National Foot and Mouth Disease
Prevention and Control Plan

Third Edition 2016

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Acknowledgements

First edition, 1996
Late Dr. JB Gurung

Second Edition, 2005
Dr. Pasang Tshering
Dr. Kinzang Dukpa
FOREWORD

Foot and Mouth Disease (FMD) is one of the most important diseases affecting livestock production in Bhutan and it is a notifiable disease as per the Livestock Rules and Regulations of Bhutan 2008. FMD has been always a threat to the success of livestock development programs in the country. FMD is a Transboundary Animal Disease (TAD) that is highly contagious and has the capacity to readily cross national boundaries. Therefore, it is extremely important to control the disease to enhance livestock production and contribute to enhancing the livelihoods of our rural population. Such intervention will also facilitate livestock trade both within Bhutan and with other countries in the future. As part of the global effort to control this disease, Bhutan is also using the concept of Progressive Control Pathway (PCP) developed jointly by World Organization for Animal Health (OIE) and Food and Agriculture Organization (FAO). The document clearly outlines strategies and activities to achieve stage 3 of the PCP by 2020.

Livestock development is a dynamic process with emerging challenges especially with animal diseases. Therefore, I am happy to note that the National Centre for Animal Health (NCAH), Animal Health Division, Department of Livestock (DoL) has taken the lead in revising and updating the National Foot and Mouth Disease Prevention and Control Plan. I would like to extend my appreciation to all individuals who have contributed towards revising and updating this very important national plan document.

I hope this revised plan document (Third edition) will be useful as a ready reference to all those involved in the prevention and control of FMD in the country. I am confident that this plan document will directly contribute in bringing down the incidence of FMD in the country thereby improving the livelihood of the rural population.

(Dr. Tashi Samdup)
DIRECTOR GENERAL

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Abbreviations

AHD Animal Health Division
BAFRA Bhutan Agriculture and Food Regulatory Authority
BPU Biological Production Unit
DDM Department of Disaster Management
DoFPS Department of Forests and Park Services
DOIT Disease Outbreak Investigation Team
DVH Dzongkhag Veterinary Hospital
ELISA Enzyme Linked Immuno-Sorbent Assay
FAO Food and Agriculture Organization of the United Nations
FMD Foot and Mouth Disease
FMDV Foot and Mouth Disease Virus
GT Gewog Tshogdue
IEC Information, Education and Communication
LEC Livestock Extension Centre
LPB antibody ELISA Liquid-phase blocking antibody ELISA
MoF Ministry of Finance
MoAF Ministry of Agriculture and Forests
NCAH National Centre for Animal Health
NFMDCP National Foot and Mouth Disease Control Program
NGO Non-governmental organization
NSP-ELISA Non-structural protein Enzyme Linked Immuno-Sorbent Assay
OIE Office International des Epizootic (World Organization for Animal Health)
PCP Progressive Control Pathway
RBP Royal Bhutan Police
RLDC Regional Livestock Development Centre
RNE-EC Renewable Natural Resources-Extension Center
RRT Rapid Response Team
RT-PCR Reverse Transcription Polymerase Chain Reaction
SAARC South Asian Association for Regional Cooperation
SOP Standard Operating Procedure
TADInfo Transboundary Animal Disease Information
# Background

1. **Situational analysis**  
2. **Objectives**  
3. **Epidemiology of FMD in Bhutan**
   1. **Spatial distribution**
   2. **Temporal distribution**
   3. **Species affected**
   4. **Virus serotypes**

# The Disease

1. **Causative agent**  
2. **Host range and susceptibility**
3. **Virus Survival**
4. **Source of virus**
5. **Pathogenesis**
6. **Transmission**
   1. **Direct and indirect contact**
   2. **Transmission by ingestion**
   3. **Air borne transmission**
   4. **Iatrogenic transmission**
7. **Clinical signs**
   1. **Cattle**
   2. **Sheep and goats**
   3. **Pigs**
8. **Diagnosis**
   1. **Clinical diagnosis**
   2. **Laboratory diagnosis**

# Prevention and Control Strategies

1. **Institutional arrangements**
   1. **Department of Livestock**
   2. **National Level**
   3. **Regional Level**
   4. **Dzongkhag Level**
   5. **Gewog Level**
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.6.</td>
<td>Bhutan Agriculture and Food Regulatory Authority</td>
</tr>
<tr>
<td>3.1.7.</td>
<td>Other relevant agencies/organizations</td>
</tr>
<tr>
<td>3.2.</td>
<td>Prevention strategy</td>
</tr>
<tr>
<td>3.2.1.</td>
<td>Risk zone identification and prevention strategies</td>
</tr>
<tr>
<td>3.2.2.</td>
<td>Vaccination program</td>
</tr>
<tr>
<td>3.2.2.1.</td>
<td>Vaccine procurement and supply</td>
</tr>
<tr>
<td>3.2.2.2.</td>
<td>Vaccine strain and quality</td>
</tr>
<tr>
<td>3.2.2.3.</td>
<td>Cold chain maintenance</td>
</tr>
<tr>
<td>3.2.2.4.</td>
<td>Target species for vaccination</td>
</tr>
<tr>
<td>3.2.2.5.</td>
<td>Age for vaccination</td>
</tr>
<tr>
<td>3.2.2.6.</td>
<td>Time of vaccination</td>
</tr>
<tr>
<td>3.2.2.7.</td>
<td>Frequency of vaccination</td>
</tr>
<tr>
<td>3.2.2.8.</td>
<td>Vaccination of migratory animals</td>
</tr>
<tr>
<td>3.2.2.9.</td>
<td>Calf-hood vaccination</td>
</tr>
<tr>
<td>3.2.2.10.</td>
<td>Corridor vaccination</td>
</tr>
<tr>
<td>3.2.2.11.</td>
<td>Mass vaccination campaign</td>
</tr>
<tr>
<td>3.2.2.12.</td>
<td>Barrier/ring vaccination</td>
</tr>
<tr>
<td>3.2.2.13.</td>
<td>Reporting the progress of vaccination coverage</td>
</tr>
<tr>
<td>3.2.3.</td>
<td>Regulation on import of livestock and livestock products</td>
</tr>
<tr>
<td>3.3.</td>
<td>Control strategies</td>
</tr>
<tr>
<td>3.3.1.</td>
<td>Outbreak investigation and reporting</td>
</tr>
<tr>
<td>3.3.2.</td>
<td>Declaration of Provisional Infected Zone</td>
</tr>
<tr>
<td>3.3.3.</td>
<td>Declaration of the Infected Zone and FMD outbreak</td>
</tr>
<tr>
<td>3.3.4.</td>
<td>Activation of the Rapid Response Team</td>
</tr>
<tr>
<td>4.</td>
<td>Surveillance system</td>
</tr>
<tr>
<td>4.1.</td>
<td>Clinical surveillance</td>
</tr>
<tr>
<td>4.1.1.</td>
<td>Syndromic surveillance</td>
</tr>
<tr>
<td>4.1.2.</td>
<td>Surveillance during outbreak</td>
</tr>
<tr>
<td>4.2.</td>
<td>Laboratory surveillance</td>
</tr>
<tr>
<td>4.2.1.</td>
<td>Sero surveillance (structured population based survey)</td>
</tr>
<tr>
<td>4.2.2.</td>
<td>Virological surveillance</td>
</tr>
<tr>
<td>5.</td>
<td>Other support plan</td>
</tr>
<tr>
<td>5.1.</td>
<td>Awareness education</td>
</tr>
<tr>
<td>5.2.</td>
<td>Border harmonization</td>
</tr>
<tr>
<td>5.3.</td>
<td>Research and development</td>
</tr>
<tr>
<td>5.4.</td>
<td>FMD coordination workshops</td>
</tr>
<tr>
<td>6.</td>
<td>Programme financing</td>
</tr>
</tbody>
</table>
7. Monitoring and evaluation

8. Annexure

Annexure 1: Zoning, target species of animals to be vaccinated, frequency and time of vaccination against FMD

Annexure 2: Rapid Response Team (RRT) during Foot and Mouth Disease Outbreak

Annexure 3: Standard Operating Procedures

3.1. Standard Operating Procedure for Disease outbreak investigation
3.2. Standard Operating Procedure for Ring vaccination
3.3. Standard Operating Procedure for the treatment of FMD affected animals
3.4. Standard Operating procedure for disposal of FMD carcasses by burial
3.5. Standard Operating Procedure for disinfection and decontamination of contaminated premises and materials
3.6. Standard Operation procedure for quarantine and movement control
3.7 Standard Operating Procedure for sample collection to diagnose FMD in animals
3.8 Standard Operating Procedure for NSP antibody Rapid Test

Annexure 4: Standard Forms

FORM: 1 Temperature recording form (to be used to record temperature of vaccine storage refrigerator)

FORM 2: FMD syndromic surveillance and reporting form

FORM 3: Flash Report format for disease outbreak reporting

FORM 4: FMD Vaccination form

FORM 5: FMD Sample submission form

FORM 6: Disease Outbreak Investigation Form

9. References
FMD is a highly contagious viral disease that affects all cloven-footed animals including cattle, yak, sheep, goat, pig and other wild ruminants. The disease is endemic in many parts of the world, particularly in developing countries of Asia, Africa, the Middle East, and some parts of Europe. In FMD-endemic countries, FMD can have serious economic losses through reduced production in terms of milk, meat and draught power and deaths, while in FMD-free countries, the outbreak will impact economic in terms of trade restrictions, costs of disease control and eradication.

FMD is the most important disease affecting livestock production in Bhutan and it is a notifiable disease as per the Livestock Rules and Regulations of Bhutan 2008.

1.1. Situational analysis

Livestock forms a vital component of the Renewable Natural Resources (RNR) sector of the rural economy and in alleviating poverty. One of the main objectives of livestock development programs in the country is to enhance the income of the rural farmers through successful livestock farming.

There is significant potential for dairy farming given the increasing demand for milk and milk products in the country. Similarly, there is a good potential for meat production (beef and pork) given the essentially meat-based diets of the Bhutanese and the increasing buying power of the consumers.

However, diseases such as FMD have been always a threat to the success of such livestock development programs in the country. Despite the implementation of vaccination programs, outbreaks of FMD are reported frequently, particularly in
Dzongkhags adjoining the border areas. Without the current vaccination programs there would be significantly higher levels of disease outbreaks and the impact of the disease would be much greater.

The first National FMD Control Program (NFMDCP was developed in 1996 through the EU funded project. The document was then revised in 2005 which consisted of two documents viz: ‘Policy and Operational Strategy Guidelines (Volume I)’ and a ‘Field Guide Manual (Volume II)’. This new control plan builds on the NFMDCP (1996 and 2005) and is also based on the outcomes of a FAO/DOL technical cooperation project, and findings of the postgraduate study program. It is also linked to new regional developments for the progressive control of FMD.

1.2. Objectives

FMD is recognized as a Transboundary Animal Disease (TAD) that is highly transmissible and has the capacity to readily cross national boundaries. Therefore, the effective long term control of disease in South Asia requires regional approaches and SAARC is working with the EU, FAO, OIE, and other international organizations and donors to implement the progressive control pathway (PCP) and supporting roadmaps for FMD control. This provides an opportunity for Bhutan to participate in the regional program and this will reduce the risk in neighbouring countries and help Bhutan achieve its objectives.

The PCP-FMD is a set of FMD control activity stages that, if implemented, should enable countries to progressively increase the level of FMD control through 6 stages on the way to achieving free zone status without vaccination (Figure 1).

It is considered that Bhutan is currently at Stage 2 and progression to Stage 3 by 2020 requires Bhutan to progress as given in Table 1. Stage 2 involves implementing risk-based control measures such as targeted surveillance, targeted vaccination and other measures based on risk zones. Stage 2 also involves implementing risk-based control measures such that the impact of FMD is reduced in one or more livestock sectors and/or in one or more zones. Progression to Stage 3 requires a revised, more aggressive control strategy that has the aim of progressive reduction in outbreak incidence, followed by elimination of FMD virus circulation in domestic animals in at least one zone of the country and includes development of more active contingency and emergency preparedness plans. An application for OIE-endorsement of a national control programme can be submitted in an advanced phase of Stage 3.
Figure 1. The FAO/OIE Progressive Control Pathway for FMD

Table 1. Timeline to achieve Stage 3 of the Progressive Control Pathways for FMD in Bhutan

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<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage of PCP</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
1.3. Epidemiology of FMD in Bhutan

1.3.1. Spatial distribution

FMD outbreaks are more frequently reported from the Dzongkhags sharing borders with India e.g. Chukha, Sarpang, Samtse, Samdrup Jongkhar (Figure 2 and 3). Vaccination programs are likely to have reduced the spread of the disease and clinical expression in affected herds. Outbreaks are also reported more from those villages/Gewogs that undertake cattle migration on seasonal basis.

Figure 2. Spatial distribution of FMD outbreaks in Bhutan (1996-2007)

Figure 3. Spatial distribution of FMD outbreaks in Bhutan (2008-2015)
1.3.2. **Temporal distribution**

Between 1996 and 2015, an annual average of 17 outbreaks of FMD have been reported at village level (Figure 4). The highest incidence of FMD outbreaks was noticed during autumn and winter months, with the maximum being between November and February.

![Figure 4a. Annual incidence of reported FMD outbreaks at the village-level in Bhutan (1996-2015)](image)

![Figure 4b. Seasonal pattern of reported FMD outbreaks at village-level in Bhutan (1996-2015). Note: 1: Autumn; 2: Spring; 3: Summer; 4: Winter. The dotted red line is the centered moving average of the reported FMD outbreak in Bhutan.](image)
1.3.3. Species affected

In the year 2014, Bhutan had 421,917 FMD-susceptible domestic animals out of which cattle (71.7%, n=302,504) was the highest followed by goats (11.6%, n=48,864), yaks (10.7%, n=44,993), pigs (3.4%, n=14,204), sheep (2.6%, n=10,778) and buffalo (0.14%, n=574). As in most countries cattle are the most important susceptible species for FMD and the disease affects this species more frequently than for other species. Other species such as pigs, sheep and goat do not seem to play an important role in FMD epidemiology in Bhutan. A sero-survey conducted in 2011, indicated that the true prevalence at the animal-level for all species was 15% (95% CI: 13.5, 16.7) whilst the true prevalence for cattle, goats, sheep and pigs were 17.6 (95% CI: 15.6, 19.5), 11.9% (95% CI: 5.6, 18.3), 11.9% (95% CI: 1.3, 25.1), and 1.9% (95% CI: 0.0, 3.8), respectively.

1.3.4. Virus serotypes

Serotype O is the most commonly recorded FMDV serotype in Bhutan. Since 2003, we have recorded occurrence of the Pan Asia strain of the Middle East–South Asia (ME–SA) topotype of type O. The last recorded outbreaks of other strains of FMD in Bhutan were serotypes C (1991), A (2012) and Asia 1 (2002). This is similar to the situation in adjoining areas of India from where most livestock and livestock products are sourced.
2.1. **Causative agent**

Foot and mouth disease is caused by the FMD virus (FMDV) which is a non-enveloped RNA virus belonging to the *Aphthovirus* genus of the family *Picornaviridae*. The FMDV has seven clinically indistinguishable serotypes: O, A, C, Asia 1, SAT 1, SAT 2, SAT 3. These serotypes do not induce cross protection against each other and therefore vaccination against one serotype will not provide protection against other serotypes.

2.2. **Host range and susceptibility**

It affects all cloven-hoofed domestic animals including cattle, sheep, goats, pigs and buffalo. A wide range of cloven-hoofed wild animals including wild pigs, deer, antelopes, although, apart from the African buffalo (*Syncerus caffer*), the other wild species do not seem to play a significant role in the epidemiology of FMD. Cattle are the main reservoir hosts for the virus, although in some instances, the virus is found to adapt to pigs, sheep and goats.
2.3. **Virus Survival**

Foot-and-mouth disease virus is most stable near a neutral pH. At pH 7.5, the virus may remain infective for 18 weeks at 4°C, 7 hours at 43°C, and only 3 seconds at 61°C. The virus is rapidly inactivated at a pH below 5 or above 11. The virus can be detected within the musculature of slaughtered animals for up to 30 hours but is destroyed by the formation of lactic acid during *rigor mortis* at 4°C. However, if the carcass is frozen before the onset of *rigor mortis*, the virus can survive for up to 8 months. The virus can be rapidly inactivated by acids and alkalis, including citric acid, phosphoric acid, sulphuric acid, lactic acid, hydrochloric acid, sodium carbonate, sodium hydroxide and sodium metasilicate.

2.4. **Source of virus**

The FMDV is excreted in several of the body secretions and excretions including saliva, milk, semen, urine, faeces, nasal discharges and exhaled air. The infected animals usually start excreting virus at least 24 hours prior to the development of clinical signs. This has important epidemiological implications as animals are infectious before the onset of clinical signs. Amongst the domestic animals, pigs are known to be the “amplifier hosts” with a capacity to release 3000 times more virus than cattle or sheep.

2.5. **Pathogenesis**

After entry through the aerosol route, the initial virus replication takes place in the pharyngeal or lung tissue. If the virus has entered through skin abrasions, initial multiplication occurs in the dermal and sub-dermal tissues. The virus is then distributed, through the vascular system to the predilection sites such as the epithelium of the feet, oro-pharynx, teat and udder. Virus multiplication at these sites leads to the development of lesions which is usually preceded by fever. The virus also probably replicates in the pituitary gland and this is speculated to be the cause of the “heat intolerance syndrome” or “panting” seen in recovered animals. The clinical signs of FMD are more apparent in FMD-naïve animals than in animals from endemic areas or in an immune population.
2.6. Transmission

The most common route of entry of FMDV is through the respiratory tract although, less commonly, the virus can gain entry through abrasions in the epithelium of the oral cavity, feet or teats. Cattle are the most susceptible species to be infected by the inhalation route owing to their large inspiratory capacity compared to other susceptible domesticated species.

2.6.1. Direct and indirect contact

FMD is most commonly spread by direct contact between an infected and a susceptible animal. The disease can also be spread indirectly by farmers, veterinarians, inseminators, and movement of contaminated animal products such as meat, milk, semen and hides. Activities such as shearing, de-worming, blood sampling and milking can also lead to indirect contact with virus from infected animals if proper hygiene and aseptic precautions are not taken.

2.6.2. Transmission by ingestion

Animals, especially pigs, can be infected through ingestion of contaminated uncooked swill.

2.6.3. Air-borne transmission

Infected animals produce a large amount of virus in their exhaled air. Cattle and sheep are particularly susceptible to infection by the aerosol route compared with pigs. An important mode of spread of FMD has been the air-borne spread, especially in temperate countries where the climate is conducive for the survival of the virus.

2.6.4. Iatrogenic transmission

Use of FMDV-contaminated instruments, such as hypodermic needles during parenteral administration of drugs or vaccines, could lead to transmission of infection.
2.7. Clinical signs

2.7.1. Cattle

The incubation period in cattle can range from 2 to 14 days depending on the infecting dose, the virus strain and the route of infection. Affected animals will initially exhibit pyrexia, lasting for one or two days, followed by development of vesicles on the tongue, hard palate, dental pad, lips, gums, muzzle, coronary band and interdigital space. Infected animals have excessive salivation and a nasal discharge. Signs of lameness are exhibited by frequent stamping of the feet. Depending on the severity of the disease, lactating animals can develop vesicles on the teats. There is a significant drop in milk production. The vesicles in the mouth usually rupture within 24 hours of formation, leaving shallow erosions surrounded by shreds of epithelium. Healing of oral lesions is usually rapid, in contrast to those on the feet. The disease morbidity can reach up to 100%, especially in a non-immune population; however, mortality is usually restricted to young animals that can develop viral myocarditis. Clinical signs are more apparent in cattle as compared to other domestic species.

2.7.2. Sheep and goats

The incubation period in sheep and goats ranges from three to eight days. Unlike in cattle, clinical signs are often in-apparent in sheep and goats resulting in the disease frequently being missed during routine clinical inspections. Lameness is usually the first indication of FMD in sheep and goats.

2.7.3. Pigs

Generally, the incubation period in pigs is 2 to 6 days. In acute cases, infected pigs will show signs of lameness, blanching of the skin around the coronary bands, vesicle formation on the nostrils and in the mouth and pyrexia.
2.8. Diagnosis

2.8.1. Clinical diagnosis

Clinical signs are more obvious in cattle than other species and therefore clinical diagnosis is useful in this species as compared with small ruminants and pigs. However, other epidemiological features such as rapid spread of disease and high morbidity should also be used to support clinical diagnosis.

2.8.2. Laboratory diagnosis

As FMD is clinically indistinguishable from other vesicular diseases, the disease needs to be confirmed using laboratory tests. The laboratory tests currently used for diagnosis of FMD in Bhutan include lateral flow immunochromatography (rapid NSP antibody test), virus detection tests (PCR, indirect sandwich ELISA), ELISAs to detect FMDV non-structural proteins (NSP) and structural proteins (SP) in sera.
3.1. Institutional arrangements

The animal health services in the country are delivered to farming communities through the network of various Livestock extension centres (Veterinary hospitals, livestock extension and RNR Centres). Technical and laboratory support are provided through National Centre for Animal Health (NCAH), Regional Livestock Development Centres (RLDCs), Satellite Veterinary Laboratories (SVLs), and Dzongkhag Veterinary Hospitals (DVHs).

3.1.1. Department of Livestock

The Animal Health Division (AHD) at the Department will oversee policy formulation related to National Foot and Mouth Disease Control Program (NFMDCP) in the country. The specific roles includes the following:

- Mobilize resources including fund for FMD control program in the country
- Liaise with different stakeholders/agencies/international organizations (e.g. FAO, OIE, SAARC) for facilitating better implementation and ensuring success of the control program
- Collaborate with BAFRA to enable better enforcement of the Livestock Acts and By-laws of the country
- Collaborate with relevant national agencies (DoFPS, DDM, NGOs) for ensuring and mobilization of support required for FMD control
- Coordinate border harmonization meetings with the Indian counterparts at the state and central levels.
3.1.2. National Level

The NCAH will function as the national focal agency for the overall planning, coordination and implementation of the National Foot and Mouth Disease Control Program (NFMDCP) in the country. The responsibilities for the national focal agency should be:

- Coordinate the overall implementation of the NFMDCP in the country
- Mobilize resources at the national level in terms of supply of vaccine and equipment
- Support the activation of rapid response team (RRT) in the event of disease outbreak
- Liaise with different stakeholders/agencies for facilitating better implementation and ensuring success of the control program
- Coordinate conduct of epidemiological research on FMD in collaboration with national, international diagnostic and research institutions
- Production of education (IEC) materials and make available for wider circulation for advocacy campaign
- Ensure maintenance of database on FMD control program (e.g. vaccination coverage), analysis and dissemination of information/progress report to the Department/Ministry/other stakeholders regarding the progress of the control program
- Conduct FMD coordination workshops at national level to review and realign the control program
- Coordinate the conduct of field simulation exercise among RRT
- Monitor and evaluate the control programs implemented by the field units
- Ensure vaccination coverage as per the risk zones
- Declaration of risk zones/compartments for FMD
- Assess the status of these zones / compartments by regular surveillance and monitoring
- Standardization of protocol for diagnosis of FMD and ensuring uniformity across diagnostic laboratories in the country
- Regular update of information about rabies on database and to all the stakeholders
3.1.3. **Regional Level**

The Regional Livestock Development Centres (RLDCs) would function as regional focal agency for FMD control program. The main roles of the regional focal agency should be to:

- Coordinate the overall implementation of the NFMDCP at the regional level
- Coordinate the activation of rapid response team (RRT) in the event of disease outbreak
- Provide support and coordinate logistics arrangement at the regional level
- Liaise with the BAFRA at the regional level for facilitating better enforcement of the Livestock Acts and By-laws
- Monitoring and evaluation of the control programs in their respective regions
- Ensure prompt reporting of outbreak and updating the disease status in TADInfo database.
- Ensure maintenance of database on FMD control program (e.g. vaccination coverage), and submit progress report to the NCAH
- Monitor and evaluate the control programs implemented by the field units

3.1.4. **Dzongkhag Level**

At the Dzongkhag level, the Dzongkhag Veterinary Hospital (DVH) would function as the focal agency for implementation of the FMD control program. The Dzongkhag focal agency should carry out the following tasks:

- Implement the NFMDCP in the field
- Arrange logistics at the Dzongkhag level and assist the Gewog staff with their logistics
- Liaise with the BAFRA at the Dzongkhag level for facilitating better enforcement of the Livestock Acts and By-laws
- Support the activation of rapid response team (RRT) in the event of outbreak
- Mobilize manpower in the Dzongkhag for routine and ring vaccination program
- Ensure prompt reporting of outbreak and updating the disease status in TADInfo database.
- Ensure maintenance of database on FMD control program (e.g. vaccination coverage),
- Submit monthly reports to the RLDC regarding status of the disease in the Dzongkhags
- Receive the inputs from the NCAH/RLDC and maintain inventory in the Dzongkhags
3.1.5. Gewog Level

The Livestock Extension Centre/RNR Extension Centres/Veterinary hospitals at Gewog should be the focal agency for that Gewog. They would play a very crucial role in the implementation of the FMD control program in their respective Gewogs.

The main roles of the Gewog focal agency are as follows.

- Implement the FMD control program in the field as per the NFMDCP.
- Ensure prompt reporting of outbreak through FLASH report and updating the disease status on weekly basis
- Implement provisional emergency control measures in the locality in the event of outbreak
- Ensure maintenance of proper recording of vaccinated herds and other records
- Liaise with the BAFRA at the Gewog level for facilitating better enforcement of the Livestock Acts and By-laws
- Liaise with the Gewog administration (GT), gups, other local leaders and farmers for facilitating proper implementation of the program in the field
- Play lead role at the time of vaccination campaign and disease outbreak investigation in their respective Gewogs
- Conduct regular disease awareness campaign for the farmers and other clients

3.1.6. Bhutan Agriculture and Food Regulatory Authority

Bhutan Agriculture and Food Regulatory Authority (BAFRA) as a Regulatory Authority under MOAF is mandated to enforce and implement the Livestock Act and By-laws and its regulations.

- Enforcement of movement ban of livestock and livestock products in and out of the FMD outbreak areas
- Quarantining of infected animals in the affected areas.
- Monitor the livestock movements from one Dzongkhag to others.
- Inspection and certification of suspected livestock products
- Carry out bio-security measures during the outbreaks (segregation, disposal, cleaning and disinfection)
- Border vigilance on the illegal movement of livestock & livestock products in the peace period.
3.1.7. **Other relevant agencies/organizations**

The prevention and control of FMD require joint effort at various level including the regional and international organizations.

**Department of Forests and Park Services**

The domestic livestock graze freely in the forest where there is a possibility of mixing domestic animals with wild ruminants. There may also be disease transmission (FMD) at the domestic-wild life interface since most of the villages in the country are surrounded by forests. Therefore, collaboration between livestock and forestry sectors is important for disease surveillance, sharing of disease outbreak information and prevention and control program.

**Dzongkhag Administration**

The Dzongkhag, Dungkhag and Gewog administration support is important for coordinating FMD prevention and control activities including management in the event of outbreak in their areas. Local government support is crucial for strict implementation of NFMDCP at the village and community level.

**Royal Bhutan Police**

The Royal Bhutan Police (RBP) support is necessary for enforcement of FMD control measures and regulations especially in the event of massive outbreak.

**Ministry of Finance**

The Ministry of Finance (MOF) should provide adequate fund for implementation of NFMDCP in the country. The additional fund support should be sought from MOF if the existing budget is not sufficient at the different levels during implementation and in emergency situation.
International Organizations

It is important to build linkages with the international organizations such as the Food and Agriculture Organization (FAO), World Organization for Animal Health (OIE) and other institutes for seeking fund and technical support, human resource development, and referring of samples for laboratory diagnostic services.

The SAARC Regional Support Unit should play an important role in helping with developing coordinated program for FMD control in the SAARC countries and also sharing facilities like laboratory services, disease information centre, and facilitate in quality vaccine procurement. Coordination meetings with the state veterinary departments of the adjoining Indian states (Assam, West Bengal, and Arunachal Pradesh) are needed to help with common understanding and the development of collaborative efforts for disease control in both countries.

3.2. Prevention strategy

3.2.1. Risk zone identification and prevention strategies

Risk zone identification and categorization for FMD is important for defining the strategies to be used in each zone and for defining disease status in accordance with the FMD-PCP.

The country has been divided into three risk zones based on the epidemiology of the disease (number of outbreaks), sharing of border with neighbouring countries, road connectivity, and these are high risk, medium risk and low risk zones (Figure 5, Table 2). This will guide strategies for surveillance, vaccination and animal movement regulation. However, the risk zones would be reviewed periodically based on the disease status to increase the efficiency of the prevention and control program.

In all risk zones, the national vaccination coverage should be minimum of 80% of the targeted susceptible species population during each vaccination schedule/campaign.
**High risk zone**

A total of 45 Gewogs sharing borders with Indian states, fall under this zone (Figure 5, annexure 1). These areas experience frequent outbreaks of FMD owing to long porous border. Bi-annual vaccination of all species of animals in the high risk zone would create an immune buffer (*cordon sanitaria*) and prevent entry of disease from across the border thereby reducing the risk of spread to medium and low risk zones. In this zone a minimum of 80% of all susceptible animals should be vaccinated during each campaign. The zone will remain under stringent vaccination schedule as stipulated above until such time when the disease risk is zero.

Those villages under medium and low risk zone that share immediate border with villages and Gewogs falling under high risk zone, along the national and Dzongkhag highways, near towns may also be considered as high risk areas and animals should be vaccinated bi-annually.

**Medium risk zone**

A total of 124 Gewogs fall under this zone (Figure 5). The medium risk zone includes the Gewogsthat share border with those Gewogs that are under high risk zone, falling along the major roads, following migratory practices and with incidences of FMD in the last five years. The medium risk zone is the interface with the high risk zone, where there is seasonal movement of livestock between high and low risk areas.
Although annual vaccination program is recommended in the medium risk zones, animals residing on either side of the national and Dzongkhag highways, near towns (corridor vaccination) and also the migrating animals should be vaccinated twice a year (bi-annual, risk-based and targeted vaccination).

**Low risk zone**

A total of 36 Gewogs fall in this zone (Figure 5). The low risk zone has been defined where the villages and Gewogs fall under remote and mountainous terrain and where the prevalence of FMD is low with sporadic outbreaks. Owing to low prevalence of FMD in this zone, one of the objectives is to achieve recognition of freedom from FMD in accordance with the objective for Stage 3 of the PCP. To achieve this, the strategy should involve vaccination of cattle and yaks. However, vaccination would cease when absence of FMD can be demonstrated.

Under this zone, animals residing on either side of the national or Dzongkhag highways, near towns (corridor vaccination), including the migrating animals should be vaccinated twice a year (bi-annual, risk-based and targeted vaccination).

**3.2.2. Vaccination program**

**3.2.2.1. Vaccine procurement and supply**

The NCAH should procure vaccine and supply as per the annual indents submitted by the Dzongkhags. The total FMD vaccine doses requirement in each Dzongkhag should be calculated based on the susceptible animal population, risk zone and 80% coverage target during each campaign. A vaccine bank at the regional level should be established at RLDCs (e.g. Khangma and Zhemgang) for emergency supplies during outbreaks.

**3.2.2.2. Vaccine strain and quality**

For the routine as well as ring vaccination oil adjuvant trivalent FMD vaccine containing serotypes O, A and Asia-1 should be used. The quality of vaccine should be monitored through periodic vaccine efficacy study and vaccine matching tests.
3.2.2.3. Cold chain maintenance

The quality of vaccine should be maintained throughout the cycle (storage, transportation and handling of vaccine at all levels). The maintenance of optimal temperature during the supply of vaccine by the supplier to NCAH should be monitored by Biological Production Unit (BPU) and storage at BPU should be monitored by Program Director, NCAH. The distribution of vaccines from the BPU to the field should be done in a refrigerated van to the RLDCs and the Dzongkhags. During the distribution of vaccine, it should be ensured that the optimal temperature is maintained in the refrigerated van by use of temperature data logger, which should be monitored by BPU. At the RLDCs and Dzongkhags, the concerned staff should record the temperature of the refrigerators daily and maintain the data at all levels using standard form (refer FORM 1), which should be checked and monitored by the RLDC. It is the responsibility of the concerned Gewog in-charges to ensure that vaccines are kept under proper cold storage during the entire phase of the vaccination program. Vaccine should be carried to the field in cool-boxes using ice-packs. In order to maintain the cold chain, vaccination program should start early morning and end by afternoon. Normally the ice packs may last only up to 24 hours and should be replaced with new ice packs. Data logers should be used to find out the temperature of FMD vaccine used in the field.

3.2.2.4. Target species for vaccination

All cloven hoofed domestic animals - cattle, yak, buffalo, pigs, sheep and goat are to be covered in high risk zone. In the medium risk zone cattle, yak, and buffalo shall be vaccinated whilst in the low risk zone, only cattle and yaks should be vaccinated. The target species shall be reviewed from time to time depending on the disease epidemiology. However, all target species shall be vaccinated in all government farms irrespective of in which zone the farm is located. And target species in the villages located in the vicinity of the government farms should also be vaccinated.

3.2.2.5. Age for vaccination

All animals (cattle, yak, sheep, goats and pigs) 3 months and above should be vaccinated against FMD (see calf hood vaccination).
3.2.2.6. Time of vaccination

Mass vaccination campaigns should be carried out in the month of September-October followed by second vaccination in March-April in the high risk zones. In the medium and low risk zones vaccination should be done during September-October.

3.2.2.7. Frequency of vaccination

In the high risk zone, vaccination should be carried out every six months (bi-annual) to ensure maximum coverage and protection. In the low and medium risk zones, annual vaccination with 80% coverage should be done. However, bi-annual vaccination should be done along the national and Dzongkhag highways; near towns; migrating animals (see other sections).

3.2.2.8. Vaccination of migratory animals

Migrating cattle and yaks should be vaccinated twice a year and at least three to four weeks before the animals migrate in either direction. This applies for all zones. All owners are required to obtain migration permits before their animals are moved. Checkpoints should be established in an appropriate location along the migration route and manned by BAFRA and livestock personnel. Migratory herds shall be allowed to proceed on further journey only 21 days after vaccination except under certain justifiable reasons (sudden unknown disease outbreak). This is to ensure movement of immunized herds only.

3.2.2.9. Calf-hood vaccination

The primary vaccination in the calves should be given at 3 months of age and a booster should be compulsorily given one month after the primary injection. Thereafter, vaccination should be repeated every six months in high risk zone except in medium and low risk zone where it is repeated annually. Calf-hood vaccination is to be given very high priority and practiced stringently and carried out in all zones.

3.2.2.10. Corridor vaccination

The ‘corridor’ is an area of approximately 1 km or the selected list of villages on either side of the migratory routes, major highways, Dzongkhag roads and periphery of the towns. All FMD susceptible animals that falls in the corridor should be vaccinated two times (bi-annual) a year to create immune buffer.
3.2.2.11. Mass vaccination campaign

To achieve at least 80% vaccination coverage within short time period, a mass vaccination campaign should be undertaken by the Dzongkhags especially in high risk zone. The concerned Dzongkhag may seek support from RLDCs/NCAH during such campaign.

3.2.2.12. Barrier/ring vaccination

In the face of an outbreak, ring vaccination around the foci of infection (protection zone) should be carried out to prevent further spread of the disease. All susceptible animals within an imaginary ring measuring about 10 km radius around the foci of outbreak or identified villages based on the geographical terrain should be included for ring vaccination to create an immune belt around the foci of infection. The vaccination team should move from the periphery of the ring inwards till they reach animals in close contact with infected animals (refer annexure 3.2 SOP Ring vaccination).

Table 3: FMD Vaccination program in different risk zone, target species, frequency and time of vaccination

<table>
<thead>
<tr>
<th>Risk zone</th>
<th>Target species</th>
<th>Age</th>
<th>Frequency</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>High risk</td>
<td>cattle, yak,</td>
<td>3 months &amp; above</td>
<td>Bi-annual</td>
<td>1. September-October</td>
</tr>
<tr>
<td></td>
<td>buffalo, pigs,</td>
<td></td>
<td></td>
<td>2. March-April</td>
</tr>
<tr>
<td></td>
<td>sheep and goat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium risk</td>
<td>cattle, yak,</td>
<td>3 months &amp; above</td>
<td>Annual</td>
<td>September-October</td>
</tr>
<tr>
<td></td>
<td>and buffalo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low risk</td>
<td>cattle and yaks</td>
<td>3 months &amp; above</td>
<td>Annual</td>
<td>September-October</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Some of the villages under medium and low risk zones (e.g. near towns, along the highways, Dzongkhag roads, villages practicing migration, villages near government farm, and all government farms) should be considered as high risk zone and animals be vaccinated bi-annually covering minimum of 80% during each schedule/campaign in either high, medium and low risk zone.
### Table 4: Type of FMD vaccination program in animals

<table>
<thead>
<tr>
<th>Vaccination program</th>
<th>Target species</th>
<th>Age</th>
<th>Frequency</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calf-hood vaccination</td>
<td>Calves</td>
<td>3 months and above</td>
<td>First vaccination at 3 months and then booster vaccination after one month</td>
<td>-do-</td>
</tr>
<tr>
<td>Barrier or ring vaccination</td>
<td>All species (cattle, yaks, pigs, sheep, goats)</td>
<td>All ages except animals below 3 months of age</td>
<td>One time at the time of outbreak</td>
<td>At the time of outbreak</td>
</tr>
<tr>
<td>Corridor vaccination</td>
<td>All species (cattle, yaks, pigs, sheep, goats)</td>
<td>All ages except animals below 3 months of age</td>
<td>Bi-annual</td>
<td>Sep-Oct March-April</td>
</tr>
<tr>
<td>Migratory animals vaccination</td>
<td>All species (cattle, yaks, sheep, goats)</td>
<td>All ages except animals below 3 months of age</td>
<td>Bi-annual</td>
<td>Before winter migration at the originating Gewog and before returning</td>
</tr>
</tbody>
</table>

*Note: Refer the specific vaccination section for the details*

#### 3.2.2.13. Reporting the progress of vaccination coverage

The details of animals vaccinated in the field should be reported using the Monthly Animal Health Report Form to DVH and RLDCs. The DVH/RLDCs should enter the data in the existing Veterinary Information System or other need based database developed by NCAH and submit to NCAH on quarterly basis. The concerned Dzongkhag carrying out the mass vaccination campaign should also report the vaccination details to the respective RLDCs using the Monthly Animal Health Report Form.

#### 3.2.3. Regulation on import of livestock and livestock products

FMD is a transboundary disease that can be introduced by movements of susceptible animals, meat and dairy products and biological products. Regulation of movement of live animals and animal products requires coordinated approach between BAFRA and DoL under the Ministry of Agriculture and Forests (Refer Animal Health Import Standards).
Import of live animal

For the importation of domestic ruminants and pigs, an official veterinary certificate must be attested certifying that the animals:

- Showed no clinical sign of FMD on the day of shipment;
- FMD has not occurred within a ten-kilometre radius of the establishment of origin for the past 3 months;
- Were vaccinated using FMDV vaccine (oil adjuvant trivalent vaccine containing serotypes O, A and Asia1) minimum 21 days or not more than 6 months prior to the shipment day;
- Were permanently identified and the identification number stated in the certificate.

Procedures to be followed on arrival at the quarantine station:

- The animals should also be tested for non-structural protein (NSP) antibodies after 2 days upon arrival at the quarantine station. If the herd NSP test result comes out positive, all animals will have to be closely examined for any clinical signs and lesions of FMD daily until the end of quarantine period. The animals can be released if no clinical signs or lesions of FMD are shown irrespective of NSP test result;
- In the event of an outbreak of FMD with clinical signs during quarantine, animals should be subjected to further quarantine for another 21 days from the date of first case on the basis of maximum 14 days of incubation period and the highly infectious nature of the disease. However, on the 21st day of quarantine, all the animals need to undergo a thorough physical/clinical examination for any fresh cases/healing status before the animals are released. Final laboratory confirmation with sero-typing (sandwich ELISA and/or PCR) needs to be done to support the clinical diagnosis;
- All animals upon completion of quarantine period shall be vaccinated against FMD with trivalent vaccine (serotypes O, A and Asia 1) minimum of 7 days prior to release except in case of confirmed clinical cases during quarantine.

After release into the respective farms or villages:

- Animals should be kept under observation for a period of one month
- Follow regular disease surveillance procedure
- The field observation should be done by concerned Livestock extension staff
Import of livestock product

Importation of livestock products originating from ruminants and pigs:

- Should originate from source that did not report FMD prior to purchase and slaughter
- Importer should produce valid import certificate to regulatory authority on demand
- Importer should produce ante-mortem inspection certificate to regulatory authority on demand to ensure:
  
  a. Animals were free of clinical signs associated with FMD
  b. Animals were healthy and fit for slaughter

- Importer should produce post-mortem inspection certificate to regulatory authority on demand to ensure:
  
  a. Animals were slaughtered in a facility with standard hygiene performance
  b. Slaughtered animals did not have any lesions concurrent to FMD

3.3. Control strategies

3.3.1. Outbreak investigation and reporting

Since FMD is a notifiable disease, the livestock owners/ farmers should immediately report even a mere suspicion of this disease to the Gewog Livestock Health official(s) or to the Gewog administration. The Gewog Livestock Office should immediately investigate all suspected clinical cases of FMD and should be declared as “suspected FMD outbreak” if the affected animal shows salivation with foot and oral lesions and when there are more than one cases in the herd (see case definition below). Following this, the concerned Gewog livestock staff should immediately report to the Dzongkhag Veterinary Hospital, Regional Livestock Development Centre and National Centre for Animal Health using Flash Report Form (also through phone call) through fastest communication means. The DVH/RLDC should send Disease Outbreak investigation team to investigate the suspected case immediately (refer SOP for disease outbreak investigation) and inform BAFRA. This team should undertake comprehensive epidemiologic assessment in the field to confirm the case as well as collect appropriate samples. The clinical diagnosis should be further confirmed at NCAH including sero-typing of virus. Samples should be also referred
to OIE designated reference laboratories for characterization of the FMD virus. The disease outbreak investigation team should also update the detail of the outbreak through online TADinfo database followed by weekly update of the disease outbreak situation.

**Case definition for FMD**

**Suspect case:**

If the affected animal(s) show either foot or mouth lesions and/or both foot and mouth lesions and when there are more than one cases in the herd/village depicting similar clinical signs.

**Confirmed case:**

An animal that has clinical signs consistent with FMD with several animals in the same herd/village affected with varying stage of disease which is being reconfirmed through detail epidemiological investigation by the veterinarians with positive laboratory results at NCAH.

**3.3.2. Declaration of Provisional Infected Zone**

When FMD is suspected, Gewog Livestock Staff should immediately quarantine the suspect infected place (farm or a village) and the surrounding area (based on risk assessment) as a Provisional Infected Zone. The geographical limits of the Provisional Infected Zone should be determined after due consideration of the epidemiologic risk and natural geographical settings. The Provisional Infected Zone should be declared by the Gewog Livestock Office.

The following control measures should be implemented in the Provisional Infected Zone to prevent spread of the suspected disease.

- Immediate segregation of affected animals including separate management (feeding, watering, milking etc.)
- Symptomatic treatment of the affected animals as per SOP.
- Disinfection/ Decontamination of the contaminated premises as per SOP.
- Provisional ban on the movement of cloven-footed animals and their products from the infected premises.
- Awareness and education of the livestock owners in the affected village on zoo sanitary measures.
3.3.3. Declaration of the Infected Zone and FMD outbreak

If the case definition of FMD is met, the area where the disease has occurred within a radius as decided by disease outbreak investigation team should be immediately declared as Infected Zone. The geographical limits of the infected zone should be determined after due consideration of the epidemiologic risk and natural geographical settings. The disease outbreak investigation team should also declare vaccination zone within certain radius of infected zone where immediate ring vaccination in the surrounding villages should be carried out to prevent further spread of outbreak. Based on the recommendation of the disease outbreak investigation team, the Dzongkhag Administration should issue the disease outbreak declaration order with information to the Gewog Administration, DOL, BAFRA, NCAH, RLDC and DVH.

All the provisional control measures should be continued with reinforcement of the efforts in the required areas once the disease outbreak is officially declared. If the disease suspected is not FMD, all the provisional control measures that are being implemented should be immediately discontinued and the alternate measures specific to that disease should be undertaken.

*Figure 6: Declaration of infected and vaccination zone. The arrows indicate the direction in which the vaccination team should move*
3.3.4. Activation of the Rapid Response Team

Once the FMD outbreak is confirmed by the disease outbreak investigation team, Rapid Response Team (RRT) should be activated immediately to rapidly contain the disease without allowing it to spread to other places. RRT should mainly constitute four main groups to effectively implement disease control measures(Figure 8). The DOL should be responsible for disease outbreak investigation, treatment of sick animals, ring vaccination, surveillance and logistic supply. BAFRA should be responsible for quarantine and movement control of susceptible livestock and livestock products from the infected zone. The roles of various teams under the RRT are described in Annexure.

Figure 7: Time line for FMD outbreak containment activities

Figure 8: Composition of Rapid Response Teams (RRT) for FMD control
Following activities should be implemented by the RRT to effectively control the FMD outbreak.

a) Isolation and treatment of affected animals

All the affected animals should be isolated and provided symptomatic treatment to prevent mortality and to enable faster recovery (refer SOP). The separate team (preferably the livestock staffs who had already contact with the sick animals) should be fully involved in treatment of the sick animals as well as for implementing the zoo sanitary measures in the affected areas.

b) Zoo-sanitary measures

The carcass of animal died due to FMD should be properly disposed to avoid spread of virus through contamination (Refer SOP for carcass burial). All the staff exiting the infected areas should strictly disinfect themselves while leaving the affected areas following the procedures described in SOP for zoo-sanitary and personal hygiene.

c) Ring vaccination

The main objective behind ring vaccination is to prevent the spread of the disease to non-affected areas. By doing this, the risk of disease spread is minimized and thereby infection is extinguished within the outbreak area. Ring vaccination should be done by separate team (Vaccination Team) who has not been in contact with the infected animals. Ring vaccination in the nearby villages should be carried out considering the geographical barriers, common grazing areas, water source and proximity to the affected area. The vaccination should start from the periphery to the inside (focus of infection) until the infected area is reached and should be completed as soon as possible (within one week) – refer SOP.

d) Ban on the movement of livestock and livestock products

Ban on the movement of all cloven-footed animals including their products (such as milk, meat, butter, cheese, hides etc) both into and out of the affected areas should be strictly implemented to prevent spread of the infection to other places. BAFRA should mobilize their staff to attend the check posts and entry points and to strictly control the movement of livestock and livestock products in and out of the outbreak area.
e) **Surveillance and weekly follow-up**

The Rapid Response Team should also carry out the clinical surveillance in the infected zone and vaccination zone on the occurrence of any new cases as well as to monitor any mortality of the FMD infected animals. An update on the disease outbreak situation should be done as follow-up report on weekly basis through TADinfo online system.

f) **Logistic support**

In order to implement the successful containment of FMD outbreak by RRT adequate logistic support should be mobilized. There is need to mobilize additional man power, vaccines, mobility and fund to carry out the activities by RRT.
Surveillance is a collection, collation and analysis of data that enables the prompt dissemination of the information to take timely appropriate action. Every country in the world has some kind of animal disease surveillance system. Surveillance is needed to understand the health status of the animals in the country, so that problems can be identified and actions taken. However, different countries have different surveillance needs and surveillance capabilities. For an appropriate surveillance activity to be performed, we should have a clear objective and understanding of the need. There are large numbers of reasons why veterinary authorities undertake surveillance activities and can be summarized into four general purposes:

- Demonstrating freedom from disease
- Early detection of disease
- Measuring the level of disease
- Finding cases of disease

Surveillance is a key element of the NFMDCP and will become even more important as Bhutan works to move along the Progressive Control Pathway for FMD.
4.1. **Clinical surveillance**

4.1.1. **Syndromic surveillance**

This surveillance will be conducted through monthly reporting system on the absence or presence of FMD in the country. Each livestock centres including central farms should collect information on FMD status in animals from their respective areas (village/Chiwogs and farms). The reporting should be done from Gewog to Dzongkhag office. The Dzongkhag Livestock Sector (DVH) should then submit the report to NCAH and RLDCsof FMD syndromic surveillance and reporting forms in form 2. The NCAH shall maintain national data, perform analysis and provide feedbacks to all the stake holders in the country. The analysed report shall support validating FAO/OIE PCP for FMD in Bhutan and determine Bhutan's FMD-PCP stage.

4.1.2. **Surveillance during outbreak**

Once the FMD outbreak is confirmed by the disease outbreak investigation team, continuous surveillance should be carried out in the infected and vaccination zone by RRT. The update on the disease status shall be submitted on weekly basis to RLDC and NCAH using Form 6B (appendix) and/or online TADinfo database. When the outbreak is effectively contained, effected ban period shall be lifted 21 days post reporting of the last case.

4.2. **Laboratory surveillance**

4.2.1. **Serosurveillance (structured population based survey)**

A structure based survey shall be conducted regularly to determine seroprevalence of FMD virus in animals using NSP antibody ELISA (NCAH SOP SERIES: SERO-014). The study findings shall demonstrate the success of NFMDCP. Simultaneously, NSP antibody rapid test kit shall be employed to detect antibody developed due to infection.

Additionally, similar survey shall be conducted to determine immune profile developed due to vaccination. An LPB antibody ELISA (NCAH SOP SERIES:
SERO-016) shall be employed to test samples collected from vaccinated animals in addition to NSP antibody ELISA. All the reactive samples in NSP ELISA shall be excluded and immune profile developed only due to vaccination is deduced. These findings shall determine the success rate of vaccination programme.

4.2.2. Virological surveillance

During outbreak period samples such as epithelium, vesicle/vesicle fluid, milk and serum should be collected and tested using RT-PCR test (NCAH SOP SERIES: SERO-020) to detect the presence of virus. Samples should be collected from affected animals around the time of infection or while exhibiting clinical signs. Once the virus is detected in the tested sample antigen ELISA (NCAH SOP SERIES: SERO-015) should be performed to determine the serotype of virus involved.

Another sampling procedure shall be employed to understand the carrier status of the animals by collecting oropharangeal fluid using probang cup after 28 days of infection. Samples should be subjected to RT-PCR (NCAH SOP SERIES: SERO-020) to detect virus and to understand the role of carrier animals in FMD outbreak.
5.1. **Awareness education**

Public awareness campaigns are needed to ensure that the farming communities and the livestock industry are made aware of NFMDCP and its potential benefit and the activities of the programmes being implemented in the field. Following are the awareness programmes to be implemented during prevention phase:

- Awareness on FMD and its economic impact on affected animals and/or farms
- Awareness on vaccination and vaccination coverage
- Awareness through trainings of stakeholders (farmers, traders, meat vendors, livestock officials) on disease and control measures
- Awareness on timely reporting of disease outbreak
- Following are the awareness programmes to be implemented during outbreak phase:
  - Awareness on regulation of movement of livestock and livestock products
  - Awareness on timely reporting of disease outbreak
  - Awareness on ring vaccination
  - Awareness on safe disposal of animals that died of FMD
5.2. **Border harmonization**

Coordination meetings with the state veterinary departments of the adjoining Indian states (Assam, West Bengal, and Arunachal Pradesh) are needed to help with common understanding and the development of collaborative efforts for disease control in both countries.

The Ministry of Agriculture and Forests should interact with the Ministry of Agriculture, Government of India for bringing about understanding between the two countries (political sanction) and to revitalize the border harmonization meetings with the Indian counterparts. The Department of Livestock shall coordinate BHM with support from relevant agencies.

5.3. **Research and development**

Research will be necessary to provide the information to guide the strategy to reach Stage 3 on the FAO/OIE PCP. Further, research is needed to identify and characterize new strains, test vaccine efficacy, target high risk areas, demonstrate free zones and to continue evaluation and refine vaccination strategies. Economic loss due to disease and its control methods should be assessed. The role of wildlife in the epidemiology of FMD in Bhutan needs to be clarified.

Data from clinical surveillance and from areas that had not reported FMD for a considerable period of time should be analysed to categorise provisionally free of FMD. This will aid in validating FAO/OIE PCP qualifying to Stage 3. In contrast, surveillance will focus more on areas that continue to report FMD.

5.4. **FMD coordination workshops**

It is necessary to conduct annual National FMD coordination workshops where all the stakeholders come together to review and revise the program.
NFMDCP will require development of annual business/operational plan which includes clear specification of the physical requirements and the estimated costs of the work for every subsequent year. The required budget should be proposed to Ministry of Finance each year by AHD, NCAH, RLDCs and Dzongkhags based on the roles and activities required to be executed by respective agencies. It will also need clear specification of the output, key performance indicator, responsibility and timeline.
At the national level NCAH should monitor and evaluate the progress of the FMD prevention and control programme using the data submitted by Dzongkhags. RLDCs should monitor and evaluate the progress in their respective regions at the regional level. Field visits by authorities from the NCAH and AHD should be made to physically validate the progress. The plan may be amended periodically based on the M & E findings.
## Annexure 1: Zoning, target species of animals to be vaccinated, frequency and time of vaccination against FMD

### Risk zone & name of Dzongkhags and Gewogs

#### High Risk zone

<table>
<thead>
<tr>
<th>Dzongkhag</th>
<th>Gewog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trashiyangtse</td>
<td>Khamdang, Teotsho, Yalang</td>
</tr>
<tr>
<td>Trashigang</td>
<td>Sakteng, Merak</td>
</tr>
<tr>
<td>SamdrupJongkhar</td>
<td>Langchenphu, Samrang, Pemathang, Phuntshothing, Dewathang, Orong</td>
</tr>
<tr>
<td>Pemagatshel</td>
<td>Norbugang, Chokhorling</td>
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<td>Zhempang</td>
<td>Ngangla</td>
</tr>
<tr>
<td>Sarpang</td>
<td>Taraythang, Umling, Serzhong, Chhuzagang, Gelephu, Bhur, Dekiling, Shompangkha, Hilley, Singye; Jigmechoeling</td>
</tr>
<tr>
<td>Dagana</td>
<td>Nichula, Deorali, Lhamoizingkha</td>
</tr>
<tr>
<td>Chukha</td>
<td>Bongo, Darla, Sampheling, Phuntsholing, Logchina</td>
</tr>
<tr>
<td>Samtse</td>
<td>Tading, Pugli, Samtse, Chengmari, Ugentse, Yoeseltse, Charghaerey, NamgayChoeling, Sipsu, Biru, Tendo, Bara</td>
</tr>
</tbody>
</table>

#### Medium Risk zone

<table>
<thead>
<tr>
<th>Dzongkhag</th>
<th>Gewog</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>Chukha</td>
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<td>Samdrupjongkhar</td>
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<tr>
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<td>Thrimshing, Kangpara, Bidung, Radhi, Kanglung, Khaling, Yangnyer, Shongphu, Samkhar, Lumang, Bartsham, Udhorong</td>
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Trashiyangtse: Tongzhang, Jamkhar, Ramjar, Yangtse
Lhuntse: Khoma, Menji, Menbi, Jarey, Tsenkhar, Gangzur
Mongar: Drametse, Narang, Chaskhar, Ngatshang, Saleng, Mongar, Chhali, Tsamang, Tsakaling, Sherimung, Drepung,
Trongsa: Langthel, Drakten, Tengsibji, Nubi
Wangdue: Gasetshowom, Gasetshogom, Phangyul, Bjena, Nyisho, Dangchu, Sephu, Nahi, Phobji, Gangten, Kazhi, Rubesa, Theltsho
Punakha: all 11 Gewogs
Thimphu: Genye, Chang, Kawang, Mewang
Haa: Eusu, Katsho, Bji
Tsirang: Beteni, Mendrelgang, Kikhorthang, Gosarling, Rangthangling, Tsholingkhar, Patala
Bumthang: all 4 Gewogs

**Low Risk zone**

Gasa: all 4 Gewogs)
Dagana: Lajab, Khipisa, Gesarling, Dorona
Lhuntse: Kurtoe, Khoma, Metsho
Mongar: Gongdue, Jurmej, Kengkhar, Thangrong, Silambi, Balam
Trongsa: Korphu
Wangdue: Athang, Daga
Thimphu: Naro, Soe, Lingshi, Dagala
Tsirang: Phuentenchu, Tsirangtoe, Barshong, Shemjong, Dunglegang
Pemagatshel: Dungmin, Yurung, Chimgom, Chongshing
Samtse: Dumtoe, Denchukha
Haa: Sama, Gakiling, Sombaykha,

**Note:** Some of the villages under medium and low risk zones (e.g. near towns, along the highways, Dzongkhag roads, villages practicing migration), villages near government farm, and all government farms should be considered as high risk zone and animals be vaccinated bi-annually covering minimum of 80% during each schedule/campaign in either high, medium and low risk zone.
Background/ Rationale

Foot and Mouth disease is highly contagious viral disease which spreads rapidly if not controlled promptly. Such infectious disease needs to be controlled rapidly at source without allowing for further spread. Therefore, the formation of Rapid Response Team (RRT) to respond against outbreak of FMD should be formed with the following objective.

- To conduct thorough investigation of disease outbreaks for the assessment of the disease/agent as well as to identify the source(s) of the infection.
- Rapidly contain the disease without allowing it to spread to other places, which includes certain actions even before the disease/agent is confirmed
- Risk communication on the disease and its control measures to educate the general public and field staff.
- To coordinate with the different stakeholders in responding to the disease outbreak within a shortest possible time to reduce the cost of response
Team Members for RRT

- Head of Animal Health section, RLDC-Team Leader
- Laboratory Technician of RLDC
- Livestock Health Supervisor, RLDC.
- Dzongkhag Livestock Officer, DLS
- Veterinary Officer, DVH.
- Concerned Regulatory Official from BAFRA
- Concerned In-charge of LEC/RNR-EC of the affected Gewog.
- Mangmi/Tshokpa of the affected Gewog/ Chiwog
- Epidemiologist/ Expert from NCAH Serbithang.
- Laboratory Officer/ Sr. Lab. Technician, NCAH, Serbithang
- Livestock staff from nearby Gewogs or DVH as and when required.

Note: the team composition shall vary depending on the magnitude of the outbreak which will be decided by RLDC.

Roles of RRT

- As soon as suspected cases are reported, conduct a thorough investigation of the reported outbreak.
- Recommend Dzongkhag Administration to issue outbreak declaration order.
- Declare infected and vaccination zones.
- Implement ban on the movement of livestock and their products.
- Isolation and treatment of affected animals.
- Disinfection of infected premises using appropriate disinfectants.
- Collect samples from sick animals and refer samples to NCAH.
- Carry out ring vaccination in the designated areas (vaccination zone).
- Conduct surveillance in infected and vaccination zones.
- Constantly monitor the outbreak situation in the affected area.
- Daily recording of the disease outbreak status and vaccination coverage
- Mobilize the different teams for actions as per their roles.
- Submit the weekly follow up report on the disease status toDzongkhag/ RLDC/
  NCAH/DOL/ BAFRA.
- Create awareness to different stakeholders.
- Mobilization of manpower and resources.
- Seek the support of the Department /NCAH on any additional fund/logistics
Roles of different teams under RRT

The RRTs should be divided into different groups as per the mandate of the respective technical sectors involved for the disease control measures. The livestock sector will be mainly responsible for surveillance, vaccination, treatment, outbreak investigation and logistic support while BAFRA will be responsible for the quarantine and movement control of susceptible livestock and products. In case there is the requirement of RBP to maintain law and order, their support will be sought by the team leader of RRT as and when required.

Disease Outbreak Investigation Team (DOIT)

The DOIT shall be responsible for conducting disease outbreak investigation which includes identifying the source of infection, risk assessment and confirming the outbreak. They should be responsible for the identification and establishment of infected premises and declaration of Infected Zone and vaccination zones and make key recommendations to RRT to improve the control activities based on the disease situation in the area (Refer SOP for DOIT). The team is also responsible for the weekly reporting of the disease status to NCAH/Department.

The DOIT will constitute following members:

- Epidemiologist/ Veterinary Officer
- Laboratory Technician
- BAFRA official

Vaccination Team

The vaccination team (“clean team”) is responsible for conducting ring vaccination of the susceptible livestock population against FMD in the vaccination zone as per the directives from the team leader of RRT and as per the details mentioned in SOP (refer ring vaccination SOP). Simultaneously, this team will also carry out the surveillance activities.
The vaccination team shall be composed of following members:

- Veterinary Officer (Team Leader)
- Para veterinarians (number will be decided by RRT Team leader)
- Laboratory Technician
- Mangmi/ Tshogpa

**Treatment Team**

The members of the treatment team are the “dirty team” who are responsible for the treatment of FMD affected animals in the infected zone. They will undertake the task as per the SOP (refer Treatment SOP). Their movement should be restricted within the infected zone and should not mix with other team. Any member or vehicle leaving the infected zone should strictly disinfect themselves following the procedures described in SOP.

**The treatment team shall consist of following members**

- Para veterinarian
- Laboratory Technician (for sample collection)

**Quarantine and Movement Control Team**

The Quarantine and Movement Control Team shall be responsible for enforcement of quarantine and movement control in and out of the infected zone to control and prevent the spread of disease. Detailed procedure on enforcement of quarantine and movement control measures shall be done as per the Livestock Rules and Regulations of Bhutan 2008 by BAFRA.

The Quarantine and movement control team will be composed of following members:

- Livestock Regulatory and Quarantine Officer, BAFRA
- Police personals (optional)
Logistic Team

The main roles and responsibility of the Logistic team is to ensure that all necessary logistic facilities like PPE, materials and equipment, food/refreshment and transport are made available to RRT and to reinforce all essential supplies.

The logistic team shall be composed of following members:

- Team Leader of RRT
- Dzongkhag Livestock Officer
- Livestock Supervisor
- Mangmi/Tshogpa

Modalities/ Modus Operandi

- Following the report of disease outbreak in the field, RLDC should decide on the activation of the RRT based on the disease situation.
- RRT should be activated in the field within 24 hours based on the advice of the Disease outbreak investigation team.
- RRT should seek the support of NCAH and Department of Livestock as and when required.
- Once the ring vaccination is completed the RRT Team Leader should decrease the number of members involved in FMD control activities as the main activities of the remaining team will be on the surveillance in the vaccination zone and other nearby areas. The final deactivation of RRT will be after two weeks of the last case of FMD.
Logistics

Manpower:

- Mobilize additional staffs from nearby centres, RLDCs, NCAH, Department and other Dzongkhags.

Vehicle

- Mobilized from Dzongkhags, RLDCs, NCAH, projects and other central programs if required

Diagnostics

- RLDC/ NCAH should facilitate rapid diagnostic kits and other sampling equipment.

Communication equipment

- Recharge vouchers should be provided to the members

Vaccines

- NCAH shall arrange the required quantity of vaccines during the emergency in consultation with RRTs

Fund

- The fund required for the purchase of vaccines and consumables should be made available by NCAH.
- The fund for payment of DSA to team members should be met from the respective unit/Dzongkhag/RLDC/ NCAH.
- Expenses for the working lunch/refreshment during the diseases containment program should be arranged by RLDC and Dzongkhag. If there are no fund provision or insufficient fund, NCAH and Department should provide required fund support to RRT.
3.1. **Standard Operating Procedure for Disease outbreak investigation**

A disease outbreak has been defined as the occurrence of one or more cases of FMD in a herd or village clustered in time and space. An outbreak can be considered as separate outbreak if the case(s) occur in a herd or village separated from other herds or villages by physical barriers and or occurs after one month apart in the same village.

An outbreak investigation is a systematic procedure to help identify causes and sources of epidemic with a view to control an existing epidemic and prevention of possible future ones.

**Purpose**

- To identify the causes and sources of disease outbreak
- To identify measures to prevent further spread of disease
- To control and contain the existing disease outbreak

**Scope**

- This SOP outline the general principles and steps for investigation of Foot and mouth disease (FMD) in the field

**Users or targets**

- Veterinary Officers and para-veterinarians
- Rapid Response Team

**Team composition**

- Veterinary Epidemiologist/ or Veterinary Officer (Team Leader)
- Laboratory technician
- Field para-veterinarians
- BAFRA official
### Materials and equipment

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>Gumboots</td>
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</tr>
<tr>
<td>Apron</td>
<td>5 nos</td>
</tr>
<tr>
<td>Shoe covers</td>
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<td>Forceps</td>
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<tr>
<td>50% PBS glycerine saline</td>
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<tr>
<td>Vaccutainer with anticoagulant</td>
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</tr>
<tr>
<td>Vaccutainer without anticoagulant</td>
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</tr>
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<td>3 nos</td>
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<tr>
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<td>40</td>
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</tr>
<tr>
<td>Cool box</td>
<td>2 nos</td>
</tr>
<tr>
<td>Bio-hazard bags</td>
<td>5 nos</td>
</tr>
<tr>
<td>Disinfectant (Virkon-S/bleaching powder)</td>
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<tr>
<td>Antiseptic hand wash</td>
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<td>Ice pack</td>
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<td>GPS</td>
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<tr>
<td>Disease outbreak investigation form</td>
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</tr>
<tr>
<td>Laboratory sample submission form</td>
<td>5 nos</td>
</tr>
<tr>
<td>Written Instructions/SOP Print-outs</td>
<td>3 nos</td>
</tr>
<tr>
<td>Notebook and pens</td>
<td>2 nos</td>
</tr>
</tbody>
</table>
Steps for Investigation

Pre-investigation preparation

- Formation of investigation team and planning the response among team members
- Discuss each person’s roles and responsibilities
- Arrangement of materials and logistics (refer materials and equipment requirement)
- Epidemiological materials: Investigation form, note book, laptop, GPS
- Laboratory: swabs, needles, cool box, viral transport medium
- Educational: SOPs, guidelines
- Decontamination
- Mobility - vehicle
- Extension gears

Gather preliminary information: Following information needs to be collected by the team prior to their departure

- Farmers name and phone number (if available),
- Name of village, Gewog, Dzongkhag
- Type of enterprise and number of animals, (commercial, semi commercial, backyard cattle, sheep, goat, pig (specify),
- Date and time of report of outbreak from farmer to LEC/ DVH.
- Date and time of report from LEC/ DVH to RLDC/NCAH.
- Date and time of visit by veterinarian or field staff,
- Name of contact field staff, address and phone number.
- Provide information about the team visit to outbreak area.
- Date and time of visit
Field investigation

Background information to collect

- Farm and village background information,
- Different animal categories and numbers (herd size,)
- Farm type and husbandry practices
- Whether any inter-mixing of animals such as cattle, sheep, goat and pigs
- General information regarding introduction of any new animals
- General information regarding buying and selling of any livestock and livestock product
- General information about the affected village/ farm (no. of households; household rearing cattle, sheep, goat and pigs and farming system.
- General information about any recent local festival or gathering in the village/locality.
- Collect XY coordinates (using GPS), altitude, road network, Government offices, frequency of movement of people in an out of the outbreak area

Baseline morbidity, mortality and clinical signs

- Determine baseline mortality for period (week or month) before the outbreak and in previous year, both generally, and more specifically for the same seasonal time period as the present outbreak in the previous year;
- General information of the present disease outbreak such as number of households affected, population at risk, livestock population in the surrounding villages etc...
- Record of the daily morbidity and mortality figures in the farm/village
- Record of the detail clinical signs.

Bio-security arrangements

- Describe bio-security arrangement of the farm e.g. disinfectant foot wash, perimeter wall/fence (applicable to only Government and commercial farms);
- Mixing of different groups’ e.g. Contact between cattle, sheep, goat and pigs.
- Feeding and management
- Describe the grazing system (cattle, sheep, goat) followed including whether the animals are grazed in their own private pasture or in shared community pastures and tsamdos.
• Describe feed sources/s including whether the animals are fed with swills.
• Describe the housing type and the bedding materials used in the shed.
• Describe water source/s and including whether the affected animals are deliberately made to dip their footing the river or stream.

Wild animals

• Determine the presence of any cloven footed wild animals in the area
• Determine whether there are any suspected FMD cases in the cloven footed wild animals in the vicinity.

Vaccination history

• Record vaccination programs and verify whether the animals in the affected herd/ villages are vaccinated against FMD and other diseases.

Laboratory investigation

Laboratory investigation in the field (refer specific SOP for sampling, packaging and transportation to the laboratory and rapid field test)

• Put on proper PPE (apron, gloves, gumboots and shoe cover)
• Carry out physical examination of the sick animals and check whether the animal has foot and oral lesions.
• Collect vesicles fluid/ tissues from the oral lesions in 50% Glycerine saline and blood samples and transport to the laboratory (refer SOP).
• Carry out rapid diagnostic test for FMD on blood in the field (refer SOP).
• Laboratory diagnosis(refer specific SOPs for laboratory diagnosis). Following laboratory tests will be done at NCAH for further confirmation.
• Rapid tests
• Sandwich ELISA for FMD virus detection (serotyping).
• Polymerase Chain Reaction tests for detection of FMD virus.
• Liquid phase blocking ELISA for detection of antibodies
• NSP ELISA for DIVA.

Characterize the outbreak.

• Establish or verify the outbreak
• Provisional diagnosis made on clinical signs, epidemiological pattern, and gross pathology.
• Provisional disease control measures should be in place before the confirmatory diagnosis is made.

Establish the case definition for FMD.

**Suspect case:** If the affected animal(s) show both foot and mouth lesions and when there are more than one cases in the herd/village depicting similar clinical signs.

**Confirmed case:** An animal that has clinical signs consistent with FMD with several animals in the same herd/village affected with varying stage of disease which is being reconfirmed through detail epidemiological investigation by the Veterinarians with or without positive laboratory results at NCAH.

Differential diagnosis has to be made against Bluetongue, Foot Rot, Malignant Catarrhal Fever (MCF), Vesicular Stomatitis, Swine vesicular disease, physical injuries (feet and tongue), Contagious Ecthyma, Peste des Petits Ruminants (PPR), Rabies, mineral poisoning.

Describe outbreak in terms of time, animal and place.

**Time** (draw epidemic curve by plotting cases against the time from available data—preferably time series)

• When was the index case?
• What is the exact period of outbreak?
• Given the diagnosis what is probable period of exposure?
• Is the outbreak most likely to be point source or propagated or both?
Animal (attack rates, risks etc.)

- Any differences in the attack rates among different herds, species etc.
- Which groups (cattle, pig, sheep, goat) have the highest and which have the lowest attack rate?
- Any difference in the attack rate among different age group of the susceptible animals?

Place (plot the location of outbreak on a map with physical characteristics such as road, water bodies, mountains, infrastructures etc.)

- What are the geographical distributions of the cases?
- What is the pattern of the cases among different livestock species in different management system?
- Whether case farm is close to the international borders, national highways, migratory routes or other spatial risk factors?

Develop hypothesis based on the pattern of disease (animal, time and place).

- Source of disease outbreak - forward and backward contact tracing
- Mode of transmission.
- Whether the outbreak is a common source or propagating
- If a common source, whether it is point or multiple exposure
- What are the risk factors associated with problem?

Control and Prevention (Refer specific SOPS for RRT; ring vaccination and treatment of FMD affected animals etc.)

- Provisional control measures should be in place before the outbreak is officially declared.

Declaration of Provisional Infected Zone

When FMD is suspected, Gewog Livestock Staff should inform DVH, DLO, RLDC, NCAH, DOL and BAFRA and immediately quarantine the suspect infected place (farm or a village) and the surrounding area based on risk assessment as a Provisional infected zone. The geographical limits of the provisional infected
zone should be determined after due consideration of the epidemiologic risk and natural Geographical settings. The Provisional Infected Zone should be declared by the Gewog Livestock Office and Gewog Administration.

All places with susceptible livestock species with in the Provisional Infected Zone shall be considered at-risk / suspect and should be visited to establish their infection status.

Quarantine and movement control of susceptible livestock species and their products, farm workers; vehicles etc. should be imposed (refer SOP for quarantine and movement control).

Strict surveillance and movement control should be maintained on all other areas within the infected Zone.

**Declaration of Infected zone:**

If the case definition of FMD is met, the area within a radius as decided by risk assessment team/ Disease Outbreak Investigation Team should be immediately declared as protected zone. The Geographical limits of the protected zone should be determined after due consideration of the epidemiologic risk and natural Geographical settings.

Once the outbreak is confirmed by the Disease Outbreak Investigation Team (DOIT) and officially declared by the Dzongkhag Administration, RRTs should be immediately activated. Quarantine and movement control on susceptible livestock species and their products, farm workers; vehicles etc. Should be imposed (refer SOP for quarantine and movement control).

**Declaration of Vaccination Zone**

In order to create buffer zone around the infected zone vaccination zone should be declared by the DOIT. The Geographical limits of the vaccination zone should be determined after due consideration of the epidemiologic risk and natural Geographical settings. RRT should carry out ring vaccination and other containment activities on all the properties/ villages within vaccination zone based on the direction of disease outbreak investigation team (refers specific SOPs). Public awareness and strict surveillances should be undertaken within the vaccination zone.
Reporting

- Document the findings (Background; investigation procedures, epidemiological and laboratory findings; economic impact etc.
- Provide recommendations to all the relevant stakeholders (farmers/ producers; Managers; DoL, BAFRA and other agencies)
- Submit the final report

Surveillance and monitoring (will be done by the treatment and vaccination team).

- Is the frequency of the disease remaining constant; increasing or decreasing?
- Is the control program effective?
- Does the disease have any impact on productivity or profitability
3.2. **Standard Operating Procedure for Ring vaccination**

**Purpose**

The purpose of this SOP is to effectively carry out ring vaccination in the vaccination zone so as to prevent the spread of disease to non-infected area.

**Scope**

This SOP describes the procedures for ring vaccination in vaccination zone thereby preventing spread of disease from the infected zone to other places.

**User**

Veterinary Officers/Para-veterinarians/RRT

**Manpower**

Veterinary Officer - 1  
Paravets (number will be decided by RRT Team Leader)  
Laboratory Technician – 1

**Materials/Equipment**

- FMD vaccine  
- Cool-box  
- Auto-syringe  
- Syringe and needle  
- Vaccination form  
- PPE (hand gloves, gum boots, apron etc.)  
- Disinfectants/ antiseptics

**Procedure**

- Put on the required PPE (Gloves, apron and gumboots)  
- All susceptible livestock falling within the vaccination zone are required to be vaccinated against FMD in order to create an immune belt around the foci of infection.
Note: The arrows indicate the direction in which the vaccination team should move

**Figure 10. Different zone**

- The vaccination should start from the periphery to the inside (focus of infection) until the infected area is reached and vaccination should be completed as soon as possible and preferably within one week time.
- The members of this team should not visit the “infected” area nor mix with the members of Treatment Team. This team should be solely involved in ring vaccination.
- This team will also act as a surveillance team and should examine and assess whether there is any cases of FMD in animals at the time of vaccination
- The details of animals vaccinated should be recorded in vaccination form
- The team should thoroughly disinfect themself as well as vehicle and equipment after completing the day’s work.
3.3. **Standard Operating Procedure for the treatment of FMD affected animals**

**Purpose**

The purpose of this SOP is to effectively treat FMD affected animals for the faster recovery and to prevent death of the animals.

**Scope**

The treatment guidelines describe the different treatment approaches undertake symptomatic treatment of the FMD affected animals.

**Users**

Veterinarians and Para-veterinarians

**Manpower**

Animal Health Supervisor
Veterinarian

**Materials/Equipment**

- Antibiotics
- 10% Formalin
- Potassium Permanganate powder
- Needle and syringes
- Cotton
- Scissors
- Forceps
- Scalpel blade with handle
- Gumboots
- Disposable hand gloves
- Biohazard bags
- Savlon
- Kidney/Instrument trays
- Tr. Iodine
- Himax/Lorexane cream
Procedure

The staff involved in treating affected animals with FMD should take only the supplies required for the treatment and only the disinfected items should be taken back after the treatment.

- Staff entering the affected premises shall put the gumboot/ shoe cover, apron and gloves.
- Select a clean area for the display of the treatment items and accordingly tether the sick animals for treatment.
- Only the items required for the treatment should be opened or taken out of the container.

Washing and dressing of the Wound of the mouth, teat and hooves

- Restrain the animal and open the mouth. Gradually wash the mouth with any of the antiseptics like Alum (2%), Boric acid (2-3%), Copper sulphate (0.5%), Potassium permanganate solution (1:2000), or Sulphanilamide (1%) solution.
- After washing the mouth, smear buccal mucosa with the collutoria composed of Tannic acid and Glycerine @ 30g and 150ml respectively after mixing.

Foot dip

- The hooves of the FMD animals should be washed with the above antiseptics and then foot dipped with any of the disinfectants like 5% formalin or antiseptics like 1:1000 to 1:5000 Potassium Permanganate. The foot dip with formalin has the advantage as it makes the hooves hard and avoid injuries during walk.

Teat ulcers

- The washing of the teat with ulcers can also be done similar way to that of the mouth and applied 2-3% Boric acid ointment.
Treatment to control secondary bacterial infection

The most important reason for treatment of FMD affected animal is to control the secondary bacterial infection using antibiotics.

- The choice of antibiotics to control secondary bacterial infection are
  - Streptopenicillin @2ml/50kg body weight i/m after mixing 2000000 IU procaine penicillin and 2.5g Streptomycin sulphate vial with 7.5ml of distil water.
  - Long acting Oxytetracyline @ 1ml/10kg or 20mg/kg body weight.
  - In case of pyrexia, use Sodium Salicylate @ 60 gram with sodium bi carbonate @ 60 g mixed with honey to make paste and give half the preparation twice daily. The parenteral injection with antipyretics/analgesics is also recommended for immediate relief of pain and fever.
  - Energy supplements such as dextrose (iv) may be given in severely affected animal.
  - The local therapies like the use of jaggary, honey and flours mixed in sweet vehicles may be given as immediate source of energy for off feed animals which may either be drenched or smeared on the tongue, mouth and the dental pad.
  - If the hooves have sloughed, bandage the hoof after dressing with sulphanilamide or Boric acid powder or other wound ointments on daily basis with the application of fly repellents in fly dominated areas.

Once the treatment is completed all the used materials shall be burnt or buried while the reusable instruments and materials should be thoroughly disinfected with savlon or potassium permanganate solution. The disposal gloves and used materials should also be buried. The concerned staff involved in treatment before leaving the premises should follow zoo-sanitary measures like proper washing of hands and gumboot with antiseptic solutions.
3.4. **Standard Operating procedure for disposal of FMD carcasses by burial**

**Purpose:**

The purpose of the SOP is to have standard procedure for safe disposal of FMD infected carcasses and infected materials.

**Scope:**

This SOP describes procedures for site selection and burial of FMD carcasses in a safe manner to avoid spread of the virus through contamination.

**Users:**

Veterinary Officer/Para veterinarians

**Manpower:**

Veterinarians
Para-veterinarians
Village Tshogpa
Animal owners

**Materials/Equipment required:**

- Hand gloves
- Face masks
- Apron (disposable)
- Gum boot
- Disinfectant - Lime/Virkon-S
- Digging tools: spades, crowbars, peak-axe
Procedure:

- Select an appropriate site for carcass burial. The site should be away from the water source, residential areas, livestock facilities and pastures. Preferably it should be away from any footpaths or roads leading to the site.
- Prepare a pit with sufficient width to accommodate the carcass with a minimum depth of 2 meters considering the size of the carcasses.
- Wear apron, face masks, gumboot and hand gloves before handling the carcasses.
- Drop the carcasses into the pit and dispose the hand gloves, face mask, apron into the pit.
- Cover the carcasses with soil, 400 mm is suggested, and add an unbroken layer of lime (calcium carbonate). Do not spray lime directly on to the carcasses as it will slow decomposition process.
- Close the pit with sufficient soil and make a heap over the site.
- Then put a layer of lime over the soil.
- Disposal site should be secured by putting stones, thorns, logs etc...
- All tools, utensils, equipment used for burial should be thoroughly cleaned and disinfected with disinfectant solution using the above disinfectant.
- The animal handlers should thoroughly clean and disinfect themselves before leaving the burial site.
3.5. **Standard Operating Procedure for disinfection and decontamination of contaminated premises and materials**

**Purpose:**

To have standard procedure for effective disinfection and decontamination of contaminated premises and materials.

**Scope:**

The document describes procedures for disinfection and decontamination of contaminated materials and premises.

**Users:**

Veterinarians/Para-veterinarians

**Manpower:**

Veterinarians
Para-veterinarians
Animal owners/ Helpers

**Materials/ Equipment required:**

- Hand gloves
- Apron (disposable)
- Gum boots
- Buckets
- Mugs/jugs
- Water
- Virkon-S (disinfectant)
- Sprayer (if available)
Procedure:

- Prepare 2% Virkon solution in a bucket.
- Collect the bedding materials and bury them with carcasses if it is in small quantities; or collect and burn it in a pit if in larger quantities.
- Contaminated premises should be disinfected thoroughly with 2% Virkon-S. Allow contact time of 2-3 hrs.
- Disposable items, including used PPEs must be buried in a pit.
- While leaving the infected premises the personals and vehicles should be thoroughly disinfected.
- All tools, utensils, equipment used for burial should be thoroughly cleaned and disinfected with disinfectant solution using 2% Virkon-S.
3.6. **Standard Operation procedure for quarantine and movement control**

**Purpose:**

To have standard procedure for effective quarantine and movement control during FMD outbreak

**Scope:**

The document describes procedures for quarantine and movement control to contain the disease

**Users:**

Regulatory Officers (BAFRA officials)
Police personnel
Veterinarians/ Para-veterinarians

**Manpower:**

Regulatory Officers (BAFRA officials)
Police personnel
Veterinarians/Para-veterinarians

**Materials/ Equipment required:**

Barrier tape
Sign board
Basic PPEs (Mask, Gloves)
Procedure:

- Ban and movement restriction of all cloven-hoofed animals and their products from the FMD outbreak areas and or routing through an affected area.
- Ban on importation of all cloven-hoofed livestock and livestock products into/routing through an area affected with FMD.
- BAFRA should mobilize their staff to attend check posts and entry points, and to strictly control movement of livestock and livestock products in and out of the outbreak area in the event of outbreak.
- The slaughter and sale of all cloven-footed animals for meat should be banned in the outbreak area.
- The animals in the affected herd should be confined within their shed or grazing area and avoid mixing with other healthy animals in the neighbouring village.
- The affected animals within the herd should be segregated from other apparently healthy animals and given appropriate treatment.
- Sought Local government support for enforcement
3.7 Standard Operating Procedure for sample collection to diagnose FMD in animals

Purpose

To have standard procedure for collecting appropriate samples from host for laboratory diagnosis.

Scope

This standard Operating Procedure (SOP) describes the steps and precautions required while collecting samples that includes appropriate time of collection and type of samples to be collected for each type of indicated test.

User

Veterinarians/ Laboratory Officer/ Laboratory Technicians /Paraveterinarians

Manpower

Veterinarians
Para-veterinarians,
Laboratory technician
Animal attendants
Animal owners

Materials/equipment required

1. Sample submission form
2. Vacutainer blood tubes (red cap)
3. PBS tablet/pre-prepared PBS
4. Glycerine
5. Needle and syringe (18 and 22 gauze, 2.5 ml)
6. Needle holder
7. Serum tube
8. Screw capped bottle
9. Gum shoes
10. Disinfectant (Calcium carbonate, Virkon-S)
11. Apron
12. Hand gloves  
13. Cool box  
14. Marker pen (permanent)  
15. Cotton/tissue paper  
16. Sample label  
17. Self-sealing plastic bags/snap lock bag  
18. Scissor  
19. Blades  
20. Packing tape  
21. Ethanol 70%  
22. PBS 50% glycerine(PBSG) (7.5 pH)  
23. Waste disposal bag/bio-hazard bag  
24. Sharp container  

Sample collection procedure  

Follow the sampling guide chart provided below to collect appropriate sample at appropriate time  

Blood collection  

1. Restrain animal properly  
2. Put on gumboots, apron and hand gloves  
3. Swap jugular area with 70% ethanol  
4. Collect the blood in the disposable plastic syringe or Vaccutainer  
5. Allow the blood to clot within the syringe. The syringe should be placed at 45 degree angle for better serum separation at room temperature or at 37ºC for 20-30 minutes.  
6. Separate the serum in eppend or ftubes/cryo vials for sending to the laboratory  
7. Complete sample submission form with the details of each sample  
8. Label each tube with code number corresponding to that in the sample submission form  
9. Pack properly in the plastic bags and keep in cool box
Epithelium and vesicle /vesicle fluid collection

1. Restrain animal properly
2. Put on gum shoes, apron and hand gloves
3. Collect epithelium from affected buccal area
4. If vesicles are present, aspirate fluid using needle and syringe and transfer into 50% glycerine PBS saline pre-aliquated in a screw cap vial
5. Complete sample submission form with the details of each sample
6. Label each tube with code number corresponding to that in the sample submission form
7. Pack properly in the plastic bags and keep in cool box

Oropharyngeal fluid collection

1. Restrain the animals properly
2. Put on gum shoes, apron and hand gloves
3. Insert probang cup into the oropharyngeal cavity and scoop fluid by taking utmost care not to release probang into oesophagus or trachea
4. Transfer fluid into 50% glycerine PBS saline pre-aliquated in a screw cap vial
5. Complete sample submission form with the details of each sample
6. Label each tube with code number corresponding to that in the sample submission form
7. Pack properly in the plastic bags and keep in cool box

Waste disposal

1. Used glove, syringe and disposable apron should be collected in a waste disposable bag and sealed with tape. The sealed bag should be put into another bag and again sealed with tape (double bag procedure).
2. Sharps such as used needle and blades should be collected into a sharp container.
3. All the waste bags and sharp container should be sprayed with 2% Virkon-S or bleaching powder before putting back into the car.
4. Once reaching back to laboratory or office the waste should be disposed appropriately either by in cenerating or autoclaving
Disinfection and decontamination

1. Reusable instrument, apron and gum shoes should be sprayed with 2% Virkon-S.
2. Apron and gum shoes should be changed while leaving sampling site.
3. If the cars have entered sampling site, the tyres should also be sprayed with 1% Virkon-S.
4. Sampling site should be surface sprayed with 1% Virkon-S after sample collection.

Sample collection guide chart

Note: Epithelial/vesicular fluid should be collected within four days from the onset of clinical symptoms.

Serum for antibody detection should be collected six days post onset of clinical signs.

Ag: Antigen
Ab: Antibody
RT-PCR: Reverse transcriptase-polymerase chain reaction
LPB: Liquid phase blocking
NSP: Non-structural protein
ELISA: Enzyme linked immunosorbent assay
VNT: Virus neutralization test
3.8 Standard Operating Procedure for NSP antibody Rapid Test

Purpose

Foot and Mouth Disease NSP antibody is a sandwich lateral flow immunochromatographic assay for qualitative detection of FMD virus non-structural protein antibody in serum from infected animal

Assay time: 5-10 min
Sample: Serum

Scope

This SOP outlines the general principles and steps to detect FMD NSP antibody in serum samples.

Principle

FMD NSP antibody rapid test (Quicking, China) is attest based on sandwich lateral flow immunochromatographic assay. The test device has a testing window. The testing window has an invisible T (test) zone and C (control) zone. When the sample is applied into the sample well on the device, the liquid will laterally flow into the surface of the test strip. If there is enough FMD NSP antibodies in the sample a visible T band will appear. The C band should always appear the sample is applied indicating valid result. This mean the device can accurately indicate the presence of FMD NSP antibody in the sample.

User

Veterinarians and laboratory staff of RLDCs, DVH / NCAH/VH

Manpower

Veterinarians
Laboratory Officer
Laboratory Technicians
Para-veterinarian
Materials/equipment required

1. Sample submission form
2. Vacutainer blood tubes (red cap)
3. PBS tablet
4. Needle and syringe (18 gauze, 10 ml)
5. Needle holder
6. Serum tube
7. Gum shoes
8. Disinfectant (Virkon-S)
9. Apron
10. Hand gloves
11. Cool box
12. Marker pen (permanent)
13. Cotton/tissue paper
14. Sample label
15. Self-sealing plastic bags/snap lock bag
16. Scissor
17. Blades
18. Packing tape
19. Ethanol 70%
20. Waste disposal bag/bio-hazard bag
21. Sharp container
22. NSP Ab test kit (cassette in foil pouch, product insert, dropper)

Sample collection procedure

Follow SOP for sample collection (blood)

Laboratory Procedure

1. Do centrifugation to animal’s whole blood sample to collect serum or plasma for use.
2. If serum is too sticky to move, please do a dilution of 1:1 with PBS or distilled water.
3. Take out the cassette from the foil pouch and place it horizontally.
4. Gradually drip 3 drops of serum/plasma into the sample hole “S”.
5. Interpret the result in 5-10 minutes. Result after 10 minutes is considered as invalid.
Result Interpretation

![Figure 11: Serum separation and dilution process Sample loading on cassette](image)

**Figure 11. Test reaction**

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**Positive:** The presence of both C band and T band, no matter T band is clear or vague.

**Negative:** Only clear C band appears.

**Invalid:** No colored band appears in C zone, no matter whether T band appears.

Waste disposal

1. Used glove, blood tubes, serum tubes, test cassette and syringe should be collected in a waste disposable bag/bin and sealed with tape.
2. Sharps such as used needle and blades should be collected into a sharp container.
3. All the waste bags and sharp container should be sprayed with 2% Virkon-S.
4. Waste generated should be appropriately either by incenerating or autoclaving...
FORM: 1 Temperature recording form (to be used to record temperature of vaccine storage refrigerator)

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Dzongkhag:                                                    Month:

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**FORM 2: FMD syndromic surveillance and reporting form**

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Reporting period:

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</tbody>
</table>
FORM 3: Flash Report format for disease outbreak reporting

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Parameters</th>
<th>Data/Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Village</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Location</td>
<td>Latitude: Longitude:</td>
</tr>
<tr>
<td>3</td>
<td>Gewog</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Dzongkhag</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Date of outbreak</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Date of report by owner to LEC/RNREC/DVH</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Date of report by LEC/RNR/DVH to RLDC/NCAH</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Disease suspected</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Species affected</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Number of cases</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Number died</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Number of household affected</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Number of susceptible animals in the village</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Probable source of outbreak</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Contact person in village (Name and phone number)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Control measures taken</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Reported by (Name and phone number)</td>
<td></td>
</tr>
</tbody>
</table>
### FORM 4: FMD Vaccination form

Name of Centre:..........................................Gewog:.................................
Dzongkhag:...........................................................
Vaccination campaign period:........................................

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Owner name</th>
<th>House No.</th>
<th>Village</th>
<th>Chiwog</th>
<th>Cattle</th>
<th>Sheep/Goat</th>
<th>Pig</th>
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<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>Population</td>
<td>No. vaccinated</td>
<td>Population</td>
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<tr>
<td>Sl.</td>
<td>Owner name</td>
<td>House No.</td>
<td>Village</td>
<td>Name of Cattle not vaccinated</td>
<td>Total number of animal vaccinated</td>
<td>Total number of animal not vaccinated</td>
<td>Reasons for not vaccinating cattle</td>
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<td>Write the code:</td>
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<td>1: Pregnant</td>
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<td>2: Young/calves</td>
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<td>3: Milk reduction</td>
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<td>4: Animal not available</td>
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<td>5: Others</td>
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FORM 5: FMD Sample submission form

Sample collection form for the sero prevalence study of FMD
District: ……………………….Gewog: ……………………Date: …………………

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Village</th>
<th>Farmer’s name</th>
<th>Animal name / ear tag No</th>
<th>Species</th>
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<tbody>
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</table>

Please use the following abbreviations
Species: Bov – Bovine; Cap – Caprine; Por – Porcine; Ovi – Ovine
Breed: L – local; JX – Jersey cross; BSX – Brown Swiss cross; MX – Mithun cross (For Sheep, goats, and pigs, just use Local and Cross)
<table>
<thead>
<tr>
<th>Breed</th>
<th>Age (yrs or month)</th>
<th>Sex</th>
<th>Vaccinated against FMD last year? (Tick one)</th>
<th>Date of last vaccination (If vaccinated)</th>
<th>Was there any FMD outbreak in this farmer’s herd within last 3 years? (Write Yes/No)</th>
<th>Did this animal suffer from FMD within last 3 years? (Write Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>No</td>
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</table>
### FORM 6: Disease Outbreak Investigation Form

<table>
<thead>
<tr>
<th><strong>Reference No.:</strong></th>
<th><strong>Date:</strong></th>
</tr>
</thead>
</table>

| **Name of the farm & farm owner:** |

| **Contact telephone number:** |

<table>
<thead>
<tr>
<th><strong>Address:</strong></th>
<th><strong>Gewog:</strong></th>
<th><strong>Dzongkhag:</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Geo coordinates:</strong></th>
<th><strong>Longitude (N):</strong></th>
<th><strong>Latitude (E):</strong></th>
</tr>
</thead>
</table>

**Information about the farm**

**Type of farm:**
- Cattle - Commercial [ ]; Semi-commercial [ ]; Backyard [ ]; Others [ ]
- Pigs - Commercial [ ]; Semi-commercial [ ]; Backyard [ ]; Others [ ]
- Goat - Semi-commercial [ ]; Backyard [ ]; Others [ ]
- Sheep - Semi-commercial [ ]; Backyard [ ]; Others [ ]
- Yak - Free-range [ ]; Backyard [ ]; Others [ ]

**Number of Animals in the affected household**
- Cattle: Cross:……….Local:…………Bull/ Bullock:……………Calves:…………………
- Pigs: Improved:……………Local:…………………………
- Goat: Improved:……………Local:…………………………
- Sheep: Improved:……………Local:…………………………
- Yaks: Cross:……………Local:…………………………

**Information about the affected village / Number of Animals in the affected village**
- Total no. of household:……………………Total human population:…………………..
- Cattle:………………… Pigs: …………………… Goat: ……………………
- Sheep:………………… Yaks:………………… Others (specify)……………………………

**Type of housing (tick or describe briefly)**
- Cattle: Permanent shed with concrete floor [ ]; Permanent shed with local beddings [ ]; Temporary shed [ ];
- Others (specify)[ ]…………………………
- Pigs:
- Goat:
- Sheep:

**Grazing system**
- Stall fed [ ]; Private pasture [ ]; Common grazing land/ pasture [ ];
- Mixing with other susceptible animals [ ]; Mixing with other herds [ ]
- Others (specify)
- Pig:
- Sheep:
- Goat:

**Feed: Whether concentrate feed fed to animals?**
- Cattle - [Yes | No ] Source…………………
- Pig - [Yes | No ] Source…………………
- Goat - [Yes | No ] Source…………………

**Whether animals are fed with kitchen waste/ swills?**
- Cattle - [Yes | No ] ……………………
- Pig - [Yes | No ] ……………………

**Other animal present in the farm, give details**

**Presence of wild animals in area, give details**
### Bio-security arrangements in the affected farm

- Disinfectant foot bath [ ]
- Perimeter wall/fence [ ]
- Mixing of different species of animals [ ]
- Contact between different herds [ ]
- Others (specify) [ ]

### Topography of the outbreak areas:

- Road network [ ]
- Market [ ]
- School [ ]
- BHU [ ]
- RNR/LEC [ ]
- Monastery [ ]
- Towns [ ]
- Others (specify) [ ]

### Movement of animals and products

- Recent introduction of animals from other establishment/places, [Yes / No]; if yes, from where?
- Species [ ] Source [ ] Nos [ ] Date [ ]

### Recent purchase of livestock products

- Beef - [Yes | No ] [ ] kg, Date [ ]
- Pork - [Yes | No ] [ ] kg, Date [ ]
- Mutton - [Yes | No ] [ ] kg, Date [ ]
- Chevon - [Yes | No ] [ ] kg, Date [ ]
- Fresh milk - [Yes | No ] [ ] lit, Date [ ]
- Others (specify) [ ]

- Supply/sale of animals/milk/meat to other farms/places, [Yes / No]; if yes to where?
  - Village [ ] Gewog [ ] Dzongkhag [ ] Date [ ]

### Movement of people/vehicle

- Any recent movement of people or vehicle from other farms/places [Yes / No]; if yes from where? When?
- Any recent movement of people or vehicle out of farm to other farm/places [Yes / No]; if yes to where? When?
- Any recent festival or gathering in the village or nearby villages [Yes / No]; if yes to where? When?

### Vaccination history of affected household

<table>
<thead>
<tr>
<th>Type of vaccine</th>
<th>Date of vaccination</th>
<th>Vaccine details</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMD</td>
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</tr>
<tr>
<td>BQ/ HS</td>
<td></td>
<td></td>
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<tr>
<td>Anthrax</td>
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</tbody>
</table>

- Whether the affected animals vaccinated in the last vaccination?
  - Yes | No: If no, when was the last vaccination?

- What was the reason for not vaccinating during the last vaccination programme?

### Information about the disease outbreak

- Date and time of report of outbreak from farmer to LEC/ RNEC/DVH:
- Date and time of report from LEC/ DVH to RLDC/ NCAH:
- Date and time of onset of clinical signs:
- Date and time of onset of mortality:
Details of animals affected:

<table>
<thead>
<tr>
<th>Date</th>
<th>Species</th>
<th>Breed</th>
<th>Age</th>
<th>No. affected</th>
<th>No. died</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
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</table>

*Clinical signs observed*

*Necropsy findings (if any)*

*If any treatment already given in the present outbreak, give details*

*Probable source of infection*

*Action taken or recommendations*

*Samples collected*

<table>
<thead>
<tr>
<th>Sample Id.</th>
<th>Species</th>
<th>Specimen type</th>
<th>No. of specimens</th>
<th>Laboratory referred to</th>
<th>Date of shipment</th>
<th>Test requested for</th>
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</tbody>
</table>

*Name & Designation of Investigation Team:*

*Signature*


Dukpa, K (2011). PhD Thesis. The Epidemiology of Foot-and-Mouth Disease in the Kingdom of Bhutan. School of Veterinary and Biomedical Sciences, Faculty of Health Sciences, Murdoch University. Western Australia