Standard Methods and Procedures (SMPs) for Control of Peste des Petits Ruminants (PPR) in the Greater Horn of Africa
Standard Methods and Procedures (SMPs) for Control of Peste des Petits Ruminants (PPR) in the Greater Horn of Africa
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Foreword

The arid and semi-arid lands of the Horn of Africa (HOA) are home to poor and vulnerable populations, the majority of whom rely on livestock to sustain livelihoods. However, the performance of livestock in the region remains low, given the widespread occurrence of transboundary animal diseases (TADs) that are responsible for production losses, and reduced performance of intra- and inter-regional trade in livestock and livestock products. Because of disease outbreaks, live animal exports have been severely constrained during the past two decades, by bans imposed by importing countries to reduce risks associated with these diseases.

To address the negative impact of TADs on livestock trade, AU-IBAR and ICPALD together with the participating countries in the region, with financial support from the United States Agency for International Development (USAID), have developed a framework to support harmonization and coordination of the control of the diseases, referred to as the Standard Methods and Procedures (SMP) Approach. The SMP approach involves strengthening capacities of member states for surveillance, epidemiology, laboratory diagnostics, disease control programmes, and communications. The fundamental aspect of the approach is the linking of disease prevention and control activities in a country, to a set of regional minimum standards and procedures for TADs prevention and control in line with the World Organization for Animal Health (OIE) standards.

The minimum standards, procedures, methods and goals for a particular disease are contained in an individual SMPs. It deals with subject areas of surveillance, laboratory procedures and disease control, and states minimum standards, procedures and goals that must be met for harmonized regional control of a disease.

This booklet presents the SMPs for Peste des Petits Ruminants (PPR), and deals with the specific dynamics of PPR and SMPs for management and control of the disease.

The compilation of the materials in the SMPs for PPR, taking into consideration the characteristics of the Greater Horn of Africa, was made possible by technical experts from the region with technical support from AU-IBAR, FAO, OIE and AU-PANVAC. AU-IBAR is indebted to many scientists who reviewed the document and especially to Dr. James Wabacha the coordinator of the SMP-AH project for coordinating the preparation of the SMPs.

The SMPs for PPR targets field veterinary personnel, policy makers, laboratory personnel and veterinary students in the region.

Professor Ahmed El-Sawalhy
Director
African Union Inter-African Bureau for Animal Resources (AU-IBAR)
1.0 Introduction

1.1 Standard Methods and Procedures (SMP)

The Standard Methods and Procedures (SMP) approach is designed to guide and harmonize the work of Departments of Veterinary Services (DVSs) in the Greater Horn of Africa (GHoA) region in their approach to the control of trade-related Transboundary Animal Diseases (TADs).

Standard Methods and Procedures are operational protocols to create uniformity in animal disease detection and control procedures throughout the Greater Horn of Africa. An individual SMP is a protocol for detection and control of a given disease that outlines the measures that must be undertaken. The SMP deals with subject areas of surveillance, laboratory procedures and disease control, and states minimum standards, procedures and goals that must be met for harmonized regional control of a disease. It is supported with details as specified in Standard Operating Procedures (SOPs) for each subject area that are designed to fit the structure and capabilities of a given nation.

An SMP is a functional, action-oriented document and is not intended to provide a detailed description of the disease. It is also a live and flexible document and can be changed as new science and new techniques for control are discovered. The design is intended to allow for incorporation of an SMP into any larger disease control programme such as a Progressive Control Pathway (PCP).

This SMP deals with the specific dynamics of Peste des Petits Ruminants (PPR) and specifies standard methods and procedures for management and control of the disease.

The document is aligned to the AU Pan African programme for the progressive control of PPR and will be aligned to the Global Progressive Control Pathway for PPR once it is developed. Some information, as described in this SMP, is based on the current incomplete level of evidence and will be modified as new evidence is generated. For the purpose of execution of this SMP, the PPR disease status in the GHoA will be categorized into three main areas: Area of no known disease status; PPR endemic area; and PPR high risk area.

1.2 Peste des Petits Ruminants (PPR)

*Peste des Petits Ruminants* (PPR) is a highly contagious, widespread, virulent and devastating animal disease of domestic and wild small ruminants caused by a morbillivirus closely related to Rinderpest Virus (RP). Based on the fact that PPR has been reported on a few occasions in camels, cattle and buffaloes, those animal species are considered to be susceptible although their potential role in the circulation of PPR virus (PPRV) has not
Peste des Petits Ruminants (PPR) has been formally established. The presence of the virus has been confirmed in large areas in the Greater Horn of Africa (GHoA), and is spreading to new zones, affecting and threatening an increasing number of small ruminants and livestock keepers. It is a major constraint in the development of small ruminant production in Africa. PPR is a disease associated with food and income insecurities and it impacts on human health through increase in malnutrition levels, reduced access to health care and other basic needs. Goats and sheep are numerous and are found in a variety of systems in the GHoA, because of their adaptability to the harsh conditions.

Understanding of the epidemiology and socio-ecology of PPR and other small ruminant diseases in the region is needed since PPR is a dynamic disease, and only an enhanced active understanding will enable improved targeting of interventions. The basic epidemiology of PPR virus infection in wildlife and its possible role in PPR epidemics amongst livestock are unknown with only limited data from a few outbreaks in the Middle East involving a variety of species including hippos, tragine and gazelline antelopes with high morbidity and mortality. The susceptibility of camels to PPR has introduced a new dimension in the epidemiology of the disease.

Taking into account the availability of advanced tools such as reliable diagnostic methods and quality vaccine that can confer lifelong immunity, coupled with the lessons learned from rinderpest global eradication, PPR is considered relatively easier to successfully control and eradicate compared to other Transboundary Animal Diseases (TADs) in the region. However, with challenges such as movement of animals across borders, limited financial and human capacity, and inadequate supply of quality vaccines, regional coordination needs important consideration for effective and sustainable control of PPR in the GHoA. The other important consideration is the current vaccine, which is not thermostable.
2.0 Definitions

For common understanding of terminology, the following definitions will be used.

2.1 Surveillance and Epidemiology

Surveillance
Continuous collection analysis and interpretation of animal health data to inform disease control programmes for actions.

Passive surveillance
A method of surveillance that enables veterinary authorities to collect animal health data and information routinely from disease reporting stakeholders.

Active surveillance
A method of surveillance in which epidemiological information is collected by purposeful and planned interventions.

Syndromic surveillance
A surveillance approach based on observing signs/symptoms which have been agreed upon to represent a particular disease.

Targeted surveillance
A form of active surveillance based on probability of occurrence of disease in a given area and/or species.

Risk-based surveillance
A form of active surveillance that focuses on a certain area or livestock population based on perceived level of threat.

Participatory disease surveillance
A form of active surveillance that uses participatory approaches in search of disease, including knowledge and practices from communities, local livestock producers and others in the livestock value chain.

Epidemiological unit
A group of animals with a defined relationship sharing common likelihood of exposure to a disease.
**Risk mapping**
A tool used for identification, assessment, communication and mitigation of a disease in a certain geographical area.

**Zero reporting**
Periodic standard reports noting that surveillance in any form for a given disease has been carried out and no disease occurrence has been encountered.

### 2.2 Disease Status Areas

**Area of no known disease status**
A defined geographic area where no clinical disease has been seen or reported within the past three years without vaccination.

**Endemic area**
A defined geographic area where diseases are known to be present at a low level of incidence.

**High risk area**
An area with high probability of outbreaks occurring with significant high number of susceptible population.

### 2.3 Planning Documents

**Standard Operating Procedure (SOP)**
A plan of action for a particular undertaking that stipulates exact details of what must be done to accomplish the task.

**Preparedness Plans**
Preparedness planning involves capacity building, equipment procurement, personnel responsibility allocation, and training in all the disciplines that support effective disease control, e.g. epidemiology, laboratory, disease management, etc.

**Rapid Response Plan**
A pre-programmed plan for immediate response to a report of an outbreak of a TAD or other emergency disease with the goal of eliminating the index case and preventing an epidemic spread. The Rapid Response Plan includes three components: the Epidemiology Section for disease investigation; the Laboratory Section for confirmation sampling; and the Disease Control Section for immediate disease control interventions as needed.
**Contingency Plan**
An operational plan designed for immediate control of a disease outbreak, typically composed by the Department of Veterinary Services for use within that country.

**2.4 Personnel**

**Veterinary Officer**
Government employed veterinarians and field staff.

**Veterinary Personnel**
All people associated with veterinary work including public veterinary staff (government at any administrative level) and private veterinarians and their staff members.
3.0 Surveillance and Epidemiology

Strong programmes for surveillance, epidemiology, and laboratory diagnostics are necessary elements for PPR disease control. It is essential to use a standardized case definition and to consider predisposing factors for surveillance and control of PPR.

3.1 Case definition for PPR – (Stomatitis, enteritis, pneumonitis syndrome)

PPR will be suspected in sheep, goats and other susceptible animals if any one or more of the following clinical signs are encountered: laboured breathing; discharge from the eyes, nose and mouth; sores in the mouth and diarrhoea.

Differential diagnoses include, Contagious Caprine Pleuropneumonia (CCPP), Bluetongue, Pasteurellosis, Contagious Ecthyma (Orf), Foot and Mouth Disease (FMD), Heartwater, Coccidiosis and mineral poisoning.

Note - A tentative diagnosis of PPR can be made based on clinical signs, but laboratory testing is required for confirmation and/or differential diagnosis as indicated in diagnostic section four of this document.

3.2 Predisposing factors

Predisposing factors are a variety of situations that harbor or promote disease. The following are the factors.

3.2.1 Seasonality:

PPR is more common in the rainy season or dry cold season. Weather-related seasonality and livestock mobility cause stress and can compromise immune response.

3.2.2 Mobility:

Livestock mobility favours contact between infected and susceptible herds.

3.2.3 Naïve populations:

The presence of naive populations within an infected region is a major predisposing factor in epidemics. Young and non-vaccinated animals are groups at especially high risk.

3.2.4 Malnutrition, parasitism, bacterial infections:

These conditions aggravate clinical disease.

3.2.5 Close contact:

Direct transmission enables rapid spread of the virus in large groups of herding animals.
3.2.6 **Unregulated trade and porous borders:**
These factors predispose spread of PPR between neighbouring countries.

3.3 **Surveillance in areas of no known disease status**
In areas of no known disease status, surveillance is aimed at detecting presence or absence of PPR.

3.3.1 **Administrative preparations**

- a. Veterinary personnel working at all administrative levels must be trained on disease reporting using appropriate reporting systems, e.g. ARIS 2.
- b. Equip veterinary services including wildlife veterinary agencies with necessary logistical materials and provide adequate staff to undertake investigation of reported PPR cases. The veterinary services itself should be equipped, at appropriate administrative levels, with necessary sample collection equipment, disease reporting tools and materials including standardized reporting formats, mobile phones, digital pens, etc.
- c. Undertake necessary capacity building to train and equip staff personnel at all levels.
- d. Policy/legal frame work work supportive of surveillance.

3.3.2 **Passive surveillance and passive surveillance field actions**

- a. The national veterinary authorities will engage and sensitize livestock value chain actors, including producers, traders and transporters, and abattoir workers to report any disease events encountered to the nearest animal health facility, either public or private. This will include educational and informative materials on disease recognition and reporting, and use of methods such as mobile phones, digital pens, pen and paper, radio programmes, television programmes, posters, information leaflets, community meetings, etc.
- b. Veterinary personnel undertaking routine animal health activities, e.g. market stock route inspection, vaccination campaigns, extension services, abattoir activities, etc. are expected to carry out syndromic surveillance during which they will inspect livestock for signs of clinical disease and collect data from livestock keepers.
- c. Communication materials including field syndromic manuals shall be developed and disseminated to make it easier for PPR-related syndromes to be easily recognized by value-chain actors, including producers, traders and transporters, and wildlife actors.
- d. Stakeholders along the value chains (livestock producers, traders, transporters, butchers, abattoir workers, veterinary personnel and private animal health providers, and others) will be sensitized.
- e. In case of reports (written or rumours) of suspected PPR from the community and other stakeholders, the responsible veterinary personnel will conduct further
investigation with sample collection and submission to the laboratory. The responsible veterinary personnel will immediately report to the CVO and make a record in the standard reporting format.

f. If a disease outbreak is confirmed, veterinary authorities shall institute appropriate control measures as indicated under section five.

g. The records will also be submitted to the Central Epidemiology Unit by the 15th of the following month in the standard monthly report.

3.3.3 Active surveillance

The following are the major approaches to be considered under active surveillance. Each of these approaches can be used alone or in combination as deemed necessary.

3.3.3.1 Sero-surveillance field actions

a. Design a survey protocol outlining sample size determination, sampling method, target population, sampling units and sampling frame taking into consideration livestock and wildlife.

b. Prepare data collection tools, including, questionnaires for epidemiological interviews, forms, and data collection software.

c. Mobilize survey teams composed of properly trained personnel.

d. Develop a survey programme together with the survey teams.

e. Share the programme with relevant stakeholders in targeted areas.

f. Ensure that all necessary technical and logistical equipment is at hand.

g. Collect blood samples using appropriate tools and techniques such as vacutainers, filter paper, microbleeders, syringes, etc.

h. Ensure proper environment and time for serum separation, and proper storage of sera.

i. Ensure accurate labeling of samples, maintenance of test and identification records, the samples cold chain, and proper laboratory submission procedures.

j. Data will be entered in the Central Epidemiology Unit database for analysis and reporting.

k. If laboratory testing detects a positive sample, the responsible veterinary personnel should conduct an investigation.

l. If a disease outbreak is confirmed, veterinary authorities should institute appropriate control measures.

m. Ensure that activity reports are compiled immediately the exercise is through in the standard monthly report.
3.3.3.2 **Syndromic (clinical) surveillance field actions**

a. Veterinary departments should develop programmes to undertake syndromic surveillance in predefined areas to include among others: farms, livestock markets, stock route, holding grounds, abattoirs, during which they will inspect livestock for signs of clinical disease and collect data from livestock keepers.

b. Any disease syndrome characterized by laboured breathing, discharges from the eyes, nose and mouth, sores in the mouth and diarrhoea should be reported to the CVO and will be investigated in order to confirm or rule out PPR.

c. If the disease is confirmed, the responsible veterinary personnel should immediately report to the CVO in the standard reporting format.

d. If the disease is not confirmed, the reporting officer should file a zero report, indicating that PPR was not found in the flock.

e. Submit records to the Central Epidemiology Unit by the 15th of the following month.

f. Share reports generated thereof promptly with the relevant stakeholders.

3.3.3.3 **Wildlife surveillance field actions**

a. Given the surveillance is undertaken in areas of no known disease status, if possible, conduct retrospective studies using preserved wildlife sera; or target opportunistic surveillance to leverage on costs.

b. Disease information generated out of such studies should be submitted to relevant veterinary authorities to benefit disease control programmes among livestock keeping communities in areas within the livestock-wildlife interface.

c. Ensure sharing of periodic reports between veterinary authorities and wildlife managers regarding disease outbreaks.

3.4 **Surveillance in endemic areas**

Surveillance in the endemic areas is aimed at determination of baseline disease prevalence in susceptible species, establishing the geographical distribution of endemic areas and understanding the PPR epidemiology. Surveillance will also determine the herd/flock immunity after vaccination.

The following surveillance methodologies will be carried in the PPR endemic areas:

a. Passive surveillance

b. Active surveillance

c. Targeted and opportunistic wildlife surveillance
3.4.1 Administrative preparations for surveillance in endemic areas
The administrative preparations should be carried out as described under section 3.3.1.

3.4.2 Passive surveillance and passive surveillance field actions
In endemic areas, passive surveillance is aimed at detecting active disease.

The passive surveillance field actions should be carried out as described under section 3.3.2.

3.4.3 Active surveillance
The methodologies to be used include:

3.4.3.1 Sero-surveillance field actions
The sero-surveillance field actions to be carried out in endemic areas will be as described under the section on no known disease status, 3.3.3.1 and in addition, the following will be undertaken in endemic areas:

a. Baseline sero-surveillance for countries without vaccinations for PPR to determine the baseline disease prevalence in susceptible species, establishing the boundaries of endemic areas and understanding the PPR epidemiology by identifying active cases, isolating and sequencing the virus. Determination of baseline disease prevalence using sero-surveillance may not be reliable for countries undertaking vaccination.

b. Sero-monitoring in PPR vaccinated areas to check for presence of antibodies in a target population to assess the herd immunity. This will be done through pre- and post-vaccination random sampling and testing.

3.4.3.2 Syndromic surveillance
Targeted surveillance is the most appropriate approach for cost effectiveness.

The Syndromic (clinical) surveillance field actions to be carried out in endemic areas are as described in the section on no known disease status, 3.3.3.2.

3.4.3.3 Participatory disease surveillance (PDS)
The purpose of PDS is to identify disease foci, establish and map the history of PPR in endemic and non-endemic areas using the case definition of PPR. PDS is a good tool to establish the disease history for “the syndrome” or the disease in an area. It can be used to map the history of the disease in an endemic area. There may be areas where disease occurred in the last month or half a year ago or more than a year ago. Obtaining this information would help in understanding the epidemiology of the disease. PDS is based on communication and transfer of indigenous knowledge for animal diseases, using a
variety of procedures. To implement PDS follow the actions below:

a. Training (capacity building) of veterinary personnel on the technique of PDS.
b. Relevant veterinary authorities identify targeted risk areas and communities concerned.
c. Prepare relevant checklists.
d. Draw up a PDS programme and share it with the target communities.
e. Identify key contact people and if possible translators to be used.
f. Implement informal interviewing.
g. Undertake ranking/ scoring, seasonal calendar, time lines, mapping and any other relevant tools in a participatory manner with the local communities.
h. Undertake visualization of data to achieve a common understanding with the communities.
i. Undertake data cross-checking by probing, triangulation and laboratory diagnosis for confirmation.
j. Complement information so far collected with secondary information sources, direct observation and laboratory diagnosis.
k. Submit a report to the veterinary authority.
l. Share reports generated thereof promptly with the relevant stakeholders to enhance ownership.

3.4.3.4 Passive surveillance in wildlife

Wildlife surveillance should be an integral part of the surveillance system in order to improve understanding of the role of wildlife in the epidemiology of PPR and its possible role in epidemics among livestock. Surveillance in wildlife is both passive and active with potential use of opportunistic sera from hunted animals in some countries. The possible use of wildlife as sentinel herds for PPR needs to be explored particularly in areas where vaccination is undertaken. It must be remembered that encountering free-ranging wildlife is generally not easy and observation of clinical signs is more difficult in this context. However, in a vaccinated zone, wildlife disease manifested by mortality and/or sickness in susceptible wildlife species might be the only visible sign of circulation of the virus. Henceforth, the following actions are necessary:

a. Relevant veterinary authorities and wildlife managers together with stakeholders such as field personnel, scientists, hunters, naturalists and ecotourism guides should monitor deaths and sickness in wildlife, especially antelopes.
b. Undertake retrospective surveillance involving testing of opportunistic wildlife sera in cryobanks to provide a baseline of the prevalence and geographical distribution of PPR in wildlife.
c. Continue to collect sera opportunistically or electively where significant gaps exist from relevant wildlife species and population, and preserve it at -70 °C with proper
labels and geo-referencing for future analysis.
d. Use wildlife as sentinel herds for PPR detection to take advantage of trends and patterns in PPR serology since wildlife is not vaccinated.
e. Establish and maintain a network of continuous reporting animated through constant communication, training, teamwork and motivation. To achieve this, ensure that inter-ministerial or departmental cooperation, partnerships and trusting relationships are maintained.

3.4.3.5 Active surveillance in wildlife
a. Upon receipt of a disease report, undertake full investigation and laboratory confirmation to identify diseases and pathogens.
b. Involve trained field-based teams and wildlife veterinarians to promptly salvage samples before wildlife carcasses are rapidly eaten by scavengers and deteriorate in the ambient heat.
c. Conduct targeted pathogen surveillance and sero-surveillance to address targeted areas with wildlife-livestock interface where the wildlife species (buffalo, warthog, wild caprines, gazelles, reedbuck, and other antelopes) are known to be susceptible through previous serological evidence.
d. Undertake wildlife capture and sampling where no regular hunting goes on.
e. Ensure care is taken to collect good quality samples.
f. Wildlife managers together with stakeholders such as field personnel, scientists, hunters, naturalists and ecotourism guides should be involved in participatory search for disease in wildlife.

3.5 Surveillance in high-risk areas
The aim of surveillance in the high risk areas, is to identify emergence of active disease cases and to understand the epidemiology of the disease. Where vaccination has been conducted, sero-monitoring will be conducted to determine whether herd/flock immunity level after vaccination is sufficient to halt the introduction and spread of disease. In principle, these areas have no reports of the disease for the last three years.

The following surveillance methodologies will be carried out in the PPR high risk areas:

a. Passive surveillance and reporting
b. Active surveillance, including laboratory testing of samples
c. Wildlife surveillance

3.5.1 Administrative preparations
The administrative actions to be carried out in high-risk areas is as described in section on no known disease status, 3.3.1.
3.5.2 Passive surveillance and passive surveillance field actions
In epidemic/high-risk areas, surveillance is aimed at detecting PPR emergence and re-emergence for purposes of rapid response to disease outbreaks. The passive surveillance field actions should be carried out as described under the section on no known disease status, 3.3.2.

3.5.3 Active surveillance
The methodologies to be used include:

3.5.3.1 Sero-surveillance
The sero-surveillance field actions to be carried out in high risk areas are as described under sero-surveillance in no known disease status, 3.3.3.1 and in addition the activities described under sero-surveillance in endemic areas, 3.4.3.1.

3.5.3.2 Syndromic/clinical surveillance
The syndromic/clinical surveillance field actions to be carried out in high risk areas are as described under section on syndromic surveillance in no known disease status, 3.3.3.2.

3.5.3.3 Participatory disease surveillance (PDS)
The aim of this approach is to search for active disease with the community in high risk areas. A zero report is as important as a report on active disease. The participatory disease surveillance field actions to be carried out in high risk areas are as described under the section on PDS in endemic areas, 3.4.3.3.

3.5.3.4 Passive surveillance in wildlife
The passive surveillance wildlife field actions to be carried out in high-risk areas are as described under the section on passive surveillance in endemic areas section, 3.4.3.4.

3.5.3.5 Active surveillance in wildlife
The active surveillance in wildlife field actions to be carried out in high risk areas are as described under the section on wildlife surveillance in endemic areas, 3.4.3.5.
4.0 PPR Laboratory Detection, Diagnosis

All laboratory procedures described in this SMP are as prescribed in the OIE Terrestrial Manual 2012.

4.1 Minimum pre-requisite

a. Ensure you have capacity to carry out basic specific and sensitive assays for confirmatory diagnosis of PPR.

b. Periodically submit laboratory results and accompanying samples for verification by regional support laboratories and accordingly undertake proficiency testing to improve laboratory standards.

c. Veterinary laboratories should undergo external assessment for suitability for PPR confirmatory diagnosis.

d. For purposes of trade ensure OIE guideline are observed.

4.2 Basic laboratory assays

a. PPR Antigen detection:
   i. Agar Gel Immuno-diffusion (AGID)
   ii. Immunocapture enzyme-linked immunosorbent assay (ICE ELISA – Libeau et al., 1994) for antigen detection

b. PPR Antibody detection:
   i. Competitive enzyme-linked immunosorbent assay (C-ELISA) for antibody detection (e.g. Libeau et al., 1995: based on N-Protein and Anderson and McKay, 1994: Based on H-Protein)

4.3 Field diagnosis of PPR

4.3.1 Clinical diagnosis:

For field diagnosis of PPR, look for the following clinical signs that are suggestive of the disease:

- Fever, anorexia and lethargy;
- Stomatitis-enteritis syndrome: sores in the mouth and diarrhoea;
- Pneumonia signs: laboured breathing, discharges from the eyes, nose and mouth and coughing.

4.3.2 Post mortem examination

Look for the following post mortem signs that are suggestive of PPR:

- Carcass of the affected animal shows signs of emaciation and soiled hindquarters with soft and watery faeces;
• Eyes and nose containing dried-up discharges;
• Necrotic lesions in the lower lips, gums, cheeks and ventral surface of tongue;
• Erosions and haemorrhages in the abomasums, duodenum, ileum and large intestines.

4.4 **Collection of samples in the field**
Ensure sample collection procedures in the field are in line with requirements for laboratory assays to be performed, either for antibody or antigen detection or virus isolation. Observe the following requirements:

4.4.1 **For antibody detection**
Collect whole blood from live animals for serum separation.

4.4.2 **For antigen detection or virus isolation**
Collect the following suitable samples chilled and transport to the laboratory under refrigeration or on ice:

a. In live animals:
   Collect samples such as swabs of conjunctiva, nostrils, gum debris, blood in anticoagulant.

b. In dead animals:
   At necropsy, collect tissue from mesenteric and bronchial lymph nodes, spleen, lung, intestinal mucosa, liver and kidney in that order of importance in sterile normal saline for viral isolation and antigen detection. For histopathology, transport samples in 10% formalin.

4.5 **Storage of samples after arrival in the laboratory**
Preserve samples in appropriate conditions:

- tissue samples and swabs minimum at -20°C or best at -80°C (for longer storage periods);
- sera at +4°C, best at -20°C (for longer storage periods).

4.6 **Sample testing**
All laboratory procedures described in this SMP are as prescribed in the OIE Manual of Diagnostics. Sample testing should be carried out in laboratories approved by the veterinary authorities.

a. Direct diagnostic assays – Isolation of the virus and identification of the antigen.
   i. Agar Gel Immuno-diffusion (AGID): basic, simple to perform for screening, very specific but not very sensitive;
   ii. Immunocapture enzyme-linked immunosorbent assay (ICE ELISA – Libeau et al.,
iii. Virus nucleic acid recognition methods;

iv. Reverse transcription PCR (RT-PCR) techniques (Couacy-Hymann et al., 2002; Forsyth and Barrett, 1995; Saravanan et al., 2004; Kumar et al., 2007);

v. Real-time RT-PCR (Adombi et al., 2011; Balamurugan et al., 2010; Bao et al., 2008; Batten et al., 2011; Kwiatek et al., 2010);

vi. Virus isolation methods: observation of cytopathic effect on tissue culture;

vii. Suitable samples are animal tissues (lymph nodes, lungs, spleen and liver) whole blood and swabs;

viii. Suitable cell cultures for PPRV isolation are:

• Primary lamb kidney/lung cells
• Cell lines (Vero, B95a)
• Modified cell lines expressing the morbillivirus receptor, the signaling lymphocyte activation molecule (SLAM or CD150 - Adombi et al., 2011)
  – This is currently the most appropriate and easy method for PPRV isolation

b. Indirect diagnostic assays – Antibody detection tests

There are currently no available assays that can differentiate vaccinated animals from infected animals. Efforts should be made to develop such assays.

i. Virus neutralisation (VNT/SNT - the prescribed test for international trade)

ii. Competitive enzyme-linked immunosorbent assay (C-ELISA)

Two main C-ELISA tests are currently available, one based on N-Protein: (Libeau et al., 1995) and the other on H-Protein: (Anderson and McKay, 1994).
5.0 Disease Control

5.1 Disease control planning
Advance planning is critical for effective disease control operations. Following are three different planning necessities that must be designed within the framework of the SMP for PPR.

5.1.1 Preparedness planning
Preparedness planning outlines what a government needs to do before an outbreak of a disease in order to be prepared for it. This includes all things that stakeholders must do e.g. capacity building, equipment procurement, personnel responsibility allocation, and training in all the disciplines that support effective disease control, epidemiology, laboratory, disease management, etc.

5.1.2 Contingency (rapid response) plan
Details what a government will do in the event of an incursion of a disease beginning from the point when a suspect case is reported. A pre-programmed plan for immediate response to a report of an outbreak of a TAD or other emergency disease with the goal of eliminating the index case and preventing an epidemic spread. It also refers to a response to an increase in prevalence of an endemic disease situation. The Rapid Response Plan includes three components: the Epidemiology Section for disease investigation; the Laboratory Section for confirmation and sampling; and the Disease Control Section for immediate disease control interventions if/as need be.

It is important that the epidemiology and disease control sections of veterinary departments be prepared for full cooperation with the disease control programmes in cases of disease outbreak. Pre-planning for index case response is critical so that time is not lost when an index case is reported; the following should be undertaken:

a. Prepare kits with all equipment needed for effective rapid response to the index case;
b. Coordinate plans between epi-surveillance, laboratory, and disease control sections;
c. Ensure all needed equipment is identified and ready for action;
d. Establish rapid response teams.

5.1.3 Recovery plan
The plan for the safe recovery or restoration of normal activities, although possibly with procedures and practices modified in light of the experience gained during the outbreak.

5.2 Epidemiological investigation
Epidemiological investigation in disease outbreaks supporting disease control programmes
will be undertaken immediately after the first index case has been confirmed in a population. Data collection forms for all TAD investigations should be pre-designed to be compatible with the database and analysis system being used. There should be use of standardized outbreak investigation forms for collection of data. The following activities must be carried out:

a. Mobilize an investigation team;
b. Investigate factors related to livestock management and movement to determine source of outbreaks and spread of disease and identify an appropriate intervention;
c. Collect blood, serum and tissue samples for laboratory analysis, using proper biosecurity in collection, storage, handling, and transport of samples;
d. All data collected should be managed in an appropriate database, analyzed, reported, and shared appropriately;
e. Following disease control interventions, surveillance is essential to confirm that the disease has been controlled;
f. Post outbreak surveillance may be required to confirm freedom from infection in the area, to detect infective agent activity in a vaccinated population, and to confirm effectiveness of a campaign.

5.3. **Movement control and quarantine**

Livestock movement is normally regulated at markets, check-posts, stock routes, and at international borders. Pastoral production systems pose a unique challenge to PPR control in that movement is necessary for forage and water, which must be taken into account if movement control or quarantine is considered.

If PPR is suspected in susceptible species:

5.3.1 **A provisional quarantine order:**

a. Provisional quarantine order should be imposed on any group of susceptible animals.
b. During this time, samples shall be collected for laboratory analysis.
c. If PPR or other disease subject to quarantine is not confirmed, the provisional quarantine order will be rescinded.

5.3.2 **Quarantine order:**

a. Upon laboratory confirmation, identify area for quarantine; and a full quarantine should be imposed and disease control implemented as per the national SOP for PPR control.
b. Lift quarantine after completion of disease control interventions and confirmation of disease absence through surveillance by the epidemiology section. However, post outbreak surveillance may be required to confirm freedom from infection in the
area, to detect infective agent activity in a vaccinated population, and to confirm effectiveness of a campaign.

5.4 PPR vaccine quality control
AU-PANVAC certified vaccines shall be used in all vaccination campaigns.

For vaccine production the vaccine seed repository is currently available in AU-PANVAC. Vaccine production should be according to the OIE guideline. It is recommended to use the quality assured/certified vaccine (AU-PANVAC Certificate). During vaccine transportation, cold chain should be maintained from the laboratory to the field.

5.5 Vaccination coverage
Targeted mass vaccination is the principal PPR control strategy.

a. Vaccination campaigns should aim to cover 100% of susceptible animals to achieve at least 80% immunity.
b. Use a pre-designed vaccination and monitoring protocols.
c. Identify vaccinated animals to facilitate the monitoring.
d. Good communication, information distribution, and educational outreach is essential.
e. Ecosystem/cross-border PPR disease control is most effective and efficient, and coordination between national departments of Veterinary Services and joint campaigns are critical to contain epidemic outbreaks.

5.5.1 Areas of no known disease
Vaccinations for PPR are not needed in areas where PPR has not been detected or reported. Continuous passive surveillance and active surveillance should be carried out as necessary, and appropriate reactions to suspicious cases be implemented.

5.5.2 Endemic areas
a. Undertake strategic response in cases of suspect and/or positive diagnosis;
b. Use of certified vaccine to control outbreak (AU-PANVAC);
c. Apply targeted vaccination to a smaller geographical area when vaccine supply is limited and where adequate coverage will be attained;
d. Coordinate disease control implementations with DVS epidemiology section for risk analysis, risk mapping, and implementation planning according to national contingency plan;
e. Sero-monitoring in a limited area may be conducted on a randomly sampled population to confirm efficiency and vaccine efficacy;
f. Mobilization of the community and awareness creation;
g. Resource mobilization (financial and human)/operationalization of contingency plans.
5.5.3 **High risk areas**

a. Sanitary cordon/buffer zone may be established where there will be targeted, animal movement control, and active surveillance. This buffer zone will delineate the infected area to limit the spread of PPR.

b. Ring vaccination specifically to be applied around outbreak areas starting from clean areas inward;

c. All age groups of sheep and goats will be vaccinated. When the PPR vaccine is limited, vaccinations should be targeted to a smaller geographical area where adequate coverage will be attained.

d. Use of certified vaccine to control outbreak (AU-PANVAC);

e. Records of all vaccinated livestock must be properly kept by the Veterinary Services;

f. Sero-monitoring in a limited area should be conducted on a randomly sampled population to confirm vaccination efficiency and vaccine efficacy (see Section 4.3 above);

g. Further vaccination as determined by epidemiological investigation and risk analysis;

h. Mobilization of the community for awareness;

i. Immediate notification of the diseases to OIE, AU-IBAR and RECs;

j. Resource mobilization (financial and human)/operationalization of contingency plans;

k. Small ruminant markets closed in response to the outbreak;

l. In an epidemic/high risk area, stamping out may be considered to re-attain freedom from disease if the contingency plans allows;

m. Exit strategy for mass vaccination – sustained active surveillance to monitor and identify areas of epidemic maintenance until no more outbreaks are observed, then change mass vaccination into targeted vaccination depending on disease status.
6.0 Reporting and Information Management

Capacity building on information management is crucial to handle data emanating from surveillance, laboratory diagnosis, and disease control response activities. To realize this, countries in the region are advised to:

a. Adopt a common information management system such as ARIS-2;
b. Establish a disease notification system;
c. Strengthen feedback mechanisms to stakeholders;
d. Share information at regional and continental level;
e. Report to relevant regional and international including RECs, AU-IBAR OIE/WAHIS, and FAO;
f. Develop communication tools and materials.

7.0 Trade Issues

7.1 International requirements for trade

Countries in the GHoA will observe the following requirements for trade:

a. Non-symptomatic export animals from clean areas may enter export quarantine stations. This includes animals kept since or for the past 21 days in an establishment where no case of PPR was officially reported or where the establishment was not situated in a PPR-infected zone.
b. Animals should come from clean areas with identification and certification as per OIE standards;
c. Animals should be kept in quarantine station for 21 days prior to shipment;
d. Animals should not show clinical signs of PPR on the day of shipment;
e. Animals vaccinated against PPR should be shipped in not less than 15 days and not more than 12 months;
f. Vaccination within the export quarantine stations shall be done as per OIE standard;
g. Use risk assessment results to promote trade.

7.2 Verification of vaccination or infection status of animals for trade

a. Vaccination or infection status of animals that arrive into the importing or transit country should be verified by quarantine of the animals for a minimum of 21 days (incubation period is 21 days as per the OIE Terrestrial Animal Health Code).
b. During this period identify tested animals on the basis of presence of virus antigen or antibodies (paired sera 21 days apart) and by observation for absence of clinical signs.
c. If on arrival no antibodies are detected, then the animals were not vaccinated (or they were vaccinated within the last seven days and have not yet sero-converted, in which case a second serum sample collected at 21 days will indicate sero-conversion).
8.0 Risk Analysis and Risk Mapping

8.1 Risk analysis

Three elements:

a. Risk assessment – hazard identification, release assessments, potential exposure, and impacts;

b. Risk management – use of information to evaluate management options;

c. Risk communication – communicating the results of the risk analysis;

d. Recommendations of risk assessment for disease control:
   i. Determine risk of PPR introduction to areas of no known disease and mitigation of risk;
   ii. Assess progress of disease control interventions and impact of the PPR outbreak.

8.2 Risk mapping

1. Collect outbreak history maps from each country;

2. Consolidate outbreak history maps into a regional PPR history map;

3. Identify endemic “hotspots” and determine feasibility of using a regional approach based on management and production systems.