PREPARATION OF CONTAGIOUS BOVINE PLEUROPNEUMONIA CONTINGENCY PLANS

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FOREWORD

Contagious bovine pleuropneumonia (CBPP) is a serious transboundary disease of cattle, which has at one time or another been present on all continents, but now mainly occurs in Africa. Transboundary animal diseases are defined by the FAO Emergency System for Transboundary Animal and Plant Pests and Diseases (EMPRES) as those diseases that are of significant economic, trade and/or food security importance for a considerable number of countries, which can easily spread to other countries and reach epidemic proportions, and where control or management, including exclusion, requires cooperation among several countries. The International Animal Health Code of the *Office international des épizooties* (OIE) includes CBPP in its List "A" diseases, which are defined as

> "communicable diseases which have the potential for serious and rapid spread, irrespective of national borders; which are of serious socio-economic or public health importance and which are of major importance in the international trade of animals and animal products."

This manual provides information on the nature of CBPP, and the principles of and strategic options for the control and elimination of the disease. It provides guidelines for individual countries to formulate their overall national policy on CBPP control and eradication. The manual identifies personnel as well as equipment and other facilities that are needed in a national CBPP contingency plan. An outline of the suggested format and contents of a national CBPP contingency plan is also provided as a guide, and should be modified to suit the needs of and circumstances that exist in individual countries. Due consideration was given to the provisions in the OIE International Animal Health Code in the preparation of the manual. It is suggested that this manual, which is based on the format of the Australian Veterinary Emergency Plan (AUSVETPLAN), with some modifications, should be used together with the Manual on the Preparation of National Animal Disease Emergency Preparedness Plans (*FAO Animal Health Manual* No. 6. Rome, 1999).

Sources of information recommended for use in conjunction with this manual include:

Egwu, G.O., Nicholas, R.A.J., Ameh, J.A. & Bashiruddin, J.B. 1996. Contagious bovine pleuropneumonia: an update. *Veterinary Bulletin*, **66**(9): 875–888.

Manual on the preparation of national animal disease emergency preparedness plans. FAO Animal Health Manual, No.6. Rome, 1999.

Manual on participatory epidemiology. FAO Animal Health Manual, No.10. Rome, 2000.

Nicholas, R., Bashiruddin, J., Ayling, R. & Miles, R. 2000. Contagious bovine pleuropneumonia: a review of recent developments. *Veterinary Bulletin*, **30**: 827–838.

OIE [*Office international des épizooties*]. 2001. International Animal Health Code. Available at www.oie.int.

Recognizing contagious bovine pleuropneumonia. FAO Animal Health Manual, No. 13 (Rev. 1). Rome, 2002.

Schneider, H.P., van der Lugt, J.J. & Hübschule, O.J.B. 1994. Contagious bovine pleuropneumonia. pp. 1485–1494. *In* J.A.W. Coetzer, G.R. Thomson and R.C. Tustin (eds). *Infectious diseases of livestock*, Vol. 2. Oxford, UK: Oxford University Press.

This manual will be reviewed regularly and revised in the light of experience.

Suggestions and recommendations for amendment should be forwarded to:

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ABBREVIATIONS

CBPP	Contagious bovine pleuropneumonia
CCEAD	Consultative Committee on Emergency Animal Diseases
c-ELISA	Competitive enzyme linked immunosorbent assay
CFT	Complement fixation test
CVO	Chief Veterinary Officer
ECOWAS	Economic Community of West African States
ELISA	Enzyme linked immunosorbent assay
EMPRES	Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases
IgG	Immunoglobulin G
NGO	Non-governmental organization
OIE	*Office international des épizooties*
PAP	Peroxidase-antiperoxidase
PCR	Polymerase chain reaction
SADC	Southern African Development Community
TAD	Transboundary animal diseases

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1. SUGGESTED CONTENTS AND FORMAT OF A NATIONAL CBPP CONTINGENCY PLAN

A contagious bovine pleuropneumonia (CBPP) contingency plan should be a well articulated strategy document designed to define actions that should be taken in the event of a CBPP emergency. It should contain details of the resources that are needed to meet such an emergency, as well as an action plan for efficient and rapid deployment of both human and material resources for effective containment of the disease and elimination of infection. While it is not feasible to produce a model contingency plan that will be a perfect fit for all the situations and circumstances that exist in different countries, the suggested format and contents as described below should serve as guidelines for individual countries to design their national CBPP contingency plans.

It is suggested that a national CBPP contingency plan should include sections or chapters on:

- ü Nature of the disease.
- ü Risk analysis for CBPP
- ü Prevention strategies.
- ü Early warning contingency plan.
- ü Strategies for control and eradication of CBPP.
- ü Organizational arrangements for CBPP emergencies.
- ü Support plans.
- ü Action plans.
- ü Appendixes.

These are considered briefly below, and then discussed at length in subsequent chapters.

1. Nature of the disease

This section should describe the essential features of CBPP such as:

- ü aetiology,
- ü world evolution and distribution,
- ü epidemiological features,
- ü clinical signs,
- ü pathology, and
- ü diagnosis (field, differential and laboratory).

While most of these aspects, as described in this Manual, are generic and therefore could be used almost unmodified, others may need to be modified to reflect the circumstances prevailing in individual countries.

2. Risk analysis for CBPP

This provides information on just how serious a threat CBPP is for the country in comparison with other transboundary animal diseases; where and how CBPP might present; and what its potential consequences are. The risk analysis should indicate just how much effort should be put into contingency planning, and should also provide the rationale for the disease control strategies selected.

Risk analyses need to be updated regularly to take account of changing circumstances, both internally and externally.

3. Prevention strategies

This should describe the quarantine and other measures that should be taken to minimize the risk of introduction and establishment of CBPP.

4. Early warning contingency plan

This includes all the initiatives that need to be taken to ensure that an incursion of CBPP can be recognized and reacted to before it reaches epidemic proportions in the country; and for monitoring the progress of eradication campaigns. It includes disease surveillance and epidemiological capabilities such as emergency disease reporting mechanisms and animal health information systems; training of animal health staff in recognition of the disease; and public awareness programmes.

5. Strategies for control and eradication of CBPP

CBPP may be controlled by reduction of the number of infected animals in cattle populations (through stamping out); preventing transmission of the disease (through zoning, cattle movement controls and quarantine); and reducing the number of susceptible cattle (by vaccination) – or a combination of these. This section, which is the core component of the contingency plan, describes how these strategies might be put into practice in a control and eradication campaign for CBPP. It also describes how disease eradication should be verified and national freedom proven to international standards.

6. Organizational arrangements for CBPP emergencies

The administrative structures of national veterinary services, which have evolved mainly to deal with routine animal health programmes, are not necessarily appropriate for emergency disease control. This section describes the organizational arrangements that should be ready to be put in place when there is a CBPP emergency, to enable all necessary resources to be efficiently marshalled to respond to the emergency. These arrangements will vary according to the

infrastructure, veterinary services capacity and bureaucratic arrangements of the country concerned.

7. Support plans

The support plans underpin the technical plans. They include financial, resource plans and legislation. They are of vital importance and are a key to the success or failure of an eradication campaign.

8. Action plans

Action plans are the mechanisms whereby the various phases of the plan are implemented: from the initial investigation phase to the final stand-down phase.

9. Appendixes

A list of names and contact addresses, including telephone numbers, facsimile and e-mail addresses, of the following could be placed as appendixes to the contingency plan:

- ü regional and world reference laboratories for CBPP; and
- ü international organizations for possible assistance.

Also included could be information on:

- ü national animal health laws, and
- ü any other information that is specifically relevant to the individual country.

It should be emphasized that what now follows only provides a framework for countries to develop their own contingency plans for CBPP, as national contingency plans for CBPP have to take account of the particular national circumstances.

2. NATURE OF THE DISEASE

2.1 DEFINITION

Contagious bovine pleuropneumonia (CBPP) is an acute, subacute or chronic mycoplasmal disease of cattle, which may cause high production losses and mortalities. It is characterized by fibrinous pneumonia, serofibrinous pleuritis, and oedema of the interlobular septa of the lungs.

2.2 WORLD DISTRIBUTION

CBPP is currently mainly a disease of Africa, where it is regarded as one of the most serious transboundary animal diseases. Most countries in sub-Saharan Africa are endemically infected, with at least 27 countries reporting its presence. Exceptions are a number of countries in southern Africa, including Botswana, Malawi, Mozambique, Republic of South Africa and Zimbabwe, and all but the northern border areas of Namibia. There was an upsurge in the incidence of CBPP in Africa in the 1990s and serious spread of the disease in eastern and parts of southern Africa, with re-introduction to areas that had been free for considerable periods. This culminated in introduction of CBPP to northern Botswana in 1995. It was eradicated from there by a stamping-out campaign and the country was able to declare provisional freedom in January 1997.

CBPP has been present in some Mediterranean countries of Europe during the last decade (Italy, 1993; Spain, 1994; Portugal, 1999).

The disease may still be present in parts of Asia, but this is uncertain. Bangladesh is the only country currently officially reporting its presence. The other continents are free.

2.3 AETIOLOGY

CBPP is caused by *Mycoplasma mycoides* subsp. *mycoides* Small Colony variant (bovine biotype) (*Mmm*SC for short). This is a member of the 'mycoides cluster,' a grouping of six closely related mycoplasmas that are all pathogenic to a greater or lesser degree in ruminants. Members of the cluster have a high degree of serological and DNA relatedness. There is only one serotype of *Mmm*SC.

*Mmm*SC, like other mycoplasmas, lacks a cell wall and is pleomorphic. In young cultures it tends to appear as branching filaments, and in old cultures as small coccal bodies. It requires special media rich in cholesterol (added serum) for growth.

The organism is fragile and survives poorly outside the host. It is sensitive to desiccation and disinfectants.

2.4 EPIDEMIOLOGICAL FEATURES

2.4.1 Susceptible species

CBPP is mainly a disease of cattle. Both *Bos taurus* and *Bos indicus* breeds are fully susceptible. Water buffaloes have a lower level of susceptibility. The disease has also been reported in yaks and bison. Camels, wild bovids and other wild ruminants are resistant. The causative organism has been isolated from sheep and goats, but there is no evidence that these species play any part in the transmission of the disease.

2.4.2 Disease transmission

The disease is transmitted almost exclusively by direct contact between infected and susceptible cattle, by means of infected aerosols from exhaled air. Airborne spread up to 200 metres is thought to be possible. Conditions under which cattle are herded closely together favour rapid spread of the disease. Asymptomatically and chronically infected animals are very important in the spread of the disease to new areas. Chronic carriers are apparently healthy animals that have a localized focus of infection sequestered in a fibrous capsule in their lungs. Such animals are often referred to as “lungers”. The organism can persist in such lesions for many months, and in time the fibrous capsule may break down, allowing viable organisms to escape by the bronchi and so infect susceptible in-contact animals. This is particularly prone to occur when chronic carrier animals are subjected to stress, such as when mustered or walked for long distances. As the mycoplasma survives poorly in the environment, indirect methods of spread (e.g. by fomites) are unimportant.

2.4.3 Disease patterns

Epidemic CBPP may occur when the disease is introduced to previously free herds, areas or countries. It is characterized by a high incidence of disease in herds with a high proportion of cases being at the acute end of the clinical spectrum and many deaths. Spread of infection within and between herds may be rapid, particularly under conditions where cattle are congregated together, such as at watering points and markets and when droving or *kraaling* animals.

In the early stages of an outbreak, the intensity of infection may be low and the resultant spread may be slow. Under these circumstances, it may take several months for the epidemic to build up momentum. This early period is particularly dangerous in terms of early detection and disease containment.

Because of the variable and often long incubation period, and the fact that the disease may have been introduced by apparently healthy animals, it is often difficult to trace the timing and source of the disease introduction.

Unless the disease is effectively controlled, it will eventually become ***endemic*** and this is the situation that pertains in much of Africa. Endemic CBPP is characterized by insidious spread, and a high proportion of cases being at the less acute and more chronic end of the clinical spectrum. The mortality rate is low. There are occasional flare ups, and overall there are still substantial production losses in the endemic situation.

2.5 CLINICAL SIGNS

The incubation period is generally 3 to 6 weeks, but may be as long as 6 months.

In the **acute** form, there is fever (lasting 3 to 10 days), anorexia, loss of milk production in milking cows, severe depression, and rapid, laboured breathing, which is abdominal in nature. This is soon followed by dry coughing, which progressively becomes more severe, and apparent chest pain, with the animal typically facing into the wind with its back arched, elbows out and head extended. There may be nasal discharge, sometimes streaked with blood, and frothy saliva accumulates around the mouth. The mortality rate from acute CBPP may be up to 75%, and death usually occurs within 3 weeks of the onset of clinical signs. Animals that recover are extremely weak and emaciated. Many become chronic carriers. A **hyperacute form** may also occur in a few animals early in outbreaks – in this form, animals die with few premonitory signs.

Subacute and **chronic** cases are common. The clinical signs are milder and may not be detected. There may be an intermittent fever, some loss of condition, and respiratory signs that may become apparent only when the animal is vigorously exercised. **Subclinical** cases also occur.

In calves up to 6 months, CBPP may manifest itself only as arthritis, with lameness and a soft, puffy swelling of affected joints.

2.6 PATHOLOGY

2.6.1 Gross pathology

In acute CBPP, there is a severe fibrinous pneumonia with copious pleural exudate. The latter is a striking feature, and there may be up to 30 litres of yellow exudate, containing clots, in the chest cavity. One or both lungs may be partially or completely consolidated, giving a characteristic marbled appearance. Affected areas are swollen, vary from pink to dark red, have a moderately firm consistency, and exude clear fluid and sometimes blood from cut surfaces. The interlobular septa are grossly thickened. Pleural surfaces over affected areas are thickened, grey

to red, and are often covered by friable, yellow fibrin. Local lymph nodes are enlarged, oedematous, and may contain areas of necrosis.

In chronic cases, necrotic lung tissue becomes encapsulated to form a sequestrum of 1 to 20 cm diameter. The tissue within the sequestrum [plural = sequestra] tends to retain much of the architecture of the acute lesion, but may eventually become calcified or liquefied. The lesion may either break open to release viable mycoplasmas or be resorbed. Pleural adhesions are commonly found in chronic cases.

2.6.2 Histopathology

Microscopically, the earliest pulmonary lesions consist of foci of catarrhal bronchiolitis, with distension of the lymphatics in the interlobular septa and thickened alveolar walls. At the same time, or soon after, blood vessels and lymphatics become thrombosed, and alveoli are filled with fluid and cells (alveolar macrophages and sometimes polymorphonuclear leucocytes). There is proliferation of the cells in lymphatic follicles and an increase in the population of mononuclear cells around bronchioles. There is also lymphatic oedema, with distension of subpleural lymphatics.

Necrosis can occur early and tends to have a lobular distribution. It is often demarcated from living tissue by a zone of leucocytes and nuclear debris. A connective tissue capsule develops rapidly, but the necrotic material may persist for many months.

Resolution of the pneumonia is by slow connective tissue replacement of damaged tissue. This starts around blood vessels. A layer of mononuclear cells borders the connective tissue on the necrotic side, and connective tissue gradually moves in to replace the dead tissue.

2.7 DIAGNOSIS

2.7.1 Field diagnosis

The occurrence of respiratory disease in a number of cattle in a herd (Plate 1) in which there is acute or chronic coughing, dyspnoea and loss of weight should be viewed as highly suspicious of CBPP. The cardinal respiratory signs to look for are fast, difficult and noisy breathing; discharge from the nose (Plate 2) and coughing, especially after exercise.

The gross lesions are highly characteristic. CBPP should be strongly suspected when there is yellow fluid in the chest cavity; lungs covered with yellowish material (Plate 3); lungs adhered to the chest wall; lungs that do not collapse and are solid, hepatized or marbled (Plate 4); or sequestra (Plate 5) can be seen in the lungs of chronic cases.

Plate 1. Appearance in the herd

This cow is having difficulty in breathing. It stands with its head and neck extended and legs widely placed. Often the elbows are turned out.

Inflammation of the membranes surrounding the lungs causes pain in the chest, resulting in abdominal breathing movements.

Poor general condition.

(Photograph courtesy of A. Provost)

2.7.2 Differential diagnosis

The clinical signs and pathology of CBPP are fairly characteristic. Nevertheless, there are a number of diseases that may possibly be confused with it. These include:

- ü rinderpest,
- ü haemorrhagic septicaemia,
- ü East coast fever,
- ü bronchopneumonia resulting from bacterial or viral infections,
- ü acute pasteurellosis,
- ü bovine tuberculosis,
- ü actinobacillosis,
- ü traumatic pericarditis,
- ü abscesses, or
- ü hydatid cysts.

It is therefore important that the field diagnosis be confirmed by laboratory tests.

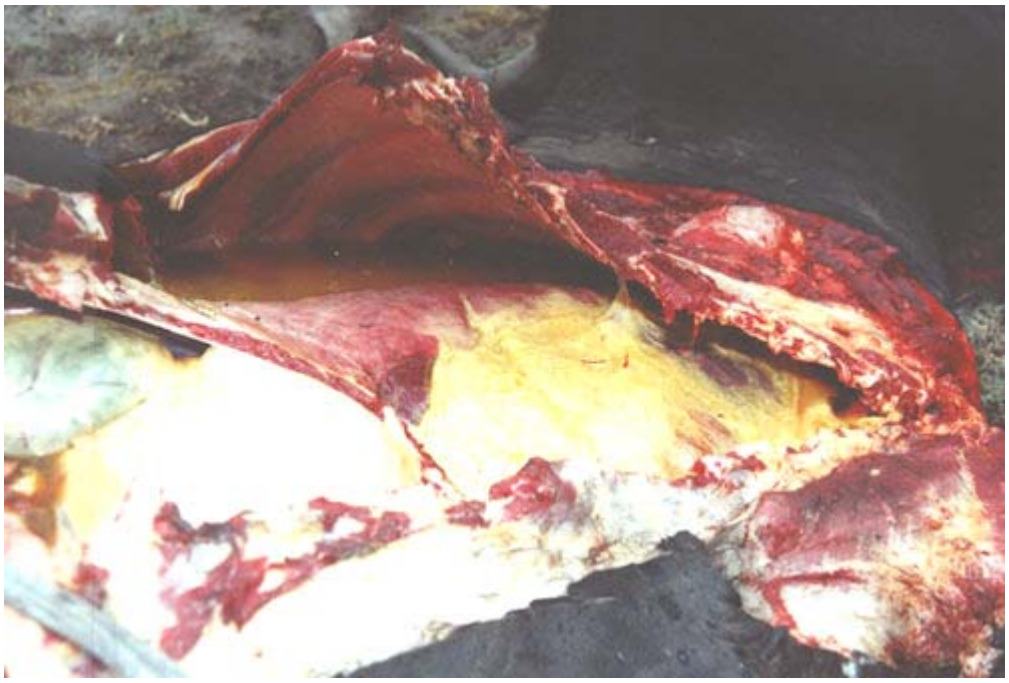


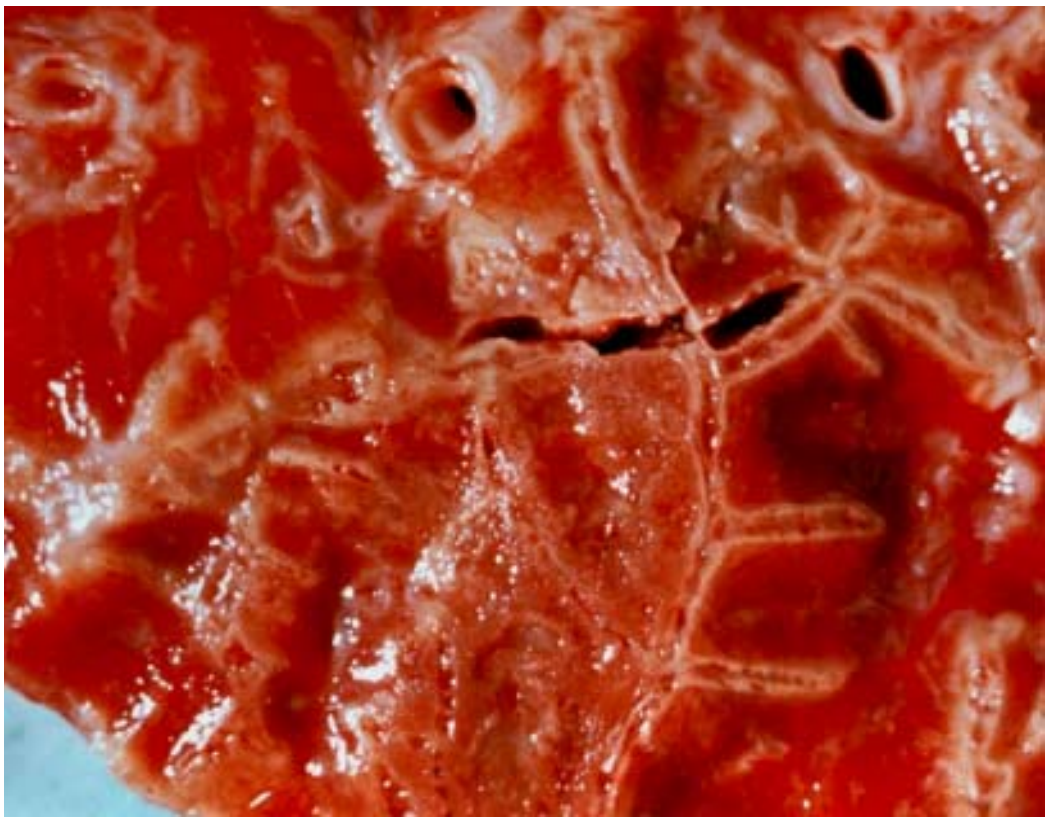
Plate 2. Typical nasal discharge in a CBPP-infected animal.

(Photograph courtesy of Veterinary Tropical Diseases Department, University of Pretoria, Republic of South Africa).

Plate 3. Characteristic post mortem appearance

Part of has been diaphragm cut away to show heavy fibrin deposits (“omelette”) on lungs and yellowish pleural fluid in chest cavity.

(Photograph courtesy of the University of Pretoria, Republic of South Africa)



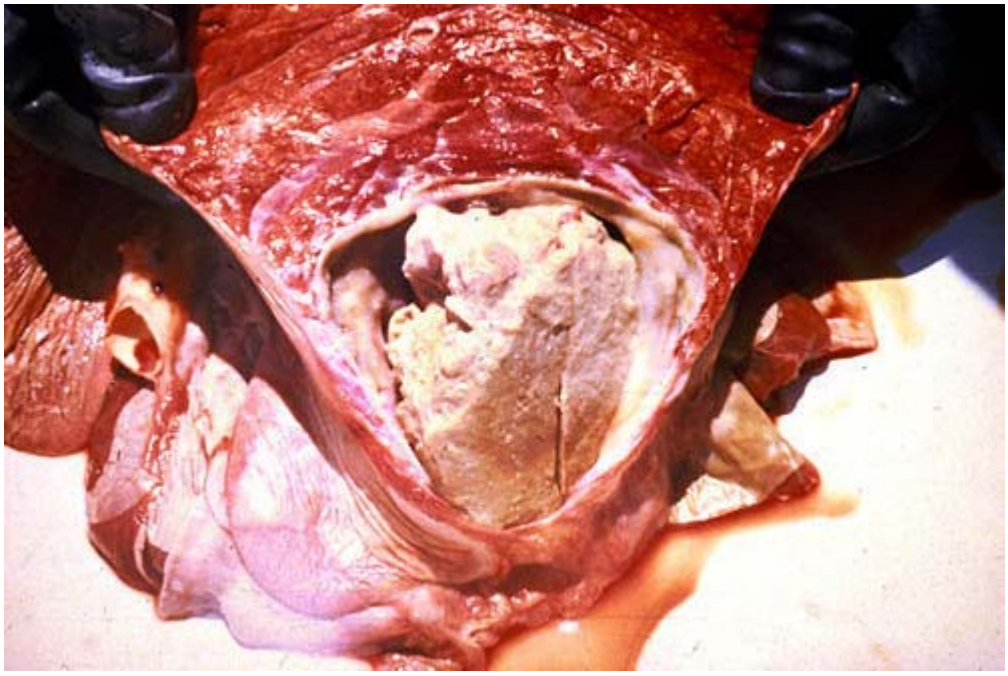


Plate 4. Gross pulmonary change

Acute CBPP. Lungs cut to show red hepatization, i.e. liver-like appearance and feel to the lungs. Note the thickened interlobular septae.

(Photograph courtesy of W. Amanfu)

Plate 5. Chronic CBPP with sequestra

Sequestra are typical lesions of CBPP to be looked for during meat inspection. Chronic cases of CBPP often have such lesions.

(Photograph courtesy of R. Windsor)

2.7.3 Laboratory diagnosis

Whilst histopathology helps, definitive diagnosis is based on isolation and identification of the causative agent and/or the finding of specific antigens or antibodies by appropriate serological tests.

Detailed instructions for laboratory diagnostic procedures for CBPP are to be found in the OIE Manual of Standards for Diagnostic Tests and Vaccines (4th Edition, 2000; this can be found at www.oie.int). The following is a summary, with the emphasis on the tests that are usually used.

Collection and transport of diagnostic specimens

Specimens of lung tissue from obvious lesions, tracheobronchial and mediastinal lymph nodes, and at least 10 ml of pleural fluid should be collected aseptically. Joint fluid from affected joints of calves should also be collected. Duplicate tissue specimens should be collected into neutral buffered formalin for histopathology.

Blood samples, about 20 ml each, for serum should be collected from any cattle showing clinical signs, as well as from several apparently healthy animals in the affected herd.

Unpreserved tissue, pleural and joint fluid specimens are best placed in a transport medium that will protect the mycoplasmas and prevent the proliferation of bacteria (heart infusion broth without peptone and glucose, 10% yeast extract, 20% serum, 0.3% agar, 500 IU/ml penicillin and 1:10 000 thallium acetate). These and serum specimens should be chilled and forwarded to the laboratory on water ice or with frozen gel packs.

Culture and identification of Mmm*SC*

*Mmm*SC can be isolated from unpreserved tissue and fluid specimens in suitable mycoplasma media such as Hayflick's or Gourlay's broth containing penicillin and thallium acetate. The organism is detected by regular dark-field microscopy examination of culture fluid for filamentous organisms. The causative organism is normally identified by growth inhibition tests and/or immunofluorescence test. Closely related *Mycoplasma* spp. may cause cross-reactions in these tests. Several new techniques that may overcome this problem are being developed and these include immunoblotting, immunoperoxidase and polymerase chain reaction (PCR) tests

Antigen detection

There are several antigen detection tests that may be useful in the confirmatory diagnosis, particularly in circumstances where good enough diagnostic samples cannot be collected for isolation of the organism. These include:

- ü Agar gel diffusion test – a practical and easy to perform test – may be used for the rapid detection of specific antigens in pleural fluid or ground lung tissues. A variation of this is the interfacial precipitation test.
- ü Indirect fluorescent antibody test, which can be applied on smears of pathological material using hyperimmune cattle serum against *Mmm*SC and labelled anti-bovine IgG. The test is best used for smears of pleural fluid, although lung impression smears may also be used. The specificity of the method can be improved by counterstaining smears with Eriochrome black.
- ü Immunohistochemistry. *Mmm*SC immunoreactive sites can be detected in the small bronchioles and alveoli and within the interlobular septa of lung lesions using the peroxidase-antiperoxidase (PAP) method on sections of paraffin embedded blocks. This is labour-intensive, but very useful, particularly on animals that die suddenly of an acute infection.
- ü PCR is currently more of a research tool than a diagnostic test that can be routinely applied.

Antibody detection

At present, complement fixation (microtitre method) (CFT) is the preferred serological test for CBPP. The specificity of this test can be as high as 99.5% in acutely infected cattle, but the frequency of false-positive reactions may temporarily be higher in certain herds. The sensitivity of the test is limited, and it may fail to identify four classes of animals:

- ü animals in the very early stages of the disease;
- ü animals in the very late stages of the disease (CFT fails to detect 30% of animals with chronic lesions);
- ü animals with massive lesions, where the antibodies produced are overwhelmed by the antigen; and
- ü animals that have been treated with antibiotics in the early stages of the disease, which may fail to develop a detectable serological response.

The CFT reaction after vaccination is inconstant and short-lived (generally less than 3 months). The CFT is generally used as a herd test.

The competitive enzyme linked immunosorbent assay (c-ELISA) has been evaluated under field conditions in several African countries, with the assistance of the International Atomic Energy Agency (IAEA). It is at least as sensitive as the CFT, but as with other ELISA systems, increased sensitivity can only be achieved at the expense of specificity, and vice versa. It is a useful tool to measure the antibody levels on a herd basis.

The passive haemagglutination test, while not used routinely, may have a place in serological diagnosis. It is more sensitive than the CFT in early and late

stages of disease, but the specificity is lower. It has a potential role as a screening test.

The slide agglutination test is simple to perform and could be used as a pen-side test. It is more sensitive in the early stages of the disease, but it lacks specificity.

3. RISK ANALYSIS FOR CBPP

3.1 INTRODUCTION

Risk analysis is a procedure that we all do intuitively in our everyday life as well as in our professional work. Only recently has it developed into a more formal discipline, which is being used increasingly in many fields of endeavour. In animal health it has perhaps been most widely applied in quarantine. Quarantine risk analyses are used for helping to decide the most appropriate health conditions for imported animals and animal products, and strategies for quarantine operations.

Risk analysis is a tool that can also be used to very good advantage for animal disease emergency preparedness planning. In this context, it is most readily applied to preparedness planning for exotic diseases (or exotic strains of endemic disease agents), and in this section risk analysis will be described for this purpose. However, there is no reason why it could not be applied for other animal health emergency planning.

3.2 PRINCIPLES OF RISK ANALYSIS

Risk analysis comprises four components: risk identification; risk assessment; risk mitigation or management; and risk communication.

3.2.1 Risk identification

In this first component, the risks of untoward events or things that may happen in the future are first identified and then described. In the context of animal health emergencies, this would include identification of all high-threat diseases (exotic or otherwise); the factors that might change the level of risk (e.g. new serotypes or biotypes, or changing epidemiological or livestock husbandry patterns); and factors that might impinge on the capacity of the national animal health services to respond effectively to these disease threats.

3.2.2 Risk assessment

The likelihood of those risks occurring is then estimated. The potential consequences of the risks if they occur are also evaluated, and are used to modify the assessment of the risk. For example, an exotic disease that had a high risk of entry to a country, but only had a low risk of establishment if it entered or only had trivial potential socio-economic consequences for the country, would only get a low overall rating on a risk assessment. Conversely, a low risk of introduction but high consequence disease would be assigned a higher rating.

The assessment of risks can be done in a quantified, a semi-quantified, or a qualitative way. It is inherently very difficult to quantify (or actually put probability numbers) to risks in many biological systems because of the lack of historical precedents and serious gaps in available biological data. It is recommended that qualitative risk assessments be used for exotic diseases. The risks can be described as 'extreme,' 'high,' 'medium,' or 'low,' or by using a simple scoring system, e.g. 1 to 5 for the level of risk, and 1 to 5 for the level of potential consequences (where 1 = negligible and 5 = maximum).

3.2.2 Risk management

This is the process of identifying, documenting and implementing measures to reduce these risks and their consequences. Risk can never be completely eliminated. The aim is to adopt procedures that will reduce the level of risk to what is deemed to be an acceptable level.

In reality, the whole of this Manual could be regarded as providing the risk management framework for CBPP Contingency Planning.

3.2.3 Risk communication

This is the process of exchange of information and opinions on risk between risk analysts and stakeholders. Stakeholders in this context would include all those who could be affected by the consequences of the risks (i.e. everyone from farmers to politicians). It is important that risk assessment and risk management strategies be fully discussed with such people so that they feel comfortable that no unnecessary risks are being taken and the risk management costs are a worthwhile 'insurance policy.'

To ensure ownership of decisions, risk analysts and decision-makers should consult stakeholders throughout the whole process of risk analysis so that the risk management strategies address stakeholder concerns, and decisions are well understood and broadly supported.

3.3 WHO SHOULD CARRY OUT THE RISK ANALYSES?

The risk assessment component would best be carried out by the Epidemiological Unit in the National Veterinary Headquarters as part of the national early warning system for transboundary animal diseases (TADs) and other emergency diseases. Risk management and risk communication are tasks for everyone, but should be coordinated by the Chief Veterinary Officer (CVO).

It should be remembered that risks do not stay static. They will change with factors such as evolution and spread of epidemic livestock diseases internationally; emergence of new diseases; and changing international trading patterns for the country. Risk analysis should therefore not be seen as a one-off activity – it should be repeated and updated regularly.

3.4 RISK ASSESSMENT FOR CBPP

As described above, risk assessment consists of identifying the risks, assessing the likelihood of them being realized, and modifying the perceived level of risk by an evaluation of the potential consequences.

The international status and evolution of outbreaks of CBPP (and of other important TADs), as well as the latest scientific findings, should be constantly monitored. This should be a routine function of the Epidemiological Unit of the National Veterinary Services. Apart from the scientific literature, the most valuable source of information would be from the OIE, through publications such as their weekly disease reports and the annual OIE *World Animal Health*, and by interrogation of the OIE Handistatus database (http://www.oie.int). Disease intelligence is also available from FAO, including in *EMPRES Transboundary Animal Diseases Bulletin*, which is published quarterly (and is also available on the Internet at http://www.fao.org/empres).

"Promed," an internet mailing service, also currently provides a useful forum for very rapid dissemination of official and unofficial information on animal, plant and human disease occurrences around the world. "Animalnet" is also a useful source of information.

Having identified and listed the exotic disease threats, the next step is to assess how serious is the threat of entry of each disease to the country, and the routes and mechanisms by which it may enter. Factors that might be taken into account include:

- ü What is the current geographical distribution and incidence of CBPP around the world?
- ü Is the distribution fairly static, or has there been a recent history of spread to new countries, regions or continents?
- ü How close is the disease? What is the status of neighbouring countries, not only in respect to known presence of CBPP, but also confidence in their veterinary services to be able to detect and control outbreaks of the disease?
- ü If it is present in neighbouring countries, where are the nearest outbreaks to shared borders?
- ü Is there a past history of introduction of CBPP to the country? Is it possible that it is still present in undetected endemic pockets of infection in cattle?
- ü Are cattle imported into the country, and do these come from known or suspected infected countries?
- ü How secure are barrier and border quarantine procedures to prevent unlawful entry of cattle into the country?
- ü Are there known patterns of unofficial cattle movements across borders from neighbouring countries through transhumance, nomadism or trading

practices, which would constitute a risk for entry of CBPP? Where do these occur?

- ü Is there civil unrest in neighbouring countries that might result in major movements of people and movement or abandonment of livestock?

The next step is to evaluate how serious the socio-economic consequences might be if there were an incursion of the disease. Factors that might be taken into consideration include:

- ü Is the disease likely to become established in the country? Are there susceptible cattle populations?
- ü Would it be difficult to recognize the disease quickly in different parts of the country?
- ü How big are the cattle populations in the country? How important are those livestock industries to the national economy? What is their importance in satisfying nutritional and other needs of communities?
- ü How is the cattle industry structured within the country: is there a large commercial beef or dairy cattle production industry, or does it consist mainly of subsistence pastoral systems? Are cattle concentrated in just a few areas of the country?
- ü How serious would the production losses be from the disease? Would food security be threatened?
- ü What effect would the presence of the disease in the country have for export trade of live cattle, meat or both? What effect would it have on internal trade?
- ü Are there populations of cattle that are poorly controlled and allowed to roam freely and which might constitute difficult-to-control reservoirs of CBPP infection?
- ü How difficult and costly would the disease be to control and eradicate? Is it capable of eradication?

Through addressing these questions and issues, it will be possible to build up a risk profile for CBPP, and to make judgements on the magnitude of the risk presented by the disease, in qualitative, if not quantitative, terms. Most importantly, it will be possible to get an idea of how CBPP ranks in relation to other high priority risk diseases, and what resources should be devoted to preparedness for CBPP in comparison with other diseases. It will also be possible to get some idea of where the pressure points may be for entry of the disease, and how veterinary services and contingency planning may need to be strengthened for CBPP.

3.5 THE VALUE OF RISK ASSESSMENTS FOR CBPP

The type of risk assessment that has been described will be of value for:

- ü determining how CBPP ranks in the priority list of serious disease threats for the country and what level of resources should be devoted to preparing for it in comparison with other disease threats;
- ü determining where and how quarantine protocols and procedures need to be strengthened;
- ü determining how laboratory diagnostic capabilities need to be strengthened;
- ü planning training courses for veterinary staff;
- ü planning farmer awareness and publicity campaigns;
- ü determining how and where active disease surveillance needs to be strengthened; and
- ü planning disease response strategies.

4. PREVENTION STRATEGIES FOR CBPP

4.1 INTRODUCTION

The old maxim that prevention is better than cure is very relevant to dealing with CBPP and other TADs. Quarantine is the first line of defence against these diseases, and all countries should devote an appropriate level of resources to ensure that they implement effective border and import quarantine policies and programmes to prevent the introduction of serious livestock diseases.

Risk analyses for CBPP should provide an estimate of the degree of risk of introduction of the disease; the more likely mechanisms and portals of CBPP entry; and the potential seriousness of the consequences should the disease enter the country. This should provide the basis for designing and implementing appropriate preventive strategies for CBPP, and making provision for the necessary resources.

The most important resource in the prevention of CBPP (or any other livestock disease) is the informed animal owner or manager. Cattle owners at all levels of production must be able to recognize CBPP and know what to do when they suspect it. This can only be achieved by intensive farmer training, using media that are easily understood, highly visual, and that will serve as a constant reminder of the disease and its importance. Lines of communication must be established between livestock owners and the veterinary services, using local authorities and agricultural personnel as intermediaries when necessary, who should also be informed about CBPP. It has been pointed out that the only people who see animals every day are their owners, and therefore informed owners or animal attendants constitute the only really viable surveillance resource for animal disease detection.

4.2 IMPORT QUARANTINE POLICY

Chapter 2.1.6 of the OIE International Animal Health Code (2001 Edition), on contagious bovine pleuropneumonia, provides zoo-sanitary guidelines for the safe importation of domestic and wild bovidae for slaughter or breeding purposes. It also sets standards for the international recognition of CBPP-free countries and CBPP-free zones within countries.

4.3 BORDER QUARANTINE POLICY

The possibility of infected cattle crossing shared borders is probably the greatest risk that most countries face for the entry of CBPP, and it is here that the most effort has to be placed to prevent the entry of the disease into currently CBPP-free countries.

Of course, for officially approved entry of cattle at national borders, the animal health guidelines recommended by the OIE International Animal Health Code for importation of cattle for breeding or for slaughter should be followed in as far as is practicable.

It is, however, the unofficial entry of cattle across national borders that presents the greatest risks and is the most difficult to deal with in respect to preventing the entry of CBPP. Such unofficial entry may occur through trading, or nomadic or transhumance practices. The sudden influx of refugees with their cattle from neighbouring, infected, countries where there is civil strife probably constitutes the greatest of all disease entry risks.

Whilst it may be very difficult or even counterproductive to try to prevent such unofficial cattle entries, every effort should be made to minimize them where practicable, and otherwise to make them safer by trying to ensure that only laboratory-tested healthy or vaccinated cattle cross at approved entry points. This entails developing a close working relationship with animal health authorities in neighbouring countries, both at the national level and at local levels in provinces adjacent to borders. It also entails developing a close relationship with cattle traders and cattle farming communities and herders in high-risk border areas. This is to help to ensure that there is early warning of any known or suspect CBPP activity near the border; that cattle are obtained as far as practicable from CBPP-free areas and are healthy and vaccinated against CBPP; and that any cattle that are sick are held apart from other cattle (i.e. self quarantine) and brought to the attention of local animal health staff as soon as possible.

5. EARLY WARNING CONTINGENCY PLANNING FOR CBPP

5. 1 INTRODUCTION

Early warning enables rapid detection of the introduction of, or sudden increase in the incidence of, a serious disease such as CBPP before it develops to epidemic proportions and causes serious socio-economic consequences. It embraces all initiatives – mainly based on disease surveillance, reporting and epidemiological analysis – that would lead to improved awareness and knowledge of the distribution and behaviour of disease outbreaks (and of infection). This should allow forecasting of the source and evolution of the disease outbreaks, and monitoring of the effectiveness of disease control campaigns.

The success of a country's capability for rapid detection of introduction or increased incidence of CBPP depends on the following:

- ü good farmer and public awareness programmes for CBPP and other high-threat epidemic livestock diseases, which implies improving the veterinary-farmer interface;
- ü training of field veterinary officers, veterinary auxiliary staff, agricultural extension officers, local authorities and cattle owners in the clinical and gross pathological recognition of CBPP and other serious epidemic livestock diseases; training all involved in collection and transportation of diagnostic specimens; and stressing the need for prompt action;
- ü sustained active disease surveillance, to supplement passive monitoring, based on close coordination between cattle owners, field, laboratory and epidemiology veterinary services, and use of techniques such as participatory questionnaires, serological surveys and abattoir monitoring to supplement field searching for clinical disease;
- ü dependable emergency disease reporting mechanisms to regional, national and federal veterinary headquarters as appropriate;
- ü implementation of an emergency disease information system (e.g. TADinfo);
- ü enhancement of laboratory diagnostic capabilities for CBPP within provincial and national veterinary laboratories;
- ü development of strong linkages between national laboratories and regional and world reference laboratories;
- ü strengthening of national epidemiological capabilities to support emergency preparedness and disease management strategies; and

- ü prompt and comprehensive international disease reporting to the OIE by all countries, and particularly neighbouring countries.

It is beyond the scope of this Manual to discuss these issues in any detail. For more information, reference should be made to the FAO Manual on the Preparation of National Animal Disease Emergency Preparedness Plans (*FAO Animal Health Manual,* No. 6); the FAO Manual on Livestock Disease Surveillance and Information Systems (*FAO Animal Health Manual*, No. 8); and the FAO Manual on Participatory Epidemiology (*FAO Animal Health Manual*, No. 10).

However, a few of the important issues for CBPP early warning preparedness are considered below.

5.2 TRAINING OF VETERINARIANS AND OTHER ANIMAL HEALTH STAFF IN EARLY RECOGNITION OF CBPP AND COLLECTION AND DISPATCH OF DIAGNOSTIC SPECIMENS

In many countries, it is likely that very few veterinarians or other animal health workers in either the public or private sector will have had any direct, first-hand experience with CBPP or other TADs, as these diseases may never have occurred in the country or may have been exotic for a considerable period. If CBPP is rated as a high-threat disease, this deficiency needs to be rectified by a systematic training programme for all those persons who, in their professional capacity, might possibly be the first to come into contact with an incursion or outbreak of this disease. Because a disease may strike in any part of the country and because of staff turnover, training programmes should be both comprehensive and regular. This training must extend to staff in the remotest parts of the country, as well as to selected officials (agricultural extension officers, local authorities) and cattle owners.

Obviously, it will neither be practicable nor necessary to train personnel to a high level of expertise in these diseases. In most cases it is sufficient that trainees be at least familiar with the basic clinical, pathological and epidemiological features of CBPP, and with what they need to do if they suspect a case of the disease. Perhaps the most important thing to inculcate in people is the mind set that if they are confronted by an unusual disease outbreak in cattle, either in the field or in the diagnostic laboratory, they should include CBPP in the range of their differential diagnostic possibilities and act accordingly. They should be trained in the steps that they need to take to secure a confirmatory diagnosis, including collection and transport of diagnostic specimens, and in the immediate disease control actions that need to be instituted at a disease outbreak site. More specialized training will be needed for those personnel who are nominated as members of specialist diagnostic teams (see below).

There are a number of training possibilities that might may be selected as appropriate. These include:

- ü sending key field or laboratory staff to another country to gain first-hand experience when there is a CBPP outbreak there, or making use of any other opportunities offered for field and laboratory staff to profit from the experience of countries that are in the process of controlling an outbreak (e.g. attending workshops);
- ü other international training opportunities that may occur from time to time. Several countries that have access to microbiologically high-security laboratory and animal facilities run training courses in which exotic diseases can be demonstrated by experimental infection of susceptible livestock species. Such courses are run in Australia, Republic of South Africa, United Kingdom and USA, and there are opportunities for external students to attend. There is also the possibility for laboratory staff to be trained at World or Regional Reference Laboratories. Training programmes may also be arranged occasionally by other international organizations;
- ü national emergency disease training workshops, which should be organized as the mainstay of training and should be targeted at government field and laboratory veterinary officers, public health and quarantine veterinarians (including those stationed at abattoirs, markets, border posts, air and seaports), veterinary practitioners, and industry veterinarians. Ideally, these workshops should include representatives from neighbouring countries, and should filter down to farmer level by means of workshops organized by those who have been trained; and
- ü field diagnostic manuals, which are most useful if they are prepared in a simple, practical and graphic format suitable for keeping always in the vehicle and therefore available for quick reference at the site of a possible disease outbreak.

5.3 FARMER AWARENESS AND EDUCATION PROGRAMMES

This is one of the most critical, but sometimes neglected, aspects of preparedness planning for emergency diseases, and for fostering ownership and support among livestock farmers and other key stakeholders for emergency disease control and eradication campaigns. It also engenders a bottom-up approach to planning and implementation of disease control programmes, to complement the more traditional top-down approach adopted by governments.

The communication strategies should aim to make stakeholders aware of the nature and potential consequences of CBPP and other important livestock diseases, and of the benefits to be derived from their prevention and eradication. Furthermore communication strategies should always have an element of rallying the community to the common cause of preventing and fighting a disease epidemic.

Ideally, this should result in farmer sanitary defence groups and farmer organizations.

One of the important messages to get across is that it is essential to notify and seek help from the nearest government animal health official as soon as an unusual disease outbreak is seen in cattle (and how to seek help). Publicity campaigns should be directed not only towards farmers, but also to local authorities and livestock traders.

5.4 SPECIALIST DIAGNOSTIC TEAM

It is recommended that a specialist CBPP diagnostic team be nominated within the country, that can be mobilized when there is a report or rumour of a suspect outbreak in cattle in the field. These arrangements should be made well in advance of any emergency, and the members should be available and equipped to travel to a disease outbreak site at short notice. The equipment should include all that is needed for the preliminary investigation of a disease and for collection and transport of diagnostic specimens.

The composition of the diagnostic team will vary according to circumstances, but might include:

(i) a veterinary pathologist from the Central or Regional Veterinary Diagnostic Laboratory;
(ii) a specialist veterinary microbiologist, preferably with first-hand experience or training in CBPP;
(iii) an epidemiologist with extensive experience of endemic diseases in cattle, and a knowledge of cattle farming in the area in question; and
(iv) any specialist required for special examinations.

The team would travel to a disease outbreak site with local veterinary staff if so directed by the CVO, and would be expected to make clinical examinations; collect histories; make preliminary epidemiological investigations, particularly in respect to trace-backs (have any new animals joined the infected herds in recent months, and, if so, where did they come from?) and trace-forwards (have any animals left the infected herds in recent weeks and, if so, to where did they go?); perform necropsies on animals that were killed in an advanced stage of the disease or on animals recently dead; and collect a range of diagnostic specimens appropriate to the endemic and exotic diseases included in the differential diagnosis, and transport these specimens under suitable conditions back to the laboratory.

A good framework for investigation of field outbreaks is given in Appendix 1.

The team should also be able to take any immediate disease control actions at the outbreak site that are necessary, and should have the necessary authorities to do this.

The team would be expected to report back immediately to the State, Provincial and Regional Veterinary Officers and the CVO on their assessment of the disease outbreak, including steps taken to secure a confirmatory diagnosis, and on their advice on further disease control strategies, including declaration of infected and surveillance zones.

5.5 LABORATORY DIAGNOSTIC CAPABILITIES

The rapid and certain diagnosis of diseases can only be assured in fully equipped laboratories, having access to a range of standardized diagnostic reagents, and with experienced staff and a sufficient throughput of diagnostic specimens to maintain expertise. Additionally, development of diagnostic expertise for exotic diseases for tests that require handling the live agent should only be attempted in microbiologically secure laboratories.

It would therefore be impractical and excessively costly for most countries to maintain a national veterinary diagnostic laboratory that has full capabilities for confirmatory diagnosis of all transboundary and other emergency diseases, many of which will be exotic. However, it is to be expected that at least all countries that have significant livestock populations should have a veterinary diagnostic laboratory that is equipped and competent to undertake a broad range of standard techniques in pathology, virology, bacteriology and serology to the standard where preliminary identification of aetiological agents for most if not all emergency livestock diseases could be attempted. If CBPP is deemed to be a very high threat disease, consideration should be given to developing capabilities for some primary key diagnostic tests.

Specimen transport containers should be kept at both Central and State or Provincial Veterinary Laboratories, and should be made readily available for field veterinary officers and specialist diagnostic teams. These should ideally consist of leak-proof primary containers, such as glass universal bottles with a metal screw-cap with rubber washer, or good quality plastic screw-top jars. These are then packed into a leak-proof secondary container (e.g. a steel paint tin or a plastic or styrofoam cool-box) with absorbent material and an ice-pack. This is finally placed into a robust outer container with good labels. Specimen advice notes should also be provided (see Chapter 2).

5.6 INTERNATIONAL REFERENCE LABORATORIES AND COLLABORATING CENTRES

For CBPP, there is a network of FAO Reference Laboratories and Collaborating Centres and OIE Reference Experts and Laboratories around the world, which are available to provide advice and assistance to countries. Their names, full contact details and geographical areas of responsibility are shown in Appendix 2.

As part of their CBPP contingency planning, countries should establish contact and a dialogue with appropriate Reference Laboratories and Collaborating Centres. They should determine the nature and range of diagnostic specimens or isolated agents that should be sent for confirmatory diagnosis or further characterization; any transport media that should be added; method of packaging and refrigeration; and labelling of package including correct address and any necessary customs or IATA declarations. This information should be documented in the contingency plans.

It is very important that potential or confirmed aetiological agents from emergency disease outbreaks be sent to the appropriate International Reference Laboratory for further characterization. It is recommended that several isolates from different geographical locations and at different phases of the outbreak be forwarded. Submission of samples to any laboratory outside the country of origin should always be subject to prior agreement with the recipient, with transportation in containers meeting IATA regulation standards.

Full use of Reference Laboratories and Collaborating Centres should also be made for the help that they can provide for training opportunities, provision of specialized advice in planning and standardized diagnostic reagents, etc.

5.7 SPECIFIC SURVEILLANCE PROCEDURES FOR CBPP

Whilst the whole range of surveillance techniques – summarized here in section 5.1 and described in greater detail in *FAO Animal Health Manuals* No. 8 and No. 10 – should be applied, emphasis is given to two fundamental techniques for CBPP surveillance, namely abattoir monitoring and clinical surveillance.

5.7.1 Abattoir monitoring

Abattoir monitoring is a cheap and highly effective method of surveillance for CBPP. The coverage that can be provided depends on the proportion of cattle in the country that are slaughtered in controlled abattoirs with meat inspection facilities. Meat inspection staff should be trained in correct methods for palpating, sectioning and examining pleura and lungs during inspection of cattle carcasses. They should receive special training in the key pathological features of CBPP, and should be provided with forms on which they may record their findings. These

should incorporate simple diagrams of lungs for drawing the location of lesions. There is also the need to monitor informal slaughter sites.

Key Indicators of CBPP in Meat Inspection

- yellow fluid in the chest cavity
- lungs covered with yellowish material
- lungs adhering to the chest wall
- lungs which do not collapse and are solid or marbled
- sequestra in the lungs of chronic cases

Diagnostic samples should always be collected from suspect lungs, and meat inspectors should be trained in how to do this, and should also be provided with collection kits. Finally, there should be simple, direct methods for them to report their findings, together with key epidemiological information on the owners and source of the cattle.

5.7.2 Clinical surveillance

Both active and passive clinical surveillance are also valuable for the early detection of CBPP. Passive clinical surveillance should be encouraged through a comprehensive national programme to the extent that everyone who comes into contact with cattle from field veterinarians, to animal health assistants, farmers, traders and down to animal attendants should be stimulated to look out for the key clinical signs of CBPP and to report any suspect cases

Simple pictorial booklets on CBPP, in appropriate languages, should be widely distributed.

Key signs to look out for in clinical surveillance for CBPP

- fast, difficult or noisy breathing
- discharges from the nose
- coughing, especially after exercise
- anorexia, debility, weakness and loss of weight

OIE has developed comprehensive surveillance standards for CBPP, particularly in the context of defining CBPP-free zones and countries. These are to be found in Appendix 3.

6. EARLY REACTION CONTINGENCY PLANNING FOR A CBPP EMERGENCY

6.1 INTRODUCTION

This Manual mainly addresses the situation where CBPP invades a country, or a zone within a country, that was formerly considered free from CBPP. Should such an emergency occur, all initiatives would be directed at rapid containment of the disease to the primary focus or zone of infection, and eradication within the shortest possible time to avoid spread and possible progression to endemic status.

However the same principles for control and eradication are also very applicable to dealing with the situation where CBPP is already endemic in part or all of the country.

6.2 EPIDEMIOLOGICAL FEATURES INFLUENCING CBPP ERADICATION STRATEGIES

There are a number of epidemiological and other factors – some favourable and others unfavourable – that need to be taken into account when devising eradication strategies for CBPP. These include:

- ü no domestic livestock species other than cattle and water buffaloes (and yaks in the restricted regions where they occur) are susceptible to CBPP; humans are not susceptible;
- ü there are no wildlife reservoirs of infection;
- ü *Mmm*SC is closely related to other mycoplasmas in the 'mycoplasma cluster,' complicating its identification;
- ü CBPP is transmitted by close direct contact between animals, and thus movement of infected cattle and congregation of animals is the key factor in its spread;
- ü the causal organism survives poorly in the environment and therefore indirect spread of infection, e.g. by fomites, is unimportant;
- ü epidemics in new areas sometimes evolve slowly, making early detection difficult;
- ü cattle that survive CBPP infection are likely to become chronic carriers, with sequestered lesions in their lungs. A proportion of these are seronegative. Sequestra may break down, particularly when cattle are stressed, and these animals again become active spreaders of infection;

- ü vaccines that are available are far from perfect. Nevertheless, vaccination campaigns, if comprehensively and consistently applied, are a valuable component of control and eradication campaigns; and
- ü the use of antibiotics, whilst ameliorating clinical signs in acute cases, may complicate eradication programmes, with the possible creation of chronic carriers of the disease.

Some of these factors, particularly the presence of chronic carriers and problems in disease surveillance, make CBPP one of the more difficult transboundary animal diseases to eradicate. Nevertheless, it has been eradicated, often under difficult circumstances. For example, it was eradicated from Australia by comprehensive vaccination campaigns, zonation, movement controls and final stamping out. It was eradicated from Botswana much more quickly by stamping out.

6.3 STRATEGIES FOR CBPP ERADICATION

Taking account of the above epidemiological and other factors, there are three broad strategies for the control and eradication of CBPP, namely:

- ü reduction in the number of infected and potentially infected animals in cattle populations through stamping-out campaigns;
- ü reduction in the rate of direct contact between infected and susceptible cattle through surveillance programmes, zonation, quarantine and strict movement controls; and
- ü reduction in the number of susceptible animals in target populations through comprehensive vaccination campaigns.

Stamping out is certainly the most rapid and effective method of CBPP control (as it is for many other transboundary animal diseases), and international recognition of disease-free status can be more quickly regained for export trading purposes (see Appendix 3) if stamping out is applied. It is also likely to be the preferred option for dealing with isolated outbreaks in developed countries. However, it is seldom a practical or economically viable proposition for developing countries. The exceptions are:

- ü when an outbreak of CBPP in a previously free country or zone of a country can be detected quickly whilst it is still localized, and the infected area can be accurately identified and sealed off; and
- ü during the final mopping-up stages of an eradication campaign, when there are only a few isolated incidences of the disease.

Comprehensive vaccination campaigns are likely to be an integral part of most CBPP control and eradication programmes. They are important in reducing the incidence of the disease to a very low level, where other control and eradication

options become more viable. However vaccination alone will not guarantee eradication, and in the long run may be very costly.

Strategic planning for the control and progressive eradication of CBPP, whether it is preparedness for the disease in a free country or if it is to eradicate the disease in a country where it already occurs, most often involves a structured approach that incorporates each of the three broad control and eradication strategies described above.

This structured approach involves progressive application of the following measures:

- ü immmediate zoning of the country to take account of the known and suspected locations of the disease;
- ü instigate quarantine and cattle movement controls that will minimize spread of infection and prevent spread outside the designated infected zone;
- ü instigate a comprehensive disease surveillance programme for CBPP throughout the country – with adjustment of infected, control and free zones according to findings;
- ü make the decision as to whether or not to proceed with a stamping-out programme, based on analysis of epidemiology, socio-economics and resource availability;
- ü if stamping out is not selected, undertake a comprehensive vaccination programme for a minimum of three years, and more probably for five years. In the case of countries where CBPP is endemic, the vaccination programme would probably need to cover the whole country;
- ü cease vaccination when the disease incidence has fallen to an acceptably low level;
- ü instigate a disease surveillance programme that will lead to a progression from provisional declaration of freedom from disease, to freedom from clinical CBPP, and finally freedom from CBPP (see Appendix 3); and
- ü have preparedness plans to respond very rapidly to any disease breakdowns, applying either stamping out (preferable) or targeted vaccination and movement controls.

6.4 SOME KEY FACTORS FOR THE SUCCESS OF CBPP CONTROL AND ERADICATION PROGRAMMES

6.4.1 The necessity for comprehensive programmes

The epidemiological nature of CBPP, where there will be persistence of infection and transmission of the disease (often over long distances) through subacute and chronic cases, dictates that, to be successful, control and eradication programmes must be both comprehensive and consistently applied over a number of years.

Equally, a piecemeal approach to CBPP control and eradication is almost certainly doomed to failure. It will condemn countries to CBPP endemicity, discourage both animal health officials and farmers, and make eventual eradication both difficult and costly.

6.4.2 The need for international cooperation and regionally coordinated CBPP programmes

In many areas where CBPP currently occurs or which are at high risk of the disease, the potential natural epidemiological range of the disease extends over territory that may encompass more than any one country and may indeed include several countries. This may occur where there are traditional cattle trading, herding, nomadic or transhumance patterns that extend over a large region. Examples of this are to be found in the well-recognized ecological zones for CBPP in West and Central Africa; eastern Africa; and southern Africa.

Significant progress towards CBPP eradication in these ecological zones will only be possible if there is a high degree of cooperation between neighbouring countries in the development and implementation of regionally coordinated CBPP prevention, preparedness and control and eradication programmes.

6.4.4 The use of chemotherapy in CBPP control and eradication programmes

Whilst penicillin and its analogues are ineffective, a number of broad-spectrum antibiotics are mycoplasmacidal. Such antibiotics may ameliorate the clinical signs of CBPP. However, they do not necessarily eliminate infection in treated animals. This makes control and eradication of the disease in endemic areas more difficult and increases the risks of spread of the disease to new areas. Since most farmers treat their cattle infected with *Mmm*SC with antibiotics in any case, a structured scientific study on the effect of various types of antibiotic treatment on the course of CBPP disease is needed. This will provide the scientific basis for the rational use – or otherwise – of antibiotics in CBPP control.

6.5 ZONING AND LIVESTOCK MOVEMENT CONTROLS

When CBPP is detected in a previously free country or region of a country, the first step to be taken is to immediately quarantine the known affected farms to prevent the movement of potentially infected cattle from these farms. An urgent epidemiological assessment is then undertaken to make an initial estimate of the likely spread of infection that has taken place. This would be based not only on the sites of known disease occurrence, but also on movements of cattle to and from these sites and on opportunities that have occurred for mingling of infected and susceptible cattle.

Based on this initial assessment, three zones would be declared: infected zones; surveillance zones; and CBPP-free zones.

6.5.1 Infected zone(s)

The infected zone encompasses the area immediately surrounding one or more infected farms, premises or villages. Whilst its size and shape is influenced by topographical features, physical barriers, administrative borders and epidemiological considerations, OIE recommends in general that infected zones should be at least a 10 km radius around disease foci in areas with intense livestock raising, and 50 km in areas where extensive livestock raising is practised.

In the initial stages of an outbreak, when its extent is not well known, it would be wise to declare larger infected zones, and then progressively reduce these in size as active disease surveillance reveals the true extent of the outbreak.

There should be a complete ban on the movement of cattle out of the infected zone, and this should be rigorously enforced.

The chosen disease control strategy, whether it is stamping out, vaccination or a combination of these, is then instituted.

6.5.2 Surveillance (or control) zone(s)

This zone is much larger, and surrounds one or more infected zones. It may cover a whole Province or administrative region, and, in many cases, the whole country. In this zone, the most intensive disease surveillance is carried out. Cattle should not be allowed to move out of this zone unless they are moving directly under supervision to abattoirs for slaughter or are shown by testing to be free of infection.

6.5.3 CBPP-free zone(s)

This encompasses the rest of the country. However, because of the potential of CBPP for wide dissemination, it would be unwise to regard any part of a country in the throes of a virgin outbreak as unworthy of a high level of surveillance. The emphasis in free zones should be on strict quarantine measures to prevent entry of the disease from infected zones, coupled with continuing surveillance to provide confidence of continuing freedom. These zones should be subjected to the same degree of information dissemination as the zones in which the outbreak occurs. This should be extended, through good and rapid communication, to neighbouring countries.

Comprehensive disease surveillance programmes should be put into place throughout the country, and the zones should be progressively adjusted according to findings.

6.6 STAMPING OUT

A stamping-out programme for CBPP involves the destruction of all infected and potentially infected cattle in well-defined infected areas, combined with very strict movement controls to ensure that cattle cannot leave the target areas.

Careful socio-economic and resource availability analyses should be carried out before a decision is made to embark upon a stamping-out campaign. As has already been noted, stamping out is only likely to be a viable proposition under certain circumstances, including:

- ü when the disease is detected early after its introduction into a previously free country or area, and it is still limited to relatively small and well-contained geographical areas and cattle populations;
- ü during the final mopping-up stages of a control and eradication programme to deal with small, isolated disease outbreaks; or
- ü when the need to re-establish export markets dictate that stamping out should be used so that the country can gain quicker recognition of disease-free status and thus access to markets.

A stamping-out campaign should not be undertaken unless essential prerequisites can be met (see Box 1).

An early decision will need to be made whether to slaughter all cattle within the designated infected area(s), or only those on farms where the disease is detected either on clinico-pathological grounds or by other surveillance procedures (including serological testing). Because of the difficulties in maintaining a high enough level of surveillance and in preventing mixing of cattle between farms, the decision is usually taken to slaughter all cattle within the designated infected area.

Destruction of cattle would normally be by humane shooting, either by firearms or captive-bolt pistols. This is described more fully in the FAO Manual on Procedures for Disease Eradication by Stamping Out (*FAO Animal Health Manual,* No. 12).

As the causative organism, *Mmm*SC, is not transmitted in meat, consideration could be given to salvaging meat by allowing clinically healthy cattle to be transported for immediate abattoir slaughter, providing this is done in controlled abattoirs with meat inspection within the infected area.

Box1. Essential prerequisites for a CBPP stamping-out campaign

- Political and community support
- Well-defined infected area(s) based on comprehensive surveillance programmes
- Capabilities to seal off infected areas through quarantine and livestock movement controls
- Well-trained personnel and availability of necessary financial and physical resources
- Provision for fair and timely compensation for slaughtered cattle
- Legal powers
- Rehabilitation programmes for affected farming communities
- Assistance from security agents

There is no need to dispose of the carcasses of slaughtered cattle by deep burial or incineration for reasons of preventing further CBPP transmission (as would be the case for diseases such as foot-and-mouth (FMD)), although some disposal process may be desired on environmental, public health or aesthetic grounds. Likewise, there is no need to clean and disinfect infected properties after de-stocking, as would be the case for other TADs where there is longer survival of the agent in the environment and there is transmission by fomites.

Restocking should not commence until it can be assured that all infected and potentially infected cattle in the target area have been slaughtered. In areas where there is poor control of cattle or difficult terrain, it may be necessary to supplement ground searching by aerial surveys, and to remove cattle in inaccessible locations by shooting from helicopters. In some instances, monetary incentives for finding cattle during the mop-up phase have been useful in locating and destroying cattle that might have been missed during the initial destruction phase.

It would be usual practice to leave areas for 3 to 6 months (depending on circumstances) before restocking, to be on the safe side. Restocking must be done with known CBPP-free cattle, preferably from a free zone. Serological testing (CFT and c-ELISA) to confirm freedom from infection would be the ideal. The opportunity could also be taken for genetic upgrading.

6.7 VACCINATION PROGRAMMES

Vaccination programmes as components of a CBPP eradication campaign must be comprehensively and consistently applied until there is evidence from disease surveillance that the disease has either apparently disappeared or at least the incidence has fallen to an extremely low level. The target areas for vaccination should include all but proven CBPP-free zones. In endemic regions, countrywide programmes are usually needed.

Live, attenuated CBPP vaccines are used. These may involve some compromise between inocuity and immunogenicity. Vaccine strains that are currently in use are T_1-44 and T_1-SR. T_1-44 is currently the preferred vaccine in

Box 2. Compensation

It is essential that farmers and other persons who have had their cattle slaughtered should be fairly compensated for their current market value. This compensation should be paid without delay. Valuation for compensation purposes should be undertaken by experienced, independent valuers. Alternatively, generic valuation figures could be agreed upon for specific categories of cattle. At least the market value of the cattle should be paid. Under some circumstances, replacement of stock might be offered in lieu of monetary compensation.

Failure to pay adequate and timely compensation would seriously compromise CBPP eradication campaigns by causing resentment in communities, lack of cooperation and would act as a spur to the illegal smuggling and clandestine sale of cattle out of infected areas to avoid losses.

most countries. However, it has been criticized in some countries for causing excessive local reactions in vaccinated animals.

It is essential that vaccine be procured from reliable manufacturers (i.e. those with external quality assurance certification) who adhere to internationally recognized standards of good manufacturing practice and quality assurance for vaccine seed management, viable mycoplasma titre, purity, safety and potency. These standards are to be found in section 2.1.6 of the OIE Manual of Standards of Diagnostic Tests and Vaccines (see www.oie.int).

Freeze-dried vaccine is usually used. However it is essential that adequate cold-chain facilities are available at central and local vaccine storage depots, and from there to the points of injection in the field.

The limitations of current vaccines should be recognized. Primary immunization protects substantially less than 100% of the vaccinated population and immunity in many cattle lasts less than one year. Furthermore, vaccination will not necessarily eliminate infection in animals already infected, particularly carrier animals. Both the immune coverage and duration of immunity improve markedly on subsequent vaccinations. Despite these limitations, vaccination systematically applied to target cattle populations with as close as possible to 100% coverage for several years will have a dramatic effect on reducing the incidence of the disease to very low levels in infected areas.

During the initial stages (first year or two) of a comprehensive vaccination campaign, cattle should be vaccinated at intervals of 4 to 6 months. Thereafter, annual vaccination is generally sufficient. The vaccination programme must be maintained for at least 3 to 5 years, or until the disease can no longer be detected by surveillance (e.g. clinical, abattoir, serological).

Untoward vaccination reactions are more liable to occur in *Bos taurus* breeds than in *Bos indicus*. These may take the form of severe local reactions, and very occasional systemic reactions and even death. Adverse reactions can be minimized

Box 3. Essential prerequisites for a CBPP vaccination programme

- Political and community support
- Commitment by stakeholders to a comprehensive vaccination programme applied for a sufficient period of time
- Availability of safe and potent vaccines
- Availability of adequate cold chains
- Accessibility of target cattle for vaccination
- Well trained vaccination teams
- Identification system for vaccinated cattle
- Comprehensive disease surveillance
- Briefing and debriefing sessions before and after campaign

by attention to correct vaccination technique. CBPP vaccines must be injected subcutaneously (not intramuscularly, intradermally or into fascial sheets). The preferred site is in the neck, although tail vaccination is also used.

Vaccination teams, whether in the public or private sector, must be trained in the proper storage and handling of CBPP vaccines and in proper vaccination techniques. Furthermore, good facilities need to be provided for restraining cattle during vaccination.

Cattle that have been vaccinated ought to be identified as such. A consistent, permanent identification system for vaccinated cattle needs to be provided within the country. This should indicate how often, and preferably also when, the cattle have been vaccinated. A system of ear marking or notching may be adequate for this purpose.

6.8 THE FINAL STAGES OF AN ERADICATION CAMPAIGN AND PROOF OF FREEDOM

This is often the most critical phase of the eradication campaign. This occurs when the clinical disease has apparently disappeared. If the wrong actions are taken at this stage and undetected pockets of infection remain, many of the benefits that have accrued from the eradication campaign may be eventually lost.

Governments may make one of two potentially bad decisions at this stage, unless they are properly advised.

The first is that they may decide that now that the clinical disease has waned or disappeared, then the socio-economic losses are over and the scarce financial and other resources being expended might be better diverted elsewhere. If disease control activities are prematurely wound down, leaving undetected infection, the disease is likely to flare up into further serious outbreaks as immunity levels in animal populations decline.

The second possible government decision, at the other end of the spectrum, is that routine vaccination programmes should be maintained indefinitely because of the fear of the political consequences if vaccination were stopped and there were then another outbreak. In this case, there will be a continuing economic burden from the control costs.

In both cases, the export trade opportunities that may flow from having an internationally recognized disease-free status will not be available.

When the clinical disease appears to have disappeared from either a region of a country or the whole country, it is time to take stock of the situation and to carry out a thorough epidemiological and economic assessment of future options.

It may well prove desirable to maintain strategic vaccination in high-risk areas if there is still a very high threat of a new incursion of the disease, such as

from a neighbouring country. At the same time, it is in many cases very advantageous to completely change tack by stopping vaccination programmes all together and moving to a disease search-and-destroy policy. This does not necessarily mean that fewer resources will be devoted against the disease in the short term. Rather, they will be directed away from routine vaccination toward increased activities focusing on early warning and early response. There must be a willingness to enhance active disease surveillance activities and to maintain at a high level preparedness against the disease. In this way, any disease breakdowns can be detected and eliminated quickly.

It should then be possible to proceed down the pathway that will allow OIE declaration of provisional freedom from disease, to final freedom from CBPP. The level of disease surveillance required in the final stages of eradication and for the necessary OIE declarations are shown in Appendix 3.

If any breakdowns are detected during this final stage of the eradication campaign, the disease should preferably be eliminated by stamping out. The need for early detection is vital if this is to be done. Alternatively, consideration could be given to slaughter of clinically diseased animals and animals that test positive to the disease, combined with an intensive vaccination campaign for surrounding cattle herds, with strict quarantine and movement controls.

7. ORGANIZATIONAL ARRANGEMENTS DURING A CBPP EMERGENCY CAMPAIGN

7.1 RESPONSIBILITIES AND COMMAND STRUCTURES

The CVO (or equivalent, such as a Director of Veterinary Services) of the country should have the overall technical responsibility for preparedness and management of CBPP emergencies. The appropriate government Minister would of course be ultimately responsible.

In recent years, the national veterinary services of many countries have been re-structured and rationalized. This has included *inter alia* regionalization and devolution of veterinary services; privatization of veterinary services, or downgrading of government services; separation of policy functions from operational functions; and separation of administrative responsibilities of veterinary laboratories and veterinary field services.

These new structures have evolved to best meet the demands of delivering routine animal health services. However, they are often not well suited for managing a major animal health emergency, such as a CBPP eradication campaign. In such an emergency, there is a need to make decisions rapidly, based on analysis of the best information that can be made available from all sources; have the capacity to convert those decisions into clear orders that can be conveyed down the chain to those charged with the responsibility of carrying them out; and the ability to know that orders have been carried out and with what results. Therefore there must be efficient mechanisms in place for transmission of information and instructions from the National Veterinary Services headquarters right down to the front line of the disease eradication campaign in the field and laboratory, and for feedback of information to headquarters.

It is clear that for these things to happen quickly and efficiently in an emergency, the veterinary services of a country must be placed in a *command structure* or *line-management* system, for at least the duration of the emergency response to a CBPP outbreak.

There should be forward planning so that most appropriate structures and lines of responsibilities can be rapidly put in place when a CBPP emergency arises. This may include organizing one or more of the following well in advance of any emergency:

(i) An agreement made that animal health emergencies will be handled at the national level and that the CVO will assume overall responsibility for responding to the emergency, and will be directly answerable to the Minister in this role.

(ii) A mechanism provided for cooperation between different ministries if necessary to control the disease (e.g. police, army, education, media). This usually necessitates the establishment of an Inter-Ministerial Committee. In view of the difficult bureaucracy that may attend the constitution of such a committee in an emergency, it is advisable that such a committee should exist permanently.

(iii) An agreement is needed with regional or provincial authorities that their own veterinary staff will come under the line management of the national CVO in an animal health emergency response programme. Arrangements also need to be put in place to ensure that regional field and laboratory veterinary services are fully involved in emergency preparedness planning and training activities; and in collaboration with national veterinary headquarters in providing early warning of emergencies (including emergency disease reporting to national headquarters).

(iv) Similar arrangements are required for all essential government veterinary services, including the Central Veterinary Laboratory, to also come within the command structure of the CVO (if not already so) for the purposes of the emergency response.

(v) Pre-existing contractual agreements must be in place for private-sector veterinary organizations, universities and other academic institutions, research institutes, etc., to provide essential services during an animal health emergency.

(vi) Negotiation with the National Veterinary Association to establish terms and conditions for hiring of practitioners and other private-sector veterinarians as temporary government veterinary officers, if needed.

In many countries the private sector is extremely small or non-existent and it may be necessary to rely upon non-veterinary assistance for disease control. There should therefore be a mechanism to mobilize the resources available in other related sectors, e.g. agricultural extension, with appropriate training. It is vital to identify those with potentially a role in the control of animal diseases and ensure that they are prepared to act immediately in the event of an epizootic.

7.2 CONSULTATIVE COMMITTEE ON EMERGENCY ANIMAL DISEASES (CCEAD)

Countries might find it very useful to establish a standing Consultative Committee on Emergency Animal Diseases (CCEAD) that can be convened as soon as there is a CBPP emergency and that can meet regularly during the course of the emergency response. This would be principally a technical committee, whose role would be to review epidemiological and other disease control information; recommend on the activation of agreed contingency plans; maintain oversight during the campaign; and advise the CVO and the Minister on the future planning of the campaign and on implementation of those plans.

A suggested CCEAD composition might be:

- ü Chief Veterinary Officer (Chair)
- ü Director of Field Veterinary Services/Director of Disease Control
- ü Head of the Epidemiological Unit
- ü Directors of State, Provincial or Regional Veterinary Services
- ü Director of the National Veterinary Laboratory
- ü Director of any Regional Veterinary Laboratories covering the outbreak areas
- ü Senior representatives of farmer groups or organizations
- ü Representatives of other key groups, e.g. National Veterinary Association, Universities
- ü Other technical experts, as required (with observer status)

If the command structure recommended in Section 7.1 cannot be implemented for one reason or another, it becomes even more essential that a CCEAD be established so that there can be a consensus approach to the conduct of the CBPP campaign.

7.3 NATIONAL ANIMAL DISEASE CONTROL CENTRE

Countries should establish a permanent National Animal Disease Control Centre. In the event of an outbreak of CBPP or another emergency animal disease, the Centre should be responsible to the CVO for coordinating all emergency disease control measures in the country. The Centre should preferably be situated within the national veterinary services headquarters. The National Epidemiology Unit should either be attached to the Centre or should work in close collaboration with it. The CVO may delegate day-to-day responsibilities for implementing agreed policy to the Head of the Centre, who would normally be a senior government veterinarian.

The responsibilities of the National Animal Disease Control Centre in the emergency response would include:

- ü implementing the disease control policies decided by the CVO and the CCEAD;
- ü directing and monitoring the operations of Local Animal Disease Control Centres (see below);
- ü maintaining up-to-date lists of available personnel and other resources, and details of where further resources may be obtained;
- ü deploying staff and other resources to the local centres;
- ü ordering and dispersing essential supplies, which would include vaccines for many diseases, including CBPP;

- ü monitoring the progress of the campaign and providing technical advice to the CVO;
- ü advising the CVO on the definition and proclamation of the various disease control zones;
- ü maintaining up-to-date lists and contact details of risk enterprises, etc;
- ü liaising with other groups involved in the emergency response, including those that may be activated as part of the National Disaster Plan;
- ü preparing international disease reports and, at the appropriate times, cases for recognition of zonal or national freedom from the disease;
- ü managing farmer awareness and general publicity programmes, including press releases; and
- ü general and financial administration, including the keeping of records.

The National Animal Disease Control Centre should be fully equipped with a range of maps covering all parts of the country (preferably at 1:50 000 scale), and with all suitable communication equipment for liaison with regional veterinary services or specially designated Local Animal Disease Control Centres, veterinary laboratories, etc., including by telephone, radio, E-mail and facsimile as appropriate. The Centre should also be linked with the Emergency Disease Information System.

7.4 LOCAL ANIMAL DISEASE CONTROL CENTRES

During the CBPP emergency, district offices of the veterinary services closest to the infected foci, or if there are no such veterinary offices, then district offices of the agricultural extension services, act as Local Animal Disease Control Centres. Ideally, teams should be able to travel in one day to and from any site for surveillance or any other disease control activities. Otherwise, possible locations for temporary local disease control centres (e.g. local government offices) should be identified and arranged for in advance.

The regional and district veterinary officers should be in charge of disease control operations in their area, with the right to enter farms, collect samples and take any measures deemed necessary to prevent the movement of cattle within and out of the areas under their control. They should be provided with the necessary materials for sample collection, storage over short periods (a refrigerator) and transmission of samples; protective clothing; a vehicle and fuel; and the means to contact the CVO as required. Provided the necessary political structures exist, they should be able to enlist the cooperation of other services, e.g. the police, agricultural extension officers and the media, to prevent dissemination of disease. They should be provided with the materials needed to carry out a public information campaign and more intensive farmer training and information. Most importantly, they should be at all times in possession of accurate information

relating to the status of the disease in the country, and slaughter and compensation levels.

7.5 INVOLVEMENT OF THE PRIVATE SECTOR

Under many circumstances, there are good opportunities to involve the private sector in partnerships in the implementation of CBPP control and eradication programmes. This might include *inter alia* private veterinarians, community animal health workers, and non-governmental organizations (NGOs).

Areas in which they might participate include disease surveillance and reporting; extension work; and the implementation of vaccination programmes. However, if this is to be done, it should be clearly recognized by all parties that the public sector (and specifically the CVO) is accountable for the overall programme. With this in mind, suitable training programmes and quality assurance mechanisms should be established.

Plate 7. Public awareness campaigns at farmer level are essential in effective CBPP control

8. SUPPORT PLANS

Support plans provide the vital backing that make possible the implementation of CBPP or other emergency disease contingency action plans.

8.1 FINANCIAL PLAN

Experience has shown that delay in obtaining finances is one of the major constraints on rapid response to emergency disease outbreaks. The immediate application of even modest funds will very probably save major expenditure later. Forward financial planning is therefore an essential component of preparedness.

Financial plans need to be developed that provide for the immediate provision of contingency funds to respond to disease emergencies. **These are for the necessary funds required over and above normal operating costs for government veterinary services.** All arms of government, including economic planning authorities and the Treasury or Department of Finance, should approve the plans.

The funds could cover the cost of the whole eradication campaign. More usually, they will cover the initial phases of the campaign, pending a review of the outbreak and the control programme, and of the funds required to finalize eradication.

The conditions under which funds may be released should be specified in advance. Normally, they would be provided to the CVO when they advise that:

- ü CBPP or another emergency disease has been diagnosed, or there are reasonable grounds to suspect that the disease is present;
- ü the outbreak is capable of effective control or eradication; and
- ü there are approved plans in place and ready for implementation.

The funds might be held as special funds that are sequestered for the purpose, or there could be drawing rights provided up to a pre-determined, realistic, amount against a specific government account.

In some countries, it might be desirable for funds to be provided from both the government and the private sector for emergency programmes against CBPP and other agreed diseases. This would be agreed upon after a review of the nature and proportion of public good and private good benefits that would be derived from the elimination of the disease. If appropriate, a funding formula might be agreed upon that covered payment of a fixed percentage of the cost of the total campaign by each sector, or whereby each sector pays for specific components in the campaign. If the private sector is to contribute, it needs to be determined who in the private sector benefits (and therefore should share the cost). This may include

processing industries and traders, as well as farmer organizations. It also needs to be determined in advance how the private sector funds will be raised. This could be done by livestock industry levies (say on livestock transactions or slaughtering), which funds are then held in quarantined funds, or by industry-wide insurance. Voluntary individual insurance policies are satisfactory for insuring against the consequential losses from a disease or disease control actions, but are unsatisfactory for raising funds for the campaign itself.

In many cases, the funding of the whole emergency disease eradication campaign might be beyond the resources of the country. If this is the case, forward planning should identify potential international donor sources for such a campaign. This could include emergency support from FAO or appropriate international agencies. The procedures for applying for funding and requirements for preparing and submitting an application should be determined in advance.

The financial plan should also include provisions for compensation to owners for any livestock or property destroyed as part of the disease eradication campaign. Paying inadequate compensation is not only unfair, but is also very counter-productive to any campaign. Inadequate compensation fosters resentment and lack of cooperation. It also encourages farmers to hide the presence of the disease. Compensation should be based on the fair market farm-gate value of the animals at the time of slaughter (assuming a value that the animal would have had as a healthy animal). The same principle should be applied to products and property. The valuation should be done by an independent, professional valuer. If individual valuations are not practical, then generic valuations for different classes of livestock may be acceptable. Compensation for consequential, rather than direct, losses are usually difficult to administer and are inappropriate. If replacement of stock after a suitable period is considered to be a better alternative than cash compensation, this should be confirmed in consultation with cattle owners, as some might be sufficiently discouraged to not to want to resume cattle farming.

8.2 RESOURCE PLANS

The first step in preparing a resource plan is to make a *resource inventory*. This is a listing of all the resources that will be needed to respond to, say, a moderate-sized outbreak of CBPP or other high-priority emergency disease. This includes personnel, equipment and other physical resources. The following resource lists required for different operations should be regarded as indicative rather than exhaustive:

- ***National Animal Disease Control Centre***: senior disease control veterinarians and epidemiologists, financial and administrative officers and extra staff for recording and processing epidemiological and other information; maps (1:50 000 and 1:10 000); computers; communication

equipment to local headquarters (e.g. telephone, facsimile, E-mail if available);

- ü ***Local Animal Disease Control Centres***: senior disease control veterinarians and epidemiologists, technical support and administrative officers; suitable offices; office equipment; cold storage for vaccines; maps; a telephone and if possible fax machine; and pro forma guides for various disease control operations. Under some circumstances, more sophisticated equipment, such as computers, with the concomitant advantage of e-mail, may be present and functional. A list of available personnel should be prepared for ease of contact;
- ü ***Diagnostic laboratories***: trained laboratory staff; standard laboratory equipment plus any specialized equipment for key emergency diseases; facilities for isolation and identification of the causative organism; and diagnostic reagents for antigen and antibody detection;
- ü ***Surveillance***: veterinarians and veterinary auxiliary support staff; transport; maps; communication equipment; leaflets or posters on the disease(s); equipment for collecting and transporting diagnostic samples, including blood; and animal restraint equipment;
- ü ***Slaughter***: supervising veterinarian, personnel and transport; humane killers, ammunition or other approved means of killing; protective clothing; animal restraint equipment; and soaps and disinfectants;
- ü ***Quarantine and livestock movement controls***: enforcement teams and transport; road-blocks (if necessary); and signs and posters. The modalities of solicit assistance from security agents should be clear;
- ü ***Vaccination***: veterinarians and trained staff; vaccination equipment; transport; cold storage containers for vaccine; cattle restraining equipment; and ear notchers. Briefing and debriefing sessions.

Next, a list of existing resources is prepared, including their specifications, quantities and locations. In the case of specialist staff, a register should be maintained of the staff, and their qualifications, expertise and experience with CBPP. These resource lists and staff registers should be maintained at the National Disease Control Centre and, where appropriate, at Regional Offices.

Comparison of the inventory lists of needed and available resources will inevitably highlight many deficiencies. The resource plan should identify how these deficiencies would be rectified in an emergency.

There are several options for obtaining the necessary extra resources:

- ü a list of where essential equipment and stores may be purchased, hired or borrowed;

- ü in some cases, for hard-to-obtain items, it may be desirable to maintain a central store. Likewise, items that take some time to prepare (e.g. pro forma guides) could also be stored;
- ü arrangements should be made for secondment of personnel and supply of equipment from other government agencies, e.g. transport and communications equipment from the Defence Forces; and
- ü arrangements should be made through Veterinary Associations for the temporary employment or secondment of veterinary practitioners in an emergency.

Supply of diagnostic reagents presents special problems, as international sources of these are limited. An international reference laboratory for CBPP should be consulted about sources of reliable diagnostic reagents.

It should be noted that to maintain adequate diagnostic capacity, laboratories should routinely perform the basic tests on specimens of known and unknown status to ensure competence, and should send test samples to reference laboratories from time to time to cross-check even negative results.

The resource plan and associated inventory lists need to be updated on a regular basis.

8.3 LEGISLATION

Acts of Parliament or Government regulations that provide the legislative framework and powers to carry out all necessary disease control actions need to be put in place in advance, as part of preparedness planning. This might include legislation to:

- ü make CBPP and other proclaimed animal diseases compulsorily notifiable;
- ü allow the entry of officials (or other designated persons) onto a farm or other livestock enterprise for disease surveillance purposes (including the collection of diagnostic specimens) and to carry out any other approved disease control actions;
- ü authorize the proclamation (gazetting) of infected areas and disease control zones;
- ü authorize the quarantining of farms or other livestock enterprises;
- ü authorize any bans on the movement of livestock, livestock products or other potentially contaminated materials, or the issue of permits to move these only under specified animal health conditions;
- ü authorize the compulsory destruction and safe disposal of infected or potentially infected animals, subject to fair compensation;
- ü authorize any other necessary disease control actions;

- ü provide for compensation to be paid to owners of livestock and property destroyed as part of disease control programmes, and define standards for such compensation;
- ü allow codes of practice to be mandated for risk enterprises and activities (e.g. livestock markets and abattoirs) and authorize any necessary disease control actions for these;
- ü authorize the compulsory vaccination of animals; and
- ü authorize the compulsory identification of animals, where appropriate.

For countries that operate under a federal system of government, there should be harmonization and consistency of legislation for animal disease emergencies throughout the country. The same should apply between countries within regions wherein there is unrestricted exchange of livestock and animal products under free-trade pacts, e.g. the European Union, the Mercosur countries in South America, and ECOWAS and SADC in western and southern Africa, respectively.

9. TRAINING, TESTING AND REVISION OF CONTINGENCY PLANS

9.1 SIMULATION EXERCISES

Simulation exercises are extremely useful for testing and refining the contingency plans in advance of any disease emergency. They are also a very valuable means for building teams for emergency disease responses and for training individual staff.

As realistic a disease outbreak scenario as possible should be devised for the exercises, using real data where possible (e.g. for livestock locations, populations and trading routes). The scenario may cover one or more time phases during the outbreak, with possibly a range of outcomes. However, neither the scenario nor the exercise should be overly complicated or long. It is best to test just one system at a time (e.g. operation of a Local Disease Control Centre). Simulation exercises may be done purely as a paper exercise or through mock activities, or a combination of both approaches. At the immediate completion of each simulation exercise, there should be a post-mortem of the results. This review should identify areas where plans need to be modified and further training needs.

A full-scale disease outbreak simulation exercise should only be attempted after the individual components of the disease control response have been tested and proven. Premature exercises of this nature may be counterproductive. Care must be taken that simulation exercises are not confused with actual outbreaks in the minds of the media and the public.

9.2 TRAINING

All staff should be thoroughly trained in their roles, duties and responsibilities in a CBPP emergency. Obviously, more intense training will need to be given to those who will be in key positions. It should also be borne in mind that any staff member, from the CVO downwards, might be absent or might need to be relieved during a disease emergency for one reason or another. Back-up staff should therefore be trained for each position.

9.3 THE NEED FOR REGULAR UPDATING OF CBPP CONTINGENCY PLANS

Contingency plans, once prepared, should not be treated as static documents. They should rather be regarded as dynamic documents that need to be regularly reviewed

and updated as warranted by changing circumstances. In reviewing and updating CBPP contingency plans, the following factors should be taken into account:

- ü changing epidemiological situations, both within the country and externally;
- ü new CBPP threats;
- ü changes in livestock production systems and trade requirements (internal or export);
- ü changes in national legislation or in the structure or capabilities of government veterinary services (or other government agencies or mechanisms); and
- ü experiences (from both within the country and from neighbouring countries), results from training or simulation exercises, and feedback from major stakeholders, including farmers.

APPENDIXES

Appendix 1 – Investigation of field outbreaks

Appendix 2 – International Reference Laboratories and Collaborating Centres for CBPP

Appendix 3 – Recommended standards for epidemiological surveillance systems for CBPP

APPENDIX 1

INVESTIGATION OF FIELD OUTBREAKS

(Extracted from *Recognizing contagious bovine pleuropneumonia*. FAO Animal Health Manual No. 13 (Rev. 1). Rome, 2002)

Investigation leading to a conclusive decision will rely on a combination of the following activities:

(i) epidemiological investigation to obtain a general picture of disease pattern in the herd;
(ii) post mortem examination to observe the characteristic lesions in organs of dead and/or slaughtered animals; and
(iii) laboratory examination to confirm infection.

EPIDEMIOLOGICAL INVESTIGATION

When CBPP is suspected, the questions asked should include the following:

1. What species of animals (e.g. cattle, sheep, goats, pigs, wild animals) are present on the livestock holding facility (or village)? How many of each is present and which species are affected?

If domestic or wild animals other than cattle or water buffaloes are affected, a condition other than CBPP should be considered.

2. What ages of cattle or domestic buffaloes are affected?

Record the various age groups of the animals; e.g. under 6 months; 7 to 18 months; over 18 months. In CBPP, the more severe respiratory forms are observed in adult animals.

3. Have the cattle been vaccinated against CBPP or other epidemic diseases and, if so, when did the last vaccination take place? Which vaccine was used? How many animals were vaccinated? Who conducted the vaccination?

If all the cattle have been vaccinated with a quality-assured CBPP vaccine at the appropriate time intervals they should theoretically not develop the disease. However, CBPP can still occur in non-vaccinated cattle in partially vaccinated herds and even in vaccinated cattle that have not been re-vaccinated as scheduled.

4. When did the first signs of disease appear? Is this the first time that this disease has occurred? If not, what are the approximate dates of previous episodes?

This can help to indicate whether the disease is endemic or newly introduced, and can help to calculate when infection entered the herd.

5. Have other cattle been bought or introduced for any reason during the six months before the disease was first noticed? If so, from where? Did any become sick?

The answer can provide a clue as to how the disease entered the herd.

6. Was the herd exposed to another herd, during the six months before the disease was first noticed? Do nomadic herds pass through the area? If so, when and from where?

Nomadic herds can be a CBPP reservoir. The answers can also provide an explanation of how the disease might have entered the farm or herd.

7. Are grazing lands, water-holes, drinking-troughs or dipping tanks shared with other nomadic or sedentary herds?

This is to indicate possible contacts with animals from other herds, allowing tracing of the origin of outbreak, and therefore helping to provide an early warning signal.

8. Were replacement animals vaccinated against CBPP and other diseases before or after introduction to the herd?

This provides information as to why sickness might be limited to a particular group of animals.

9. Does the community know the disease and does it have a local name?

Pastoralists are often able to provide a useful guide to disease conditions they have encountered in the past.

10. Have the infected animals been treated with antibiotic(s)? If so, which type(s)?

Antibiotics may mask the clinical symptoms of CBPP and alter the progression of disease in a herd. They may also alter the appearance of typical pathological lesions and thereby complicate diagnosis of the disease.

11. What are the signs observed in diseased animals?

Respiratory signs are more evident in adult cattle, whereas enlargement of joints may be present in calves under six months of age.

12. How many animals are clinically sick out of the total?

13. How many animals have died since the outbreak occurred?

14. What is the health status in neighbouring herds?

To decide if CBPP is present in the area, the neighbouring herds should be inspected for evidence of disease.

15. Have any animals been sold, transferred or given on loan, e.g. for ploughing, or as a gift (dowry) in the last six months?

The answer to this question might give important information on spread of the disease and assist in tracing the source of the outbreak.

CLINICAL EXAMINATION

As the clinical appearance of the disease can differ between individuals in a herd depending on the different stages of disease development, it is important to examine as large a number of animals as possible in order to obtain a full clinical picture. A notebook is essential to record all the findings and to refer to this later. The use of pieces of paper is not recommended as these often get lost, and vital information with them.

1. Record the observations of the farmer or animal attendant

Ask for the farmer or animal attendant to describe the disease observed.

Has any treatment been given? Antibiotics such as tylosin and the tetracyclines can be effective in modulating clinical symptoms and progress of disease.

[Conventional understanding is that antibiotic therapy is contra-indicated in outbreaks of CBPP because it is believed that its use leads to the generation of a high proportion of "lungers" (chronic carriers with sequestra in their lungs) in the herd, and that these can later spread infection to susceptible cattle. This may be true, but in most countries in which CBPP occurs, antibiotic therapy is a fact of life. Disagreement over its use should not be allowed to create a barrier between the animal health worker and livestock owner.]

Have any cows aborted?

2. Observe the animals at rest

Before attempting to handle the animals, check if they are alert or depressed, if lameness is present and if body condition is satisfactory for the time of year and type of management system

Do any stand with the neck and head extended, forelegs spread apart, mouth open and panting for air? It is worth remembering that this happens to:

- ü animals severely affected by CBPP – acute cases; and
- ü animals with respiratory diseases other than CBPP.

Is breathing difficult, rapid and painful? If breathing is difficult, the nostrils are generally dilated, and clear or bloodstained discharge may be seen from the nostrils.

Check the character and rate of respiration. Is it fast (more than 20 per minute)?

Do any animals cough?

Is there any discharge from the eyes and nose? A clear discharge may be present.

3. Physical examination

Take the rectal temperature: in acute cases it can rise above 40°C.

Check the surface lymph nodes: enlargement is not a feature.

Check the mouth, including the lining of the lips, tongue, cheek papillae and the hard palate – lesions are not found, unlike in rinderpest and FMD, although saliva may dribble from the mouth.

4. Force the animals to run for a few minutes and then examine them again

CBPP symptoms can be more clearly seen after a few minutes exercise – coughing and signs of lameness.

APPENDIX 2

INTERNATIONAL REFERENCE LABORATORIES AND COLLABORATING CENTRES FOR CBPP

FAO World Reference Laboratory for Contagious Bovine Pleuropneumonia

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APPENDIX 3

RECOMMENDED STANDARDS FOR EPIDEMIOLOGICAL SURVEILLANCE SYSTEMS FOR CONTAGIOUS BOVINE PLEUROPNEUMONIA

This section has been taken from Appendix 3.8.2 to the OIE International Animal Health Code 2001, downloaded from http://www.oie.int/eng/normes/MCode/A_00153.htm.

1. INTRODUCTION

The Ad hoc Group on Contagious Bovine Pleuropneumonia (CBPP) Surveillance Systems held a meeting on 7-9 June 1993 with the purpose of formulating these standards, which describe surveillance systems suited to the declaration of countries and zones free of disease and free of infection. Background information is contained in the report of the meeting. In order to write these standards, the Group reviewed the following:

a) epidemiological and non-disease factors influencing the choice of CBPP surveillance systems;

b) sampling and surveillance strategies;

c) diagnostic methods applicable to CBPP surveillance systems; and

d) the implications of CBPP vaccination for surveillance systems.

This last point was the subject of lengthy discussions during the meeting of the OIE Committee in May 1994. A revised text was submitted at the following meeting of the Committee (May 1995), which requested that a small group of experts formulate revised proposals. The present text is the product of their consensus.

2. DEFINITION AND PURPOSES OF SURVEILLANCE

Disease surveillance is necessary to provide evidence that a country or zone is free from a disease or infection.

Disease surveillance should be implemented by both:

a) a system of reporting any signs of disease activity which come to the notice of Veterinary Services or livestock owners; and

b) an active programme of examination of statistically selected samples from host populations in order to detect clinical signs or other indications of the occurrence of disease or transmission of infection.

In either case, suspicion of disease activity should be followed by quarantine, confirmatory diagnostic work and any necessary disease control measures. Surveillance thus implies that official action will follow from the discovery of evidence of disease or infection. It can be contrasted with monitoring, in which the gathering of data from the field takes place similarly, but no official action based on the findings is implied in the data-gathering activity.

Within the context of pleuropneumonia, specific measures need to be implemented, such as an exhaustive inspection of all lungs of bovines throughout the country or zone.

3. STEPS TO BE TAKEN TO DECLARE A COUNTRY FREE FROM CONTAGIOUS BOVINE PLEUROPNEUMONIA

The current goal in CBPP control is to achieve freedom from disease in particular countries and later of entire world regions, with the ultimate aim of achieving global eradication. It is therefore necessary to institute a system for verifying the steps towards these short- and long-term aims, and to assist countries which wish to trade in livestock or livestock products, but face difficulties due to the presence or past occurrence of CBPP.

In conformity with the general principles for assessing disease status developed by the OIE, a four-stage process should be applied:

(i) intention to eradicate pleuropneumonia, the longest phase, depending on prevalence of the disease in the country or zone, geographical, socio-economic and administrative conditions, and the capacity of the animal health infrastructure;
(ii) once a country is free from CBPP and that disease is unlikely to be re-introduced, the country can declare itself provisionally free from disease, provided it meets the criteria listed below;
(iii) declaration of freedom from clinical CBPP, after international verification carried out under the auspices of the OIE; and
(iv) declaration of freedom from CBPP, where a country meets more stringent surveillance and control criteria.

The last three stages are strictly covered by the epidemiological surveillance methods of the OIE.

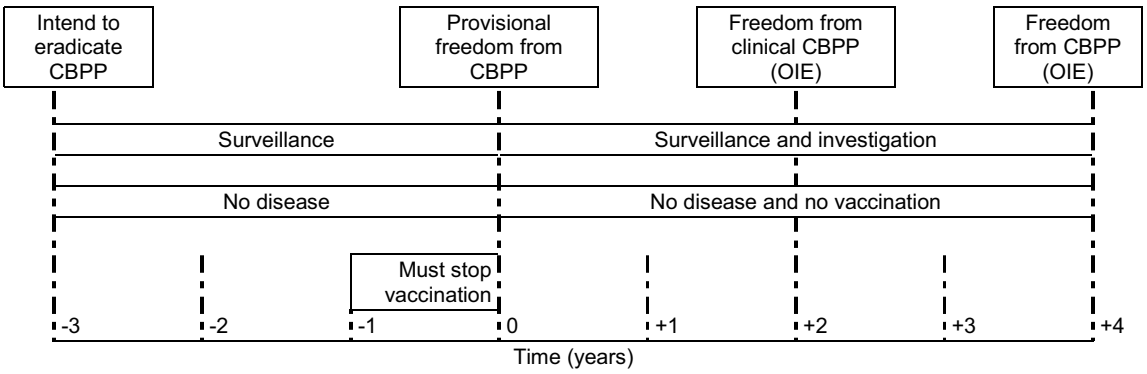
The sequence of operations differs both in terms of tactics and duration depending on whether or not the country wishing to eradicate CBPP practises vaccination.

'Disease' in the context of declaration of freedom means that the particular pathogenic agent is present and causes significant pathological effects on animals which become infected with the agent. Thus 'freedom from disease' means that there is no evidence in animals within the country or zone of any pathological effects occurring (including clinical signs) due to the presence of the agent, and from all the evidence pathogenic strains of the particular agent have been eliminated.

COUNTRIES PRACTISING VACCINATION

The process is summarized in the following chart.

Requirements for the declaration of *freedom from disease* and *freedom from CBPP*



The specific criteria proposed for each stage of this process are as follows:

a) Provisional freedom from disease

For a country to declare the whole or a zone of its territory provisionally free from disease, it must fulfill certain conditions, which are:

(i) no clinical or pathological evidence of CBPP should have been detected for at least 3 years;

(ii) There is an effective Veterinary Service which is able to monitor the animal health situation in the country;

(iii) there is effective meat inspection at *approved abattoirs*, and effective surveillance of populations in which significant numbers of slaughtered susceptible livestock are not subject to meat inspection;

(iv) all evidence suggestive of CBPP is investigated by field and laboratory methods (including serological and microbiological assessment) to refute a possible diagnosis of CBPP;

(v) there is an effective reporting system, both from the field to the central veterinary authority, and by that body to the OIE;

(vi) there is an effective system to prevent the introduction of infection, including appropriate border control, quarantine, etc;
(vii) if vaccination has been used, all vaccination against CBPP has ceased by the date of declaration; the OIE and neighbouring countries having been notified in writing, giving the date from which vaccination was discontinued.

(b) Freedom from clinical CBPP

A country which has declared itself or a zone to be provisionally free from disease may be declared by the OIE free from clinical CBPP, provided that the following criteria are met:

(i) no clinical or pathological evidence of CBPP has been detected for at least 5 years;
(ii) no CBPP vaccination has taken place for at least 2 years;
(iii) the country operates surveillance and disease reporting systems for CBPP adequate to detect disease if it were present, and ensures that veterinary staff are adequately trained in the recognition of CBPP;
(iv) all susceptible livestock at recognized abattoirs are subject to meat inspection procedures adequate to detect lung lesions, with diagnostic procedures to refute a possible diagnosis of CBPP;
(v) there has been a programme of surveillance (using serological, pathological and microbiological techniques) for at least 2 years on any populations of susceptible domestic livestock where more than 10% of slaughtering is not subject to adequate meat inspection procedures;
(vi) all evidence suggestive of CBPP is investigated by field and laboratory methods (including serological and microbiological assessment) to refute a possible diagnosis of CBPP;
(vii) there are effective measures in force to prevent re-introduction of the disease.

On meeting these criteria, a country may apply to the OIE for all, or a zone, of its territory to be declared free from clinical CBPP.

An Expert Panel for the Verification of Disease Status of the OIE will evaluate the application and decide whether or not to approve it. In coming to its decision, the Expert Panel will consider evidence presented by the country and will gather information on the extent to which the criteria are met. This information-gathering will usually include sending members of the Panel to make a field visit to the country. The Expert Panel will report its findings to the OIE Foot and Mouth Disease and Other Epizootics Commission. The Commission will report its conclusions annually to the International Committee for endorsement.

To maintain this status, a country must continue to meet these requirements until it is declared free from CBPP, and must report to the OIE an annual summary of developments.

Should there be a localized temporary outbreak of disease due to re-introduction of CBPP to a country which has met, or is within 2 years of meeting, the requirements for a declaration of freedom from clinical CBPP, that country should implement a stamping-out policy, which may be supported by intensive perifocal vaccination, to eradicate the outbreak. In such circumstances if no vaccination was carried out, it will then require at least one year from the date of the last case before the country becomes eligible to apply for a declaration of freedom from clinical CBPP. If vaccination was used, this period is extended to 2 years from the date of the last case or the last vaccination (whichever occurs later). In making an application under these special circumstances, it must be shown that the outbreak did not represent endemic infection, and that the disease has been eradicated by the actions taken.

The declaration of zones to be free from clinical CBPP will not remove the requirement for the country subsequently to meet the criteria for declaration of freedom from clinical CBPP for the country as a whole; if it wishes to achieve that status, it will have to meet all of the requirements specified above before it can apply for a declaration of freedom from clinical CBPP for the entire country.

(c) Freedom from CBPP

A country or a zone of its territory which has within the last 10 years either vaccinated against CBPP, or found clinical or pathological evidence of CBPP, may be declared by the OIE to be free from CBPP if the following criteria are met:

(i) it has been declared free from clinical CBPP at least 2 years earlier, and continues to meet the requirements for this status;

(ii) there has been effective abattoir surveillance for at least 4 years, covering all susceptible domestic livestock;

(iii) use has been made of diagnostic procedures capable of differentiating *Mycoplasma mycoides* from other bovine *Mycoplasma* infections in the investigation of respiratory disease, and the findings are consistent with freedom from *M. mycoides* infection;

(iv) there has been a programme of surveillance, including serological, pathological and microbiological components, for at least 3 years on any populations of susceptible domestic livestock where more than 10% of slaughter stock are not subject to adequate meat inspection procedures.

On satisfying these criteria, a country may apply to the OIE to be declared free from CBPP.

An Expert Panel for the Verification of Disease Status of the OIE will evaluate the application and decide whether or not to approve it. In coming to its decision, the Expert Panel will consider evidence presented by the country and will gather information on the extent to which the criteria are met. This information-gathering will usually include sending members of the Panel to make a field visit to the country.

The Expert Panel will report its findings to the OIE Foot and Mouth Disease and Other Epizootics Commission. The Commission will report its conclusions annually to the International Committee for endorsement.

In the special case of a country or zone which has been considered to be continuously free from CBPP for at least 10 years, and meets all of the following requirements:

(v) has not vaccinated against CBPP for at least 10 years;
(vi) throughout that period found no clinical or pathological evidence of CBPP infection;
(vii) had throughout that period, and undertakes to maintain permanently, an adequate disease surveillance and reporting system, covering all susceptible domestic livestock;
(viii) in appropriate circumstances, made use of diagnostic procedures capable of differentiating *Mycoplasma mycoides* from other bovine *Mycoplasma* infections in the investigation of respiratory disease, with findings consistent with freedom from *M. mycoides* infection;

the country or zone may be declared by the OIE to be free from CBPP without the necessity to proceed through the normal intermediate steps. This declaration will be based on the conclusions of the Expert Panel for the Verification of Disease Status.

Declaration of freedom from CBPP can be made for the country as a whole, or for zones within a country.

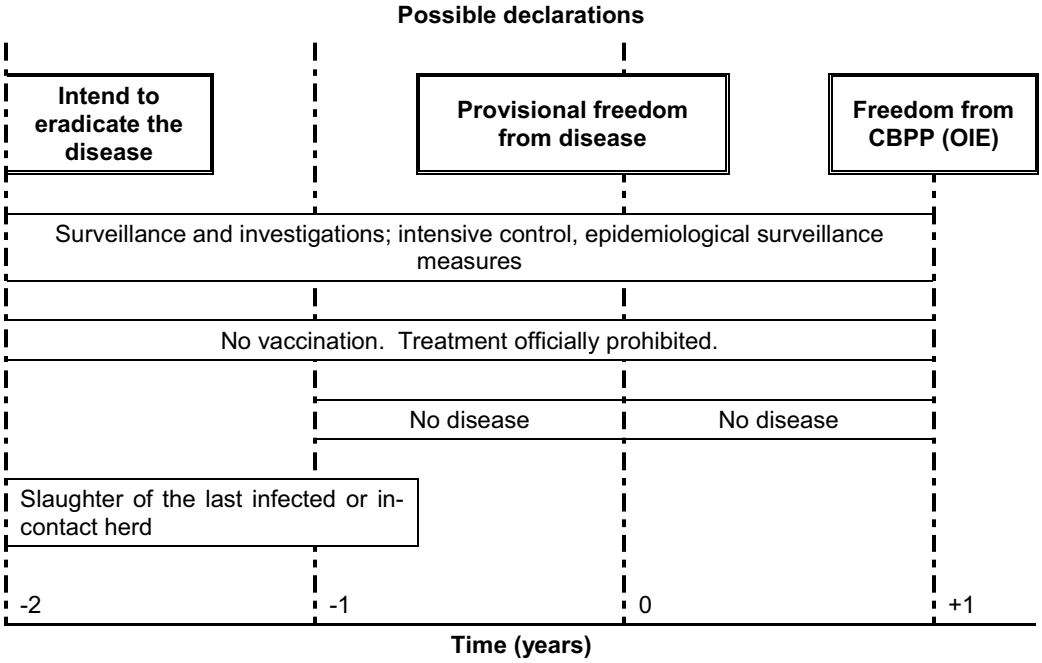
Should there be a localized temporary outbreak of disease due to re-introduction of CBPP to a country which has met, or is within one year of meeting, the requirements for a declaration of freedom from CBPP, that country may take special measures (excluding the use of vaccination) to eradicate the outbreak. In such circumstances, it will then require at least 2 years from the date of the last case before the country becomes eligible to apply for a declaration of freedom from CBPP. In making an application under these special circumstances, the country must demonstrate that the outbreak did not represent endemic infection, and that the disease has been eradicated by the actions taken.

In order to maintain this status, the country must continue to operate an efficient disease surveillance and reporting system, which would detect CBPP if it occurred.

COUNTRIES NOT PRACTISING VACCINATION

These are generally countries with a solid animal health infrastructure (with a system for individually identifying animals) where CBPP has been accidentally introduced.

The accelerated eradication process is summarized in the following chart:



The specific criteria proposed for each stage of this process are as follows:

a) Provisional freedom from disease

A country may declare the whole or a zone of its territory provisionally free from disease one year after the last infected herds and in-contact herds have been slaughtered, on condition that:

(i) there has been no vaccination in the country or zone for at least 2 years;

(ii) all treatment against CBPP is prohibited for sick animals or suspected cases;

(iii) a stamping-out policy is implemented after any CBPP outbreaks. Within the framework of the declaration, a minimum period of 12 months will be required after the last sick or in-contact herd has been slaughtered;

(iv) an epidemiological investigation, including serological tests, has been carried out to determine the prevalence of the disease in the country or

infected zone. Special attention should be given to screening animals transported into or out of the infected herds during the 6 months preceding detection of the outbreak(s);

(v) a system of livestock identification and movement control has been set up in the country or zone for the purposes of CBPP control and surveillance as follows:

– all herds are officially registered and all animals of susceptible species aged over 12 months are individually identified;

– before being moved, other than for immediate slaughter, all animals of susceptible species are to be clinically inspected and serologically tested for CBPP;

(vi) all animals of susceptible species in herds or *establishments* within a 3-km radius of an outbreak, and any animals with a possible epidemiological link, are individually identified, placed in quarantine for at least 6 months, and

– all animals of susceptible species in the aforementioned herds or *establishments* are serological tested on two occasions at an interval of 2 to 8 weeks; microbiological investigations are to be carried out on any serologically positive animal;

– during the quarantine period, animals in the aforementioned herds or *establishments* are not to be moved other than to an officially approved abattoir, where they are to be immediately slaughtered and subjected to sanitary inspection after slaughter;

– microbiological tests should be carried out on animals presenting lesions suggestive of CBPP;

(vii) surveillance is carried out in abattoirs in the contaminated country. Any lesion suggestive of CBPP should be examined microbiologically and, if the result is positive, the herd of origin must be found and subjected to serological testing;

(viii) the diagnostic tests used in the country or zone comply with OIE standards and are conducted in a nationally approved laboratory.

b) Freedom from contagious bovine pleuropneumonia

A country or zone may be declared by the OIE to be free from CBPP 2 years after the last infected and in-contact herds have been slaughtered if the conditions listed in paragraphs (a)(i) to (a)(viii) continue to be met.

4. EPIDEMIOLOGICAL METHODS

(a) Surveillance systems

In demonstrating that a country or zone is free of disease, it is necessary to conduct a surveillance programme which would have a very high probability of detecting the disease if it were present. Surveillance for CBPP will include a combination of clinical, pathological, serological and microbiological methods, built around an epidemiological surveillance approach. The mix of procedures used will depend on the specific circumstances of the country or zone.

The most efficient means of detecting CBPP is through effective meat inspection procedures at abattoirs followed by laboratory examination of suspect lesions. Where a very high proportion of susceptible domestic livestock are slaughtered in controlled abattoirs, this will provide a very sensitive surveillance system covering the whole population. It is possible that structured investigation of a statistical sample of carcasses might be used to augment the routine meat inspection procedures.

Where large numbers of susceptible livestock are exported for slaughter, it may be necessary to obtain meat inspection data from the importing country.

Where a significant proportion of susceptible domestic livestock are not subject to meat inspection at the abattoir, then it will be necessary to use alternative surveillance methods based on the examination of samples of herds so as to achieve a standard probability of detection. Animals in sampled herds would be subjected to clinical examination for signs of CBPP, but not all infected animals exhibit clinical signs. Serological testing can be useful in identifying infected herds, but due to the limitations of the currently available serological tests, and the possibility that the disease may be present at very low prevalence, such surveillance systems are not very efficient in proving freedom from disease, and require large numbers of herds to be sampled.

(b) Definition of sampling units

A sampling unit for the purposes of disease investigation and surveillance is defined as a group of animals in sufficiently close contact that individuals in the group would be at approximately equal risk of coming into contact with the disease agent if there were an infectious animal within the group. In most circumstances, the sampling unit would be a herd which is managed as a unit by an individual or a community, but there may be other epidemiologically appropriate groupings which are subject to regular mixing, such as all the animals belonging to residents of a village. Sampling units should normally be defined so that the majority of units contain between 50 and 1000 animals.

(c) Criteria for the stratification and sampling of host populations

Serological surveillance would only be adopted for CBPP in circumstances where the preferred slaughterhouse surveillance system described in item 3(c) of this document could not be carried out on an adequate scale because too low a proportion of animals was slaughtered in a slaughterhouse. Thus the following system would be used as an exceptional case, rather than as the usual procedure.

Any disease surveillance activities must be conducted on populations stratified according to disease risk, which depends principally upon the environment and management system. The cattle production systems of most countries would be categorized into between two and six strata.

Annual sample sizes must be sufficient to provide 95% probability of detecting evidence of CBPP if it were present at a prevalence of 1% of herds or other sampling units. Given perfect sensitivity of the within-herd testing procedure, this would require the examination of 300 herds from each stratum per year. However, the currently available serological tests have rather low sensitivity. The sensitivity of the test procedure at herd level is further reduced when only a sample of the herd is tested. It is possible to compensate for lower sensitivity by increasing the numbers of herds examined. The required sample size is determined by adjusting the prevalence to allow for the lack of sensitivity. For example, if there was 50% probability of detecting a sampled infected herd (sensitivity 0.5), then a true disease prevalence of 1% of herds would result in a detectable prevalence of 0.5%, and this detectable prevalence would be used to determine the required sample size.

Herds, or other sampling units, must be selected from each stratum by proper random methods, which are described in the *Guide to Epidemiological Surveillance for Rinderpest* published by the OIE. Any randomly selected herd must be examined in order to achieve the required probability of detection. However, this probability can often be increased by an important but unquantifiable margin by sampling additional herds based on subjective assessment of risk, or information gained during field work.

5. CONTAGIOUS BOVINE PLEUROPNEUMONIA VACCINES

T_1 strain (and its streptomycin-resistant variant) is the recommended vaccine, and the following facts are relevant to disease surveillance activities:

Current vaccines do not induce life-long immunity; the duration of protection after vaccination is about one year.

A significant proportion of vaccinated animals do not develop a serological response detectable by currently used techniques, although such animals may be protected against challenge. Where the serological response to vaccination is

detectable by the complement fixation test, it usually persists for less than 3 months.

As their immunity wanes, vaccinated cattle are more likely to develop chronic lesions (sequestra) after infection.

6. DIAGNOSTIC METHODS

The diagnosis of CBPP depends on: (a) clinical signs in the live animal; (b) gross pathological findings; (c) serological tests; and (d) culture and identification of the causative organism.

(a) Clinical diagnosis

The clinical signs of CBPP may be slight or non-existent. Furthermore, the use of anti-microbial or anti-inflammatory drugs can mask the clinical expression of the disease. For these reasons, clinical signs are an unreliable indicator of the presence of the disease. However, if respiratory disease is observed in a livestock population, then the diagnosis of CBPP should be considered and confirmed or rejected on the basis of further pathological, microbiological or serological investigations.

(b) Gross pathology

The lung lesions of CBPP are distinctive. Consequently, abattoir meat inspection is the most practical single method for maintaining CBPP surveillance. The pleura and lungs should be examined by palpation and section. A mixture of acute lesions and chronic lesions (sequestra) may be found in the same herd or even the same animal. In case of chronic infection, post-mortem diagnosis may be the only way of detecting asymptomatic animals, which may not react to serological tests.

(c) Serological diagnosis

The serological test of choice is the complement fixation test (CFT). The specificity of this test can be as high as 99.5%, but the frequency of false positive reactions may temporarily be higher in certain herds. The sensitivity of the test is limited, and it may fail to identify four classes of animals:

(i) animals in the very early stages of the disease;

(ii) animals in the very late stages of the disease (the CFT appears to fail to detect 30% of animals containing sequestra);

(iii) animals with massive lesions, where the antibodies produced are overwhelmed by the antigen;

(iv) animals which have been treated in the early stages of the disease may fail to develop a detectable serological response.

Despite these limitations, the CFT is a useful herd test. The CFT reaction after vaccination is inconstant and short-lived (generally less than 3 months).

An indirect enzyme linked immunosorbent assay (ELISA) is under field evaluation in several countries. It is at least as sensitive as the CFT, but as with other ELISA systems, increased sensitivity can only be achieved at the expense of specificity, and vice versa. It is a useful tool to measure the efficacy of vaccination programmes, as the detectable response is more reliable than the CFT, and may persist for as long as one year after vaccination.

Monoclonal and competitive ELISA systems are being developed and should offer higher specificity.

The passive haemagglutination test, while not used routinely, may have a place in serological diagnosis. It is more sensitive than CFT in early and late stages of disease, but with lower specificity, and has a potential role as a screening test.

The slide agglutination test is simple to perform and could be used as a pen-side test. It is more sensitive than the CFT in the early stages of the disease, but it lacks specificity.

(d) Culture and identification of the causative organism

It is desirable that all diagnoses are confirmed by isolation of the causative organism. It may prove difficult to isolate *Mycoplasma* from chronic lesions and also after animals have been treated with anti-microbial drugs.

The causative organism is normally identified by growth inhibition tests and/or the immunofluorescence test. Closely related *Mycoplasma* may cause cross-reactions in these tests. Several new techniques which may overcome this problem are being developed, and these include immunobinding, immunoperoxidase and polymerase chain reaction (PCR) tests. These need further evaluation.

(e) Testing imported animals

In formulating its recommendations for a system of declaration of freedom, the Group acknowledged that existing serological tests for CBPP are quite variable in sensitivity and specificity. Hence serological methods alone are unlikely to prevent the introduction of infection if live animals are imported from CBPP-infected countries. The chronic course of the disease may mean that diagnosis following introduction of CBPP may be delayed by a number of years. In the longer term there is a need for more sensitive and specific diagnostic tests. Pending the development of such tests, serological methods are necessary, but not sufficient to prevent introduction of the disease in live animals.