Recommended standards for epidemiological surveillance systems for contagious bovine pleuropneumonia
(revised: February 1997)

Summary
The initial draft of this document was prepared in June 1993 by the Ad hoc Group on Contagious Bovine Pleuropneumonia Surveillance Systems of the Office International des Epizooties. That draft was then amended in February 1997 by the Group of experts convened at the request of the International Committee to examine issues relating to the surveillance of the disease, with particular reference to the effects of vaccination programmes on surveillance systems. This updated report includes the following:
- epidemiological and other factors which influence the choice of surveillance systems
- sampling and surveillance strategies
- diagnostic methods applicable to surveillance systems
- the repercussions of vaccination on surveillance systems.

Keywords
Contagious bovine pleuropneumonia - Office International des Epizooties - Surveillance systems - Vaccination - Zones free from disease - Zones free from infection.

Introduction
The Ad hoc Group on Contagious Bovine Pleuropneumonia (CBPP) Surveillance Systems held a meeting from 7 to 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
d) the implications of CBPP vaccination for surveillance systems.

This last point was the subject of lengthy discussions during the meeting of the Office International des Epizooties (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.

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.

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 in 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:

- 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
- 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
- declaration of freedom from clinical CBPP, after international verification carried out under the auspices of the OIE
- 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 in 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 (or clinical signs) due to the presence of the pathological agent, and that all results prove that the pathogenic strains of the particular agent have been eliminated.

Countries practising vaccination

The process is summarised in Figure 1.

![Possible declarations diagram]

Fig. 1 Requirements for the declaration of freedom from disease and freedom from contagious bovine pleuropneumonia

The specific criteria proposed for each stage of this process are given below.

Provisional freedom from disease

For a country to declare the whole or a zone (a zone is defined in the OIE International Animal Health Code, Chapter 1.4.4.) (1) of its territory provisionally free from disease, it must fulfill certain conditions, which are:

a) no clinical or pathological evidence of CBPP should have been detected for at least three years

b) there is an effective Veterinary Service which is able to monitor the animal health situation in the country

c) there is effective meat inspection at recognised abattoirs, and effective surveillance of populations in which significant numbers of slaughtered susceptible livestock are not subjected to meat inspection

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

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

f) there is an effective system to prevent the introduction of infection, including appropriate border control, quarantine, etc.
g) 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.

**Freedom from clinical contagious bovine pleuropneumonia**

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:

a) no clinical or pathological evidence of CBPP has been detected for at least five years

b) no CBPP vaccination has taken place for at least two years

c) 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

d) all susceptible livestock at recognised abattoirs are subject to meat inspection procedures adequate to detect lung lesions, with diagnostic procedures to refute a possible diagnosis of CBPP

e) there has been a programme of surveillance (using serological, pathological and microbiological techniques) for at least two years on any populations of susceptible domestic livestock where more than 10% of slaughtering is not subjected to adequate meat inspection procedures

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

g) 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 (FMD) 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 localised temporary outbreak of disease due to re-introduction of CBPP to a country which has met, or is within two 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 two years from the date of the last case or the last vaccination (if vaccination 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.

**Freedom from contagious bovine pleuropneumonia**

A country or a zone of its territory which has within the last ten 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:

a) it has been declared free from clinical CBPP at least two years earlier, and continues to meet the requirements for this status

b) there has been effective abattoir surveillance for at least four years, covering all susceptible domestic livestock

c) use has been made of diagnostic procedures capable of differentiating Mycoplasma mycoides (the name 'Mycoplasma mycoides' is used for Mycoplasma mycoides subsp. mycoides [SC, bovine biotype]) from other bovine Mycoplasma infections in the investigation of respiratory disease, and the findings are consistent with freedom from M. mycoides infection

d) there has been a programme of surveillance, including serological, pathological and microbiological components, for at least three 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 FMD 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 ten years, and meets all of the following requirements:

a) has not vaccinated against CBPP for at least ten years
b) throughout that period found no clinical or pathological evidence of CBPP infection
c) had throughout that period, and undertakes to maintain permanently, an adequate disease surveillance and reporting system, covering all susceptible domestic livestock
d) 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 localised 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 two 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 summarised in Figure 2.

Fig. 2
The accelerated eradication process of contagious bovine pleuropneumonia

OIE: Office International des Epizooties

Possible declarations

<table>
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<tr>
<th>Time (years)</th>
<th>CBPP: contagious bovine pleuropneumonia</th>
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<tbody>
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<td>-2</td>
<td>Slaughter of the last infected or in-contact herd</td>
</tr>
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<td>No disease</td>
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<tr>
<td>0</td>
<td>No vaccination, treatment officially prohibited</td>
</tr>
<tr>
<td>1</td>
<td>No disease</td>
</tr>
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The specific criteria proposed for each stage of this process are given below.

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:

a) there has been no vaccination in the country or zone for at least two years
b) all treatment against CBPP is prohibited for sick animals or suspected cases
c) 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
d) 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 six months preceding detection of the outbreak(s)

e) 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

f) 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 six months, and
- all animals of susceptible species in the aforementioned herds or establishments are serologically 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

g) 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

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

**Freedom from contagious bovine pleuropneumonia**

A country or zone may be declared by the OIE to be free from CBPP two years after the last infected and in-contact herds have been slaughtered if the conditions listed in the paragraphs under 'Provisional freedom from disease' continue to be met.

**Epidemiological methods**

**Surveillance systems**

In demonstrating that a country or zone is free from 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 epidemiological methods 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 subjected 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.

**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 subjected 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 1,000 animals.

**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 the item 'Freedom from contagious bovine pleuropneumonia' 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.
The diagnosis of CBPP depends on:

- **Clinical signs**: 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.

- **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.

- **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:
  - **a)** animals in the very early stages of the disease
  - **b)** animals in the very late stages of the disease (the CFT appears to fail to detect 30% of animals containing sequestra)
  - **c)** animals with massive lesions, where the antibodies produced are overwhelmed by the antigen
  - **d)** animals which have been treated in the early stages of the disease, and 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 three 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 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 than the CFT in the early stages of the disease, but it lacks specificity.

Culture and identification of the causative organism
It is desirable that all diagnoses be 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.

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.

References
