

**PESTE DES PETITS RUMINANTS  
STANDARD OPERATING PROCEDURES:  
1. OVERVIEW OF ETIOLOGY AND ECOLOGY**

**FAD PReP**

**Foreign Animal Disease  
Preparedness & Response Plan**



**United States  
Department of  
Agriculture**

United States Department of Agriculture • Animal and Plant Health Inspection Service • Veterinary Services

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The Foreign Animal Disease Preparedness and Response Plan (FAD PReP) Standard Operating Procedures (SOPs) provide operational guidance for responding to an animal health emergency in the United States.

These draft SOPs are under ongoing review. This document was last updated in **November 2013**. Please send questions or comments to:

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# Contents

- Peste des Petits Ruminants Quick Summary ..... 1-1
- 1.1 Introduction ..... 1-2
  - 1.1.1 Further Information..... 1-2
  - 1.1.2 Goals ..... 1-2
- 1.2 Purpose..... 1-2
- 1.3 Etiology..... 1-2
  - 1.3.1 Name ..... 1-2
  - 1.3.2 Virus Characteristics ..... 1-2
  - 1.3.3 Morphology ..... 1-3
- 1.4 Ecology ..... 1-3
  - 1.4.1 Susceptible Species ..... 1-3
  - 1.4.2 Reservoir and Carriers ..... 1-3
  - 1.4.3 Distribution..... 1-3
  - 1.4.4 Transmission..... 1-4
  - 1.4.5 Incubation Period..... 1-4
  - 1.4.6 Morbidity and Mortality..... 1-4
    - 1.4.6.1 Clinical Signs..... 1-5
- 1.5 Environmental Persistence of PPRV ..... 1-5
- 1.6 Risk of Introduction to the United States..... 1-5
- Attachment 1.A References and Resources..... 1-7
- Attachment 1.B Abbreviations ..... 1-8

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## **Peste des Petits Ruminants**

### **Etiology & Ecology Quick Summary**

#### **Disease**

Pseudorinderpest, Goat Plague, Pest of Small Ruminants, Pest of Sheep and Goats, Kata, Stomatitis-Pneumoenteritis Syndrome, Pneumonenteritis Complex.

#### **Morbidity & Mortality**

Morbidity is higher among goats than sheep. Mortality rates vary between 50–100 percent.

#### **Clinical Signs**

Fever, depression, inappetence, necrosis of mucosa, and ocular, nasal, and oral mucopurulent discharge.

#### **Susceptible Species**

Goats, sheep, wild ungulates.

#### **Zoonotic Potential**

None.

#### **Reservoir**

None.

#### **Transmission**

Aerosols and direct contact with ocular, nasal, and oral secretions. Fomites can also contribute to transmission.

#### **Persistence in the Environment**

Fragile, does not persist for long periods of time in the environment.

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## 1.1 Introduction

Peste des petits ruminants (PPR) is a highly contagious disease of wild and domestic small ruminants. First described in 1942 in Côte d'Ivoire, the disease was originally believed to be rinderpest due to the similarity in clinical presentation. Rinderpest, however, was ruled out when it was observed that cattle did not become sick when exposed to infected small ruminants. Originally confined to West Africa, today PPR is found in East Africa, the Middle East, and areas of Asia. The incursion of PPR into Turkey in the late 1990s has raised concerns that PPR has the potential to spread into Europe.

### 1.1.1 Further Information

This document is intended to be an overview of PPR in domestic livestock. Additional resources as well as articles referenced in this SOP, are listed in Attachment 1.A. Foreign Animal Disease Preparedness and Response (FAD PReP) documents are available on the APHIS public website ([http://www.aphis.usda.gov/animal\\_health/emergency\\_management/](http://www.aphis.usda.gov/animal_health/emergency_management/)) and the APHIS Intranet (<http://inside.aphis.gov/vs/em/fadprep.shtml>) for APHIS employees. Laboratory criteria are available from the World Organization for Animal Health (OIE) *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals* (2013).

### 1.1.2 Goals

As a preparedness goal, the Animal and Plant Health Inspection Service (APHIS) will provide etiology and ecology summaries for PPR, and update the summaries at regular intervals.

As a response goal, the Unified Command and stakeholders will have a common set of etiology and ecology definitions and descriptions, to ensure proper understanding of PPR when establishing or revising goals, objectives, strategies, and procedures.

## 1.2 Purpose

The purpose of this document is to provide responders and stakeholders with a common understanding of the disease agent.

## 1.3 Etiology

### 1.3.1 Name

The name “peste des petits ruminants” is reminiscent of “peste bovine” (rinderpest), claiming the similarity in clinical presentation between the two diseases. PPR is also known as pseudorinderpest, goat plague, kata, stomatitis pneumoenteritis syndrome, and pneumoenteritis complex.

### 1.3.2 Virus Characteristics

According to the International Committee on Taxonomy of Viruses,<sup>1</sup> PPR is categorized as follows:

- Family: Paramyxoviridae

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<sup>1</sup> International Committee on Taxonomy of Viruses. Available at <http://ictvonline.org/>. Accessed September 2012.

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- Subfamily: Paramyxovirinae
    - Genus: *Morbillivirus*
  - Genome characteristics: negative-sense, single-stranded ribonucleic acid (ssRNA).

Notably, rinderpest and measles virus also belong to the genus *Morbillivirus*. The viruses in this genus are closely related and immunologically cross reactive. Partial sequencing of the gene for the nucleoprotein (N)—which together with the RNA genome forms the nucleocapsid—has revealed that there are four distinct lineages which reflect the geographic origins of the virus.

### 1.3.3 Morphology

PPR is an enveloped virus with a single-stranded RNA genome. The pleomorphic virions are composed of six proteins: N associates with the phosphoprotein (P) and the large protein (L) which are involved in viral replication; the matrix protein (M) links the nucleocapsid to the envelope; hemagglutinin (H) in the envelope allows the virus to bind to host cells; and the fusion protein (F) mediates fusion of the virus to the host cell leading to infection. Neutralizing antibodies are primarily directed against H.<sup>2</sup>

## 1.4 Ecology

### 1.4.1 Susceptible Species

PPR primarily affects sheep and goats; cattle and pigs have been shown to become asymptotically infected and are unable to transmit the virus, making them dead-end hosts. Among wild species, PPR has been detected in many; the following is a select list: Laristan sheep, gemsbok, gazelles (Arabian, Arabian mountain, Dorcas, Rheem, Thompson's), buffaloes, springbuck, impala, and Afghan Markhor goat.<sup>3</sup>

### 1.4.2 Reservoir and Carriers

It is possible that certain wildlife species serve as reservoirs for PPR but no clear evidence has been observed for the role of wildlife in the maintenance and spread of PPR. There is also no evidence that a carrier state exists.<sup>4</sup>

### 1.4.3 Distribution

According to the OIE World Animal Health Information Database (WAHID),<sup>5</sup> PPR in small ruminants is currently found (reporting period: 2012-June 2013) in the Middle East, North Africa, West Africa, South Africa, East Africa, and parts of Asia. Countries that have reported PPR to the OIE in 2012-2013 include Algeria, Angola, Comoros, Egypt, Tajikistan, and Tunisia; the Republic of the Congo, Kenya, Mali, and Uganda all report to OIE that PPR is an endemic disease. Other countries that the OIE identifies as having “disease presence” in 2012-2013

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<sup>2</sup> Diallo A, et al. 2007. “The threat of peste des petits ruminants: progress in vaccine development for disease control.” *Vaccine*. 25: 5591–5597.

<sup>3</sup> Banyard AC, et al. 2010. “Global distribution of peste des petits ruminants virus and prospects for improved diagnosis and control.” *Journal of General Virology*. 91: 2885–2897.

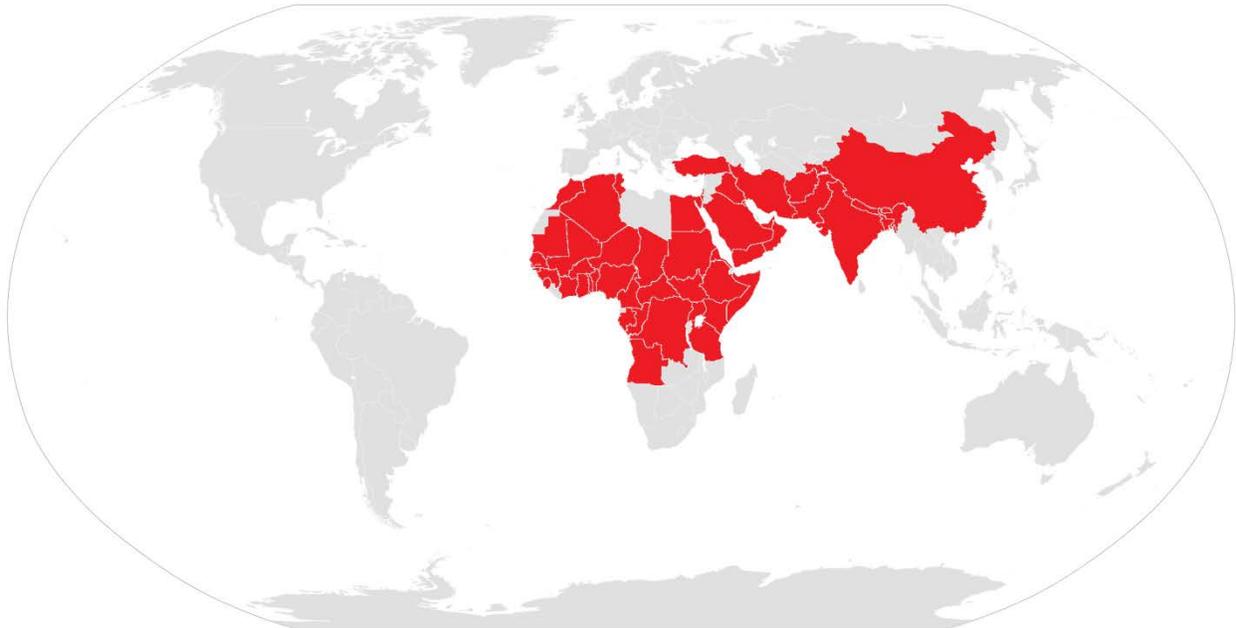
<sup>4</sup> World Organization for Animal Health (OIE). 2009. Technical Disease Card. Peste des Petits Ruminants. [www.oie.int](http://www.oie.int).

<sup>5</sup> OIE, World Animal Health Information Database (WAHID) Interface. [www.oie.int](http://www.oie.int).

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include (but are not limited to) Afghanistan, Bahrain, Bangladesh, Benin, Bhutan, Burkina Faso, Cameroon, Central African Republic, Chad, Eritrea, Ethiopia, Ghana, Guinea, Guinea-Bissau, India, Iran, Iraq, Israel, Kenya, Kuwait, Nepal, Nigeria, Saudi Arabia, Sudan, Tanzania, Turkey, and Yemen.

**Figure 1-1. Distribution of Peste des Petits Ruminants, 2005 – 2012.**



#### 1.4.4 Transmission

Transmission of PPR occurs primarily through aerosols and direct contact with the ocular, nasal, and oral secretions as well as feces of infected animals. Aerosols are formed through the sneezing and coughing of those infected. Fomites, such as bedding, feed, and water troughs can also serve as a means of disease transmission.<sup>6</sup>

#### 1.4.5 Incubation Period

The incubation period of PPR is 4–6 days but can range between 3–10 days. For purposes of the OIE *Terrestrial Animal Health Code*, the incubation period is 21 days.<sup>7</sup>

#### 1.4.6 Morbidity and Mortality

Morbidity and mortality vary with the species affected and the age of the population but in general morbidity can reach 100 percent and mortality, 90 percent.<sup>8</sup> Morbidity is found to be higher among goats<sup>9</sup> than sheep and animals age 3 months to 2 years are more severely affected

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<sup>6</sup> World Organization for Animal Health (OIE). 2009. Technical Disease Card. Peste des Petits Ruminants. [www.oie.int](http://www.oie.int).

<sup>7</sup> World Organization for Animal Health (OIE). 2013. Article 14.8.1, *Terrestrial Animal Health Code*. [www.oie.int](http://www.oie.int).

<sup>8</sup> Dhar P, et al. 2002. “Recent epidemiology of peste des petits ruminants virus (PPRV).” *Veterinary Microbiology*. 88: 153–159.

<sup>9</sup> United States Animal Health Association (USAHA). 2008. *Foreign Animal Diseases (The Grey Book)*. 7<sup>th</sup> Edition.

than those younger or older.<sup>10</sup> Among susceptible goat populations, mortality rates of 50–100 percent can be expected. In endemic areas low levels of infection are constantly circulating, outbreaks can occur when a naive population is brought in or grows in number. These periodic outbreaks are characterized by almost 100 percent mortality among both sheep and goats.<sup>8</sup> High rates of mortality have also been reported among captive wildlife.<sup>9</sup>

#### 1.4.6.1 Clinical Signs

Clinical signs typically appear within 2–6 days post infection and can vary according to many different factors such as PPRV lineage, species affected, breed, and immune status. While there is only one serotype there are different forms of the disease (acute, peracute, and subacute) that determine the severity of the course of illness. In general the disease causes fever (104–106°F/40–41°C), mucopurulent oculo-nasal discharge, conjunctivitis, and necrosis of the mucosal membranes. Death is usually the result of bronchopneumonia or dehydration from severe diarrhea.<sup>11</sup>

### 1.5 Environmental Persistence of PPRV

PPRV is fairly fragile and cannot exist for long periods of time in the environment. Not too much is known specifically about the persistence of PPRV but because it is so similar to rinderpest, it is reasonable to assume that these two viruses would share susceptibility characteristics to chemical or physical action (Table 1-1).

**Table 1-1. Resistance of Peste des Petits Ruminants Virus to Physical and Chemical Action**

Action	Resistance
Temperature	Half-life calculation of 2 hours/37°C; virus destroyed at 50°C/60 minutes.
pH	Stable between pH 5.8 and 10.0; thus inactivation at pH < 4.0 or > 11.0.
Disinfectants/chemicals	Effective agents include alcohol, ether and common detergents; susceptible to most disinfectants, e.g., phenol, sodium hydroxide 2%/24 hours.
Survival	Survives for long periods in chilled and frozen tissues.

Source: OIE Technical Disease Card for Peste des Petits Ruminants, 2009.

### 1.6 Risk of Introduction to the United States

In 2007, the most recent year for which there is data, the retail value of sheep and goats and their associated products constituted 0.2 percent (\$704.9 million) of agricultural product sales in the United States. While the incursion of PPR into the domestic sheep and goat population would be disastrous, both the food supply and the economy would not be significantly impacted. The risk of introduction is minimal as the United States imports very few sheep and goats or their associated products and most imports originate in Mexico and Canada which are currently PPR

<sup>10</sup> Center for Food Security and Public Health, Iowa State University. 2008. Peste des Petits Ruminants. Available at [www.cfsph.iastate.edu](http://www.cfsph.iastate.edu) (Accessed September 2012).

<sup>11</sup> World Organization for Animal Health (OIE). 2009. Technical Disease Card. Peste des Petits Ruminants. [www.oie.int](http://www.oie.int).

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free.<sup>12</sup> There is a slight risk imposed by the importation of wild animals for use in zoos but those animals undergo quarantine and other measures which ensure that they do not bring in any disease that might threaten the U.S. animal population. Overall, the risk of PPR introduction to the United States is low.

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<sup>12</sup> National Agricultural Statistics Service (NASS). 2011. "Overview of the United States Sheep and Goat Industry." Available at <http://usda01.library.cornell.edu/usda/current/ShpGtInd/ShpGtInd-08-09-2011.pdf> (accessed September 2012).

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## Attachment 1.A References and Resources

Banyard AC, et al. 2010. “Global distribution of peste des petits ruminants virus and prospects for improved diagnosis and control.” *Journal of General Virology*. 91: 2885–2897.

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World Organization for Animal Health (OIE), World Animal Health Information Database (WAHID) Interface. [www.oie.int](http://www.oie.int).

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## Attachment 1.B Abbreviations

APHIS	Animal and Plant Health Inspection Service
FAD PReP	Foreign Animal Disease Preparedness and Response
NASS	National Agricultural Statistics Service
OIE	World Organization for Animal Health
PPR	peste des petits ruminants
PPRV	peste des petits ruminants virus
RNA	ribonucleic acid
SOP	standard operating procedure
USDA	United States Department of Agriculture
WAHID	World Animal Health Information Database