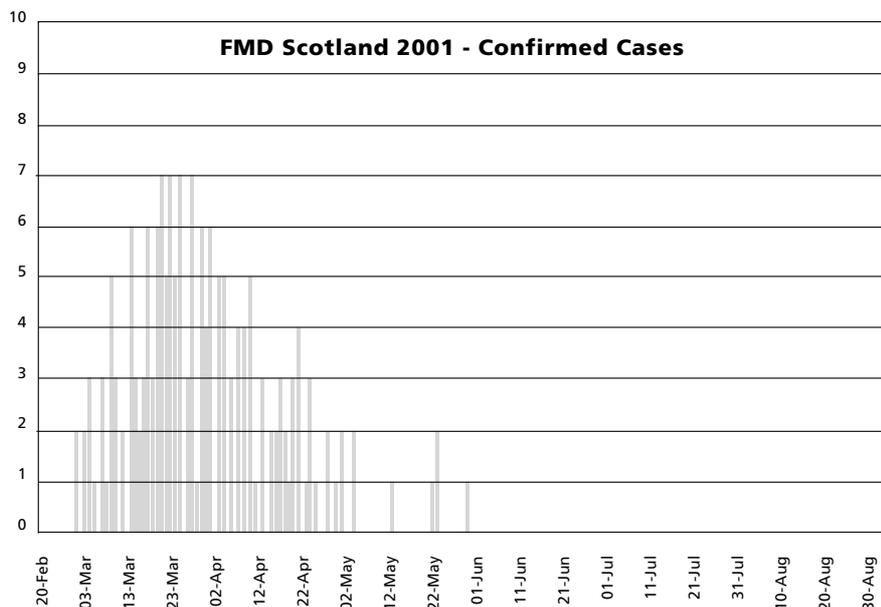
The 2001 Foot and Mouth Epidemic

8. The first case of FMD in Britain was diagnosed at an abattoir in Essex on the 20th February. It was traced to a pig farm at Heddon-on-the-Wall, Northumberland and from there airborne spread is thought to have infected cattle and sheep on a farm at Ponteland. Sheep from this farm were sent, before the disease was diagnosed but after they had become infected, to the Hexham and Longtown markets. It was from these markets that the disease spread widely to other areas, including Scotland.

9. The first case in Scotland occurred in sheep belonging to a livestock dealer at Lockerbie on 1st of March. As in England, the disease was tackled by a rigorous stamping out policy, involving the slaughter of all animals on infected premises (IPs) and all those regarded as dangerous contacts (DCs). It was decided on the advice of the State Veterinary Service (SVS) to impose a pre-emptive cull of all sheep within a radius of 3 km from an IP. This cull was later extended to pigs. In the light of modelling work undertaken for the Government, it was decided to slaughter all animals on contiguous premises (CPs) to those that were shown to be infected. Due to lack of clinical signs and the possibility of subclinical infection, it was thought at the time that the disease was spreading undetected through sheep.

10. The epidemic in Scotland was very large: 187 farms were confirmed cases, 193 dangerous contacts, 188 in the contiguous cull, 1,048 farms affected by the 3km sheep and pig cull and 28 farms where animals were slaughtered on suspicion (a breakdown of the occurrence of confirmed cases is shown in Graph 1). In all, these culls accounted for 735.5 thousand animals slaughtered in Scotland; of these 87.7 thousand were cattle, 643.9 thousand sheep (the vast majority in either the contiguous cull or the 3km cull) and 3.4 thousand pigs.

Graph 1: Graph showing daily breakdown of confirmed cases of FMD in Scotland (from the Scottish Executive)



11. In addition to these culls, 262.3 thousand animals were slaughtered under the Livestock Welfare Disposal Scheme (LWDS) because of problems resulting from the movement restrictions that were imposed; and a further 188 thousand under the Light Lamb Scheme (LLS), a scheme introduced to support producers in more difficult areas who had lost their markets because of the export ban. Some 47 per cent of the lambs destroyed under this scheme were from the Scottish islands. The total altogether was therefore 1,185 thousand animals slaughtered in Scotland alone as a consequence of the epidemic. This compares with 435 thousand animals slaughtered in the UK in 1967/68 the worst epidemic of the 20th century(3).

12. Because of the decision, unprecedented in the UK's previous handling of FMD epidemics, to slaughter on contiguous premises and sheep and pigs in a 3km radius, it is not known how many of the slaughtered animals were actually infected. Although a high proportion of the animals on infected premises were tested for disease, samples were taken for testing from only nine of the large number of contiguous premises in Scotland (of which one was in Dumfries and Galloway)(4). The purpose in killing them was, it appears, less to cull infected stock than to create a firebreak around the outbreaks of disease.

13. This policy was undoubtedly ruthless, and from evidence given to the Committee, appears to have been pursued initially with fewer exceptions being made in Scotland than in England. But it was successful in that the disease peaked at seven cases a day in the period 21-28 March and the last case occurred on 30th May, three months after the start. It was confined to the two Council areas of Borders and Dumfries and Galloway. In England the last case occurred in September more than seven months after the start.

14. The Northumberland Report on the 1967/68 epidemic recommended that vaccination be used in support of stamping out. This was not used in either England or Scotland (5). Officials from the Scottish Executive told us that it was held in readiness and plans were in place for its use. But in the event it was not used because they considered that the disease had been successfully contained by stamping out (but including, of course, the contiguous and 3km culls). The issues involved in vaccination are dealt with fully later in this report. In our view, the decision not to use it was influenced by a number of factors: an approach which favoured stamping out alone because vaccination, though widely used in other countries, had never been used in Britain in the past; a certain amount of misunderstanding about vaccination and a concern for the consequential impact on trade.

15. Under the OIE rules, as they then existed, FMD free status could only be restored, and hence exports of meat and livestock resumed, three months after the last outbreak if vaccination was not used, but only after a year if it was. This led to the view that in order to get back into export markets as quickly as possible, all vaccinates would subsequently have to be slaughtered, a policy that was followed in the Netherlands in 2001. As will be seen later (paragraph 111), these rules have now been changed with the 12 month period reduced to six, but there is also evidence of a different attitude having been taken on exports from countries that used vaccination in South America where exports of de-boned meat to the European Union were resumed in a much shorter time (6). Clearly these matters are of major importance in deciding policy.

16. In the circumstances of 2001, Ministers and others who were involved in tackling the outbreak faced a difficult situation. They received conflicting scientific advice, especially on vaccination. Some of those researching vaccines favoured their use, others felt that the disease could only be effectively ended by stamping out. Under the OIE rules, as they then existed, it was presumed that vaccinated animals would have to be subsequently slaughtered. Diagnostic tests, including those which differentiated between infected and vaccinated animals were available but for the most part they had not been developed or approved for FMD. The State Veterinary Service told us that they had a contingency plan, but it did not involve stakeholders in the wider economy whose activities would be affected. The country had had a long period of freedom from the disease and this meant that those responsible had no recent (or in most cases any) experience of the disease. The course of action followed by Ministers was therefore understandable and it is commendable that, in Scotland at least, the measures taken put an end to the outbreak in three months.

17. The purpose of this report is not to rake over the decisions taken or the policy pursued in 2001, although inevitably they will be described. But the risk of further FMD outbreaks is as great as ever, given that it is widespread across the world. The aim is therefore to advise on how that risk can be minimised and in the event of a future outbreak how it should be handled, taking account especially of the most recent developments in science and the lessons learnt from 2001.

Agriculture in Scotland

18. Agriculture in Scotland has distinctive characteristics. It is more important to the Scottish economy than to that of the UK as a whole, accounting in 1998 for 1.4 per cent of gross domestic product (GDP) as compared with 0.9 per cent for England and 1 per cent for the UK as a whole. There are approximately 60,000 employed in agriculture (including self-employed) of whom some 10,000 are part time or seasonal. As compared with England, a much larger proportion of the output is derived from livestock, 48 per cent compared with 28 per cent. Of Scotland's total agricultural area of 6,074 thousand hectares, 84 per cent (compared with 14 per cent in England) is classified by the European Union as Less Favoured Area and subject to special schemes of support. Of the total 65 per cent is rough grazing, 20 per cent grass and 11 per cent tillage (compared with 11 per cent, 37 per cent and 47 per cent respectively in England). As a result of these characteristics, the export of meat and livestock is particularly important to Scotland. Scottish Council surveys show that in 1997 livestock and livestock products accounted for 76 per cent of total overseas agricultural exports from Scotland and that a further substantial amount went for consumption in England. In 1995-97 Scotland produced 80 per cent more beef than was consumed in Scotland and 270 per cent more lamb and mutton.

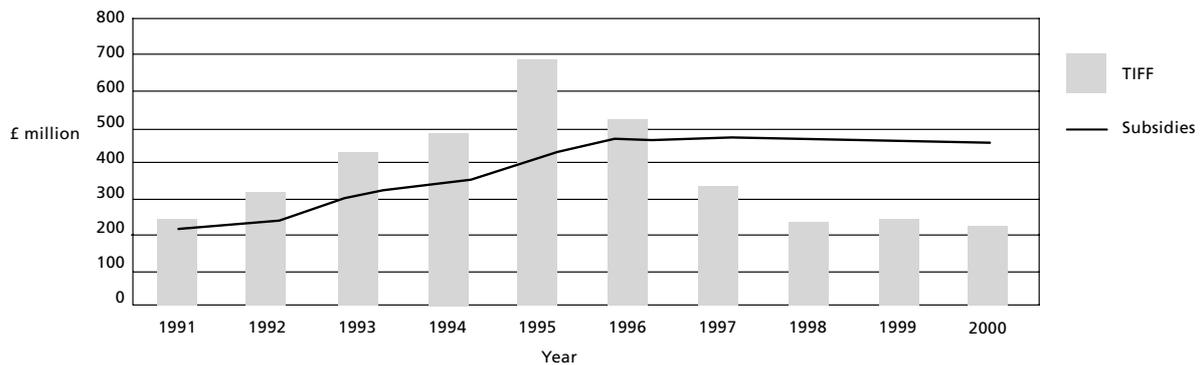
19. The last decade, however, has been a difficult time for agriculture in Scotland, as it has been in the rest of Britain. Even before the problems created by FMD, BSE had had a serious effect on consumer confidence, reducing the demand for beef and, for a while, halting the export of beef altogether. In addition to this, there has been sustained pressure for containment and indeed reduction of price support levels under the European Union's common agricultural policy (CAP), starting in the 1980s with the MacSharry reforms but continuing with the Uruguay Round of the General Agreement on Tariffs and Trade (GATT), the proposed Millennium Round of the World Trade Organisation (WTO) and the proposals for CAP reform under the EU's Agenda 2000. All of this has resulted in a significant shift from price support to other measures intended to maintain farmers' income.

20. In addition there has been a special factor peculiar to the United Kingdom. CAP prices are set in euros (before 1999 in ecus) and what the farmer receives therefore depends on the exchange rate of the euro against the pound. Over the last decade the exchange rate for the pound has changed dramatically, starting fairly high, falling sharply after the pound was forced out of the EU's exchange rate mechanism and then gradually rising again until it was higher than it was at the start of the decade. Opinion on this is divided, but there is considerable support for the view that since at least 1997 the pound has been overvalued against the euro/ecu by some 15-20 per cent. This of course depresses the income of agriculture (since CAP prices are in euros) and also affects other rural activities, in particular tourism, where it makes Britain relatively less competitive against other European countries.

21. Against this background it is not surprising that Scottish agriculture was suffering from depressed conditions even before the FMD epidemic. The gross value of Scottish agricultural output had fallen from £2,358 million in 1995 to £1,785 million in 2000 and the contribution to GDP was 97 per cent of the 1995 level in 2000 as compared with an increase to 111 per cent for the output of the economy as a whole. Total income from farming (TIFF) showed an even more dramatic change: from about £220 million in 1991 it rose to £694 million in 1995 before declining to £344 million in 1997 and back virtually to the 1991 level at £228 million in 2000. (In real terms, allowing for inflation, this means that in 2000 it was substantially below the 1991 level). In 2001, despite FMD, it recovered slightly to £273 million, but this recovery was

from a very low base and the industry was still clearly depressed. The effect on exports was even more marked: total agricultural exports overseas fell from £203 million in 1995 to £56 million in 1997 (the latest year for which figures are available); and, within this total, exports of livestock and livestock products fell from £173 million to £43 million. Clearly the effect of BSE on exports was a major factor in this decline.

**Graph 2: Total Income From Farming and Direct Subsidies
1990 to 2000**



Source: SEERAD

Tourism in Scotland

22. Tourism was one of the industries most affected by the response to FMD in rural areas. It is not an easy industry to define, covering as it does full time and part time jobs and many different activities, notably accommodation, restaurants, transport, museums, galleries and a range of both urban and rural pursuits. For this reason it is more difficult to get accurate statistics than for agriculture. Nevertheless it is one of Scotland's most important industries: VisitScotland, in evidence to us, estimated its contribution to Scottish GDP at five per cent, considerably more than that of agriculture. It injects approximately £4.5 billion into the economy and employs eight per cent of the workforce or 193 thousand, including both full and part-time workers. However, tourism in Scotland depends heavily on the landscape of the countryside for its appeal, which in turn relies on management by agriculture and forestry.

23. Like agriculture, tourism had already experienced some difficult years before the FMD outbreak. From the peak year of 1998 to 2000, spending by overseas visitors to Scotland had fallen by 17 per cent, from £945 million to £789 million, and that of UK visitors, though more stable by eight per cent from £4,029 million to £3,708 million. The strength of the pound was a major factor in this decline, although the opening up of cheap holidays in countries hitherto less accessible and the growth of low cost flights generally were also significant factors.

24. The FMD outbreak in 2001 demonstrated very clearly, as perhaps nothing else could, the interdependence of the different industries that constitute the rural economy, and the particular significance of the relationship between agriculture and tourism. It is important to recognise in our analysis of the outbreak and the lessons that can be learnt from it, that this fact has influenced our proposals for controlling a future outbreak, and the contingency planning that is essential.

II The Economic and Social Impact

The Impact on the Scottish Economy

25. The impact of the epidemic on the Scottish economy was substantial. This section of the report sets out these costs in so far as we have been able to quantify them. In doing this we have assembled as much information from published data as is available, but, inevitably, this does not give a complete picture. We have also received help from economic modelling work we commissioned from Dr Deborah Roberts of the Macaulay Land Use Research Institute (7).

The Cost to Agriculture

26. In both of the regions affected, agriculture's contribution to the economy is well above the Scottish average and depends heavily on livestock. Many other rural businesses depend on agriculture and both regions also have a significant tourist industry.

27. For animals that were culled, farmers received compensation, based on estimated market value (see paras 181-187). The full cost of this, amounting to £154 million for the culls and an additional £17 million for the LWDS and LLS (compared with £1,120 million and £210 million for the UK as a whole), was met by DEFRA and became a claim on the Treasury's contingency reserve (8). It therefore did not fall on the Scottish Executive's funds. Although this clearly has implications for UK public finances, compensation is not at the expense of any public expenditure for which the Scottish Executive is responsible.

28. The money paid in compensation does not, however, meet the full cost to agriculture of the epidemic. In the first place, for farms that were culled, the intention was to compensate for the capital represented by the livestock lost, rather than loss of income. These farms were without income for the considerable time that they were without livestock. In effect the compensation money amounts to a form of compulsory purchase of assets rather than compensation for loss. Secondly farms which were not culled also suffered because of movement restrictions. For a time this affected the whole country: it prevented animals going to market at the right time, thereby imposing additional costs on the farmer; and even when these restrictions were lifted for the rest of the country, they remained in place in the affected regions. Indeed, some of the farmers who suffered most were those in proximity to culled areas, who could neither move nor sell their animals and who sometimes did not have enough feed to maintain them in good health. These additional costs to farmers have been estimated at £60 million by SEERAD.

29. The scale of the culling led to the loss of valuable bloodlines of some important breeds. Evidence given to the Committee emphasised this, for example, in relation to South Country Cheviots (9). FMD, of course, resulted in an immediate ban on exports and this was particularly important for Scotland. Beef exports had only just started to recover from the effects of BSE and the sheep sector, which, as was shown above, depends heavily on exports, lost its market.

30. In addition, substantial costs were involved in cleaning up and disinfecting culled farms, in the employment of substantial numbers of additional personnel – veterinarians, slaughtermen and contractors of various kinds. DEFRA estimate the full public sector costs, including compensation, at £2,580 million. The Scottish share of this was largely met by DEFRA and the Treasury. DEFRA are responsible for funding the SVS; they also took responsibility for the cost of the Army and all other disease control measures, apart from administrative support to Animal Health Officers, which was met by SEERAD. The share of the total cost of the epidemic falling on public funds was therefore largely met by DEFRA and the Treasury, with only a relatively small part paid for by SEERAD.

The Costs to the Economy as a Whole

31. As mentioned earlier, Scottish agriculture now accounts for only 1.4 per cent of GDP. It is clear therefore that even an epidemic as major as that of 2001 will not have a large effect on GDP at the Scottish level. Even taking account of the knock-on effects to the rest of the economy, in particular tourism, the effect overall on Scottish GDP will still not be large, however bad it may be in particular areas and sectors. This is confirmed both by surveys conducted for the Scottish Executive (10) and by Dr Roberts' research, which put the effect on GDP at up to 0.8 per cent and a maximum effect on employment of 17,000 (Full Time Equivalents) or 0.92 per cent of the work force.

32. These estimates are difficult to make, depending, as they do, on a number of assumptions that are open to differences of judgement. For the UK as a whole a wide range of estimates have been made for the cost of the disease to the economy. In the pre-budget report the Treasury have estimated the cost at 0.2 per cent of GDP. The Countryside Agency in August 2001 put the cost at between £2.4 billion and £4.1 billion or 0.2 to 0.5 per cent of GDP. Since Scotland has a large livestock industry and lost some 17 per cent of the animals slaughtered in the UK and its economy is about 8.5 per cent of the British economy, a rough approximation would suggest the loss may be a rather higher proportion of GDP, perhaps between 0.5 and 0.8 per cent, the maximum in Dr Roberts' research.

33. The effect of the epidemic in Dumfries and Galloway and in the Borders, however, where agriculture is a more substantial part of the economy, was much greater. Scottish Enterprise told us in oral evidence that they expected recovery in Dumfries and Galloway to take a minimum of three years. Not only would the loss to agriculture directly affect the output of the region, but many rural activities were affected by the closure of the countryside, and the ban on movement of animals and personnel from farms. This affected hunting, fishing and small businesses, such as forestry contracting work, as a result of the access restrictions; those responsible for vermin control and other activities linked to agriculture. The problems were greatest in the two regions but also applied elsewhere in Scotland. Auction markets were closed, dealers and contractors who transport livestock had to lay off employees and for a time lost their livelihood.

34. But most serious of all was the effect on tourism, especially in rural areas. As already mentioned (paras 22-24), tourism contributes substantially more to Scottish GDP than agriculture. Tourism was directly affected not only by the closure of the countryside but also by the sight and smell of burning carcasses, images which were relayed to a large public on television. The damage to tourism was obviously greatest in Dumfries and Galloway and Borders. Borders Tourist Board told us that the effect in their region was about twice the cost to agriculture and that there was a loss of about 14 per cent in tourist revenue (11). Similar estimates applied to Dumfries and Galloway.

35. Although the closure of the countryside in non-affected areas was lifted, the effect persisted. Ministers tried to promote the countryside and the National Trust for Scotland, together with other bodies, launched the Comeback Code; but the public was warned to avoid contact with animals and many public footpaths

retained notices prohibiting entry because of the risk of introducing FMD, long after the danger had become negligible. It proved easier to shut down the countryside than to open it up again. Many overseas visitors decided not to come to the UK deterred in many cases by unjustified fears about the disease. For the domestic tourist, however remote the risk of spreading the disease, especially by an urban public visiting areas that were not affected, farmers and landowners were understandably nervous. Generally the public respected their concern but many holidays and trips were simply cancelled. The apparent confusion about what it was safe or not safe to do led to frustration and a loss of confidence in official advice.

36. For Scotland as a whole between 2000 and 2001, spending by overseas and UK tourists in Scotland fell by £119 million or 3%. There was some increase in urban tourism, which partially compensated for the loss in rural areas; there was also a recovery in the autumn months. But VisitScotland estimate that overseas visitors were down seven per cent in the first nine months of 2001 and there was a loss of about a quarter in visitors from the rest of the UK in the months April to June, mainly affecting self-catering and bed and breakfast. One company responsible for self-catering cottages, based in the Borders but with properties throughout Scotland, found that 40 per cent of its existing bookings were cancelled a few months into the FMD outbreak. In the course of our enquiry, during a public meeting in Newcastleton, the Committee were told by the owner of a bed and breakfast that in contrast to a normal year when her accommodation was full virtually all summer, cancellations had left her with only three bookings for the 2001 season. The effect struck places and activities one might not immediately have thought of: Edinburgh Zoo had to close and lost over £400,000 in revenue and, in Glasgow, Pollok House (with animals in the park) was closed, and similarly lost revenue. Overall, VisitScotland estimate a loss of £200-250 million for Scotland in gross revenue from tourism.

37. The problem for many businesses is not confined to the year 2001, bad though that was. As we heard at first hand when the Committee visited Dumfries, Inland Revenue and Customs and Excise have been helpful in allowing due payments to be postponed and banks have also helped by providing loans. But helpful though this was at the time, it only means that the amount of money due for payment in 2002 is greater than ever. Some valuable rural businesses may well be driven into insolvency.

Assistance from Scottish Executive and Public Agencies

38. In the early stages of the crisis the Scottish Executive set up a Ministerial Group with representation across the relevant Departments and an Impact Assessment Group with representation from the Enterprise Network, VisitScotland, the Scottish Agricultural College, the employment service and the local authorities to report to it on the situation as it evolved. Reports on the various sectors of the rural economy were provided and three surveys were conducted in April, June and October, covering some 2,700 businesses (12). To establish how far they were affected by FMD, case studies were prepared covering the most affected sectors – agriculture/food, tourism and transport – and, in the two Council areas affected, the Council, the local enterprise company and local tourist board submitted their own recovery plans to the Executive.

39. As a consequence the Executive has spent £30 million on measures intended to alleviate hardship caused by FMD and to assist with economic restructuring. Of this £13.5 million was announced at the end of March 2001 to meet specific and urgent needs and a further £7 million in May. This was followed by £10 million in August to assist the long term recovery of key sectors, particularly agriculture and tourism. In addition to this £30 million a further £2 million was provided as match funding to charities for relief of distress and hardship.

40. The bulk of these funds has been channelled through VisitScotland, the local enterprise companies (LECs) and the local authorities. VisitScotland is not able to fund enterprises directly but has targeted its marketing and promotion to assist the two affected regions. The two LECs were able to assist directly, Dumfries and Galloway Enterprise secured additional in-year funding of £5 million from the existing Scottish Enterprise budget, which was applied in loans, interest relief grants, community regeneration

programmes, specialist business advice, skill training and a variety of other ways to support tourism and agriculture. This was aimed at short-term need as part of a three-year recovery programme. Scottish Borders Enterprise had a similar programme and secured additional funding of £2.5 million. In addition the two local authorities received funds from the Scottish Executive to cover rates relief and to assist with the costs of controlling the disease. This assistance is important and undoubtedly useful; it is good that it was able to be made available quickly. But, even at £30 million, its scale is undoubtedly modest when compared with the revenue lost as a consequence of the epidemic. It is also small when compared with the compensation paid to agriculture for animals slaughtered, although it must be remembered that the latter is mainly in respect of a loss of stock and is therefore not strictly comparable with the losses of income suffered in other sectors.

Conclusions on Economic Effects

41. This brief analysis of the damage to the economy from the FMD epidemic in Scotland shows clearly that, serious though the damage to agriculture was, the damage to the wider rural economy was at least as great and probably greater. It was not confined to the affected regions, although of course it was most severe there, nor was it likely to be confined to the year 2001, even if visitor numbers recover in 2002, because of the roll forward of financial debt.

42. A policy for the effective control of FMD, or indeed any other livestock epidemic, as if it were purely an agricultural problem is inadequate. The interests of the agricultural and non-agricultural rural economy may not always point to the same policy being adopted. In future there may well be a choice between different courses of action and if this is so, the effect on all sectors of the economy must be considered to reach a balanced view on the best course of action.

43. We therefore recommend that in considering the options for controlling FMD, the Scottish Executive must take account of the effects of the wider interests of the rural economy and involve the appropriate stakeholders.

Social and Psychological Effects

44. It was clear to us, both from our visits to the affected areas and from evidence presented to us, that the full extent of the damage caused by this outbreak could not be shown in economic terms alone. For those involved, or even those not involved but living in the locality, there was trauma. Many farmers and their families required counselling and many of those with rural businesses, especially where they had recently undertaken investment, perhaps financed by borrowing, suffered serious stress from the financial predicament that loss of revenue caused. For many of these people, and perhaps especially their children, the events of 2001 were a nightmare and it will take time for them to recover.

45. The Committee had the opportunity to hear testimony from individuals about the effect on human lives and on communities. Although not quantifiable, this "cost" was real and needs to be recognised. The Royal Scottish Agricultural Benevolent Institution and the Church of Scotland have both documented the profound effect on individuals, families and communities. During the crisis, the lack of co-ordinated up-to-date and reliable information led to frustration and anger. Telephone help lines were set up for farmers, farm staff and their families; the counselling and advice provided was widely welcomed and used. But depression was common and suicide a danger. Children and families could not conduct normal lives, engage in social exchange or attend school and this will have a long-term impact on those affected. The RSABI asserts that there will be a need to support many families for several years to come.

46. It should be recorded that within the affected areas, those families on farms where animals were not culled also suffered stress and financial loss. The inability to move animals and lack of feed for them were a source of major anxiety over their welfare. Apart from the worst cases, where animals were slaughtered under the Livestock Welfare Disposal Scheme, the resulting loss was not compensated.

47. While much of the media coverage concentrated on the plight of the farmers, farm staff were equally affected not only in coping with the slaughter of stock but also in dealing with the prospect of loss of jobs and tied houses and the difficulty of obtaining benefit support while isolated on affected farms. Communities suffered from tension about access between farmers and local businesses, particularly tourism. Further serious problems were caused by the changes in valuation levels between affected farms.

48. We suggest that decisions on the handling of any future FMD epidemic should take account of the social and psychological impact of the policy adopted; and that contingency planning should ensure that up-to-date information, advice and, where necessary, counselling is available to all those affected.

III Biology and Disease Control

The Disease and its Diagnosis

The Disease

49. Foot and mouth disease is a highly infectious disease of global distribution, caused by an RNA virus, affecting cattle, pigs, sheep, goats and other cloven hoofed animals. It is not a disease of humans. Some very rare instances have been reported of humans who were handling diseased animals being mildly affected. But these are quite exceptional and there was no known instance during the 2001 epidemic. Certain areas of the world have remained free of FMD, at least for the last half century (*e.g.* Australia, New Zealand and North America). In other countries the disease occurs sporadically (*e.g.* UK) or is endemic (*e.g.* parts of South America, Asia, the Middle East and parts of Africa). The part played by the susceptible species, cattle, sheep and pigs, in the spread and the importance of the method of spread varies from epidemic to epidemic. For instance: movement of cattle disseminated FMD in the UK epidemic in 1960; infected meat and airborne spread from pigs were important in the 1967-68 epidemic and airborne spread across the Channel from pigs in France carried infection to the Isle of Wight in 1981. Sheep, pigs and cattle were all involved in the spread of FMD in the 2001 epidemic.

50. FMD is characterised by the development of blisters (vesicles) on the tongue, in the oral cavity and the lips and nostrils, on the feet and on the teats. The affected animal salivates profusely and becomes lame. The blisters rupture leaving a raw, painful surface, which eventually heals, provided there is no secondary infection. There is a loss of condition in animals and milk production is affected. Pregnant animals may abort. Clinical signs vary in severity and the disease is often mild or not apparent in sheep. Calves, lambs, kids and piglets may die suddenly through damage to heart muscles. A variable proportion of cattle and sheep may retain virus in the throat beyond 28 days, despite the development of antibodies.

51. FMD virus infects animals through the nose, mouth or skin. It multiplies in the animal and can be found in the breath, milk or semen two or more days before vesicles are seen. The incubation period from infection to appearance of signs can be from 2 to 14 days, depending on the strain of virus, the dose the animal receives and the susceptibility of the animal. At the height of the disease the tissues contain large amounts of virus; one gram of infected cattle tongue epithelium may contain many millions of infective virus particles. In cattle most virus is found in infected epithelium, milk and faeces, and in pigs in infected epithelium and breath. Sheep give out less virus than cattle or pigs. Antibodies develop in the animals after the lesions rupture and start to heal, and peak in three weeks.

52. Virus spreads rapidly between animals in close contact. Over longer distances it is spread by movement of animals, through milk and milk tankers, in vehicles that have carried infected animals, by people, wild animals and birds that have been in contact with infection, and by wind. Airborne spread is further over the sea than over land, but over land the distance is affected by the site of the source and the nature of the terrain downwind.

Diagnosis

53. The application of diagnostic tests in FMD in the face of an outbreak have to be viewed from several different perspectives:

- Controlling the infection nationally or regionally, with the criteria set by national governments.
- As a prerequisite to the resumption of trade:
 - a) trade within the EU context, where the criteria are set by the EU commission and are EU wide applying both to exports and imports.
 - b) trade between the EU and countries outside the EU where the criteria for the tests can be laid down by bilateral agreement but must not exceed in stringency the tests laid down by the OIE.

At the end of an outbreak, and prior to the resumption of trade, diagnostic tests must be applied on a herd basis for the export of de-boned meat and meat products. Individual testing would be required for live animals.

54. Because other vesicular diseases of cattle, sheep and pigs resemble FMD, it is crucial that any suspect case of FMD in susceptible species within a disease free area is rapidly subjected to laboratory diagnosis. FMD can be diagnosed at different stages using one or more of three criteria:

- the presence of clinical signs,
- the detection of the virus and/or
- demonstration of antibody against the virus.

Diagnostic testing, in a laboratory, involves detecting virus or viral components in the infective period of the disease, and antibodies in the later stages.

55. Correct and rapid diagnosis is essential since the disease will have been incubating before clinical signs appear. Clinical diagnosis even by an experienced veterinarian should, wherever possible, be confirmed by laboratory testing. This is particularly so in the case of sheep and goats, in which the disease is often difficult to detect clinically. This caused problems in the early stages of the 2001 epidemic, when sheep were the principal species involved, and may have resulted either in the disease being undetected or in animals being suspected of FMD when they were suffering from another clinical condition. Tests in such cases are essential. In the UK, these laboratory procedures for diagnosing FMD have been undertaken at the Pirbright Laboratory of the Institute of Animal Health. However, such was the scale of the 2001 epidemic that Pirbright was severely stretched at the start of the outbreak, until assistance was forthcoming by secondment of qualified laboratory staff from other institutes in the UK. Apart from the difficulties in handling large numbers of samples early in the outbreak, poor sampling techniques by inexperienced veterinarians and prolonged transport time from Scotland contributed to some delays.

56. Regardless of what method of detection is used, there is the possibility of identifying animals that are FMD free as being infected and vice versa. The issue for any test is to be as sensitive and as specific as possible. Sensitivity (Se) is the proportion of diseased animals detected by the test as being diseased. Specificity (Sp) is the proportion of healthy animals identified as disease-free by the test. Note that at different times in the epidemic one may be more interested in detecting one or the other. Sensitivity and specificity are independent of disease prevalence. Some tests will have high Se and high Sp or both low, while some have high Se and low Sp or vice versa. This will depend upon the test under consideration and the species in which it is being applied. The determination of sensitivity and specificity requires the availability of large numbers of infected animals which may only be available during a course of an outbreak.

Tests for Detection of the Virus

ELISA (Enzyme-Linked Immunosorbent Assay) in the diagnosis of FMD Virus

An ELISA is a test in which specific antibodies or antigens are indicated by an enzyme-catalysed colour change.

The technique enables rapid analysis of multiple samples and is widely used for the diagnosis of human and animal diseases. ELISAs can be used to detect antigen or antibody.

57. The tests used to diagnose FMD during the 2001 epidemic were two procedures accepted by the OIE for the detection of the virus or its components in clinical samples collected from animals (13).

- a) An ELISA (Enzyme-Linked Immunosorbent Assay) to detect antigen which produces a result in four hours, provided it is collected from fresh lesions. As a result the test is very reliable in samples from pigs and cattle but less so from those in sheep and goats.
- b) Direct virus isolation in tissue culture. This test is the current 'gold standard' for infection but can require up to four days to complete before a negative result can be assured. Samples for virus isolation require careful handling and a laboratory with highly specialised containment facilities.

The Pirbright laboratory is the only veterinary facility in the UK where these two tests can currently be safely and legally carried out since live virus is involved. Therefore, special facilities must be maintained at Pirbright.

The procedures for the use of these and other tests in 2001 are shown in Figure 1.

58. Reverse Transcriptase – Polymerase Chain Reaction (RT-PCR), a nucleic acid detection technique which amplifies many-fold a targeted region of viral RNA, has not so far been used to diagnose FMD in the field in the UK, although several of those who gave evidence to us argued strongly that it should have been. The test is widely used to diagnose a range of other diseases. The test can detect all seven serotypes of FMDV. It could offer important advantages in high sensitivity and specificity, speed and use in regional laboratories because it uses inactivated virus. Developments in technology have allowed the use of single containers for all reactions, thereby eliminating the possibility of cross contamination. One potential Real Time RT-PCR assay which allows a more quantitative assessment of target RNA to be determined has been under development in the USA over the past three years. The major benefits of this test include the short time required for processing (less than two hours) and the use of equipment capable of being easily transported. This means that it could readily be used in a regional laboratory, thereby avoiding the delay involved in sending samples from Scotland to Pirbright (14).

59. An on-farm diagnostic test would also be extremely valuable as it would reduce the need to send all samples to an approved laboratory, thus achieving an earlier diagnosis. We understand that several such tests based on ELISA technology are under development at present and one which, like the human pregnancy test, utilises chromatographic strip test technology for the detection of antigen is particularly promising (15). Early results for FMDV detection indicate that its sensitivity is approximately equivalent to the antigen detection ELISA currently used. As with that ELISA, a negative result would require confirmation by a more sensitive method such as virus isolation or RT-PCR.

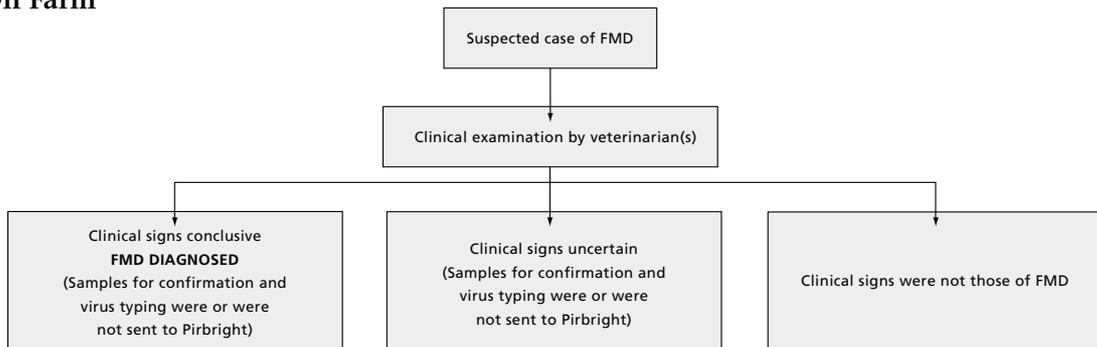
60. Proposed future procedures for the diagnosis of FMD incorporating these new tests, is outlined in Figure 2. A detailed suggested breakdown of the procedures is shown in Appendix 7

61. **We recommend that SEERAD identify a regional laboratory in Scotland to undertake diagnosis of FMD using tests where live virus is not required. The latter should remain the responsibility of Pirbright.**

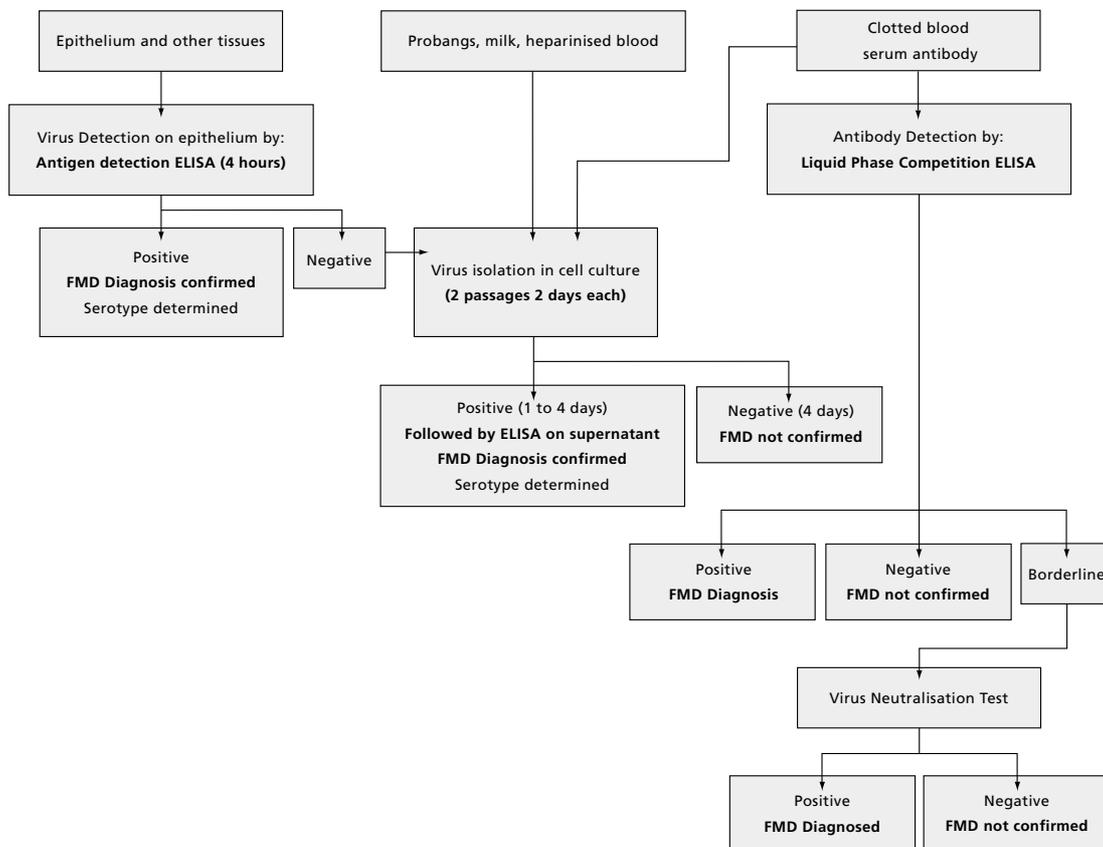
62. We further recommend that, in view of the clear advantages they offer, SEERAD in consultation with DEFRA, Pirbright and interested commercial organisations should, as a matter of the highest priority make resources available for the development of improved tests for the detection of FMD, especially RT-PCR; and that they should give similar priority to support the development and evaluation of on-farm tests for the detection of virus or viral components.

Figure 1: Procedure for the diagnosis of FMD in 2001

a) On Farm



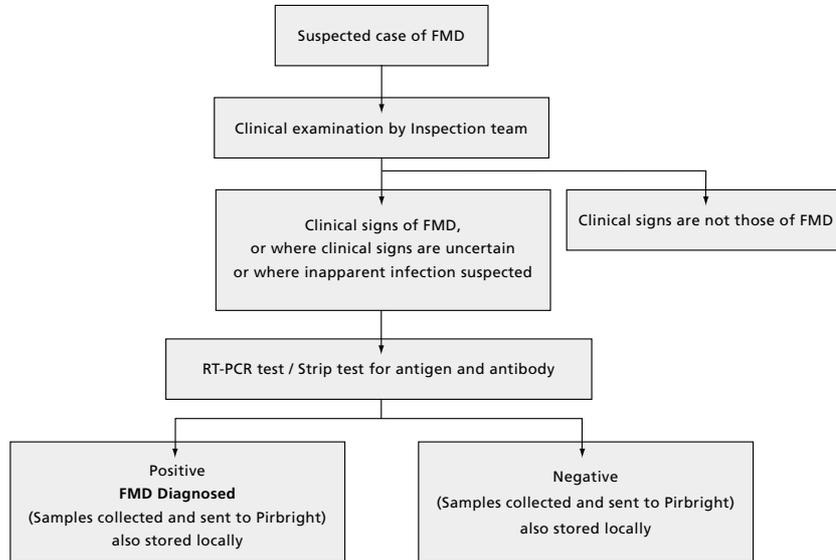
b) Diagnosis at Pirbright Laboratory



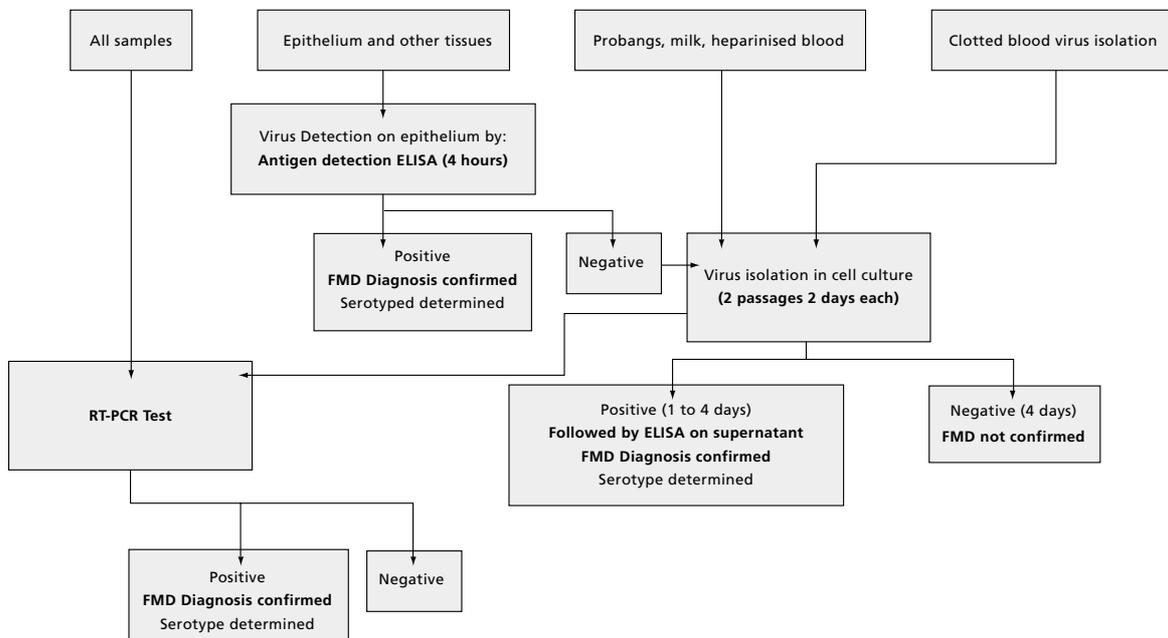
Note: Samples sent to the Laboratory were also tested for swine vesicular disease. Cell cultures, calf thyroid cells, continuous pig kidney cells and lamb kidney cells are types of cell culture that were used.

Figure 2: Proposed future procedure for the diagnosis of FMD

a) On Farm



b) Diagnosis at Pirbright Laboratory



Note: Antibody detection on blood sera uses the Solid Phase Competition ELISA instead of the Liquid Phase ELISA.

Detection and Measurement of Antibodies

63. Following exposure to FMD virus, the infected animal's immune system responds by producing antibodies specific for the virus, which can be detected in serum post-infection. During the 2001 outbreak there were two tests for the detection of antibodies, a liquid phase competition ELISA and the virus neutralisation test. The latter, regarded as the gold standard test, requires high containment facilities as it is carried out with live FMD virus. Until the infecting serotype is established both tests require to be run against multiple serotypes. Recently, a solid phase competitive ELISA for FMD virus has been validated at Pirbright and five other UK laboratories. Data have been submitted to the OIE for consideration as an internationally accepted test. Apart from its diagnostic function, this test will be helpful in surveillance by demonstrating freedom from FMD virus. However, if a vaccination policy is to be used in future outbreaks, none of these tests can discriminate between antibodies resulting from vaccination or exposure to field viruses.

64. Tests that discriminate between antibodies arising from modern purified vaccines and those arising from field viruses have, however, been developed. This is a major advance, since it would permit the use of a vaccination policy without risk of confusion between vaccinated and diseased animals. One such test, a direct ELISA, detects antibody against non-structural proteins (NSPs) of the virus in animals recovering from FMD virus infection. Such antibodies are not produced by animals vaccinated with the modern purified vaccine in which the non-structural protein elements of the virus are almost completely absent. The importance of this is that serological discrimination of vaccinated from infected livestock is not only essential for disease control purposes but also for the early resumption of trade. The OIE has recently approved the technology of this type of test on a herd basis. Details of their position is given in Appendix 3 (16).

65. The discriminatory ELISA has been internationally proven with sera from experimental infections as well as in the field, from samples taken from 5,000 animals (cattle, sheep and pigs). It covers all main FMD virus types and is not serotype dependent. Several tests have been developed, which are reported to have a specificity approaching 100% in vaccinated livestock (17). These tests are being looked at by the Joint FAO/IAEA Division of the IAEA in Vienna under a Co-ordinated Research Programme. The benefit of all of these tests is that they would provide the technology to screen vaccinated herds/flocks and determine which have been exposed to FMD virus.

66. We recommend that SEERAD, in consultation with DEFRA, press for early adoption of tests that can discriminate FMD vaccinated from FMD infected animals to facilitate emergency vaccination in dealing with future outbreaks of FMD. A regional laboratory in Scotland could carry out these tests which do not involve the use of live virus.

Controlling the Disease

67. FMD can be controlled and eradicated by three methods:

- A stamping out policy that involves culling of infected animals and dangerous contacts, disposal of their carcasses and disinfection of premises. This method has been widely used in countries where the disease is sporadic and has been the method employed in the UK.
- In some situations this policy is supplemented by emergency vaccination applied in a ring or barrier around infected areas. The vaccinated animals may or may not be subsequently slaughtered depending upon the rules for the resumption of international trade within the EU or international trade beyond.
- In countries where the disease is endemic, prophylactic vaccination has been used on an annual or more frequent basis.

68. In the 2001 outbreak the UK used a stamping out policy alone; vaccination was considered but not used and the sequence of key events in Scotland was:

- Following confirmation of the first case in the UK on 20th February a ban was imposed on both international (21st February) and national (23rd February) animal movements.
- Culling of IPs and DCs commenced following confirmation of Scotland's first case on 1st March.
- On 2nd March movements under License to Slaughter Scheme were permitted, commencing 5th March and this was extended to licensing local/occupational animal welfare movements on 12th March.
- On 15th March the pre-emptive 3km cull of sheep and pigs in Southern Scotland was announced and implemented on 22nd March, the delay being due to the scale and complexity of the operation. The Welfare Disposal Scheme was also announced.
- On 21st March the Minister of State gave approval for the Army to operate in Scotland to aid with the pre-emptive 3km cull and subsequently the contiguous cull.
- On the 23rd March a policy that required culling in 24 hours for IPs and 48 hours for CPs was announced by Professor King, and by the Scottish Executive on 24th March.
- The daily case rate peaked by the end of March.
- On 17th April the cull was intensified to remove remaining sheep near Dumfries and Canonbie.
- On 26th April exemptions were allowed for cattle on contiguous premises following a veterinary assessment; high biosecurity premises; a number of sheep from rare breed flocks.
- On 14th May the need for 3km sheep cull was assessed on a case by case basis.
- The last case in Dumfries and Galloway was on 23rd May and the last case in the Borders was on 30th May.
- On 20th August Auction marts in Scotland restarted.
- From September 11th Scotland was designated as a Provisionally Free Area.
- On 16th January 2002, EU restrictions lifted on export of meat, animal products and livestock, except for live sheep.
- On 22nd January the UK regained its FMD free status.

Analysis of Actions Taken and Problems Encountered

Livestock Movements

69. There are a large number of weekly markets in the UK and coupled with the move to fewer and larger slaughterhouses, often linked to supermarket requirements, this results in considerable animal movements over large distances. Banning movement is therefore a drastic step but an essential one. Many of those who gave evidence argued that an earlier ban – immediately following confirmation of the first UK case and at the same time as the international ban – would have resulted in many fewer cases. This could have been in time to prevent the sales at the Longtown market. Professor Woolhouse, in oral evidence to us, and Professor King, in evidence to a House of Commons Committee, both estimated that this might have enabled a third to a half of the animals slaughtered to be saved (18).

70. The scale of the spread of the disease prior to identification was clearly underestimated. But as the disease was first discovered at an abattoir, it was known that the index case had not been identified. Undoubtedly the precautionary principle should have been applied, and an immediate ban imposed on all movements of susceptible livestock.

71. Once the ban was in place, movement controls were kept under constant review against the disease profile, biosecurity compliance, animal welfare problems and business needs. A complex system of movement licensing arrangements was introduced and subsequently frequently refined. In Scotland, an FMD stakeholders' group, with a broad range of industry bodies and government agencies represented, acted as consultation group and catalyst for the revisions to the livestock movement controls. Communication of the changes throughout the industry and to local government was difficult, given the frequency and complexity of such changes. Unfortunately this led to inconsistent interpretation and application.

72. The implementation of movement controls and disease risk classifications in Scotland differed in some respects from those applied elsewhere in the UK. In the early stages the controls were applied more strictly in Scotland but in the later stages of the outbreak they were more relaxed, reflecting the different disease profile in Scotland. Scotland was divided into three areas, Infected Area (IA), At Risk Area (ARA) and the Provisionally Free Area (PFA). The movement controls were very strict in preventing farm to farm movements from higher disease risk areas to lower risk areas. Scotland was fortunate in managing to avoid outbreaks of disease in new areas and this permitted progressive dismantling of the restrictions.

73. As a result of the very strict movement controls applied initially throughout Scotland, and latterly only in the IAs and ARAs, animals on winter grazings could not be brought home and in some instances were trapped many miles away. In others unnecessary problems were caused because farmers could not move their animals even within the farm to better pasture. This gave rise to welfare problems with the result that many animals, in total around 262 thousand, had to be slaughtered under the Livestock Welfare Disposal Scheme.

74. We recommend that a complete ban on movement of susceptible animals throughout the country must be imposed immediately an FMD case is confirmed. This may be speedily relaxed in consultation with the relevant stakeholders, including rural businesses, once the source of the disease is traced. Within farm units, farmers should, in accordance with strict biosecurity rules, be able to move their animals in such a way as to minimise welfare problems and the risk of spreading disease.

20-Day Standstill Rule

75. The structure of Scottish livestock farming means that animals bred in the north and west move to the south and east of the country for finishing. This movement of stock is a long established practice and involves substantial movements of animals throughout the year as animals are moved to the natural location of fodder and ultimate marketplace.

76. One of the key controls that operated subsequent to the outbreak, has been the standstill of movement of all susceptible species for a 20-day period following a susceptible animal being brought onto a farm. The implementation of the 20-day standstill rule, which has been in place since the end of the epidemic, is regarded by producers and ancillary livestock industries as over restrictive. Whilst exceptions to the rules have been allowed, it continues to obstruct the financial viability of the business, particularly on farms that have to buy in animals at the same time as selling others. The problems caused by the 20-day standstill were particularly acute in 2001 during the autumn peak of movement on upland livestock farms when stock is sold and replacement breeding stock is purchased in a concentrated period. Although the present concession whereby producers can gain exemption from the 20-day rule by undertaking to keep animals separate provides some much needed flexibility, it is unlikely in itself to be a permanent solution and it is difficult to monitor.

77. The SVS regard the 20-day rule as a vital measure to restrict potential disease spread. A greater awareness and implementation of biosecurity at farm level and the selective application of a standstill rule, with a reduced timescale, and only applied to traded animal movements, could be an achievable compromise.

Traceability

78. Ability to trace animal movements is crucial to the effective tackling of an outbreak. For cattle, the individual cattle passports and the movement recording system British Cattle Movement Scheme (BCMS), which was introduced in 1998, proved effective and valuable.

79. We commend SEERAD and the industry for having established an electronic notification system for cattle movements through auction markets and to abattoirs. This initiative should be given high priority for continual improvement. Rapid traceability is vital if movement restrictions are to be properly defined. Once an advanced system is in place linking all species, consideration should be given by Government and the industry on animal health and welfare grounds to restricting 'repeat and speculative' trading.

80. By comparison, the ability to trace sheep movements was poor, a factor that was particularly important in view of the role played by sheep in the 2001 epidemic. Reliance on second party information, such as farm movement records, was clearly recognised as inadequate for rapid tracking of disease. Further research is needed into identification methods for sheep, taking into account animal welfare considerations (19). The recent introduction of a central movement recording system for sheep (see Appendix 13) in Scotland has begun to address this issue. Coupled with the BCMS and the Pigs (Records, Identification and Movement) Order (PRIMO) movement arrangements for pigs, disease contact tracing in Scotland should not be a problem in future.

The Implementation of the Culling Policy

81. In addition to the standard stamping out policy with culling of infected premises (IPs) and traceable dangerous contacts (DCs), the 3km sheep and pig cull was undertaken on SVS advice. This was based on (a) the known high risk of onward transmission from pigs and (b) the difficulty of detecting the disease in sheep. It was responsible for 394 thousand of the 644 thousand sheep slaughtered (apart from the welfare scheme) but only 57 of the pigs (see Appendix 3 for details). It was controversial and we have received conflicting evidence on the value of this cull (20). It was also decided, following epidemiological modelling work undertaken for the Government's Chief Scientist, to cull susceptible animals in premises contiguous to sites of infection (CPs).

82. We have heard evidence that there was inconsistent application of the culling of DCs. In some instances apparently healthy animals, which had indeed been at risk of contact, were culled well beyond the period when disease could have occurred. In these instances where there was a delay, testing would have resolved the issue but evidence the Committee received made it clear farmers were refused testing.

83. Where a TVI was suspicious of but not convinced of premises being infected the animals were culled on instruction from DEFRA at Page Street, London, and material taken for confirmatory tests. Premises that subsequently were confirmed as being infected were recorded in culling statistics as being IPs. Those confirmed as negative were termed Slaughter on Suspicion (SOS) culls. This latter category included 28 premises in Scotland. The grounds for suspicion appear to have been variably defined and the ensuing actions variably implemented. Testing could have negated the need for some of these culls.

84. An important issue arising from evidence presented to us was the way in which the term contiguous was interpreted for the CP cull. In some instances this meant that animals distant from an IP but on a farm that was contiguous, even if there was stock free land or a wood separating the animals, were culled; yet animals much nearer to an IP, but on a holding that was not strictly contiguous, were left unculted. In the midst of an epidemic it is obviously difficult to operate other than by fairly simple rules, but risk needs to be more carefully assessed, using information about the topography and data on animal populations. We note, however, the modifications to both CP and pre-emptive cull that were adopted later in the epidemic and endorse this risk-based approach.

The Use of Models

85. Quantitative techniques, including risk assessment, analytical epidemiology and modelling, are dependent upon good quality data that is accurate and timely. This includes accurate and timely diagnosis (see paragraphs 53-56).

86. Models can be used to describe past and current epidemics and to explore the course of ongoing and future epidemics. In view of the data that are available and the complexity of the epidemiology of infectious disease, any model will, at best, only approximate to reality. Whilst models can be useful, they should not be the sole dictator of policy nor should they remain unchallenged and unvalidated. Given that most epidemics are unique in one or more aspects, historical models might provide a useful framework but will inevitably require updating and the addition of local information relating to climate and topography will be necessary.

87. Plume models developed by the UK Meteorological Office and the Danish Meteorological office, used early in the outbreak, showed that cattle and sheep on a nearby farm to the pig unit in Northumberland were most likely infected from that pig unit and that the risk of long distance spread of the disease to Europe through airborne virus was extremely low. Airborne spread over 3km was not found to play a significant role in the epidemic (21). Most spread within 3km ('local spread') was attributed to local aerosol spread between animals or contamination in the areas near the outbreaks. The model indicated that spread from cattle and sheep was minimal. However this was criticised in evidence received, since it did not take account of the enormous quantity of foot and mouth disease virus in lesions, milk and faeces from cattle (22). Incorporation of such a source of the virus from cattle in a short range model would have helped to identify farms down wind at risk as well as local contamination.

88. Much of the controversy during the 2001 FMD epidemic related to the use of models to predict the course of the outbreak on which the intervention strategy was based. At the time of the outbreak, there was much criticism of some of the assumptions underlying these models. Some of those responsible for the modelling work argued that, without the action that followed, the epidemic would have been a great deal worse. Others, who submitted papers to us, took the view that the epidemic was already passed its peak before the contiguous culls that were based on the models took effect (23), albeit that modelling can assist in the process. Subsequently a generation of more complex and mature models have emerged which have

benefited from more complete data sets and greater investment of time. However, they remain models and the scenarios they explore are only possible examples of what might have happened (24). A thorough analysis of the complete data from the epidemic must therefore be a priority.

89. In the context of quantitative epidemiology, modelling analyses are ideally performed in consultation by a team of people with the relevant quantitative, clinical, virological, immunological skills. For disease controls and policy to be effective there must be consensus, consistency and compliance. Stakeholder inclusion is critical to this success. Several of those submitting evidence were strongly of the view that there was neither consensus among informed experts nor stakeholder inclusion in 2001 (25).

90. It is challenging to model an epidemic in which there is a large amount of spatial and temporal variation, either due to regional differences or changes brought about by the interventions occurring during control. It is particularly demanding to develop a model which explores the impact of a range of possible interventions where complex biological systems are necessarily represented by a few variables. It is highly likely that unmeasured or unknown variables and factors exist. Transparency is therefore of the utmost importance. In the 2001 epidemic one of the most influential models was not available for inspection by the wider scientific community until it had been published in the scientific press after it had informed policy (26).

91. It was not explained how scientific advice was solicited in either the UK or Scottish context, despite recommendations existing for such procedures (27). There was a large body of epidemiological and modelling expertise in Scotland, in research institutes and the universities, that was not called upon during the epidemic. Similarly, data management skills and land use databases existed that were not immediately accessible. We received evidence that geocoded data regarding animal distribution were flawed (28).

92. In the epidemic of 2001, some reassurance can be taken from the fact that the several different models largely came to the same conclusions. But as very few of the contiguous premises were tested it is impossible to tell whether this aspect of the policy was justified.

Information Systems

93. We received evidence suggesting that the lack of appropriate information systems, especially data on livestock populations and density and integrated Geographical Information System (GIS) seriously impaired analysis and modelling. We were also told that logistics were impaired by the lack of an integrated information system. Instead many different software and hardware systems were in place, sometimes differing even within an organisation (*e.g.*, laboratory and field databases).

94. We recommend the establishment of an appropriate GIS detailing land use, livestock numbers and other information relevant to disease control. We further recommend that uniform standards in database design and data handling protocols be established.

Vaccination as a Control Option

Vaccination

Emergency vaccination

Used to limit the spread of a focal outbreak of FMD in a country or region not practising prophylactic vaccination. It is applied only for the duration of the outbreak.

Emergency vaccination is '*suppressive*' when the intent is to dampen an epidemic at its centre and eventually to kill the vaccinates. It is '*protective*' when vaccinates are maintained in production but subject to close and regular surveillance until the outbreak is over.

A *ring* or *zone* of vaccination is established around the outbreak to contain it.

If a disease is spreading, *barrier* vaccination can be used to close off and protect an area or region containing susceptible livestock (e.g. along Forth-Clyde corridor to prevent northward spread FMD).

Prophylactic vaccination

Recurrent vaccination (twice annually initially, then annually) to prevent occurrence of disease in the face of continuing risk of exposure. May be applied nationally or regionally within a country.

95. Although the Government maintained that vaccination was an option, it was not in fact implemented in 2001. However, for good scientific reasons, vaccination should be given serious consideration as an integral part of a future control policy. It has the potential to avoid excessive culling of uninfected animals and to minimise the scale and impact of socio-economic disruption that attended the 2001 outbreak and, because of new testing technology, to do so without unduly compromising the return to FMD free status. All FMD vaccines are prepared from chemically inactivated virus and incorporate an aqueous or oil-based adjuvant. There is a statutory obligation on the manufacturer to show, by appropriate testing, that the finished vaccine is free of residual live virus and that none of its constituents pose any risk to consumers. Manufacturers can formulate vaccines as monovalent (single serotype of virus) or multivalent (several serotypes) as required and at suitable potency. Thus, vaccines can readily be tailored to need.

96. Prophylactic vaccination together with control of outbreaks by slaughter of infected animals and their contacts, reinforced by ring vaccination, was employed by the EU up to 1991, though not in the UK, Republic of Ireland or Denmark. After 1991, it became EU policy to stop vaccination in favour of eradication by slaughter as practised in the UK. This decision was reached because it was believed that by 1989 FMD was no longer endemic in Western Europe. Sweden, Finland and Austria, which became member states of the EU after 1991, also prohibited prophylactic vaccination. However, recourse to emergency vaccination of cattle and other susceptible livestock to curtail outbreaks was retained as an additional option for individual member states in dealing with any outbreaks, subject to European Commission approval, which can be rapidly given. Outbreaks in Italy in 1993 and in Greece in 1994 and 1996 were controlled by stamping out measures without invoking emergency vaccination.

97. During the 2001 outbreak in the UK emergency vaccination as an aid to control was clouded by scientific controversy. Issues of contention included:

- whether the vaccine would simply mask infection and create 'carrier' animals, thereby risking persistence of endemic infection;
- whether sufficient supplies of vaccine were available or could be produced to meet requirements;
- whether large-scale vaccination could be managed in the tight time-scales of an escalating multi-centred epidemic;
- whether there would be consumer resistance to products from animals vaccinated against FMD.
- whether vaccinated animals would, in any event, require to be slaughtered to ensure early return to OIE recognised disease-free status and resumption of exports;
- severity of restrictions on movement and trade of animals and products from within the vaccinated zone until freedom from disease could be established.

98. Submissions to the Inquiry confirmed the value and benefit attached to vaccination in areas of the world where FMD is endemic or where major flare-ups have occurred (29). Thus routine prophylactic vaccination in the years up to 1991 cleared FMD from Western Europe and also aided its control in South American countries such as Brazil, Chile, Uruguay and Argentina. In 2001 Uruguay, which had been 'FMD free without vaccination' since 1996, experienced a major country-wide epidemic of type A virus. The extensive spread was attributed to dispersal of cattle from an auction in the area of the index case some days before disease was first diagnosed in late April. Initial attempts at control by 'stamping out' were abandoned one week into the epidemic in favour of a complete movement ban and strategic systematic vaccination of the entire national herd (10.5 million cattle). This commenced in early May and was completed one month later, by which time the number of new cases per day had fallen from a peak of 40-60 to single figures. A second round of vaccination was started in late July and the last case of FMD occurred on 21st August. Sheep, even those in close contact with cattle, were not vaccinated. During the epidemic fewer than 10,000 animals were killed. Imports to the EU were resumed on 1 November 2001.

99. In the 2001 outbreak in the Netherlands the disease was brought under control by stamping out and vaccination, further outbreaks ceasing eight days after the completion of the suppressive vaccination programme. Following slaughter of the vaccinates the country regained its disease-free status just three months after the first case was confirmed in mid March. In all, 270,000 animals were slaughtered.

The 'Carrier' Issue

100. In the UK, much debate centred on the occurrence and importance of the carrier state in FMD. A carrier is generally defined as an animal which harbours virus in the throat more than 28 days after infection i.e. significantly beyond the time when it should have been cleared by the development of immunity. A variable proportion of cattle, sheep and goats (but not pigs) can become carriers; in cattle this can be more than 50% but is lower in sheep and goats (30). The proportion of carriers falls over time, most animals clearing infection within five months although extremes of 42 months (cattle) and 12 months (sheep) have been recorded. Significantly, no lesions, even at the microscopic level, are found in the tissues where the virus persists which may imply a change in virus properties (31). Numerous studies have sought, and failed, to demonstrate transmission of FMD from persistently infected cattle to susceptible animals. In the field, apart from the special case of buffalo and cattle in southern Africa (32), any evidence of dissemination of virus leading to disease is anecdotal (33). It has been shown experimentally that vaccinated cattle, if exposed to virus challenge, can become persistently infected, perhaps because virus in the throat is less accessible to antibody, but such animals have not been found to transmit virus to susceptible cattle with which they have been placed in contact. There are no grounds for believing that vaccination per se will enhance the carrier state. Indeed there is some evidence that substantially fewer carrier animals are found amongst vaccinated animals that have been exposed to infection (34).

101. Studies have shown that cattle exposed to infection before or a few days after vaccination become infected and develop FMD. From four days after vaccination, herd immunity and movement controls, leads to a progressively reducing risk of virus transmission, which is negligible by three weeks (35). If all the remaining animals are vaccinated the risk is very small. Nevertheless, careful surveillance of animals vaccinated during an outbreak is therefore essential.

102. In recent years substantial progress has been made in developing serological tests that can discriminate between vaccinated and naturally infected animals (see paragraph 64). However, in this respect, official recommendation has not kept pace with scientific advance, as discriminatory tests have only recently been approved and on a herd basis. The availability of such tests further justifies the use of emergency vaccination in support of a focused slaughter policy as the basis for early eradication of an outbreak and return to disease-free status (36). Post-vaccination serological screening of vaccinates for anti-NSP antibodies coupled with slaughter of herds/flocks in which NSP antibody-positive individuals are detected will reduce even further any risk of inapparent lingering infection and remove the carrier problem, if indeed it can be regarded as a problem. The precautionary step of whole herd/flock slaughter is advised as

the sensitivity of current anti-NSP testing is not 100% and therefore does not allow unambiguous classification of each tested animal. This may change with further test development.

103. The submission from the National Foot and Mouth Group/Vets for Vaccination (36) helpfully set out a draft programme for emergency vaccination, building on the Strategy for Emergency Vaccination against Foot and Mouth Disease prepared by the EC Scientific Committee on Animal Health and Welfare (1999) (see Appendix 5). The Vets for Vaccination document proposes a protective vaccination zone around an infected focus to generate local herd/flock immunity and so arrest spread and dissemination of virus. FMD cases cease rapidly in well vaccinated populations. A two pronged approach can be adopted, with 'clean' supervised vaccination working from the periphery of a defined zone (perhaps 10km radius) towards its centre and 'dirty' teams starting at high risk contiguous premises and moving outwards. The former will establish a barrier of immune animals in advance of presumptive viral challenge from the centre while the latter will reduce virus amplification at the centre. Used in conjunction with early slaughter of confirmed cases and dangerous contacts, emergency protective vaccination will obviate the need for excessive culling of uninfected animals and should shorten the course of an outbreak and its associated economic and social disruption. Pigs and cattle at risk should be primary targets for vaccination as they pose the highest risk of disseminating virus. Lower priority can be accorded to sheep because of the low rate at which they transmit virus although, despite the experience of Uruguay, where sheep and cattle are present on the same farm, sheep should always be included in the vaccination programme. From information provided to the Inquiry it would appear that the cost of vaccination is not a barrier to its use in an emergency programme.

104. With protective emergency vaccination animals judged by surveillance not to have been infected remain in production and, at present excepting cattle entering the over 30 months scheme, their produce can enter the food chain without need for separate identification. However, there is need to provide consumer reassurance on product acceptability and this matter is considered in paragraphs 107-109.

Availability of Vaccine Stocks in 2001

105. Protective emergency vaccination can be effective only if enough doses of the relevant vaccine are available. The Northumberland Committee (1967-68) recommended the creation of a stockpile of vaccine for use in a future emergency, although at that time it was only possible to hold reserves of fully formulated vaccine. By 1974, methods had been developed for the production, purification, concentration and low temperature storage of viral antigens and the first national FMD antigen bank was established in Denmark in 1976. At March 2001, 13 West European countries held stocks, several being maintained by commercial producers and the remainder held in national institutes. An International Vaccine Bank was established at Pirbright to serve as a reserve for the UK and non-EU countries and has a minimum of 500,000 doses of each of the main strains. The European Vaccine Bank was set up in 1991 to service member states. At present it holds antigen equivalent to one million doses of the various strains. There are other banks in various countries holding a range of strains and therefore there was antigen available at the time of the 2001 outbreak. Commercial manufacturers also hold stocks of antigen for their own use. One of the major international manufacturers holds UK authorisation for production of FMD vaccines. From various submissions we calculate that at the time of the outbreak some 3 million doses of vaccine of the appropriate serotype were available.

Management of Large Scale Vaccination

106. Vaccine prepared from purified antigen induces early (4-6 days) onset of protection against infection which persists for several months. Experienced field staff with back up support could be expected to vaccinate large numbers of animals within a few days, as has been the case in other countries where emergency vaccination has been employed. For example, in the Netherlands 115,000 animals were vaccinated in three days; in Uruguay, vaccination of 10.5 million cattle was accomplished in one month.

Safety of Meat and Milk Products from Vaccinated Animals

107. Concerns have been raised about the safety for human consumption of meat and milk products from vaccinated animals. We have therefore examined this issue and taken evidence on the matter from the Food Standards Agency (FSA). The FSA pointed out that farm livestock were vaccinated already for a variety of diseases and said they had no concerns on this score about FMD vaccines. They considered that meat and milk from vaccinated animals were perfectly safe for human consumption. The Committee noted that:

- the vaccine used was not a live vaccine and was therefore incapable itself of passing on disease;
- all the major EU countries had used prophylactic and ring vaccination for many years before 1991 without any suggestion that it had any harmful effect;
- and meat has been in the past and is now imported to Europe from countries that use vaccination, in particular from South America (37).

108. Concern was also raised during the recent outbreak that some retailers, including supermarkets, would either not sell meat and milk from vaccinated animals or would require it to be specially labelled. The Chairman of the British Retail Consortium Food Group has told us that at a meeting in April 2001 he told Ministers that his Group's position on milk and milk products from vaccinated animals would be guided by the reaction of the public and that the Group would have no problem with vaccination so long as public confidence was maintained. They therefore considered it essential that the Food Standards Agency should make a clear statement to assure the public of the safety of these products. The position on meat, though not discussed with Ministers at the same meeting, was essentially the same. Retailers would be guided by the FSA, and it would be for the FSA and the EU to decide whether any specific labelling of meat products might be necessary. We see no more need for products to carry special identification for FMD vaccine than for any other vaccines that have been used for many years.

109. Nevertheless, since the issue has been raised, there is a need to meet any concern that consumers may have. In view of the extent to which large quantities of vaccinated meat have been consumed over many years and the fact that vaccination against FMD in an emergency is EU policy, the matter needs to be tackled. **We therefore recommend that the Food Standards Agency should give public reassurance on the consumption of milk products and meat from vaccinated animals and should do so at a time, not of crisis, but when it is able to be dealt with as a routine issue in relation to imported meat already consumed in Europe.**

International Trade and Vaccination

110. As was explained earlier (paragraph 6) the OIE rules on FMD free status affect a country's ability to export livestock and livestock products. This was understandably a major concern during the 2001 outbreak and affected farmers' attitude to the vaccination issue because of the need to regain export markets as quickly as possible. In Scotland this is of particular importance, because of the major role of livestock farming in its agriculture and the large amount of livestock and livestock products exported, especially sheepmeat.

111. At the time of the 2001 epidemic, the OIE required a country that had had an outbreak of FMD to wait three months after the last case, if stamping out by slaughter alone was used, or if emergency vaccination was followed by slaughter of all vaccinates; but 12 months if the vaccinated animals were allowed to live. This rightly caused concern to British farmers. It was also the reason for the Netherlands slaughtering their vaccinated animals in 2001, a step which provoked outrage in a country which, until 1991, had a policy of regular vaccination for all its cattle. The Committee was aware that the OIE, while our inquiry was in progress, took a decision to shorten the 12-month period to six for the regaining of FMD status after vaccination. This can be expected to affect policy on the use of vaccination in future.

112. It is important to recognise exactly what the OIE's powers are. It is an international organisation created by the International Agreement of 25 January 1924 with four main functions:

- to guarantee transparency of animal disease status worldwide and distribute information so that member countries can take appropriate action;
- to collect, analyse and disseminate veterinary scientific information;
- to provide expertise and promote international solidarity for the control of animal diseases;
- to guarantee the sanitary safety of world trade by developing sanitary rules for international trade in animals and animal products for which purpose it is recognised by the World Trade Organisation (WTO). As part of this it defines FMD free status.

113. The OIE, however, is not a body with power of enforcement. Decisions over imports are a matter for the individual country, though in the light obviously of OIE guidance. In Britain's case as a member of EU, it is the European Commission, which acts for all member states in respect of its obligations under WTO rules. It was presumably on this basis that the European Commission decided that, in the light of information and guarantees supplied by the veterinary authorities of Argentina, import of de-boned meat would be permitted, as from 1 February 2002, from areas of that country where no outbreak of FMD had occurred in the previous 60 days. In effect this was from the whole of Argentina apart from two provinces. This was despite the fact that an outbreak of FMD had caused trade to be suspended in March 2001; that a vaccination programme was adopted then and a further round of vaccination had been completed at the end of 2001. Import of de-boned meat is not, of course, a complete lifting of restrictions, but the time interval was much less than the year required to achieve FMD free status under OIE rules.

114. The EU is an integrated Single Market and agriculture in member states is subject to the Common Agricultural Policy. It is right therefore that the Commission, rather than member states individually, decides on what may be imported. Within the EU, likewise, it is for the Council of Ministers to decide on what policy should be and for the Commission to implement it. The rules that should apply to restriction of trade between member states if one or more of them has been subject to FMD, or indeed any other infectious animal disease, are therefore primarily an EU matter, but obviously the rules on trade between member states should be no different and certainly no stricter than the rules applied to imported meat and livestock from third countries.

115. Clarification is certainly needed. In the Committee's view disease-free status should depend on scientific evidence from a country that its animals are free of disease, rather than on the basis of some statutory period, whether 12 or six months from the last outbreak. Although the OIE decision to reduce this period to six months is an improvement and greatly to be welcomed, it could be argued that six months is still unnecessarily long, provided that the scientific evidence is clear that there is no disease. With modern vaccines and tests that can discriminate between vaccinated and diseased animals, this should now be straightforward. But, within the EU, the Commission needs to clarify policy on the tests required and the evidence to be presented before a country that has had the disease is permitted to export again to other member states. In Scotland's case, the vast bulk of its livestock and livestock product exports are to other member states of the EU, so that it is EU policy that is of paramount importance.

Future Vaccination Policy

116. Because of its global occurrence, FMD remains an ever-present external threat to UK livestock. With enlargement of the EU the risk of introduction of the disease will increase and, with internal freedom of movement, it could spread rapidly throughout the EU. Nor can the possibility of introduction by bioterrorism be ignored. There is need to plan accordingly.

117. Assuming adoption of enhanced standards of national surveillance and bio-security (see paragraphs 129-143), routine prophylactic vaccination is not an immediate priority for the UK, although a special case may be made for elite breeding stock, rare breeds and zoo animals. However, the position should be kept under regular review. Vaccines for prophylaxis would need to be multivalent, incorporating prevalent serotypes of virus as determined by international surveillance. Prophylactic vaccination has the advantage that revaccination removes the 4+-day delay in onset of protective immunity associated with emergency vaccination. Future research on emergency vaccination could be directed at methods for overcoming that 4+-day lag period.

118. We are aware that many scientists, veterinary surgeons and others would favour a move to annual prophylactic vaccination of our national herds and flocks. This would require a major change of EU policy but we would like to see this option fully investigated in the light of new high-potency vaccines and discriminatory diagnostic tests. The increasing threats of further outbreaks occurring as global trade and travel expand and the potential costs of continuing with a stamping out policy merit discussion at the highest scientific and political level in the EU and OIE.

119. Vaccine production requires large-scale culture of infectious virus under strict containment to avoid accidental escape. Purified viral antigens containing no or only trace amounts of NSPs are obtained from the chemically inactivated virus culture and formulated as vaccines containing one or more viral serotypes according to need. High-potency vaccines stimulate protective immunity within days of administration but the limited duration of immunity induced imposes a need for regular re-vaccination (at 6-12 monthly intervals) to maintain protection. Current vaccines need to be kept under cold conditions and have a limited shelf life (1-2 years). For the future there would be advantage in circumventing reliance on large-scale production of infectious virus by developing novel synthetic vaccines capable of stimulating durable immunity systemically and locally in the upper respiratory tract where virus can persist. There would be benefit too in more fundamental studies of non-antibody mechanisms of protective immunity in FMD.

120. We have reviewed the evidence presented to us on the culling versus vaccination controversy and would wish to see the Government use emergency vaccination in a strategic manner in any future outbreaks of FMD. They should also try to persuade the EU to shorten the period required between the last case of FMD and the resumption of international trade where vaccination has been used and to remove the need to slaughter vaccinates if serological evidence of infection is negative. In this context we were disappointed that both DEFRA and SEERAD documents had scant comment on vaccination.

121. In accordance with OIE regulations on control of FMD (see Appendix 3; Article 2.1.1.7) emergency vaccination in an infected area requires establishment of a peripheral surveillance zone which, together with other biosecurity measures, is designed to prevent further dispense of virus. Outward movement of healthy FMD susceptible animals or their produce from the infected zone is permitted subject to stringent conditions. These may not be lifted until evidence of freedom from infection has been established and EU approval is given for redistribution of trade.

122. We therefore recommend

- **That UK contingency planning for future outbreaks of FMD incorporates emergency protective vaccination (ring or barrier) as an adjunct to slaughter of clinical cases and dangerous contacts.**
- **That Government ensures that vaccine manufacturers are involved in developing a national strategy for adequate production of emergency vaccine.**
- **That the Government presses the European Commission to clarify its policy on the tests and evidence required before exports of livestock and livestock products from a member state that has had the disease can be resumed to other member states. These rules should be no stricter than those applied to other countries.**
- **That the Government urges the OIE to validate tests that distinguish animals vaccinated against FMD from those that have been exposed to infection.**

Future Research Priorities

123. We have identified several areas of FMD research, which need to be addressed, properly funded and co-ordinated.

124. These include:

- Further research of diagnostic tests for both viral antigen and antibodies which would provide rapid and reliable on-farm diagnosis. Although there has been considerable progress, as described in paragraphs 58-59 and 64-65, the sensitivity and specificity could be further improved. Current knowledge in medical diagnostics coupled with advances in the biotechnology sector should be exploited and encouragement given to commercial development of prospective tests by improving access to viral strains and reagents.
- Further improvement of vaccines for the various strains of FMD virus. Priority should be given to novel vaccines developed by biotechnology which will stimulate systemic immunity and local immunity in the upper respiratory tract. Collaboration between state-funded laboratories and the pharmaceutical industry should be encouraged.
- A more precise estimate of the role of different livestock species in the spread of FMD. This need was highlighted during the 2001 epidemic, where sheep were thought to have played a major role in the early spread of the disease via markets. Difficulty in the diagnosis of FMD in sheep and the possibility of widespread unidentified infection led to the 3km cull of sheep and pigs around IPs. As mentioned previously, the benefit of this cull had been questioned by several respondents and recent published studies by Donaldson, Alexanderson et al (2001) (38) and More (2002) (39) have cast doubt on the potential of sheep as a major reservoir of infection. Further analysis of the role of sheep in the 2001 outbreak is required and early publication required.
- There needs to be an assessment of local spread of infection due to aerosols and area contamination. This would involve measuring the amounts of virus produced as an aerosol under farm conditions and the development of short range atmospheric disposal models. Such models could be used locally during an outbreak to predict local spread of infection and provide guidance in areas to be monitored or to be vaccinated.
- Mechanical spread of FMD virus by people, vehicles, feedstuffs and other objects and survival of virus outside the animal need to be reassessed. This would involve critical examination of previous publications and experiences on the subject and carrying out experiments where necessary. Such findings would be of importance in risk assessments of future controls involving biosecurity, access and welfare issues.

125. In addition to research on the development of on-farm diagnostic tests and new vaccines, **we recommend further analysis of the role of sheep, cattle and pigs in the 2001 outbreak and the publication of these results. Further studies on factors influencing the spread and survival of FMD virus strains are required.**

Funding of FMD Research

126. At present, funding is primarily provided by DEFRA, EU and the BBSRC with the former two the major providers. It has been directed predominantly towards designated institutes such as Pirbright. There is a clear need for a more co-ordinated approach to funding FMD science and widening the network of scientific groups involved, especially in universities and other institutes, to encompass the basic, applied and developmental research that is so vital to underpin the UK's ability to deal effectively with the on-going threat of a disease that is of international importance.

127. Although we see Pirbright as having a key role in future FMD science, it should be recognised that relevant expertise does exist elsewhere, including Scotland. This could make major contributions to any national plan for infectious disease of animal origin (40), including FMD. Scotland has two internationally-rated veterinary schools (each with strong departments of virology, and strong links to their respective medical schools and biology departments) and research institutes at the forefront of preventing and controlling animal diseases. Greater use should be made of all this relevant expertise.

128. **We recommend that SEERAD should foster and co-ordinate these in conjunction with SHEFC, Research Councils and the NHS. A good starting point would be an audit of available high containment facilities where FMD research could safely be undertaken.**

National and International Biosecurity

Import Controls

129. FMD only breaks out in the UK because it is brought in from other countries. The best way of preventing it would therefore be to stop it being brought in. However, the movement of people to and from the UK is ever increasing, and the countries from which they come may include those where FMD is either endemic or where sporadic outbreaks or epidemics may occur. Regulations currently allow the personal import of 1kg of cooked meat in a hermetically sealed container from countries outwith the EU. From other member states, however, any food or plants which appear healthy can be brought in if intended for domestic use. But unwittingly, or intentionally, people disregard these conditions and illegally import meat which could lead to the introduction of the FMD virus.

130. There was widespread concern expressed in submissions and interviews that a more rigorous approach is needed to reduce risk of FMD being brought in. It has to be recognised, however, that the UK is a member of the European Single Market and it is therefore not open to British governments to impose the kind of controls that exist on entry to Australia or the United States. The whole purpose of the Single Market has been to permit the movement of both people and goods from one member state to another with the minimum of restriction.

131. Nevertheless, there should be an on-going risk assessment of the source and type of meat imports and, where appropriate, the UK government should press the EU to take any safeguarding action that is necessary. The danger arises from imports to Europe, whether legal or illegal, from countries outside the EU where there is FMD. Once in, this may then move freely from one EU country to another. **We recommend that the UK government should press the EU to end the concession on the personal import of cooked meat into any member state from countries outside the Single Market and the European Economic Area and to impose stringent methods of inspection.**

132. Allied to this should be improved intelligence gathering and surveillance for the detection of illegal import of meat and meat products. The use of trained sniffer dogs should be more widely used as well as the development of other methods of meat detection in baggage. Notices should be prominently displayed at airports and ports of entry emphasising the rules on personal importation of meat from countries outside the Single Market.

Surveillance

133. In addition to control at ports of entry surveillance of the disease status of other countries should be undertaken. The OIE has responsibility for dissemination of information but both the European Commission and the UK government should ensure that they are fully informed so that they know where the risks may be and can alert the responsible authorities at ports and airports to be especially vigilant.

134. Within the UK there needs to be constant vigilance, especially when it is known (as was the case in 2001) that an epidemic is spreading in other parts of the world. The government needs to clarify the role of

the relevant authorities. Careful inspection of animals at markets and abattoirs and regular assessment of animal health and welfare on farms is essential.

135. On the farm, any suspicion of FMD needs to be reported promptly. The role of the farmer and farm staff is crucial in being aware of signs that might be FMD. Further training of local veterinary surgeons in FMD clinical diagnosis is also required. However, with the number of large animal practices being reduced, and with the increased cost to the farmer of call-out, the number of visits by veterinary surgeons to farms has decreased. There is potential for developing schemes to involve veterinary practitioners who are Local Veterinary Inspectors (LVI), in surveillance on behalf of the SVS. At abattoirs, the veterinary surgeons should be alert for the clinical signs of FMD. At markets, animal welfare authorities and societies should also be encouraged to be vigilant.

136. The 2001 FMD epidemic started in pigs. Swill feeding has now been banned but pig farms still present a risk, because of the high potential from the spread of virus from pigs. Such farms should, therefore, have high priority for surveillance, as should markets and abattoirs involved in the pig trade.

137. We recommend that the government should carry out up-to-date assessments of risk in the light of the international situation; and that high priority be given to surveillance at points of entry to the UK, at markets, abattoirs and on farms.

On Farm Biosecurity

138. Biosecurity to reduce disease risk is another essential element in controlling the spread of the disease. A crucial part of this is obviously livestock movements, but movements of people, vehicles and machinery are also important. The level of appropriate biosecurity measures should be commensurate with the disease risk, *i.e.*, during an outbreak, higher levels of biosecurity measures would be required.

139. Throughout the outbreak there was poor communication to the industry, particularly to farmers, of the steps needed to achieve effective biosecurity. NFUS was the first organisation to send out information to farmers in Scotland on biosecurity, including official advice on how to protect their farms and on the use of approved disinfectants and dilution rates. Much of the information was on official websites, which relied on all farmers having internet access, using it and knowing where to find the information. Factsheets were eventually sent out to farmers, but not until the end of March and a video was sent out in July.

140. The key point in the biosecurity advice was that disinfecting alone was not effective; it had to be combined with cleaning and disinfecting of people, vehicles and machinery.

141. In recognition of the need for improved biosecurity on farms, a consultation process to produce an improved code of practice has begun with the industry. Quality Assurance Schemes have a key role to play in raising awareness and implementation at farm level and throughout the supply chain. In particular, supply and ancillary industries that have direct contact with livestock and/or move from farm to farm, such as milk tankers, have a particular need for a high level of biosecurity.

142. The higher level of biosecurity required during a disease outbreak should be agreed with the farming industry and ancillary activities as part of the contingency planning process. The effectiveness of the Blue Box scheme (Restricted Infected Areas) implemented latterly in England in areas with new outbreaks of the disease demonstrated the value of strict biosecurity in controlling the spread of the disease.

143. We recommend that SEERAD should prepare and keep in readiness up-to-date factsheets on biosecurity to be issued to all concerned at the start of an outbreak. Every effort should also be made to ensure that standards of biosecurity, even in normal times, are raised so as to minimise the risk of any infection spreading.

IV Managing the Diseases Outbreak

144. The management of the FMD epidemic was considered by several of our witnesses to have been better handled in Scotland than in England. This is borne out, at least in part, by its shorter duration – three months compared with over seven – and by its successful containment to the two Council areas of Dumfries and Galloway and the Borders. Furthermore, there was never the serious backlog in disposing of animal carcasses that became a problem in parts of England. It is important to recognise, however, that there was also an element of luck in that animals from the Longtown market had not spread the disease to other parts of Scotland. We also heard good accounts of many of those who had been involved in handling this epidemic. It is important to recognise that there were many dedicated people who worked extremely long hours in very difficult conditions and undertook tasks well beyond their normal responsibilities. They contributed very significantly to the control of the outbreak in Scotland.

145. However, evidence has been presented to us indicating that the management of the outbreak was not without its problems. A lack of preparedness, including a lack of knowledge of the recommendations of the Northumberland Inquiry and the EU Regulations on Contingency Planning, exacerbated these problems. We deal with contingency planning more specifically in the next Section. In this Section we deal with some of the specific issues raised with us about the management of the outbreak in Scotland.

146. These include the overly selective way in which government took advice from experts, and the GB role of the Minister responsible for animal health and disease control in Scotland; the paucity of SVS staff veterinarians available to manage the control of the outbreak in Scotland; concerns about veterinarians with insufficient experience and some who had difficulties with the language; concerns about delays and consistency in decision-making, communication with DEFRA at Page Street, London, and the degree of autonomy available to the SVS in Scotland; animal welfare issues related to slaughter and animal movement restrictions; concerns about carcass disposal and management protocols, and procedures for valuing destroyed livestock and compensation payments; and the difficulties encountered in managing access to the countryside. It is clear to us that these are all important issues to address in attempting to improve the management of any future FMD outbreak in Scotland.

Advice to Government

147. To bring an FMD epidemic, such as that encountered in 2001, to an end requires advice to Government both in formulating policy and on the actions necessary to bring the epidemic under control. This advice requires to be obtained in ways that the public can trust. In particular, the public and those on whom the policies will have most impact need to have confidence that the advice on which policy is based is informed by the latest developments in science, and that all views and opinions that are relevant have been taken into account. Some of those from whom we took evidence were clearly of the opinion that this was not the case in the 2001 epidemic. It has been put to us (41) that, in seeking advice, Government was selective in the experts it consulted. In particular a number of experienced people who were in a position to provide advice, on diagnostic tests and the latest developments in vaccines, were not called to do so.

148. The extent to which this was a contributory factor in eroding confidence in the decisions made by Government is impossible to say. But that it was an issue at all, shows that it is all the more important to follow the guidance given by the Office of Science and Technology in its Code of Practice for Scientific Advisory Committees (42). The Chief Scientific Advisor to the Government and others in Government Departments consulted a number of experts, notably on the epidemiological modelling on which the contiguous cull was based. In this respect the principles that underpin the Code of Practice are relevant.

149. The Scottish Minister, in so far as his/her responsibilities are affected, should have access to the same information as colleagues at Westminster, though with freedom to make his/her own assessment. Machinery should exist for the Scottish Minister to be involved in discussion with other Ministers before a particular policy is decided upon. In the context of a disease epidemic affecting the whole of the UK, Ministerial accountability to the Scottish Parliament requires a form of self-governance that is flexible enough to take full account of the responsibilities of the devolved administration and one that allows it to act accordingly. This is particularly so in relation to the Scottish Executive's and Minister's relationship with the SVS and their access to advice given to UK Ministers, as well as the advice taken from their own scientific advisers in Scotland.

150. We recommend that the role of the Scottish Minister be integral to UK decision-making and that he should have access to advice in accordance with his specific accountability to the Scottish Parliament for animal health and disease control.

The State Veterinary Service and the Chief Veterinary Officer in Scotland

151. In Scotland, the Minister for the Environment and Rural Development is responsible for animal health matters, including disease control; and he is accountable to the Scottish Parliament. The SVS, however, is a GB service funded entirely by DEFRA; and the Assistant Chief Veterinary Officer (ACVO) in Scotland, who has delegated authority to advise Scottish Ministers, is formally under the line management of the Chief Veterinary Officer in London. We do not consider this to be either satisfactory or necessary. Indeed it seems to us an anomaly: we do not see how the Scottish Minister can properly be held accountable if his most senior veterinary officer is answerable elsewhere and he does not have responsibility for funding the staff.

152. We recognise the importance of ensuring that there is consistency of approach between policies pursued in Scotland and other parts of the UK, but believe that this can be achieved through the normal machinery for consultation and cooperation, just as it is in matters relating to human health. We see no reason to seek a separate SVS for Scotland; devolution has not required a separate civil service and we see considerable advantage both for the experience gained and for the career progression of able officers if it remains a single service with opportunities of cross posting. But we do consider that the Scottish Minister cannot have responsibility for managing and deploying the SVS in Scotland without also taking responsibility for its funding.

153. We therefore recommend that a post of Chief Veterinary Officer (Scotland) be created with direct responsibility for all aspects of veterinary matters, including the eradication of FMD; and that nationally agreed control measures (including relevant protocols) should be devolved within the context of a Scottish Contingency Plan with responsibility being invested in the Chief Veterinary Officer (Scotland).

154. We also recommend that appropriate funding for the State Veterinary Service in Scotland should become the responsibility of SEERAD, with a transfer of funding made from DEFRA.

155. The Concordat between DEFRA and SEERAD should be reviewed to redefine the responsibilities of the CVO (Scotland) who should be part of a GB group to review research, laboratory facilities, analytical requirements and common protocols relevant to the SEERAD and DEFRA contingency plans and additionally be involved in all aspects of planning at a GB and EU level.

156. During the 2001 outbreak, decisions relating to stamping out on Infected Premises (IP) required approval from DEFRA, Page Street, London. This led to unacceptable delays, inconsistent decisions and considerable frustration on the part of experienced and competent veterinarians in the field, as well as delaying the implementation of control measures. In the earlier days of the epidemic we were told that advice from Page Street was generally cautious, requiring further evidence of clinical signs before approving slaughter, and thereby risking the spread of the disease. Later on the advice was to slaughter immediately, even when the clinical signs described by the local veterinarian were far from clear, thereby leading to slaughter on suspicion of some animals that were probably not infected at all. Both situations are clearly unsatisfactory. We acknowledge that the best answer to this is an improvement in the diagnostic tests available and we cover this in paragraphs 57-60 of the report. Nevertheless we also see great advantage in shorter lines of communication and devolution of this responsibility.

157. The SVS is responsible for the control and eradication of outbreaks of notifiable endemic and exotic disease in livestock. Many respondents, and not only veterinarians, expressed concern at the serious depletion in the numbers of personnel in the SVS over the years since the last FMD outbreak in 1967-68. For example, the numbers of veterinary qualified staff in the field service declined in Great Britain from 276 in 1968 to 220 in 2001, *i.e.* by approximately 20%.

158. Precise figures for the Scottish arm of the service over a similar period could not be obtained, but the percentage drop is unlikely to be different. At the time of the first FMD case on 1 March 2001 they numbered 51.5 full time staff (*i.e.* full time equivalents), many of whom were on duty in England dealing with FMD outbreaks. At present the staffing level of the field service in Scotland is 54, including some part time employees, in addition there are seven veterinarians on short fixed term contracts. This number takes account of the much greater importance of livestock in Scotland's agriculture. It nevertheless contrasts with Northern Ireland, which has 124 veterinary qualified staff in their service, including those involved in meat hygiene work. The annual pay budget for the Scottish SVS and animal health administration is approximately £6 million, whereas in Northern Ireland it is £22 million, although this is not directly equivalent as it includes the cost of staff dedicated to meat hygiene.

159. However, the 20% drop in numbers of field staff conceals the fact that much of this reduction occurred in senior and middle management. For example, in Scotland in 1968 there were three Regional and 19 Divisional Offices whereas at present there is one Regional Office and only five Divisional Offices. The cut in staff managing these offices is worrying, as the Divisional Veterinary Managers are the people who are most knowledgeable about local communities both as regards land topography and the people and their livestock. There has also been a substantial reduction in the staffing levels at Headquarters in Edinburgh and this is an unsatisfactory situation if the SVS has to deal promptly with future FMD outbreaks or other major diseases.

160. We think it unlikely that the Government will increase significantly the cadre of SVS veterinarians throughout the UK and we do not wish to argue for an SVS permanently staffed at levels required to cope with a major epidemic, when hopefully such a situation will be a rare occurrence. But a means must be found to supplement the core SVS with a well-trained task force able and ready to meet a crisis when it occurs. This group, which we liken to a Territorial Veterinary Army, must be available for rapid deployment in an emergency; it would be separate from arrangements at present in place for Local Veterinary Inspectors (LVIs). The new body, possibly designated as Reserve Veterinary Inspectors (RVI), should be recruited from private practices, departments at universities (including clinicians, epidemiologists and infectious disease experts), research institutes and the Scottish Agricultural College.

161. The proposed RVIs would be required to undertake regular and intensive contingency training and this should be given much greater priority than anything that has been done hitherto. It should include not only veterinary aspects, such as the recognition and diagnosis of the disease, culling, disposal, vaccination and biosecurity etc, but also a comprehensive understanding of all elements of the Contingency Plan, complete with the latest revisions, and the role of all operational stakeholders. In addition they need to have guidance on how to deal with farmers and the wider community in a diplomatic, sympathetic and sensitive manner, an aspect which was occasionally deficient during the 2001 outbreak.

162. Those involved in this RVI scheme should be paid an adequate retainer to encourage them to participate. The numbers required would have to be worked out with the SVS in Scotland and SEERAD, but it should be noted that there were 200 TVIs at the height of the 2001 FMD outbreak. The interaction between the proposed task force and the SVS would have considerable benefits not only for the control of disease in the field, but also for the two-way exchange of scientific information which will be useful in the training of veterinary undergraduates and may also stimulate recruitment to the SVS.

163. We therefore recommend that SVS and SEERAD establish a body of contracted veterinary surgeons, RVIs external to the SVS, that would be on stand-by for the control of any future FMD outbreaks or any other major disease outbreak. All those participating as RVIs should be paid a retainer on the understanding that they would be immediately available in the event of an emergency.

Carcass Disposal

164. During the course of the FMD outbreak in Scotland there was a need to dispose of almost 1.0 million (see Appendix 3) carcasses resulting from the Government's slaughter policy. The disposal of these carcasses was the responsibility of the State Veterinary Service (SVS) and SEERAD. In addition, there was a need to arrange for the disposal of almost 262,000 stock arising from the Livestock Welfare Disposal Scheme and a further number from the Light Lamb Scheme. The Intervention Board administered these schemes (43). Carcasses arising from the slaughter of animals on infected premises and dangerous contacts were predominantly burned while those from pre-emptive and contiguous culls were buried. Carcasses arising from the Welfare Scheme were predominantly processed through rendering plants. We believe that, if this report's recommendations are adopted, especially on vaccination, there will never be a need to dispose of so many animals again. Nevertheless, it is necessary to consider what the strategy should be.

Consequential Impacts

165. There were a number of consequences which arose from carcass disposal. The first, was the psychological effect on farmers and their families, of the whole scale slaughter and loss of the livestock they had bred and reared. Second, was the impact on the public (both in the UK and abroad) of the repeated televised pictures and press photographs of the burning pyres of carcasses on infected premises, leading to indirect negative impacts on the tourist industry in Scotland. Then third, were the direct environmental impacts of the pyres and burial sites on air, water and the soil, and their potential impacts on human health.

166. On the advice of SEPA, burning was initially used as the disposal method, as opposed to burial, to protect the vulnerable aquifers (drinking water sources) in Dumfries and Galloway from contamination. However, the use of pyres gave rise to the potential pollution of air by generating several toxic chemicals¹. Dioxins were the main concern although considered to be of low immediate risk. There was, however, concern for the longer-term impact from deposition on soil and vegetation. Analyses by the Food Standard Agency of foodstuffs, soils and herbage were undertaken and advice on food preparation and grazing of animals downwind of pyres was provided (44). The disposal of ash from the pyres constituted a risk of leaching into water supplies. To avoid such contamination sites were located as far away as possible from watercourses. Following rigorous and independent analysis and assessment², the ash from these sites was transported and buried in an engineered, lined landfill site licensed to receive controlled waste.

¹Sulphur dioxide, nitrogen oxide, carbon monoxide, hydrogen chloride, dioxins and polycyclic aromatic hydrocarbon (PAH) compounds.

²There was deemed to be no risk of the FMD surviving, due to the high temperature and burn efficiency achieved. The risk of BSE prions existing in ash was deemed imperceptible, given the low incidence of BSE in the region. The Spongiform Encephalopathy Advisory Committee (SEAC) endorsed burial in a licensed, engineered landfill site as the most practical safe disposal option. See correspondence between Ross Finnie MSP, Minister SEERAD, and John McAllion MSP (10 January 2002) received via The Scottish Parliament's Public Petition's Committee.

167. The introduction of the pre-emptive and contiguous culls generated large numbers of carcasses and a massive carcass disposal problem. While rendering was always a preferred method, the plants did not have the capacity to deal with the large numbers involved. SEERAD concluded that an extension of large-scale pyre burning could not be used, in part, because concerns were growing about impacts on human health (45). Burial became the chosen option but the potential impact of such an approach on water supplies and the leaching of micro-organisms and other products of decomposition was a major concern. The identification of the mass burial site at Birkshaw Forest, south east of Lockerbie, therefore, was crucial to the implementation of the contiguous cull policy in Scotland.

Issues Arising

168. The SVS had the statutory responsibility for arranging the slaughter of animals and their disposal. Two major issues arose: the safe disposal of carcasses with respect to the environment and human health; and the logistical handling of large numbers of carcasses following the decision to carry out pre-emptive and contiguous culls. The latter was beyond the resources of the SVS and was resolved by calling in the Army who worked in partnership with the SVS. The Army's expertise in logistics, co-ordination and the provision of leadership were decisive elements in effectively completing the pre-emptive and contiguous culls.

169. It was not until 24th April that the Department of Health issued guidance on a disposal hierarchy, recommending that rendering should be the first option followed by burning then burial. The SVS had operated on that basis from late March (46). Burning has, however, been criticised by a number of those giving evidence. It is claimed that there are risks of transfer of infection on smoke particles through the air. The UK Meteorological Office, Pirbright and MAFF have investigated this (47) and found no basis for the claim. As has been indicated, there are also respiratory and toxic risks to human health. The most vehement objections arose from the public who found this method both horrific to see and offensive to their understanding of how a civilised society should act. Burning as a method of disposal should be avoided in the future except where there is absolutely no alternative.

170. The priorities for disposal must be conditional on meeting stringent criteria. **We, therefore, recommend the following priorities:**

- **rendering plants should be considered as the first option, but only where the transfer of carcasses can be guaranteed to be within sealed containers to minimise the risk of the transferring infection to other premises and stringent disinfecting regimes applied to transport used.**
- **Burial on site should be used where there is inadequate rendering capacity provided there are no risks to water resources.**
- **Burning should be used only as a last resort.**

The same disposal priorities should be used for carcasses arising from pre-emptive culls should they be implemented; but, where mass burial sites are used, the same rigorous conditions for the transfer of carcasses that we make for rendering plants should also apply to transfer to mass burial sites.

171. The potential environmental impact of the disposal methods available to the SVS, particularly on water sources, required the assistance and co-operation of the regulatory authority, the Scottish Environment Protection Agency (SEPA). SEPA's role during the crisis was to ensure that the quality of Scotland's environment was protected. It was agreed at the outset that SEPA would act in support of the SVS and SEERAD in this role. It did not seek to regulate the activities of the SVS in carrying out its duties nor did it seek to fulfil the statutory obligations of other organisations (48). In effect, SEPA, with the assistance of the

British Geological Survey (BGS), advised the SVS and SEERAD on the suitability of sites for burning and burial by undertaking risk assessment on a day-by-day basis. This did not preclude, however, SEPA threatening to serve a notice under the Groundwater Regulations (1998) to prevent burial on at least four locations based on such advice (49). SEPA had an important role in assisting SEERAD in locating and assessing the mass burial site at Birkshaw Forest.

172. SEPA did not have regulatory authority over smoke emissions from pyres. This was a matter for local authority control. Dumfries and Galloway Council undertook air quality monitoring and a report is available (50). That air pollution was a significant concern undoubtedly influenced decision-making towards the use of mass burial on suitable sites. In future, if burning is to be used as a method of disposal it would be preferable if one authority undertook the risk assessment analysis for the placement of such sites. Since SEPA has the capacity to assess risk to water, soil and air (it has regulatory responsibility for the control of industrial emissions) it would make sense to make SEPA responsible for risk assessment of disposal sites overall.

173. The identification of sites for burial and undertaking risk assessment was a major issue for which there appears to have been little preparation prior to the outbreak. Although a Memorandum of Understanding between SEPA and the SVS had been agreed in November 2000 this only covered forward communications and guidance on notifiable diseases. It was not until 5th April 2001 that a memorandum was issued setting out the arrangements within SEPA for co-ordination and management during the course of the outbreak. Neither the SVS nor SEPA had a formalised contingency plan or established policy and guidance for dealing with such an eventuality as the disposal of large numbers of carcasses quickly and safely (51). SEPA were not an integral part of the overall co-ordinating team meeting regularly with SEERAD. **We recommend that SEPA's role in protecting the environment is properly incorporated into contingency planning and the management of the emergency at the highest level.**

174. During the course of the outbreak every potential burial site had to have an individual risk assessment carried out before it could be used. Applying data from various sources, including BGS, SEPA used the recommendations contained in the Prevention of Environmental Pollution From Agricultural Activity (PEPFAA) Code of Good Practice as a process for locating burial sites in combination with its Groundwater Regulations (1998) Procedural Manual. This had to be done at very short notice. Although there appears to have been excellent co-operation between SEPA, BGS and the SVS, the lack of pre-planning and, in some cases, shortage of information, was not helpful in facilitating an efficient and calm management response. However, SEPA has also pointed out that the PEPFAA Code only gives guidance on how to deal with fallen stock (52): there is also pending legislation that is likely to be introduced in the first half of 2003 which will prohibit burial or burning on farms. Thus while we have made recommendations regarding carcass disposal within existing legislation as we understand it, we would expect any new legislation to take account of the exceptional circumstances of the kind that were encountered during the FMD outbreak of 2001. Any new legislation will need to include provision for notifiable disease outbreaks: in addition, farmers should be encouraged to assist SEERAD and SEPA in assessing sites for future carcass disposal on their farms as part of their contribution to contingency planning.

175. Good quality information is required to assess objectively the risk of contamination of groundwater (53) from potential burial sites. BGS hold much of the geological information required, other information is held by SEPA, Scottish Natural Heritage, and the Macaulay Institute. It should not be difficult to co-ordinate the use of these data to identify potential burial sites using GIS linked datasets to improve the decision making process. Much of the data has been obtained through Government funding and should continue to be made readily available for such emergencies. There is considerable scope for collaborative modelling and risk assessment by the data holders and others. **We recommend that the Scottish Executive, in consultation with relevant bodies, should give priority to identifying large burial sites throughout Scotland.**

176. However, BGS, in responding to requests for information on 36 sites in Scotland, also highlighted deficiencies in the geological knowledge of Scotland particularly in the areas of quaternary science and the solid geological mapping of the eastern Border region. The BGS responses were in part based upon very old data and in some places no data at all. Over the next ten years, BGS plan to complete the geological re-survey to a modern baseline standard, adequate for environmental resource assessment in Scotland. The Scottish Executive should use its powers to speed up this process by re-prioritising the work programme of BGS in Scotland. In addition, to provide additional data, action should be taken to extend the legislative requirement to ensure that all data from excavations and bore holes (*i.e.* those <15m) are captured and stored in the National Geoscience Data Archive.

177. Having established burial sites and used them is not the end of the story. It is well appreciated by the authorities that continued monitoring and inspection, particularly of the large burial sites, in relation to the fate of gases and leachate will be required. It will be important that sufficient resources are allocated to ensure that this is done. The confidence of the public in the Executive's and its Agency's ability to ensure the continued safety of these sites must not be jeopardised.

Animal Welfare

178. Animal welfare became an issue on two counts during the course of controlling the outbreak. The first concerned the arrangements during the slaughter of animals; the second arose because of animal movement restrictions.

179. In Scotland, the SVS ensured that there was veterinary supervision on all premises where slaughter was in progress: this included premises subject to pre-emptive or contiguous cull procedures. However, observations about poor or inadequate handling facilities, excessive haste, and 'piece-rate' working by slaughter men are aspects that need to be considered in designing contingency plans for the future. Slaughter men should not be employed on 'piece-rate' but rather paid on a basis that ensures their full commitment to the task in hand under the full authority of the veterinary officer in charge. The inquiry supports the recommendations of the Farm Animal Welfare Council (FAWC) (54). The organisational principles of large-scale killing under field conditions should be defined and used to set out the operational guidelines and training for those having to set up and implement procedures on farms having widely different facilities.

180. Restriction on animal movements that were put in place at the beginning of the outbreak, despite being progressively relaxed as the disease was brought under control and in areas that were considered to be less at risk, brought with it serious concerns about animal welfare. These arose because in some circumstances farmers were unable to move stock to fresh pasture, and/or were unable to provide conserved fodder. The Livestock Welfare Disposal Scheme was introduced to slaughter animals whose welfare problems could not be resolved by any other means (43). This was a drastic measure and the Inquiry agrees with the FAWC (55) that 'the destruction of healthy breeding stock and unfinished animals should be regarded as a last resort'. In future, movement restrictions need to take account of the dispersed nature of land that now constitute farm holdings and the implications of this for the provision of fodder and the welfare of livestock.

Compensation

181. Part 3(2) of Schedule 3 of the Animal Health Act 1981 requires the Minister to pay compensation in respect of slaughtered animals. Section 34(7) of the Act states that Ministers may make such orders as they think fit for prescribing the mode of ascertainment of value of an animal slaughtered or liable to be slaughtered, whether a commercial or breeding stock. During the recent outbreak four Orders relating to FMD were introduced. The procedures for valuing livestock destroyed therefore varied from time to time over the course of the FMD outbreak, which led to considerable confusion amongst farmers and valuers.

Where animals were slaughtered before 22 March, the procedures which were to be followed were set out in the 1959 Disease of Animals (Ascertainment of Value) Order. This provides for individual valuation to ascertain the compensation to be paid, and for appeals to be considered if notification of disputed valuation was submitted within 14 days of receipt of the original valuation.

183. This was replaced on 22 March by the Foot and Mouth Disease (Ascertainment of Value) (Scotland) Order, which introduced standard values and did not permit any arbitration procedures. The owner or keeper of the livestock was given the choice of electing for the standard values or for an individual valuation.

184. These procedures were changed again very shortly afterwards, on 30 March, by a further Order which re-instated a similar procedure to that in the 1959 Order. This had the effect of allowing either standard values or an individual valuation to be used; and for the latter, set out arrangements for an appeals mechanism. Insufficient guidance on valuation procedures and the successive changes were sent to valuers and farmers: for example on whether the animals should be valued individually or collectively and whether direct support payments were to be included in the valuation.

185. Standard valuations were apparently introduced to speed up the slaughter process. However, in most cases farmers still had their stock valued. The procedure created discrepancies for those stock slaughtered before standard valuations and below these values. The 14-day appeal period was too short, given the emotional distress of the situation and the constraints put on the movement of people on and off the farm to seek advice. There were substantial delays in the payment of many compensation claims for livestock destroyed. DEFRA, which was responsible for compensation in Scotland, had insufficient resources to deal with the payments. Additional staff was seconded at a late stage, which helped alleviate the problem, but many farmers were aggrieved that interest was not paid on delayed payments.

186. As the outbreak progressed there was a gradual rise in the level of livestock valuations. This was principally due to the increase in livestock slaughtered and therefore the expectation of increased costs for restocking. This was identified in the Northumberland Report on the 1967/68 outbreak and appendix IV in the second part of that report proposes an indexing system for valuations when it appears an outbreak is likely to be protracted (56).

187. The Report suggested that the date at which normal trading is ceased should be set as the index date. All subsequent valuations would then be set at the values on the index date. When normal trading is resumed, a panel of senior valuers would advise Government of a series of index figures for defined classes of livestock (both commercial and breeding) at various dates during the period of the outbreak. The final compensation paid would then be based on these index figures, incorporating the date on which the farm was able to restock. The Committee support this approach.

Items Destroyed

188. Part II, Section 36 in the Animal Health Act 1981 states that compensation will be paid for items seized to prevent the spread of Foot and Mouth Disease at their value at the time of seizure. However, there have been inconsistencies between farms as to what items have been compensated for and the amount of compensation paid.

Cleansing and Disinfection

189. Internal DEFRA guidance on cleansing and disinfection, “that any damage to property (*e.g.* to a farm building or to a farm track) during the course of cleansing and disinfection must be made good.” However, this advice was not communicated directly to farmers and there are instances when advice to farmers from cleansing and disinfection officials was contrary to this guidance.

190. Under the Foot and Mouth Disease Order 1983, the Minister has no statutory authority either to require the occupier to undertake repair work or to require the occupier to pay for such repair work. The FMD Order makes no provision for the Minister to pay for such work, although in exceptional circumstances *ex gratia* payments may be paid. There are examples of farms advised verbally to carry out repair work for cleansing and disinfection and that the cost would be met. However, when cleansing and disinfection claims were submitted the work was not compensated for.

191. We recommend that a clear strategy for dealing with the valuation process should be in place and a current list of competent valuers held by SEERAD. An annual review should also be considered to establish stock values and those values should be adhered to throughout any future outbreak.

Access to the Countryside

192. Inevitably there is bound to be conflict between measures to reduce to the minimum the spread of the disease and keeping the countryside open to the public to minimise the damage to tourism and other rural businesses. In 2001 the countryside was closed to start with and warnings given to the public to keep off paths and farmland and to avoid contact with any animals. When it became apparent how much damage this would do to the rural economy and that the risk primarily related to areas affected by the disease, efforts were made to open the countryside again in non-affected areas. The National Trust for Scotland, together with other bodies concerned with the countryside, took the lead with the Comeback Code in trying to encourage the public to return to the countryside for recreation and leisure activities. Unfortunately this was not fully effective. Landowners, farmers and crofters remained understandably nervous that people crossing their land, even on recognised footpaths, might bring infection from areas that had the disease. For the most part the public respected the anxiety of farmers.

193. It is not easy to resolve this problem. Landowners and farmers, unless they have a tourism enterprise themselves, have nothing to gain by permitting access and taking a risk, however small. Yet if access continues to be restricted, even after official restrictions are lifted, the damage to tourism and other rural activities is likely to be serious.

194. If in future, as previous sections of this report recommend, an FMD outbreak is dealt with by slaughtering only infected animals and using emergency ring or barrier vaccination, the amount of virus would be greatly reduced and much less likely to be spread inadvertently. Access to areas where vaccination has been carried out would not pose a threat and the risk from spreading infection to non-infected areas outside the vaccination ring would be greatly reduced compared with the situation in 2001.

195. Nevertheless there may be a problem in the initial stages of disease before its origin and extent are properly known. If the outbreak is an isolated case and its origin immediately apparent, as it was in the Isle of Wight in 1981, there would be no need to close the countryside except in the affected area. But if, as in 2001, it takes some time to establish the index case and how widely it has spread, we see no alternative to a general closure of the countryside, until its extent is established. An immediate ban on animal movements should ensure that the disease was much less widespread than in 2001 and with improved traceability its spread should be established quickly. This should enable the greater part of the countryside to be reopened before the end of the three weeks.

196. The problem in 2001 was that once closure of the countryside was imposed, attempts to reopen it, even in non-affected areas, were not fully effective. We believe that this would be much less likely to happen if it was made clear from the start that the closure was for a finite period in areas where there were livestock until the extent of the disease was established. The maximum length of time required for the disease to show itself is three weeks and, as a precaution, we think that general closure should be for this time in the first instance, but with the expectation that improved traceability would enable the restriction to be lifted in most areas in a much shorter period.

197. We suggest that a designated zoning system is used to indicate risk and in zones where risk is considered to be low or very low all normal economic activity would resume. Elsewhere, even in a controlled zone, activities such as forestry work, sporting and fishing could continue but would be subject to approval.

198. We therefore recommend that in the event of an outbreak, unless its origin and spread are immediately apparent, the countryside should be closed for a limited period of three weeks at the same time as the animal movement ban is announced; but that, as soon as the extent of the disease is determined, the closure should be lifted in non-affected areas.

199. We further suggest that, while an epidemic continues, people using the countryside in areas that have been opened should abide by the normal rules:

- Avoid all contact with animals.
- Do not feed animals (the disease risk from leftover sandwiches should be highlighted).
- Before entering agricultural property ensure footwear and clothing is clean.
- Avoid/minimise vehicle contact.
- Observe and respect signposting.
- Close all gates and keep to recognised rights of way.

V Contingency Planning

200. As we pointed out earlier, views were widely expressed both in interviews and in submissions made to us that such GB contingency plans as existed were poorly integrated and inadequate to cope with an FMD epidemic on such an unprecedented scale. In Scotland SVS have assured us that they had their own plans but others giving evidence questioned their adequacy. Certainly many of those who were affected were not party to such plans and were even ignorant of their existence. After the outbreak struck, SEERAD developed an organisational structure (Appendix 8) which established links between all major stakeholders; but despite the responsiveness of many of those involved, many weaknesses have been revealed at the national, regional and local levels, which could have been avoided if those responsible had been more prepared.

201. The United Kingdom is bound by OIE and EU regulations to control FMD. (These are listed in Appendix 4 for international regulations and Appendix 6 for UK and devolved legislation). It is vital that both the European Commission and the UK Government regularly undertake risk assessment to update their contingency plans. This should be based on global information about the spread of diseases such as FMD and use comprehensive epidemiological evidence employing all appropriate techniques, including modelling.

202. While the OIE has succeeded in monitoring and reporting outbreaks of FMD throughout the world, recording the spread of type O strain from Asia in recent years, they have not effectively and timeously developed strategies for its control. Within Europe, FMD is recognised as one of the most economically damaging diseases of livestock; yet the funding for research and development in this area has been low and poorly integrated. One of the main problems in using vaccination during the UK 2001 FMD crisis centred on the OIE rules concerning restriction of trade if livestock are vaccinated and not subsequently slaughtered. This simply demonstrates the need for rules and legislation to keep pace with the developments in science and the need for the European Commission to ensure that policy within Europe is clarified and amended accordingly.

203. From the outset it was evident that although the UK contingency plan had been approved by the EU, it was inadequate to deal with an outbreak of the scale of the 2001 epidemic and insufficient attention had been paid to the recommendations of the Northumberland Report. For example, the need for an adequate number of specially qualified veterinarians in the what is now the SVS; that arrangements should be made to seek assistance from the army at an early stage; the need to liaise with local authorities and other relevant bodies on suitable burial sites in advance of outbreaks; and the need to consider the vaccination of wild cattle and valuable breeding stock.

204. The result was that, despite hard work and long hours on duty on the part of many of those involved, the scale of the outbreak placed an acute demand on SEERAD, the SVS, local authorities and other agencies. For the SVS this was made the more acute because many staff had been transferred to help with the outbreak in England before it struck Scotland. Experienced veterinarians engaged as Temporary Veterinary Inspectors (TVIs), were not always effectively deployed, while some other TVIs were inadequately trained and unable to handle the difficult situation that confronted them.

205. Communication between agencies, with farmers and the wider public was often unsatisfactory, sometimes inconsistent and occasionally unclear. Incompatible IT systems at an operational level led to difficulties. The plans themselves had important omissions and did not adequately involve other stakeholders. For example, the logistical problems associated with the massive cull had not been anticipated and little thought had been given to the effects on other rural activities. This is illustrated by the guidelines on access which did much damage to tourism even after the restrictions were lifted, a problem which had to be addressed through the initiative of non-governmental agencies.

Issues to be Covered in Contingency Plans

206. Several issues arise from this analysis. It is clear that the United Kingdom, and therefore the Scottish Parliament, has specific responsibilities in terms of contingency planning that must be fulfilled in relation to OIE and EU regulations. These must be met more effectively in the future and linked to an effective import control, biosecurity, surveillance, diagnosis and testing strategy (see paragraphs 53-66, 129-143). There must also be clear understanding and transparency in the arrangements as they apply to GB as a whole, to the devolved administrations separately and to the local authorities within their areas.

207. Moreover, there are implications for all stakeholders, not simply Government and those in the public sector. Farmers, landowners, auctioneers and all who have specific interests in the land and the rural economy require to be aware of the potential risk that an epidemic such as that encountered in 2001 could have on their activities and businesses. All stakeholders have a responsibility to ensure that they have thought through the implications of an epidemic and have made such contingency plans as they can. Contingency planning and communication should be a partnered responsibility and therefore requires consultation and co-ordination at all levels. We believe that while contingency plans have to be set in the context of EU regulation, and the OIE, and focus primarily on the control and elimination of FMD, they must also address the potential disruptive impacts on other rural industries and the public's interests (see paragraphs 41-43).

208. Crucially the plan must:

- be clear about how resources can be readily marshalled and put quickly into place;
- delineate the essential pre-planning activities that require to be undertaken prior to a disease outbreak (*e.g.* vaccine supply and storage (paragraphs 105,122), biosecurity, animal movement and traceability (paragraphs 74, 78-80, 143), access (paragraphs 192-198), compensation and valuation (paragraphs 181-191), and carcass burial sites (paragraphs 170 and 175));
- it should set out an unambiguous and transparent set of action plans (or protocols as suggested in the DEFRA Contingency Plan) to deal with the immediate response to an outbreak (*e.g.* paragraphs 74, 122, and 163) including carcass disposal method (see paragraph 170);
- it should set out the protocols whereby alternative options can be considered and implemented once a clear understanding of the nature and virulence of the disease has been established;
- these protocols should inform the continuing management and control of the disease, the management of animal movement, and public access to the countryside; and the protocols should be evidence based but should invoke the 'precautionary principle' where the science base is weak.

209. The contingency plan should also include arrangements for considering and analysing the impact of an outbreak not only on agriculture but on other rural sectors and beyond. It should:

- outline ways in which recovery can be assisted and implemented as soon as practicable;
- lay out the arrangements and protocols for unequivocal lines of communication to the stakeholders involved and to the public;

- contingency plans should be monitored, updated and developed on a continuing basis and engage and involve the relevant stakeholders in this process; and
- contingency plans should be supported by relevant research (see paragraphs 62, 124-128) and respond to new information and incorporate new control strategies as they emerge.

At the GB Level – Strategy

210. At the national (GB) level contingency planning needs to be strategic and comprehensive so that it can deal with outbreaks whether they are large or small. This should enable rapid tactical decisions to be taken as soon as an FMD outbreak occurs. The SVS should identify those policies and protocols which are required to implement all EU and UK legislation. This will include an immediate ban on animal movement, the destruction of infected stock and decisions on the application of culling and vaccination. Thereafter we consider that responsibility for all operational procedures for FMD eradication in Scotland should lie with the Scottish Minister responsible and the CVO (Scotland) and should be followed in accordance with the contingency plan drawn up by SEERAD.

– Links with SEERAD

211. The DEFRA Interim Foot and Mouth Contingency Plan proposes a National Disease Emergency Control Centre (DECC) to be based in Page Street, London. Given a clear national strategic plan, we see no justification for the role of the DECC to extend to Scotland, since a similar arrangement to control the implementation of eradication procedures could be integral to a SVS/SEERAD Contingency Plan. There is much to be gained by having short lines of communication. Indeed, this proved to be effective when much of the decision making process was devolved as the last epidemic progressed. But to ensure national co-ordination of policies, the creation of a Joint Co-ordination Centre as described in the DEFRA Contingency Plan would be valuable.

At the Scottish Level – the CVO and Control Measures

212. The CVO (Scotland) should establish an expert team, comprising virologists, epidemiologists, modellers and practising veterinarians, some of whom may be drawn from universities and research institutes. They would participate with the SVS in analysis of the various options and on tactical control measures. (see paragraphs 74, 122 and 163)

213. Central to the effective management of a FMD outbreak is a rapidly accessible geographical information system. In 2001 it was not possible to get quick access to all of the information on which policy decisions could be based. Using Geographical Information Systems (GIS) technology it is now feasible with data aggregation systems to provide information to meet a range of needs (57). The latter would include maps with farm data, such as boundaries, livestock numbers and category, rivers and other natural boundaries and areas where few or no farm livestock are present, such as deer forests. This information should be used for the control of disease. It would make possible a much better assessment of areas at risk because of proximity to a centre of infection and avoid the approach that was employed in the contiguous cull of 2001. In addition, areas could be clearly delineated where normal economic activity could continue, including recreational access (58).

214. Access to this technology and data provides the means of testing possible scenarios and sensitivity analysis, utilising the most up-to-date epidemiological information and control options. This should be a component of an on-going research and development programme providing insight and intelligence that will allow constant adjustment and development of contingency plans. The output will have implications for the identification of areas of greatest risk, the relevance of FMD regional control boundaries, and their coincidence with administrative boundaries and SVS resources.

215. It is not for us to attempt to set out how the Department's staff should be deployed in the event of an outbreak. But what is essential is that a properly worked out plan should exist showing how this is

to be done. Everyone involved must be clear about their responsibilities; and, where outsiders, such as RVIs, are to be employed, they must be clear about their responsibilities too.

216. We recommend that at least once a year a practice exercise should be undertaken at which there is a mock outbreak at a site not revealed until the start of the exercise. This would require all those involved to act as they would in a real outbreak as a means of testing their effectiveness and the suitability of the organisational structure.

– Socio-economic impacts

217. The management of an outbreak must take account of the wider economic impact of the eradication programme to be adopted. This applies not only to agriculture but also to tourism and to ancillary industries, such as meat and food processing, auction marts, haulage, forestry and a wide range of other rural activities, many of which are linked to agriculture. Representatives of these interests must have a means of making an input into decisions on the control strategy.

218. The social and psychological impact of the last outbreak was acute. While it must be hoped that, if the recommendations in this report are followed, particularly on vaccination, it will be possible to avoid an epidemic of the magnitude of that in 2001, careful thought needs to be given to essential support services. The help-line services established were immensely beneficial, but failure of communication often made them less effective than they could have been. We were impressed by the manner in which Buccleuch Estates, as a large landowner, were pro-active in advising, informing and counselling their tenant farmers. Information and counselling services from NFUS on behalf of their members was highly commendable.

219. We recommend that SEERAD, in association with other stakeholders, such as local authorities, health boards and, where appropriate, the local enterprise companies (LECs), should establish a responsive system to assist members of the rural community to cope with stress, during and following a FMD outbreak.

– Communication

220. Deficiencies in the effectiveness of communication have emerged at all levels. We have already referred to incompatibility in IT systems. This must be rectified with the greatest of urgency to provide comprehensive information and communication with all those who should be involved in an eradication programme. Several comments, verbal and written, were made about poor communication both between agencies and from those handling the outbreak to farmers, to those concerned with tourism and other rural activities and to the general public. This calls for professional skills of a high quality if people are to be properly informed and advised without causing needless alarm.

221. We recommend that a comprehensive review should be undertaken into the most effective means of communication to those concerned in the event of an outbreak and that the appropriate mechanisms be incorporated in the Scottish contingency plan.

At the Local Level – Review

222. All local authorities are required to have plans for tackling an emergency, including one caused by FMD. It was fortunate that the Dumfries and Galloway Council, following the Lockerbie air disaster ten years earlier, had an effective emergency planning system that was well prepared and able to go into immediate action. This, coupled with outstanding leadership from its Convener and Chief Executive, enabled the Council to respond rapidly and efficiently. Many of those who gave evidence to us complimented the Council on what they had done. The Scottish Borders Council, forewarned of the emergency, sought the advice from Dumfries and Galloway and rapidly established a fully operational control centre in one large building. This centre worked well and was praised by many of those involved. Borders staff also merit commendation.

223. We were not able to assess the state of emergency planning in other areas. The truth probably is that it is variable and some other Scottish Councils might have struggled to cope with an FMD emergency with the effectiveness shown in the two Council areas affected. In a submission from Fife Council attention was drawn to the lack of an immediately available national contingency plan and to communication problems with the Scottish Executive about guidelines on biosecurity and access. The Council later undertook a thorough review to update its plans. For some of the smaller Council areas consideration should be given to establishing FMD disease control regions with boundaries which may encompass two or more Councils with a unified emergency plan and designated a control centre.

224. We recommend that the Scottish Executive should review the emergency plans of all Scottish Councils to ensure that they adequately cover the action required in the event of an FMD outbreak; and that all Councils should update their plans, if that has not already been done. Such plans should be reviewed annually in the light of developments in science and consequential changes in policy.

Monitoring

225. To ensure that contingency planning at all levels is kept up to date and takes account of the latest developments, we recommend that the Minister in the Scottish Executive with responsibility for animal health, should establish an independent standing committee to monitor this work and to assess the effectiveness of mock exercises. Members should have the capacity to judge the scientific status and veracity of the plans, the extent and quality of their impact analyses, their administrative effectiveness and the availability of resources.

226. In particular, the Committee should keep under review developments in diagnostic tests, vaccines and associated technology. For mock exercises, account should be taken of the way in which zoning of areas affects normal economic activity, restricting it no more than necessary in controlled zones, where there is a risk, and permitting it elsewhere.

Appendix 1:

Membership of the Royal Society of Edinburgh Foot and Mouth Disease Inquiry

Chair

Professor Ian Cunningham CBE, BSc, PhD *Drhc*, FRSE, FIBiol, FRAGS, HonAssocRCVS, FRSGS: Former Principal, West of Scotland Agricultural College, Ayr; Professor of Agriculture, Glasgow University.

Vice-Chair

Professor Gavin McCrone CB, MA, MSc, PhD, LLD, FRSE: Visiting Professor at University of Edinburgh Management School.

Members

Professor Ian Aitken OBE, BVMS, PhD, DVM&S(*hc*), MRCVS, FIBiol, FRAGS: (from 19/2/2002): Scientific Director, Edinburgh Centre for Rural Research; Former Director, Moredun Research Institute.

Professor Sir James Armour CBE, PhD, FRSE, FRCVS, FMedSci, *Drhc*, HonDVMS, HonDUniv, HonFIBiol: Emeritus Professor of Veterinary Parasitology & Former Dean of Glasgow University Veterinary School and Vice-Principal, University of Glasgow.

Professor Brian Ashcroft BA, MA: Director, Fraser of Allander Institute, University of Strathclyde.

Dr Jean Balfour CBE, BSc(Hons), DSc, FRSE, FICFor, FIBiol, JP: Former Chairman, Countryside Commission for Scotland & Partner, Balbirnie Home Farms.

Mr Ivan Broussine: Chief Executive, Scottish Tourism Forum

Professor Sir David Carter MD, HonDSc, HonLLD, FRSE, FRCSE, FRCS, FRCPSG, FRCPE, HonFACS, HonFRCSI: Vice-Principal, University of Edinburgh & Former Chief Medical Officer, Scottish Executive.

Dr W James Irvine BSc(Hons), MB ChB(Hons), DSc (Edin), FRSE, FRCPE, FRCPath(London), FlnstBiol, FlnstDirectors(London): Farmer and former Consultant Physician, Endocrine Unit/ Immunology Labs (Medicine), Royal Infirmary, Edinburgh.

Dr Barbara Kelly CBE, DL, DipEd, Hon LLD (Strathclyde), (Aberdeen): Partner in farming enterprise near Dumfries; Convenor, Southern Uplands Partnership; past Board Membership, SNH.

Professor Donald JR MacRae BSc (Hons) MBA FCIBS FRAGS: Strategy & Finance Director, Lloyds TSB Scotland. Visiting Professor in Business & Economic Development at the University of Abertay Dundee.

Dr William Martin PhD (Glas), DVM*hc* (Perugia), HonDMed, DVSM, HonDVMS (Edin,Glasgow) FRSE: (14/12/2001-23/1/2002) Former Director, Animal Diseases Research Association, Moredun Research Institute, Edinburgh.

Professor Jeff Maxwell OBE, BSc, PhD (Edin), FRSE, FRSGS: Former Director, Macaulay Land Use Research Institute.

Dr Laura Meagher: Consultant & Senior Partner, Technology Development Group.

Mr David Mitchell: (resigned 27/6/2002) Farmer and Chairman, NFU Scotland Livestock Committee.

Dr Peter Nettleton BVMS, MSc, PhD, MRCVS: Virus Surveillance Unit, Moredun Research Institute, Edinburgh.

Professor Stuart Reid BVMS, PhD, DipIecVPH, FRSE, MRCVS: Professor of Veterinary Informatics and Epidemiology, University of Glasgow Veterinary School and University of Strathclyde.

Dr Robert Sellers MA, ScD (Cantab), BSc, PhD (Edin), FRSE, MRCVS, FIBiol: Former Director, Animal Virus Research Institute, Pirbright, Surrey.

Secretary

Mr Loudon Hamilton CB, MA: Former Secretary, Scottish Office Agriculture and Fisheries Department.

In taking forward the programme of work the main Committee subdivided into two Sub-Committees:

Biological and Disease Control

(Remit: to look at the organism, the disease and methods of control.)

Chairmen

Dr William Martin

Professor Ian Cunningham

Sir James Armour

Dr Jean Balfour

Members

Professor Ian Aitken

Sir David Carter

Dr James Irvine

Dr David Mitchell

Dr Peter Nettleton

Professor Stuart Reid

Dr Robert Sellers

Economic Impact

(Remit: to look at the impact on the economy generally and the impact on tourism.)

Chairman

Professor Gavin McCrone

Members

Dr Brian Ashcroft

Mr Ivan Broussine

Dr Barbara Kelly

Professor Donald MacRae

Professor T J Maxwell

Dr Laura Meagher

Appendix 2:

Oral and written evidence submitted to the Inquiry and visits made

The RSE Foot and Mouth Inquiry heard evidence from 14 December 2001 to 25 April 2002. A list of organisations and individuals that submitted or gave evidence is provided below:

Organisations who submitted written evidence to the Inquiry

Aberdeenshire Council
Advocates for Animals
Aspira
Barwise Aberdeen Angus
British Cattle Veterinary Association
British Llama and Alpaca Association
Buccleuch Estates Limited
CARA Consultants Limited
Dumfries and Galloway Primary Care Research Network
Edinburgh Centre for Rural Research
Farm Animal Welfare Council
Farm Business Steering Group
Fife Council
Micropathology Ltd
National Foot & Mouth Group and Vets for Vaccination
National Trust for Scotland
National Farmers Union Scotland
Ramblers' Association of Scotland
Roxburghe Estates
Royal Highland and Agricultural Society of Scotland
Royal Scottish Agricultural Benevolent Institution
Royal Veterinary College
Royal Zoological Society of Scotland
Scottish Borders Council
Scottish Borders Tourist Board
Scottish Countryside Alliance
Scottish Executive Environment and Rural Affairs Department
Scottish Landowners' Federation
Scottish Natural Heritage
Scottish Parliament Public Petitions Committee
ScotWays
Scottish Environmental Protection Agency
sportscotland
Transscotland Ltd
United Biomedical Inc
University of Newcastle, Centre of Rural Economy

Individuals who submitted written evidence to the Inquiry

Mr W P Allison
Dr A J Beale
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Professor Fred Brown, US Department of Agriculture
Professor Joe Brownlie, Department of Pathology and Infectious Diseases, The Royal Veterinary College
Professor R H Campbell

Dr Sheila Crispin, University of Bristol
Mrs Mary Critchley,
Dr. John R. Crowther, Technical Officer, Joint FAO/IAEA Division, International Atomic Energy Agency; and
Dr Aldo Dekker, Senior scientist, Laboratory vesicular diseases, International Atomic Energy Agency
Mr George D Curran and **Mr Ronan M T Fleming**, Temporary Animal Health Officer, Epidemic Department, Ayr Animal Health Office
Dr Tim Doel, Merial Animal Health Ltd
Dr Alex I Donaldson, Pirbright Laboratory
Dr A J Forman and **Dr Tony Garland**, International Veterinary Consultants
Mr Robert K Graham, RKG Farms
Suzanne Greenhill
Miss L Gwynne
Mr Robert H B Hall
Dr I C Hancock and **Professor D C Ellwood**, Department of Microbiology and Immunology, University of Newcastle
Mr David Hawker, D. H. Ecological Consultancy
Dr Susan Haywood
Professor G J R Hovell
Mr John Hutchison, Director, STILL MOVING picture company
Dr H A P Ingram
Mr G D James
Ms Joanna Kemp
Archy Kirkwood MP and **Michael Moore MP**
Mrs Anne Lambourn
Norman Leslie
Magnus Linklater, Columnist, The Times and Scotland on Sunday
Ms Valerie Lusmore
Mr Henry McCubbin MEP
Dr Dominic Moran, Senior Natural Resource Economist, Scottish Agricultural College
Mr W A Morrison
Ms Helen O'Hare, Veterinary Surgeon
(a & b) Ms Edina Pelvin
Professor Hugh Pennington, Department of Medical Microbiology, University of Aberdeen
Mr K G Peters
Mr Alan Richardson
Mr Fenton F Robb
Mr John Ryan, Veterinary Consultant

Mr David Stanley

Mr C B Strang Steel, Farmer, Galashiels

Dr Keith Sumption, International Animal Health Centre for Tropical Medicine, University of Edinburgh

Paul Sutmoller, Former Chief of Laboratories of the Pan-American Foot and Mouth Disease Centre

Ms Margaret Taylor

Dr Nick Taylor, Department of Agriculture, University of Reading

Mr T W Tennant

Professor Kenneth J Thomson, Department of Agriculture & Forestry, University of Aberdeen

Mr Alfred Ward, World Heritage Golf Links Ltd

Mr D D Wardrope, Local Veterinary Practitioner, Lockerbie

Dr Ruth Watkins, Clinical Epidemiologist

Miss M M K Wheeler

Professor Peter Wilson, Emeritus Professor of Agriculture and Rural Economy, University of Edinburgh

Mr Roger S Windsor, retired veterinarian

Mr W M Wood, Chartered Surveyor

Professor Mark Woolhouse, University of Edinburgh

Organisations and Individuals who gave oral evidence to the Inquiry

52 Lowland Brigade, Brigadier, The Hon. Hugh Monro

52 Lowland Brigade, Major Lindsay McDuff, Chief of Staff

Aberdeen and Northern Mart, Mr Brian Pack , Chief Executive

British Geological Survey, Dr Martin Smith

Programme Manager, Integrated Geoscience Surveys (Northern Britain)

Buccleuch Estates, Mr Michael Clark, Chief Executive

Buccleuch Estates, Mr Richard Williamson, Policy and Communications

Clinical Epidemiologist, Dr Ruth Watkins

Department of Environment and Rural Affairs,

Mr Sam Mansley, Veterinary Officer

Dumfries and Galloway Council, Mr Philip Jones,

Chief Executive

Dumfries and Galloway Council, Mr Andrew Campbell,

Convener

Edinburgh University, Professor Mark Woolhouse,

Epidemiologist

Farm Animal Welfare Council, Dr Judy MacArthur Clark, Chair

Farmer, Galashiels, Mr Colin B Strang Steel

Food Standards Agency, Ms Lydia Wilkie, Assistant Director of Scotland

Former Chief of Laboratories of the Pan-American Foot and Mouth Disease Centre, Dr Paul Sutmoller

Institute of Auctioneers and Appraisers in Scotland,

Mr Robin Anderson, Junior Vice President

Institute of Auctioneers and Appraisers in Scotland,

Mr William Blair, Executive Secretary

Institute of Auctioneers and Appraisers in Scotland,

Mr Hamish McCall, President

International Animal Health Centre for Tropical Medicine,

University of Edinburgh, Dr Keith Sumption

Langholm Estate, Mr Stephen Vickers, Factor

Moredun Research Institute, Dr Hugh Reid, Head of the Division of Virology

National Trust for Scotland, Mr Andrew Bachell

National Trust for Scotland, Mr Roger Smith

NFU Scotland, Mr Jim Walker

Pirbright Laboratory, Dr Alex Donaldson

Pirbright Laboratory, Dr A J M Garland,

Special Adviser, IAH,

Roxburghe Estates, Mr R E Jackson, Factor

Royal Veterinary College, Professor Lance Lanyon, Principal

Scottish Borders Council, Miss Louise Comrie

Scottish Borders Council, Mr Paul Gregory, Director of

Economic Development and Environmental Planning

Scottish Borders Tourist Board, Mr Riddell Graham,

Chief Executive

Scottish Countryside Alliance, Ms Aileen Orr, Regional

Director - East

Scottish Enterprise Borders, Mr Gilbert McBride

Scottish Enterprise Borders, Mr Julian Pace, Director-

Strategy and Planning

Scottish Enterprise Dumfries and Galloway,

Mr Colin Williamson

Scottish Executive Environment and Rural Affairs

Department, Mr David Crawley

Scottish Executive Environment and Rural Affairs

Department, Mr John Graham

Scottish Executive Environment and Rural Affairs

Department, Mr Neil Ritchie, Head, Economics,

Food (Rural Economy) Branch

Scottish Landowners Federation, Mr Robert Balfour

Scottish Natural Heritage, Dr Colin Galbraith,

Chief Scientist

Scottish Environmental Protection Agency,

Mr Rob Morris, Land Unit Manager

Scottish Environmental Protection Agency, South West

Area, Mr Robert Kerr, Deputy Environmental Regulation

and Improvement Manager

State Veterinary Service in Scotland, Mr Graeme

Cochrane, Divisional Veterinary Manager in Ayr

State Veterinary Service in Scotland, Mr Leslie Gardner,

Chief Veterinary Officer

State Veterinary Service in Scotland, Mr Charles Milne,

Veterinary advisor

University of Aberdeen, Department of Agriculture &

Forestry, Professor Kenneth Thomson

University of Aberdeen, Department of Medical Microbiology, Professor T H Pennington, Professor of Bacteriology and Head of Department
University of Edinburgh, Clinical Studies Department, Dr Mike Thrusfield
University of Newcastle, Centre for Rural Economy, Professor Philip Lowe
US Department of Agriculture, Professor Fred Brown
VisitScotland, Dr Brian Hay

Public Meetings

In addition to taking oral evidence at the Royal Society of Edinburgh, the Inquiry held two public meetings (in Dumfries and Galloway and the Borders) to hear views and comments from concerned members of the public. Details of these visits are provided below:

Visit to the Scottish Borders – 26 February 2002

Public meetings were held at Newcastleton Village Hall and in the Council Chamber, Newtown St Boswells. Oral evidence was also heard at the George & Abbotsford Hotel, Melrose, from:

Ian Hogarth, Emergency Centre
Chief Superintendent Watson McAteer
Mr Tom Walker, Head of Operations
Mr John Lafferty, Trading Standards Agency
Mr Keith Robeson, Countryside Rangers
Mr Bob Noble, Local NFU Scotland
Ms Sheila Robertson, Farm business advisor
Norman Oliver, Haulage industry
Mr Rennie Gresham, Veterinary Service
Ms Marion Oates, Tourist Board
Mr Nigel Murray, The Border Union Show Ground
Mr James Leeming, Local rod & line fisheries
Ms Margaret Hindmarsh, Borders Forum for Council of Voluntary Service

Visit to Dumfries – 11/12 March 2002

A public meeting was held at Easterbrook Hall, Dumfries on 11 March 2002. Oral evidence was also heard at Dumfries Council on 11/12 March 2002, from:

Mr Robin Spence, local farmer
Mr Stewart Jamieson, local farmer
Mr Ben Graham, local farmer
Mr Douglas Kerr, local farmer
Mr Alan Stannet, local farmer
Mr John Sproat, local veterinary practitioner, Chairman of BVA (Scotland)
Mr Ian Anderson, Assistant Secretary, Scottish Executive Environment and Rural Affairs Department
Mr Andy Robertson, Chief Agricultural Officer, Scottish Executive Environment and Rural Affairs Department
Mr Donald Biggar, Chairman of Farmers Support Group
Mr John Kilgour, Chairman, local Federation of Small Businesses
Ms Wilma Dunbar, Cream o'Galloway
Mr Alan Rogers, Langholm
Ms Margaret Burton, Dumfries and Galloway Chamber of Commerce
Ms Joan Mitchell, Chair of the Tourist Board
Mr Robertson, local small business
Mr Paul Thomas, Annandale and Eskdale Council Voluntary Services

Appendix 3:

International regulations for the control of Foot and Mouth Disease

Office International des Epizooties (OIE)

The OIE is an intergovernmental organisation created by the International Agreement of 25 January 1924, with the following missions.

- to guarantee the transparency of animal disease status world-wide.
- to collect, analyse and disseminate veterinary scientific information.
- to provide expertise and promote international solidarity for the control of animal diseases.
- to guarantee the sanitary safety of world trade by developing sanitary rules for international trade in animals and animal products.

OIE standards are recognised by the World Trade Organisation as reference international sanitary rules. The following OIE regulations relate to Foot and Mouth Disease at the time of the FMD outbreak in 2001.

Article 2.1.1.2: FMD free country where vaccination is not practised

To be listed in FMD free countries where vaccination is not practised, a country should:

1. Have a record of regular and prompt animal disease reporting;
2. Send a declaration to the OIE that there has been no outbreak of FMD and no vaccination has been carried out for at least 12 months, with documented evidence that an effective system of surveillance is in operation and that all regulatory measures for the prevention and control of FMD have been implemented;
3. Not have imported animals vaccinated against FMD since the cessation of vaccination.

The name of the country will be included in the list only after acceptance of submitted evidence by the OIE.

Article 2.1.1.3: FMD free country where vaccination is practised

To be listed in FMD free countries where vaccination is practised, a country should:

1. Have a record of regular and prompt animal disease reporting;
2. Send a declaration to the OIE that there has been no outbreak of FMD for the past two years, with documented evidence that:
 - a) an effective system of disease surveillance is in operation and that all regulatory measures for the prevention and control of FMD have been implemented, and;
 - b) routine vaccination is carried out for the purpose of the prevention of FMD and that the vaccine used complies with the standards described in the Manual, and
3. Have a system of intensive and frequent surveillance for detection of any viral activity.

The name of the country will be included in the list only after acceptance of submitted evidence by the OIE.

If an FMD free country where vaccination is practised wishes to change its status to FMD free country where vaccination is not practised, a waiting period of 12 months after vaccination has ceased is required.

Article 2.1.1.4: FMD free zone where vaccination is not practised

An FMD free zone where vaccination is not practised can be established in an FMD free country where vaccination is practiced or in a country of which parts are still infected. The free zone is separated from the rest of the country and from neighboring infected countries by a surveillance zone, or physical or geographical barriers and animal health measures which effectively prevent the entry of the virus. A country in which an FMD free zone where vaccination is not practised is to be established should:

1. have a record of regular and prompt animal disease reporting;
2. send a declaration to the OIE that it wishes to establish an FMD free zone where vaccination is not practised, where there has been no outbreak of FMD for the past two years, where no vaccination has been carried out for the past twelve months, and that no vaccinated animal has been introduced into the zone since the cessation of vaccination;
3. supply documented evidence that an effective system of surveillance is in operation in the FMD free zone where vaccination is not practised as well as the surveillance zone if applicable;
4. describe in detail:
 - a) the boundaries of the FMD free zone, and the surveillance zone, where vaccination is not practised,
 - b) the system for preventing the entry of the virus into the FMD free zone, and supply evidence that these are properly supervised and that all regulatory measures for the prevention and control of FMD have been implemented.

The name of the free zone will be included in the list of FMD free zones where vaccination is not practised only after acceptance of submitted evidence by the OIE.

Article 2.1.1.5: FMD free zone where vaccination is practised

An FMD free zone where vaccination is practised can be established in a country with a free zone where vaccination is not practiced or in a country of which parts are still infected. The free zone where vaccination is practiced is separated from the rest of the country and, if relevant, from neighboring infected countries by a buffer zone, or physical or geographical barriers and animal health measures which effectively prevent the entry of the virus. A country in which an FMD free zone where vaccination is practiced is to be established should:

1. have a record of regular and prompt animal disease reporting;
2. send a declaration to the OIE that it wishes to establish an FMD free zone where vaccination is practiced, where there has been no outbreak of FMD for the past two years;
3. supply documented evidence that an effective system of surveillance is in operation in the FMD free zone where vaccination is practised as well as the buffer zone if applicable, that routine vaccination is carried out for the purpose of the prevention of FMD, and that the vaccine used complies with the standards described in the Manual;
4. describe in detail:
 - a) the boundaries of the FMD free zone where vaccination is practised and the buffer zone if applicable,
 - b) the system for preventing the entry of the virus into the FMD free zone, and supply evidence that these are properly supervised, and that all regulatory measures for the prevention and control of FMD have been implemented;
5. have a system of intensive and frequent surveillance for detection of any viral activity in the FMD free zone where vaccination is practised.

The name of the free zone will be included in the list of FMD free zones where vaccination is practiced only after acceptance of submitted evidence by the OIE.

If a country that has an FMD free zone where vaccination is practised wishes to change the status of the zone to FMD free zone where vaccination is not practised, a waiting period of twelve months after vaccination has ceased is required.

Article 2.1.1.6: FMD infected country

An FMD infected country is a country that does not fulfil the requirements for being considered as an FMD free country.

When FMD occurs in an FMD free country or zone where vaccination is not practised, the following waiting periods are required to regain the disease free status:

- a) Three months after the last case, where stamping-out and serological surveillance are applied; or
- b) Three months after the slaughter of the last vaccinated animal where stamping-out, serological surveillance and emergency vaccination are applied.

When FMD occurs in an FMD free country or zone where vaccination is practised, the following waiting periods are required to regain the disease free status:

- a) Twelve months after the last case where stamping-out is applied, or
- b) Two years after the last case without stamping-out, provided that an effective surveillance has been carried out.

Article 2.1.1.7: FMD infected zone

An FMD infected zone is a zone where the infection is present in a country with a free zone where vaccination either is or is not practised. The infected zone should be separated from the free zone either by a surveillance zone, or a buffer zone, or by physical or geographical barriers and animal health measures which effectively prevent the escape of the virus.

Live animals from FMD susceptible species can only leave the infected zone if moved by mechanical transport to the nearest designated abattoir located in the buffer zone or the surveillance zone for immediate slaughter. In the absence of an abattoir in the buffer zone or the surveillance zone, live FMD susceptible animals can be transported to the nearest abattoir in a free zone for immediate slaughter only under the following conditions:

1. no animal in the establishment of origin has shown clinical signs of FMD for at least 30 days prior to movement;
2. the animals were kept in the establishment of origin for at least 3 months prior to movement;
3. FMD has not occurred within a 10 km radius of the establishment of origin for at least 3 months prior to movement;
4. the animals must be transported under the supervision of the Veterinary Authority in a vehicle, which was cleansed and disinfected before loading, directly from the establishment of origin to the abattoir without coming into contact with other susceptible animals;
5. such an abattoir is not export approved;
6. all products obtained from the animals must be considered infected and treated in such a way as to destroy any residual virus; in particular, meat must be processed in conformity with one of the procedures referred to in Article 3.6.2.1.;
7. vehicles and the abattoir must be subjected to thorough cleansing and disinfection immediately after use.

Animals moved into a free zone for other purposes must be taken to a quarantine station under the supervision of the Veterinary Authority. Freedom of infection of these animals must be established by appropriate tests.

European Union

The European Union Commission applies EU wide controls on acute animal diseases which impact on intra-community and international trade. EU legislation concerning the use of vaccination against foot and mouth disease is contained within Article 13 of Council Directive 85/511/EEC Introducing Community Measures for the Control of Foot and Mouth Disease, as amended by 90/423/EEC.

Article 13:

1. Member States shall ensure that:

- the use of foot-and-mouth vaccines is prohibited,
- the manipulation of foot-and-mouth virus for research, diagnosis and/or manufacture of vaccines shall be carried out only in approved establishments and laboratories listed in annex A and B,
- the storage, supply, distribution and sale of foot-and-mouth vaccines on the territory of the community are carried out under official control,
- the establishments and laboratories referred to in the second indent shall be approved only if they fulfil the minimum standards recommended by the FAO for laboratories working on foot and mouth viruses *in vitro* and *in vivo*.

2. Veterinary experts from the Commission, in collaboration with the competent authorities of the Member States, shall carry out spot checks to ascertain whether the security systems applied in the establishments and laboratories referred to in annexes A and B comply with the FAO's minimum standards.

The Commission shall carry out these checks at least once a year, the first of these checks being due before 1 January 1992, and shall submit, also before that date, an initial report to the standing veterinary committee. The list of establishments and laboratories in annexes A and B may be reviewed in the light of these checks by the Commission, in accordance with the procedure referred to in Article 17, by 31 December 1991. The list will be regularly updated in accordance with the same procedure. In accordance with the same procedure, a decision may be taken to adopt a uniform code of good conduct for the security systems applied in the establishments and laboratories listed in annexes A and B.

3. Notwithstanding the provisions of paragraph 1 concerning the use of foot-and-mouth disease vaccine, it may be decided, when foot-and-mouth disease has been confirmed and threatens to become extensive, that emergency vaccination using technical procedures guaranteeing the animals' total immunity may be introduced. In this case, the measures to be taken shall include:

- the extent of the geographical area in which emergency vaccination is to be carried out,
- the species and the age of the animals to be vaccinated,
- the duration of the vaccination campaign,
- a specific standstill of vaccinated animals and their products,
- the special identification and special registration of the vaccinated animals,
- other matters appropriate to the emergency situation.

The decision to introduce emergency vaccination shall be taken by the Commission in collaboration with the Member State concerned, acting in accordance with the procedure laid down in Article 16. This decision shall have particular regard to the degree of concentration of animals in certain regions and the need to protect special breeds.

However, by way of derogation from the first subparagraph, the decision to introduce emergency vaccination around the outbreak may be taken by the Member State concerned following notification to the Commission, provided that basic community interests are not endangered. This decision shall be immediately reviewed in the standing veterinary committee in accordance with the procedure laid down in Article 16.

Appendix 4:

Scottish foot and mouth Cull Statistics – 2001 outbreak

FMD slaughter figures for Dumfries and Galloway

	No. of cattle	No. of sheep	No. of pigs	No. of others (specify)	Total	No. of farms
Infected farms	33,744	81,685	193	149 goats	115,771	177*
Dangerous Contacts	21,567	49,317	2,279	20 goats	73,183	179
Contiguous cull	22,799	56,810	8	8	79,625	147
3km sheep cull		365,171	57	287	365,515	1,002
Slaughter on suspicion	1,671	10,543	0	27	12,241	22
Total	79,781	563,526	2,537	491	646,336	1,527

Source: Scottish Executive

FMD slaughter figures for Galashiels Division – Scotland

	No. of cattle	No. of sheep	No. of pigs	No. of other (specify)	Total	No. of farms
Infected farms	1,012	9,590	4	37goats	10,643	11
Dangerous Contacts (including Longtown tracings)	367	7,893	0	0	8,260	14
Contiguous cull	6,085	32,003	873	1goat	38,962	41
3km sheep cull	96	28,376	0	0	28,472	46
Slaughter on suspicion	367	2,478	0	0	2,845	6
Total	7,927	80,340	877	38	89,182	118

Source: Scottish Executive

FMD Slaughter figures for Scotland

	No. of cattle	No. of sheep	No. of pigs	No. of other (specify)	Total	No. of farms
Infected farms	34,756	91,275	197	186 goats	126,414	187*
Dangerous Contacts (including Longtown tracings)	21,934	57,210	2,279	20 goats	81,443	193
Contiguous cull	28,884	88,813	881	9 goats	118,587	188
3km sheep cull	96	393,547	57	287	393,987	1048
Slaughter on suspicion	2,038	13,021	0	27	15,086	28
Total	87,708	643,866	3,414	529	735,517	1,644

Source: Scottish Executive

*Note: IP 526 straddled the border with Cumbria and was slaughtered by SW Scotland Disease Control Centre, thus the animals slaughtered feature in the Dumfries and Galloway cull statistics. However the farm does not feature in the total number of infected premises in Scotland as the actual farm premises are located in Cumbria.

Pre-emptive cull data reflects entries on the spreadsheets for culls – this does not necessarily correlate with farm numbers (as individual owners may be recorded, rather than individual premises).

Scottish Figures for the Livestock Welfare Disposal Scheme and the Light Lamb scheme

	No. of cattle	No. of sheep	No. of lambs	No. of pigs	Total
LWDS	20,516	130,598		111,173	262,287
LL scheme			187,609		187,609
Total					449,896

Source: Scottish Executive

Note: The Livestock Welfare Disposal Scheme (LWDS) closed completely at the end of February 2002, from 1,674 applications and the figures are those at the end of the scheme.

The Light Lamb (LL) scheme (which ran from September to October 2001) was a UK scheme administered in Scotland, on behalf of the Scottish Executive, by the Intervention Board, now the Rural Payments agency. The LL scheme was designed to help those farmers who had traditionally depended on exports and on moving their sheep into more productive areas, denied to them during the 2001 FMD outbreak and in its aftermath. 88,000 (47%) of the lambs in this scheme were from the Scottish islands. The number of Scottish lambs taken in this scheme represented 36% of the total number for the UK as a whole.

Appendix 5:

Conclusion and recommendations of the 1999 EU Strategy for Emergency Vaccination against Foot and Mouth Disease (FMD)

(http://europa.eu.int/comm/food/fs/sc/scah/out22_en.pdf)

In conclusion, the Scientific Committee on Animal Health and Animal Welfare having reviewed the scientific and technological progress made in the field of FMD diagnosis and vaccine production considers that emergency vaccination can be a useful tool in the control of FMD outbreaks with a risk or tendency towards uncontrolled spread. The text of this report sets out criteria leading to a decision to implement emergency vaccination against foot and mouth disease and establishes guidelines both for a vaccination programme and for the movement of animals and animal products within and out of the vaccination zone(s).

In particular, the Scientific Committee on Animal Health and Animal Welfare recommends:

- The Community Reference Laboratory for foot and mouth disease should be established as a matter of urgency.
- The foot and mouth disease situation world-wide should be carefully monitored by the European Commission;
- The antigens of recent highly contagious and significantly antigenically different FMD virus strains, particularly from regions neighbouring Europe, should be produced and stored in the EU or National antigen banks for production of emergency vaccines;
- The quality of the antigens stored in the banks should be monitored by an Institute (Community Reference Laboratory) designated by the EU;
- The suitability of the strains of antigens held in the banks should be kept continually under review;
- Non structural proteins (*e.g.* 3ABC) should not be present in vaccines;
- Computer assisted models should be further developed for strategic purposes (future planning, allocation of resources, operational use in epidemics);
- The National Contingency Plans should consider the possibility of emergency vaccination and provide an estimate of all logistical requirements such as the number of vaccination teams required in different areas, in order to complete the task as rapidly as possible.
- NSP tests should be optimised and further validated. The antigen used in these tests should be standardised. Regional laboratories should be trained in their practical use. An ELISA test kit, validated by an Institute designated by the EU, should be available at the national FMD laboratories.

- In particular the specificity of NSP tests needs to be determined more accurately, especially when following the use of highly potent vaccine. A panel of positive and negative sera should be established. Inter-laboratory comparison trials for diagnostic tests should be regularly carried out.
- It is considered necessary for the Commission to pursue efforts to reach progress in negotiations within the framework of the World Trade Organisation for recognition of a regionalisation policy regarding trade restrictions for areas where FMD emergency vaccination has been applied, based on the principle of an acceptable risk level.

Appendix 6:

British and Scottish regulations for the control of Foot and Mouth Disease

The EU legislation is implemented in GB by the FMD Disease Order 1983 made under the Animal Health Act 1981. Under the terms of the Scotland Act (1998) legislation on all animal health matters was devolved to the Scottish Parliament and policy and implementation was made the responsibility of the Scottish Ministers.

The State Veterinary Service arrangements are enshrined in Concordats between the Scottish Executive and the DEFRA. The main Concordat establishes an agreed framework for co-operation between administrations for all matters relating to the Scottish Parliament's responsibilities for agriculture, fisheries and food, as envisaged in the White Paper "Scotland's Parliament". This is supplemented by a separate concordat in respect of the State Veterinary Service and animal disease compensation, which provides for a single unified SVS under the line management of the Chief Veterinary Officer. The concordat also specifies that compensation payments for notifiable diseases (other than TB and brucella) will be made by DEFRA Animal Health Group. The Scotland Act 1998 (Concurrent Functions) Order 1999 gives DEFRA the statutory authority to make these payments.

Scottish Statutory Instruments relating to the 2001 Foot and Mouth disease outbreak

2001

- No.45** The Diseases of Animals (Approved Disinfectants) Amendment (Scotland) Order 2001
- No.49** The Foot-and-Mouth Disease Declaratory (Controlled Area) (Scotland) Order 2001
- No.51** The Diseases of Animals (Approved Disinfectants) Amendment (No. 2) (Scotland) Order 2001
- No.52** The Foot-and-Mouth Disease (Amendment) (Scotland) Order 2001
- No.55** The Foot-and-Mouth Disease (Amendment) (No. 2) (Scotland) Order 2001
- No.56** The Foot-and-Mouth Disease (Scotland) Declaratory Order 2001
- No.59** The Foot-and-Mouth Disease (Scotland) Declaratory (No. 2) Order 2001
- No.60** The Foot-and-Mouth Disease Declaratory (Controlled Area) (Scotland) (No. 2) Order 2001
- No.61** The Export Restrictions (Foot-and-Mouth Disease) Amendment (Scotland) Regulations 2001
- No.63** The Foot-and-Mouth Disease (Scotland) Declaratory Amendment Order 2001
- No.65** The Foot-and-Mouth Disease (Scotland) Declaratory (Amendment No. 2) Order 2001
- No.66** The Foot-and-Mouth Disease (Scotland) (Declaratory and Controlled Area) Amendment Order 2001
- No.90** The Foot-and-Mouth Disease (Scotland) (Declaratory and Controlled Area) Amendment (No. 2) Order 2001
- No.91** The Foot-and-Mouth Disease (Scotland) Declaratory (Amendment) (No. 3) Order 2001
- No.95** The Import and Export Restrictions (Foot-and-Mouth Disease) (Scotland) Regulations 2001
- No.101** The Foot-and-Mouth Disease (Amendment) (No. 3) (Scotland) Order 2001
- No.109** The Foot-and-Mouth Disease (Scotland) (Declaratory Orders) General Amendment Order 2001
- No.110** The Foot-and-Mouth Disease (Scotland) Declaratory (Amendment) (No. 4) Order 2001
- No.111** The Foot-and-Mouth Disease Declaratory (Controlled Area) (Scotland) (No. 3) Order 2001
- No.112** The Import and Export Restrictions (Foot-and-Mouth Disease) (Scotland) Amendment Regulations 2001
- No.120** The Foot-and-Mouth Disease (Ascertainment of Value) (Scotland) Order 2001
- No.121** The Foot-and-Mouth Disease (Ascertainment of Value) (Scotland) (No. 2) Order 2001
- No.122** The Foot-and-Mouth Disease (Scotland) Declaratory (Amendment) (No. 5) Order 2001
- No.127** The Import and Export Restrictions (Foot-and-Mouth Disease) (Scotland) Amendment (No. 2) Regulations 2001
- No.130** The Foot-and-Mouth Disease (Ascertainment of Value) (Scotland) (No. 3) Order 2001
- No.131** The Foot-and-Mouth Disease Declaratory (Controlled Area) (Scotland) (No. 3) Amendment Order 2001
- No.141** The Import and Export Restrictions (Foot-and-Mouth Disease) (Scotland) Amendment (No. 3) Regulations 2001

- No.146** The Foot-and-Mouth Disease (Scotland) (Declaratory and Controlled Area) Amendment (No. 3) Order 2001
- No.148** The Foot-and-Mouth Disease (Scotland) Declaratory (Amendment) (No. 6) Order 2001
- No.149** The Foot-and-Mouth Disease (Scotland) Declaratory (Amendment) (No. 7) Order 2001
- No.150** The Foot-and-Mouth Disease Declaratory (Controlled Area) (Scotland) (No. 3) Amendment (No. 2) Order 2001
- No.153** The Foot-and-Mouth Disease (Scotland) Declaratory (No. 3) Order 2001
- No.157** The Foot-and-Mouth Disease (Scotland) Declaratory (No. 4) Order 2001
- No.158** The Import and Export Restrictions (Foot-and-Mouth Disease) (Scotland) Amendment (No. 4) Regulations 2001
- No.159** The Foot-and-Mouth Disease (Scotland) (Declaratory and Controlled Area) Amendment (No. 4) Order 2001
- No.160** The Foot-and-Mouth Disease (Marking of Meat and Meat Products) (Scotland) Regulations 2001
- No.165** The Foot-and-Mouth Disease (Scotland) Declaratory (No. 5) Order 2001
- No.168** The Foot-and-Mouth Disease (Scotland) Declaratory (No. 6) Order 2001
- No.170** The Foot-and-Mouth Disease Declaratory (Controlled Area) (Scotland) (No. 3) Amendment (No. 3) Order 2001
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Appendix 7:

Proposed future procedure for the diagnosis of FMD virus

At the Start of an Outbreak

In the Field: Collection of samples to send to Pirbright; determination of time of infection from examination of animals; RT-PCR test and strip test on epithelium; strip test on antibody.

Regional laboratory: preparation for dealing with samples.

At Pirbright: Typing of sample; isolation of virus from sample; antigenic and genetic characterisation of virus; origin of virus; choice and availability of vaccine; vaccine tests; behaviour of virus in susceptible animals.

During an Outbreak

In the Field: RT-PCR and strip tests for presence of virus and antibody; collection of samples for regional laboratory and Pirbright.

Regional laboratory: Determination of presence of virus (strip test), presence of viral nucleic acid products (RT-PCR), and presence of antibody (SPC ELISA, strip test); serological survey with SPC ELISA.

At Pirbright: Typing of samples especially from new areas; changes in nature of virus; confirmatory virus and antibody tests; dealing with new problems; serological survey (SPC ELISA); supplying test reagents.

At the End of an Outbreak

In the Field: Collection of samples for testing at Regional laboratory and Pirbright.

Regional laboratory: determination of freedom from infection; serum surveys; antibody tests for infection and vaccination; monitoring vaccine coverage.

At Pirbright: Confirmatory virus and antibody tests; distinguishing between antibody due to infection and antibody due to vaccine; further research on new tests; serological survey (SPC ELISA).

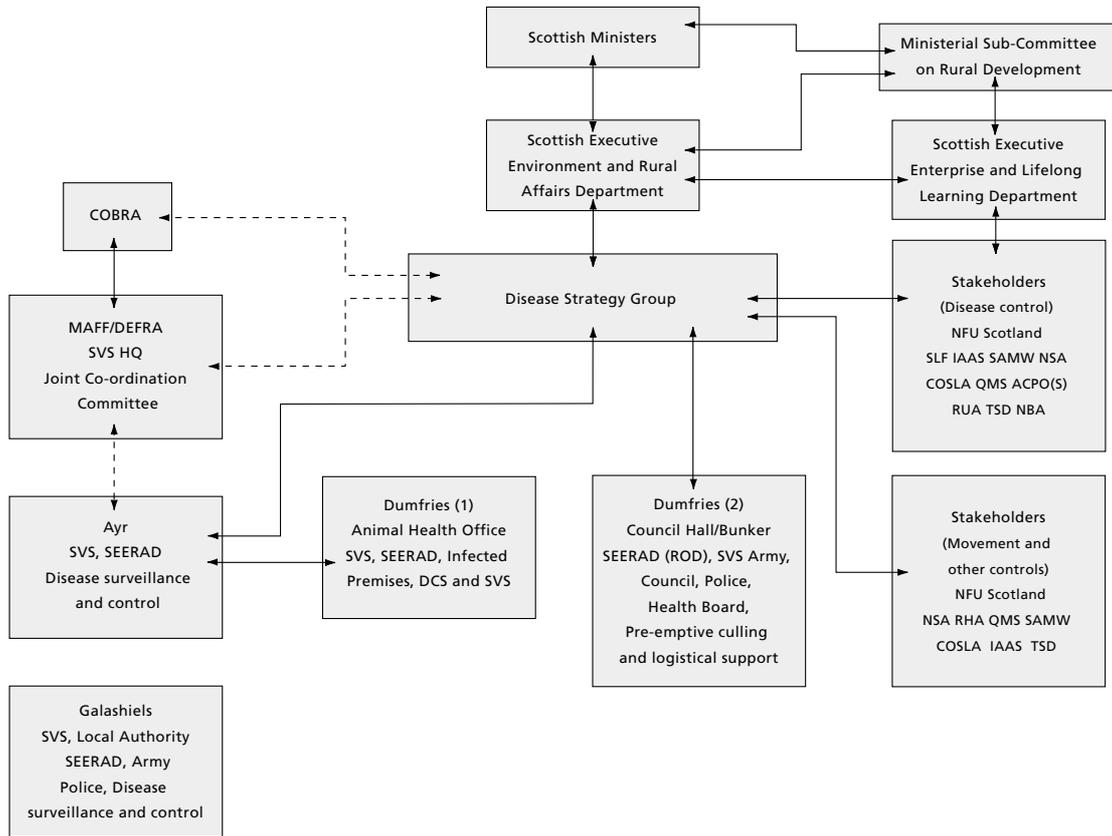
After an Outbreak

Regional laboratory: Testing to allow trade export using inactivated antigen.

At Pirbright: Testing to allow trade import and export using virus RT-PCR and virus isolation on probang samples; antibody tests for infection and/or vaccination.

Appendix 8:

Scottish Executive's Diagram of Organisation Links



Appendix 9:

FOOT AND MOUTH DISEASE 1938-2001

Causes of Primary Outbreaks in the United Kingdom since 1938

1938-1953 (Gowers Report 1954)

	Number	Percentage
Birds	88	16
Swill	214	40
Imported meat & bones	50	9
Infected Serum	1	
Unknown (?swill)	36	7
Obscure	151	28
Total Number of Primary Outbreaks	540	

1954-1967 (Northumberland Report 1969)

	Number	Percentage
Imported Meat and Meat Wrappings	97	54
Birds	42	23
Obscure	40	23

It is now thought that the majority of primary outbreaks attributed to birds coming from the Channel Coasts of Holland, Belgium and Northern France can be attributed to carriage on the wind of virus from the Channel Coasts.

1967-68 Epidemic

Infected meat from South America.

1981 Outbreak Isle of Wight

Carriage on the wind of virus from infected pigs in Brittany. Vaccine administered to cattle in the area contained infective virus, which was then transmitted to the pigs on farms in the district.

2001 Heddon-on-the-Wall

Suggested illegally imported meat or meat products fed to pigs.

Change in origins over the years.

Control of foot and mouth disease in France, Belgium and Holland has led to fewer outbreaks in those countries and thus reduced the danger of virus introduction by birds or virus carried on the wind.

Recommendations in the Northumberland Report on import of meat products and offal (de-boning and heat treatment respectively) has led to a reduction in the risk of foot and mouth disease from endemic countries which export meat and meat products to the United Kingdom. There remains the possibility of virus being introduced by illegal means.

Up till 1953 over 20% of origins remained obscure.

1967-68 Epidemic: Methods of Spread

There were 2364 outbreaks, of which MAFF assigned 40 as primary, although the Northumberland Committee concluded it was impossible to identify the number and some could be attributed to the airborne route.

Secondary outbreaks

	Number	Percentage
Local Spread	2,303	97
Animal Movement	1	
Vehicles	18	0.76
People	10	0.42
Milk Products	9	0.38
Hay		1
Recrudescence	12	0.51
Total	2,354	

Of 55 outbreaks 14 to 110 km from the nearest foot and mouth disease outbreak, origins were obscure in 32 cases. Hugh-Jones & Wright (1970) found wind blowing with rain from the main infected area in those cases they examined suggesting carriage of virus on the wind. (*Reference Hugh-Jones ME & Wright PB Journal of Hygiene 1970, 68; 253 - 271*)

Local spread refers to outbreaks where the other methods of spread could not be found. Such spread could be attributable to uncontrollable methods, airborne over varying distances, wild animals and birds, people and evasion of controls (see later for 2001 epidemic).

1967-68 Epidemic	Animals Affected on Farms
Cattle only	2129 cases
Sheep only	117 cases
Pigs only	62 cases
Cattle & Sheep	27 cases
Cattle & Pigs	25 cases
Cattle, Pigs & Sheep	3 cases
Pigs & Sheep	1 case

Of the 27 cases involving cattle and sheep, among the 20 cases for which age of lesions was given, in 15 lesions were older in sheep than in cattle, in two they were older in cattle than in sheep and in the remaining three there was no difference. In one case the lesions in sheep were reported as being 3-4 weeks old.

Of the three cases involving cattle, sheep and pigs, sheep had the oldest lesions in two cases and cattle in one.

In the one case affecting pigs and sheep, the lesions in sheep were older than those in pigs. This was the final case in the 1967-68 epidemic and was reported 17 days after the previous case.

In the 2001 epidemic local spread refers to spread within 3km, where no cause can be found. It could have resulted from local aerosol spread between animals or from contamination of areas near infected premises. Airborne spread refers to carriage of virus by wind for distances over 3km.

Outbreaks in Scotland from 1950

1952 Type A

County	Number of Outbreaks	Dates of Outbreaks
Aberdeenshire	1	26.4.52
Angus	2	20.4.52
Argyllshire	2	10.5.52-15.5.52
Clackmannanshire	1	2.5.52
Dumfriesshire	63	2.6.52-13.8.52
Fifeshire	2	4.5.52-7.5.52
Kirkcudbrightshire	5	12.6.52-29.6.52
Midlothian	1	4.5.52
Perth and Kinross	2	2.5.52-7.5.52
Stirlingshire	2	2.5.52-12.5.52
Wigtownshire	5	13.5.52-22.5.52
and also in Cumberland	15	1.7.52-5.8.52

Calves originating from a disease-free district in SW England were sent by train to Chester. They were fed at Crewe with infective milk. The calves were sent on from Chester by the Chester agent to Scotland and gave rise to outbreaks in Aberdeen, Perth, Angus, Fife, Isle of Mull and Wigtown. Meat salvaged from the Wigtown outbreaks went via kitchen waste to infect animals in Dumfriesshire. Spread occurred from Dumfriesshire to Cumberland. Some of the calves died without showing foot and mouth disease but passed the disease on to other animals on the farm. Spread during the epidemic occurred through movement of infective calves, sale of store cattle and via market. Infective waste was also responsible. No reason was found for some outbreaks and some were attributed to spread by birds or by farmers to farms where there were sick animals, subsequently shown to have foot and mouth disease. Delay in reporting disease tended to occur in Dumfriesshire in the early stages. The district was heavily stocked, "a fact which greatly favoured the spread of disease and made control and eradication more difficult".

(Adapted from Appendix V in the Gowers Report *"An Account of the Outbreaks of Foot and Mouth disease in Great Britain November 1951-November 1952"*)

In paragraph 127, page 53 the Gowers Report, discussing Ring vaccination, states "At the beginning of June 1952, for instance, an outbreak near Dumfries was followed during the ensuing three months by 82 secondary outbreaks in the counties of Dumfries, Kirkcudbright and Cumberland and the slaughter of 18,000 animals. If it had been practicable at the beginning of June promptly to carry out Ring vaccination with monovalent vaccination of the right type, it seems probable that many of these might have been saved." MAF pointed out it was easy to be wise after the event and exceedingly difficult, if not impossible, to tell beforehand whether it would be worthwhile or not.

1960-1961 Type A

Cattle moved from the Ponteland Market, Northumberland on 31 October 1960 were found affected on 7 November. These cattle gave rise to further outbreaks in Durham and Northumberland. The vehicle used for these cattle was subsequently used on 31 October for conveying cattle from Newcastle Market to Newcastle Station for transport to Aberdeen. However the cattle were taken in error to Norwich, where they contaminated cattle in the same loading dock giving rise to outbreaks in East Anglia. The cattle reached Aberdeen on 3 November, where they were slaughtered. However in Aberdeen before going to the slaughterhouse they were watered in the market, where they transmitted infection to other cattle. Disease was confirmed on 10 November. There were 25 outbreaks in Aberdeenshire by 19 November and 30 by 30 December. Spread occurred to Banffshire and Kincardineshire through cattle. Spread through a

dealer was found in South Ronaldsay, Orkney. Cattle from the Aberdeen Market caused disease in Glasgow City Abattoir, Dumbartonshire, Hamilton Slaughterhouse. Outbreaks associated with Glasgow were found in Stirlingshire, Fifeshire, Lanarkshire, Renfrewshire. Cattle from Lanark Market caused disease in Lanarkshire, West Lothian, Cumberland and Stirlingshire. Ayrshire was also infected. Gorgie Market, Edinburgh became infected and disease spread to East Lothian. On 24 December an outbreak was confirmed in Dumfriesshire. In 1961 there were outbreaks in Aberdeenshire and Fifeshire.

Outbreaks occurred in the following counties :- Aberdeen 56, Ayr 2, Banff 2, Dumfries 2, Dunbarton 1, East Lothian 1, Fife 8, Kincardine 1, Kinross 1, Lanark 10, Orkney 13, Renfrew 2, Stirling 5, West Lothian 1 and one in Cumberland. Spread of disease resulted from movement of cattle (especially that involving markets and abattoirs), vehicles, dealers, people, feeding of swill and of skim milk, fomites and local spread.

Both the 1952 outbreak and the 1960 outbreak involved introduction of FMD infection by animal movement from England.

Present Epidemic

Cause

The present epidemic is caused by FMD serotype O PanAsia strain. The strain was first identified in northern India in 1990 and belongs to the Middle East/South Asia (ME-SA) topotype. (O Manisa, the strain used to prepare vaccine also belongs to this topotype.)

Spread to west

1994 Saudi Arabia

1994-1999 Middle East

1996 Turkey , Turkish Thrace, Greece, Bulgaria

Spread to east

1991-1994 Other parts of India, Nepal

1995 Malaysia

1996 Bangladesh

1998 Bhutan

1998 Peoples Republic of China, Yunnan

1999 Peoples Republic of China, Tibet, Hainan, Fujian

1999 Taiwan Province of China, Kinmen Island, Taiwan mainland.

2000 All SE Asian countries affected.

2000 South Korea, Japan

2000 Eastern Russia

2000 Mongolia

The spread of the PanAsia strain is unique. It appears to have had a competitive advantage over other O strains in the areas involved, but the reasons for its dominance are unknown. In experiments at Pirbright the amounts of FMD virus excreted as an aerosol by pigs and sheep infected with the PanAsia strain were less than the amounts from pigs and sheep infected with a virus strain isolated during the 1967-68 epidemic. The virus has been found to spread rapidly to animals in contact.

Spread to South Africa

September 2000 South Africa. Swill collected from port of Durban was fed to pigs. The virus spread to a neighbouring farm and cattle on communal grazing land. Monovalent type O vaccination was carried out around the outbreaks. No further outbreaks due to type O have been reported.

Spread to UK: UK epidemic

The first outbreak in the UK since 1981 was diagnosed on 20 February 2001 in pigs at an abattoir near Brentwood, Essex. This outbreak was linked to a swill fed pig premises near Heddon-on-the-Wall, Northumberland, which was probably infected in early February and the source of the epidemic. Airborne virus from the pig premises infected a nearby cattle and sheep holding before the first outbreak was confirmed in Essex. The movement of infected sheep from Northumberland through a series of sheep markets resulted in extensive spread in the northwest and southwest of England. Additional movements of sheep resulted in the dissemination of FMD virus to Scotland, Wales, Northern Ireland, Republic of Ireland and France. Calves which had been in contact with sheep imported into France from the UK spread the virus to the Netherlands. All isolates belonged to the type O topotype and there has been no change during the epidemic.

Summary of FMD situation in Europe during 2001

Country	No. outbreaks	No. animals slaughtered	Vaccination	Pre-emptive culling
Great Britain	2026	4,204,814	No	Yes
Northern Ireland	4	51,199	No	Yes
Rep. of Ireland	1	60,000	No	Yes
France	2	57,968	No	Yes
The Netherlands	26	250,000	Yes	Yes

Appendix 10:

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Appendix 12:

SEERAD Sheep and Goat ID and Traceability System

Background

1. The enhanced system introduced with effect from 18 February 2002 incorporated the existing system based on current EU legislation, practical and enforceable elements from the latest EU proposals and took account of experience gained from the recent FMD outbreak.

Components of the system

2. The new system is comprised of the following key elements:

- **Baseline tags or tattoos** – with effect from 18 February all animals moving off their holding of birth for the first time will be uniquely identified with a number showing the flock number of their holding of birth and up to a six digit sequential number. All other animals from that date will also be uniquely identified prior to movement to another holding (not required for a move direct to slaughter). The number is preceded by an 'S' to distinguish it from a holding of birth tag or tattoo.
- **Standardised movement documents** – Each keeper has been issued with movement documents. These are part completed by the consigning farmer by recording the details of the consigning keeper and location, number and type of animals being moved, date, and the details of the receiving keeper and location. The top copy of the document travels with the animals to the destination location with the remaining copy being retained on farm to help inform farm records. The receiving keeper checks the details on the movement document on receipt and records on it reasons for any discrepancies. This information is used to report the movement to the central database and is then retained to inform farm records. Although each animal has a tag or tattoo with an individual ID there is no requirement to read and record it. Until fully operational electronic ID systems are available the data captured on movement documents and the database by the new system is limited to consigning and destination locations, the total number of sheep being moved and the date of movement.
- **Reporting movements to central database** – All movements between different locations must be reported to the central database except for specific short term management moves where the animals return to the original location (these moves must be recorded as with all other moves in the farm record book). For a farm to farm move it is the receiving location that reports the details of the whole move to the database. Where the move is to a market, it is the market that reports the details of the whole move including the consigning location and the location the animals will go to after the market. For moves to an abattoir, it is the abattoir that notifies the database of the details of the whole move. Legislation requires the details of a move to be notified to the database within 3 days. This new system has been designed with electronic reporting as the preferred option. Virtually all the market and abattoir reporting is undertaken electronically thereby shortening the time taken to capture the data and improving the quality of data on the database. Farmers are also being encouraged to adopt electronic reporting for farm to farm moves.
- **Central database** – The database records the information supplied from the movement documents via e-mail, fax or post. It also has electronic links to the licensing database covering England and Wales to report movements from Scotland across the border. This will be maintained until a GB contacts database is in place. The database provides information for enforcement and general monitoring purposes.

Effective Traceability

3. The database can be interrogated to provide:
 - List of all locations and the number of animals sent to a market on any date along with a list of all locations these animals subsequently went to.
 - Details of the original location of a batch of animals currently on another location even if the animals arrived via a market.
 - Details per location of all movements on to and off a location on a set date or over a period of time.
 - Data per location for inspectors for enforcement purposes.
 - Data per location for inspectors to support future subsidy crosschecks.
 - General statistical reports on sheep movements.
4. Hence, where disease is detected in sheep at a specific location, the database can be interrogated – at the touch of a button – to determine what other sheep the diseased sheep may have come into contact with on previous holdings either directly or through a market.

General points

5. The database currently also records data on pig movements in Scotland and will do so until a GB contacts database is available. The new Sheep and Goat ID and traceability system also includes a short-term measure, which supports the move from the FMD licensing system through the early introduction stages of this new ID and traceability system. This involves the insertion of an additional movement tag for moves from other than the baseline tag location to another holding. The tag simply records the flock number of the consigning location prefixed by an 'S'. The need for this additional element will be reviewed shortly.

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