



Clinical Practice Guideline (CPG) for PRRS in Thailand



THAI SWINE VETERINARY ASSOCIATION



U.S. Department of Agriculture
Animal and Plant Health Inspection Service

Clinical Practice Guideline (CPG) for PRRS in Thailand

First edition © 2015



Thai Swine Veterinary Association.

Clinical Practice Guideline (CPG) for PRRS in Thailand.-- Bangkok :
Thai Swine Veterinary Association, 2015.
56 p.

1. Swine--Virus diseases--Prevention and control. I. Title.

636.40896

ISBN 978-616-91341-2-1

Publisher

Thai Swine Veterinary Association

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USDA-APHIS-IS, U.S. Embassy Bangkok

120-122 Wireless Road, Bangkok, Thailand 10330
Tel: +66 (0) 2-205-5966, <http://www.aphis.usda.gov>

Printed by

Post Print, The Post Publishing Plc.

Bangkok Post Building, 136 Na Ranong Road
Klong Teoy, Bangkok 10110, Thailand
Tel: +66 (0)2-616-4000 ext. 3141
postprint@bangkokpost.co.th



Clinical Practice Guideline (CPG) for PRRS in Thailand

Preface

The Thai Swine Veterinary Association (TSVA) has prepared the “Clinical Practice Guideline (CPG) for PRRS in Thailand: 4th Revision in Thai language”, by combining the recommendations and put forward into the first, second and third guidelines. This revision was revised in a more concise format for effective monitoring and prevention of Porcine Reproductive and Respiratory Syndrome (PRRS) disease. The objective is to minimize PRRS negative impacts on pig farms since PRRS can cause a serious problem by a large variety of factors. However, the recommendations in the CPG represent only the principal guidelines that can be adopted or applied to diverse animal health conditions of each farm. It is hoped that the CPG English version will be able to reduce or stop PRRS damages to swine farms as well as to promote the important roles of pig farm veterinarians in establishing major PRRS prevention and control measures for pig farms in Southeast Asia.

The Thai Swine Veterinary Association would like to thank all of the authorities in the field for their valuable time and advice on the preparation of “Clinical Guideline (CPG) for PRRS in Thailand: 4th Revision”. We gratefully thank the United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA APHIS) for funding assistance in the printing of the CPG. We would also like to extend our sincere gratitude to all pig farm veterinarians for their contributions to the advancement and recognition of the veterinary profession among pig farmers.

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CONTENTS

| | |
|---|----|
| Preface | 4 |
| List of Participation Committee | 5 |
| Chapter 1 Key Principles of PRRS Prevention | 9 |
| A. Biosecurity | 10 |
| B. Principles of Replacement Breeding Stock Preparation and Acclimatization | 13 |
| Replacement Breeding Stock Acclimatization | 15 |
| Evaluation of Replacement Breeding Stock Acclimatization | 17 |
| Preparation of Replacement Breeding Stock for Placing into PRRS Free Breeding Herd | 22 |
| Chapter 2 Classification of PRRS Status of Herds | 23 |
| Chapter 3 Summary of PRRS Prevention and Control | 26 |
| Annexes | 29 |
| Annex A Principles of Herd Management | 30 |
| Annex B Individual House Herd Management | 36 |
| Annex C Principles of Breeding and Nursery-Fattening Herds Vaccination | 40 |
| Annex D Principles of Specimen Collection and Evaluation of Laboratory Test Results | 44 |
| Annex E PRRS Laboratory Diagnostic Service Providers in Thailand | 47 |
| Annex F Cleaning and Disinfection | 51 |
| Annex G Pictures related to PRRS | 53 |



Chapter 1

Key Principles of PRRS Prevention



Key Principles of PRRS Prevention

The key principles of PRRS prevention that should be observed by all pig farms to prevent damages from PRRS include three measures: Biosecurity, Replacement Pigs Preparation and Acclimatization, and Specimen Collection and Evaluation of Laboratory Test Results.

A. Biosecurity

This principle is based on the Ministry of Agriculture and Cooperatives Notification on Thai Agricultural Standard: Good Agricultural Practices for Pig Farms, issued under the Agricultural Product Standards Act B.E. 2551 (2008), dated 30 September 2009. The following information are emphasized and added for more appropriate prevention and control of PRRS.

Farm components

- 1.1. Located not less than 5 kilometers from a residential community, abattoir, and live animal market.
- 1.2. Pig houses/pens must be enclosed with fences to prevent accessibility of other types of animal. Warning sign about entry/exit precautions must be posted at all gates.
- 1.3. Farm's accommodations, kitchens and office buildings must be located in an especially assigned area. No habitation is allowed in animal houses/pens.
- 1.4. Animal feed mixing sheds and raw material storages must be located separately from pig-raising areas.
- 1.5. A quarantine building for animal acclimatization must be provided and located at a far distance from pig houses/pens.
- 1.6. Pig trading area must be located outside and clearly separated from the farm's pig-raising areas for convenience of cleaning and disinfection.
- 1.7. Strict segregation of workers in the quarantine house and pig sale areas from workers in other production units.

Transportation management

- 1.8. Outside animal feed/raw material transport vehicles are prohibited from entering the pig-raising areas. When it is necessary to transport animal feeds to the pig-raising areas the vehicles must be sprayed with disinfectant (See more details in Annex F). Outside transport or pig trading vehicles are strictly prohibited from entering the farm.
- 1.9. Transport vehicles for use within the farm must be cleaned, sprayed with disinfectant, and left to dry after each use.

Animal health management

- 1.10. Efficient disease monitoring, control and prevention systems, including disinfection measures before entering and after leaving the farm, must be set up to prevent accumulation of disease inside the farm, the spreading of disease to the outside as well as to enable quick control and mitigation of disease.
 - 1.10.1. Disinfection measures before entering and leaving the farm
 - Outside vehicles and visitors entering or leaving the farm must go through a disinfectant spray station.
 - Outside visitors entering the pig-raising areas must not have visited other pig farms at least within the past 48 hours.
 - Persons entering the pig-raising areas should bathe and change their clothing and change into the shoes provided by the farm.
 - 1.10.2. Disposal of dead animals
 - A special area within the farm, outside the pig-raising areas, must be assigned for disposal of dead animals.
- 1.11. Since pigs brought from outside to raise in a farm can be PRRS carriers, they should come from a single trustworthy breeding farm.
- 1.12. Semen used in the farm must be free of PRRS virus.

Environmental management

A proper waste elimination or waste treatment system must be set up. Wastes from pig farming must be disposed of in the assigned dead animal disposal area.

Disease prevention measures

All farms should add the following disease prevention measures:

1. All types of transport vehicles for pig purchasing, especially those with pigs from other farms onboard, should not be allowed into the farm. Farm workers should not be permitted to have any contact with such vehicles as they may be contaminated with disease from previous transportation of sick pigs through their visits to many pig farms in a single day. In general, these vehicles are not properly cleaned and sprayed with disinfectant.
2. No service should be obtained from transport vehicles between farms with no known history of transportation and resting periods after previous use. This practice applies to transport vehicles for breeding stock, nursery and fattening pigs since the animal may be contaminated with disease from sick pigs transported on the vehicles on previous trips despite the fact that there is no contamination in the origin farm.
3. Washing, cleaning, and disinfectant spraying measures should be strictly imposed. There must be service timeout between a trip to an abattoirs and the next pickup trip of pigs from farms as there is a high risk of contamination from abattoirs.
4. Outside visitors or persons with history of past contact with sick pigs or persons with high contamination probability should not be allowed to enter a farm in all cases, except when they have undergone a quarantine period of at least 72 hours.
5. Fresh pork from outside should not be purchased for consumption within a farm because if the pork is contaminated, farm workers may also be contaminated during the cooking process and may subsequently spread the disease to the pigs.

6. Pig farms with history of contamination with dangerous strain of PRRS are prohibited from moving their pigs to other farms to prevent a spread of the disease. This prohibition is enforced until there is proof that the disease in such farms has subsided. In case of breeding farms, when they are contaminated with dangerous strain of PRRS it is recommended that they should switch to raising fattening pigs for abattoirs only. They may choose an alternative of destroying all pigs from the farms and replacing them with disease-free pigs (Depopulation and Repopulation).
7. Sick pigs should be disposed of by burial or cremation only. Farms are not permitted to move sick pigs elsewhere while the remaining pigs can only be moved to abattoirs. This measure is implemented to prevent a spread of the disease.
8. In case of smallholders, they are advised to closely follow news of a spread of the disease. If their farms are located in an infectious area, they must stop all movement of pigs. For example, they must stop replacing pigs or introducing piglets from other sources into the farms, stop purchasing semen from breeding stock farms with no known history of pig sickness, and stop selling pigs. They may sell pigs but must not allow pig purchasing vehicles to enter pig house areas. Pig farmers in such farms must stop visiting each other and prohibit other pig farmers to enter their farms until the spread of the disease has subsided.

B. Principles of Replacement Breeding Stock Preparation and Acclimatization

Replacement breeding stock preparation house is the house used in raising replacement breeding stock that is built with the objectives of providing a quarantine station where the animals await a disease contamination check. It is also used for acclimatizing replacement breeding stock before placing them in breeder herds. This house plays important roles in the prevention and control of various diseases, especially PRRS. In principle, a replacement breeding stock preparation house is crucial to the achieving of maximum efficiency in the prevention of diseases. This house is based on the fundamental veterinary

concept that during their quarantine and acclimatization periods before being placed in the herds these breeding stocks must not be the source of disease to other herds in a farm. Each lot of replacement pigs will be placed in a breeding herd only when they are immune to the disease and stop spreading it.

This section will mainly focus on the importance of the replacement breeding stock preparation house in preventing and controlling PRRS disease. In compliance with this concept, it is necessary for pig farms to set up the following management of replacement breeding stock preparation houses:

1. To prevent a spread of PRRS, replacement breeding stock preparation houses must be located at a safe distance from other breeding stock houses for the following reasons:
 - 1.1. To prevent a spread of PRRS from replacement breeding stock to other breeder herds or other pig herds in the farm when the replacement pigs come from farms that are not PRRS free and are still in infectious.
 - 1.2. To prevent a spread of PRRS from replacement breeding stock to other breeding herds or other pig herds in the farm when the incoming replacement breeding stock has not been infected with PRRS. During the initial period of acclimatization to PRRS, the replacement herd will shed high level of PRRS virus, resulting in a high risk of the disease spreading to other breeder herds.
2. Replacement breeding stock preparation houses should be managed in such a way that they can keep the animals for at least 90 days. This will provide sufficient time for replacement pigs to become acclimatized to donors from the existing breeding herds. This period generally lasts about 30 days and another resting period of over 60 days is required after the animals are infected. It is hoped that after 90 days the replacement breeding stock will have sufficient immunity, enter a non-infectious period, and be ready for a placement in the breeding herds.
3. An All-In/All-Out (AIAO) system should be adopted in the management of replacement breeding stock preparation houses to prevent different lots of replacement breeding stocks from mingling. Without this measure

it will be difficult to predict the cessation of PRRS contamination in any incoming replacement breeding stocks. In the case that it is not possible to implement AIAO for the entire house, the house may be divided into rooms for separate implementation.

4. Replacement gilts should not represent more than 40 percent of a herd as they may increase the risk of spreading PRRS into the farm.

Replacement Breeding Stock Acclimatization

Objectives: To induce immunity among replacement breeding stock and bring them into non-infectious period before placing them into the breeding herds. This measure reduces damages from PRRS and prevents possible problems of, for example, irregular return to estrus, abortion, stillbirths, mummified pigs, embryonic deaths, and weak piglets among replacement breeding stock.

During this step preparation of replacement breeding stock houses is carried out as follows:

Method 1 Donors

Procedures:

1. Selection of donors by farm veterinarian supervisors who will evaluate and determine the groups of donors based on the laboratory reports. Identified donors are then moved to a replacement breeding stock preparation house. The appropriate ratio is 1 donor to 5-10 replacement breeding stock.
2. Move the replacement breeding stock into the same house as donors for approximately 30 days. During this period donors in each pen should be replaced at every 1 or 2 weeks to increase the infection rate among the replacement breeding stock. (Separate stalls should be provided for donors to prevent fighting during the initial period of mingling).
3. Remove donors from the pens at least 30 days after mingling to let the replacement breeding stock rest.

4. Keep the replacement breeding stock in the same house for another 60 days. During this period the focus is on stress management among the replacement breeding stock in order to speed up their non-infectious period.
5. Mix antibiotics in the replacement breeding stock feed to control secondary bacterial infection during the first 30 days of their acclimatization.
6. Complete the vaccination programs set up by the veterinarians, which are vaccines for swine fever, pseudorabies, foot and mouth disease, parvo virus, atrophic rhinitis, etc. Vaccination during the first two weeks of PRRS acclimatization should be avoided as it may affect the immune response to the vaccines.

Method 2 Vaccination

Vaccine means the PRRS vaccine registered with the Food and Drug Administration, the Ministry of Public Health.

Procedures:

1. Follow the same procedures as the first method, using vaccines instead of donors.
2. Administer one dose of live PRRS virus vaccine 5-7 days after the replacement breeding stock were delivered, followed by another 1-2 doses of dead or live virus vaccine at 3-4 week intervals. In this program, live virus vaccine is injected to induce Cell Mediated Immunity (CMI) while repeated injection of dead or live virus vaccine is to increase PRRS immunity levels (injection of dead virus vaccine in uninfected replacement animals induces a very low level of immunity).

* Decision on the use of vaccination appears in Annex C

Method 3 Autogenous virus vaccination

See the procedures of this method in Annex C

Evaluation of Replacement Breeding Stock Acclimatization

1. Collect blood samples from not less than 10 percent of the replacement breeding stock, which must not be less than 10 pigs, for an inspection of PRRS immunity level.
2. Guidelines for the collection of blood samples for evaluation purpose are as follows:

| Case No. | PRRS status | | Post-acclimatization period (day) | | | |
|----------|----------------------------|---------------------------------------|-----------------------------------|---------------------------|---------------------------|---------------------------|
| | Replacement breeding stock | Breeding herd/Receiving farm | 1 st time (0) | 2 nd time (30) | 3 rd time (60) | 4 th time (90) |
| 1 | Uninfected | Uninfected (Stable/Without Donor) | ● | ○ | ● | ○ |
| 2 | Uninfected | Infected (Stable-Unstable/With Donor) | ○ | ○ | ● | ● |
| 3 | Infected | Infected (Stable/Without Donor) | ● | ○ | ● | ○ |
| 4 | Infected | Infected (Unstable/With Donor) | ● | ○ | ● | ○ |

Notes: ● Collection of blood sample is required

○ Collection of blood sample depends on the judgment of the farm veterinarian supervisor

3. The last collection of blood samples in all cases may be undertaken before placing a replacement breeding stock into the breeding herds, depending on the judgment of the farm veterinarian supervisor.
4. In the case that the existing breeding herds are initially classified as the groups with donors (Cases 2 and 4) but after a while the farm has become stable and no donor can be found, the said herds can be reclassified as the groups without donors (Cases 1 and 3). The replacement breeding stock can then be placed in the herds as usual after the determined acclimatization period is completed.

5. In the case that the existing breeding herds are initially classified as the stable groups without donor (Cases 1 and 3) but after mingling with the replacement breeding stock the farm is found to be infected with PRRS, the said herds can then be reclassified as the groups with donors (Cases 2 and 4) instead.

Details of blood collection procedure for evaluation of each acclimatization of the replacement breeding stock are as follows:

Case 1 Replacement of PRRS uninfected pigs in uninfected breeding herds

This is the case where the breeding herds do not spread PRRS virus so a donor cannot be found or the herds may spread PRRS virus but a donor cannot be identified. The following blood collection procedures must be taken:

1. **First blood collection**
Blood samples are collected on the day of the replacement breeding stock delivery to evaluate whether they are truly uninfected or not and to prevent the spread of PRRS virus to the existing breeding herds during the stable state.
2. **Second blood collection**
Blood samples are collected 30 days after acclimatization to evaluate whether the replacement breeders are infected by donors or not. This collection depends on the judgment of the farm veterinarian supervisor.
3. **Third blood collection**
Blood samples are collected 60 days after mingling or before the replacement breeding stock are put to work. Compare their immunity levels with previous collections. If the results among the replacement breeding stock continue to be negative, check PRRS state of the breeding stock and their piglets again before placing them into breeding houses. However, if the immunity levels have increased, it means the donors still continue to spread PRRS virus. The said breeding stock must be kept until they enter the cool down period and stop spreading virus before placing them into the existing breeding herds.

4. **Fourth blood collection**
Blood samples are collected 90 days after acclimatization. However, this blood collection depends on the judgment of the veterinarian supervisor.

Case 2 Replacement of PRRS uninfected pigs into PRRS infected breeding herds

This is the case where the breeding herds may be in either a stable or unstable state and donors can be found. The following blood collection procedures should be taken:

1. **First blood collection**
Blood samples are collected on the day of the replacement breeding stock delivery to evaluate whether they are truly uninfected or not and to prevent the spread of PRRS virus to the existing breeding herds during the stable state. The first evaluation depends on the judgment of the farm veterinarian supervisor.
2. **Second blood collection**
Blood samples are collected 30 days after mingling to evaluate whether the replacement breeding stock is infected by donors or not. The second evaluation depends on the judgment of the farm veterinarian supervisor.
3. **Third blood collection**
Blood samples are collected 60 days after mingling to evaluate the immunity level of replacement breeding stock after being infected by PRRS virus from donors.
4. **Fourth blood collection**
Blood samples are collected 90 days after mingling or prior to putting the replacement breeding stock to work. Their immunity levels are compared with previous blood collection results. In the case that the immunity level begins to drop and the animals are not infectious they can be placed with the existing breeding herds.

Case 3 Replacement of PRRS infected pigs in PRRS infected breeding herds

This is the case where the breeding herds are stable and there is no spreading of PRRS virus, making it impossible to identify a donor. The following blood collection procedures should be taken:

- 1. First blood collection**
Blood samples are collected on the day of the replacement breeding stock delivery to evaluate their immunity levels before mingling.
- 2. Second blood collection**
Blood samples are collected 30 days after mingling to evaluate if the replacement breeding stock are infected by donors or not. This is ascertained from an increase in immunity level when compared to the first blood collection results. In the case that there is no donor among the breeding herds, the immunity level will drop when compared with the first blood collection results. But if the immunity level increases, this means the donors still continue to spread PRRS virus and the animals involved should be left to rest until they enter the cool down period. The second evaluation depends on the judgment of the farm veterinarian supervisor.
- 3. Third blood collection**
Blood samples are collected 60 days after acclimatization or before the replacement breeding stock are put to work. Their immunity levels are compared previous blood collection results. In the case that the immunity level begins to drop and the animals are not infectious they can be placed in the existing herds. If repeated infection is found, the animals involved should be left to rest until they enter the cool down period before placing them in the existing breeding herds.
- 4. Fourth blood collection**
Blood samples are collected 90 days after acclimatization, depending on the judgment of the farm veterinarian supervisor.

Case 4 Replacement of PRRS infected pigs in PRRS infected breeding sows herd

This is the case where there is a spread of PRRS virus in the herd and donors can be found. The following blood collection procedures should be taken:

- 1. First blood collection**
Blood samples are collected on the day of the replacement pigs delivery to evaluate their immunity level prior to mingling.
- 2. Second blood collection**
Blood samples are collected 30 days after mingling to evaluate if the replacement pigs are infected by donors or not, by comparing their immunity level with the first blood collection results to determine if there is any increase. The second evaluation depends on the judgment of the farm veterinarian supervisor.
- 3. Third blood collection**
Blood samples are collected 60 days after mingling or before the replacement breeding stock are put to work. Their immunity levels are compared with previous blood collection results. In the case that the immunity level begins to drop and the animals are not infectious they can be placed in the existing breeding herds. If repeated infection is found, the animals involved should be left to rest until they enter the cool down period before placing them in the existing breeding herds.
- 4. Fourth blood collection**
Blood samples are collected 90 days after acclimatization, depending on the judgment of the farm veterinarian supervisor.

Preparation of Replacement Breeding Stock for Placement in PRRS Uninfected Breeding Herds

Replacement breeding stock to be placed into PRRS uninfected breeding herds must come from the herds that have been evaluated and found to be free of PRRS virus. Farm veterinarian supervisors must set up schedules for regular evaluation programs. Before moving replacement breeding stock from a disease-free source farm they must be sampled for examination to ensure that the animals are still uninfected. Once they are moved to a disease-free breeding herd in the destination farm, the animals must be evaluated for their disease-free status again. The following procedures must be taken:

1. First blood collection

Blood samples are collected from all replacement breeding stock on the day of delivery to evaluate whether they are truly PRRS uninfected or not. ELISA and RT-PCR (pooled serum) are used for the evaluation.

2. Second blood collection

Blood samples are collected 15 days after delivery to evaluate whether the replacement breeding stock are infected with PRRS virus during transportation or not. The second evaluation depends on the judgment of the veterinarian supervisor.

3. Third blood collection

Blood samples are collected 30 days after delivery or before the replacement breeding stock are placed in the existing breeding herds. All replacement breeding stock to be placed into breeding herds must pass the evaluation and found to be PRRS-free.

Chapter 2

Classification of PRRS Status of Herds

Classification of PRRS Status of Herds

PRRS-infected and PRRS-free herds can be classified into 4 categories as follows:

1. Uninfected breeding, nursery-fattening herds (Negative Herd)
 - Negative ELISA test results for both the breeding and nursery-fattening herds
 - No PRRS problems in both the breeding and the nursery-fattening herds
2. Infected breeding and nursery-fattening herds with no problems (Stable/Inactive herd)
 - Positive ELISA test results for the breeding herds and positive and/or negative for the nursery-fattening herds
 - No PRRS-related problems in both the breeding and the nursery-fattening herds
3. Infected breeding herd with no problems. The problems are confined to the nursery-fattening herds (Stable/Active Herd)
 - Positive ELISA test results for both the breeding and the nursery-fattening herds
 - PRRS-related problems are confined to the nursery-fattening herds
4. Infected breeding and nursery-fattening herds with problems (Unstable Herd)
 - Positive ELISA test results for both the breeding and the nursery-fattening herds
 - Both the breeding and the nursery-fattening herds have PRRS-related problems

Table 1 PRRS status of herds, classified by problems and ELISA and RT-PCR laboratory test results

| Herd type | Breeding herd | | | Nursery-fattening herd | | |
|--|---------------------------|----------------------------|----------|---------------------------|----------------------------|----------|
| | Blood test result (ELISA) | Blood test result (RT-PCR) | Problems | Blood test result (ELISA) | Blood test result (RT-PCR) | Problems |
| 1. Uninfected breeding and nursery-fattening herds (Negative Herd) | - | - | ✗ | - | - | ✗ |
| 2. Infected breeding and nursery-fattening herds with no problems (Stable / Inactive herd) | + | - | ✗ | ± | ± | ✗ |
| 3. Infected breeding and nursery-fattening herds with problems confined to nursery-fattening herds only (Stable / Active Herd) | + | - | ✗ | + | + | ✓ |
| 4. Infected breeding and nursery-fattening herds with problems (Unstable Herd) | + | + | ✓ | + | + | ✓ |

Note: Additional RT-PCR test may be conducted to confirm ELISA blood test results

Summary of PRRS Prevention and Control

| Herd type | PRRS control approach | |
|--|---|--|
| | No vaccination | Vaccination |
| 1. Uninfected breeding and nursery-fattening herds (Negative Herd) | <ul style="list-style-type: none"> The emphasis is on biosecurity system management as outlined in Chapter 1. Neither live nor dead PRRS virus vaccination is recommended | |
| 2. Infected breeding and nursery-fattening herds with no problems (Stable / Inactive herd) - | <ul style="list-style-type: none"> The emphasis is on biosecurity safety system management as outlined in Chapter 1. | |
| | Using donor for the acclimatization of replacement gilts as outlined in Chapter 1. | <ol style="list-style-type: none"> Using vaccine for the acclimatization or replacement gilts as outlined in Chapter 1. Management of sow herd as outlined in Annex C, Clauses 1 and 4 Vaccination is not recommended in piglets |
| 3. Infected breeding herds with no problems, problems are confined to nursery pigs in the nursery-fattening herds (Stable / Active Herd) - | <ul style="list-style-type: none"> The emphasis is on biosecurity safety system management as outlined in Chapter 1. | |
| | <ol style="list-style-type: none"> Using donor for the acclimatization of replacement gilts as outlined in Chapter 1. The emphasis is the management methods specified in Annex B | <ol style="list-style-type: none"> Using vaccine for the acclimatization of replacement gilts as outlined in Chapter 1. The emphasis is the management methods specified in Annex B Management of breeding herds as specified in Annex C, Clauses 1 and 4 |

Chapter 3

Summary of PRRS Prevention and Control

| Herd type | PRRS control approach | |
|--|--|--|
| | No vaccination | Vaccination |
| | | 4. Live virus vaccination in nursery-fattening herds as specified in Annex C, Clauses 3 and 4 |
| 4. Infected breeding and nursery-fattening herds with problems (Unstable Herd) | <ul style="list-style-type: none"> ● The emphasis is on biosecurity safety system management as specified in Chapter 1. ● The emphasis is on the management methods specified in Annexes A and B | |
| | Using donor for the acclimatization of replacement gilts as outlined in Chapter 1. | <ol style="list-style-type: none"> 1. Using vaccine for the acclimatization of replacement gilts as outlined in Chapter 1 2. Live virus vaccination in breeding herd as specified in Annex C, Clauses 2 and 4 3. Live virus vaccination is recommended in piglets prior to infection only, as specified in Annex C, Clauses 3 and 4 |

ANNEXES

Annex A

Principles of Herd Management

Three alternative management approaches are available:

1. **Herd Closure**
2. **Depopulation and Repopulation**
3. **Closed Herd System**

1. Herd Closure

The key principle of this approach is to stop bringing in replacement gilts for a certain period of time with the objectives of:

- Stopping the spread of disease (Vertical and Horizontal Transmission)
- Reducing the amount of virus within a farm
- No importing of new virus into a farm

Guidelines to breeding herd management

1. Stop bringing in replacement gilts for at least one month or until no symptoms are detected among breeding herds (which may be as long as 210 days). If necessary, replacement gilts may be prepared or bred outside the farm before replacement, as outlined in **Chapter 1**.
2. Reduce movement of herds of different age groups and limit the operating space of farm workers and farm equipment.
3. Eliminate modifying factors which may be the sources or carriers of disease among pigs, such as water, animal feed, syringes, equipment, animal carriers, etc.
4. Mass administering of antibiotics to the entire herd both through injection and mixing with animal feeds (depending on the severity of the disease) to reduce and prevent secondary bacterial infection. Treat the herd according to their symptoms, such as administering medication to relieve fever and inflammation.

5. Reduce the amount of virus in the environment by spraying suitable disinfectant (in terms of type, concentration and amount per area), disposing dead piglets and stillbirth placenta to diminish problems of repeated infection in other pigs.
6. Consider culling sows with history of stillbirth or severe symptoms of disease from the herd.
7. Consider modification of the farm environment to reduce stress among pigs.
8. Consider management of farrowing houses as specified in Annex B
9. Consider management of boars as specified in Annex B

2. Depopulation and Repopulation

The key principle of this approach is to reduce pig population and replace them with uninfected animals to build up disease-free herds. Two practices are available:

- 2.1 Depopulation and Repopulation
- 2.2 Partial Depopulation

2.1 Depopulation

The underlying principle of this method is to eliminate all of the breeding herds and replace them entirely with disease-free herds.

Depopulation and repopulation are generally implemented when there is an epidemic of a disease which causes severe damages and no effective control measure for breeding herds is available. It is crucial to fully eradicate the disease by culling all pigs from infected farms and replace them with new herds that are free from the particular disease. This method can also be used when there is a need to introduce a disease into uninfected breeding herds so that damages to the herd will not be as serious as in the first case. It is a preferred method for building PRRS-free breeding herds from PRRS-infected herd in GGP and GP farms.

Depopulation and repopulation procedures in farms with combined breeding and nursery-fattening herds will be cited as an example here.

Procedures

1. Stop insemination of breeding sows and sell all of the existing breeding sows with weaned piglets at a particular time.
2. Sell all breeding sows in a farm after weaning. It will take about four and a half months to complete this task.
3. Sell all boars in the farm.
4. Sell or move weaned piglets and raise them in outside farms. The farm should set up a plan to sell all fattening pigs at the same time as the sale of breeding sows with weaned piglets.
5. After selling off all pigs in each house wash and clean the equipment, pig houses and their vicinity before spraying with disinfectant. Structures which are hard to wash, clean, and disinfect such as those with wood-pulp, rubber or plastic sheet materials should be removed and replaced with new ones.
6. Conduct major washing, cleaning, and spraying with disinfectant again after the sale or removal of all pigs from the farm. The desired level of cleanliness must be on par with a new farm that has never before raised any pigs.
7. Farm veterinarian supervisors must inspect and evaluate the washing and cleaning operation again to ensure that there are no traces of any diseases in all areas of the farm. There must be no disease both inside and outside of the pig houses, water system, sewage, pig waste ponds, supplementary structures, etc.,
8. Put the farm to rest for 1-2 months (after the farm veterinarian supervisor has evaluated its cleanliness) before bringing in a new crop of pigs. To have the replacement breeding sow herd produce piglets as fast as possible, a readiness plan to prepare the replacement

breeding stock may be set up to rent an outside farm for the raising of replacement breeding stock and insemination. The main goal is to be able to move the first crop of breeding sows in and start farrowing immediately after the farm's rest period ends.

2.2 Partial Depopulation

The underlying principle of this method is to remove some animals from the breeding herds.

Partial depopulation is one of the control methods of diseases, especially diseases with apparent symptoms such as swine fever, pseudorabies, foot and mouth disease, etc. In this section the emphasis will be vital measures for the control of HP-PRRS, which is the more serious strand of PRRS. This method is quite similar to Depopulation with the only difference lying in the culling of only the pigs with apparent symptoms and pigs that show no symptoms but are likely to have been infected by sick pigs. It aims to stop the contamination cycle and the spreading of disease to other herds in the same farm as well as to completely eradicate the disease from the farm. Keys to the success of Partial Depopulation are immediate implementation of control measures at the first sign of symptoms and the assured knowledge that the disease has not yet spread beyond control.

Procedures

1. Evaluate the disease status from its symptoms and spread patterns. This method is not recommended if there is a tendency that the disease will spread beyond control.
2. Cull animals with apparent symptoms from the herds and move all healthy pigs in the same house as the sick pigs to other housing outside the farm. If no outside house is available, the herds may be sent to isolated houses in the same farm far from the original houses.

- If sows in the last stage of pregnancy become sick, the breeding sows which have just been moved into the farrowing houses may have to be removed from the herds (depending on the risk evaluation by the farm veterinarian supervisor).
- If a disease strikes the farrowing houses during the pre-weaning period, the breeding sows in the breeding and gestation houses which have just been moved from the farrowing houses together with the nursery pigs in the nurseries which were weaned one week before may have to be removed from the herd (depending on the risk evaluation by the farm veterinarian supervisor).
 - a. Clean, disinfect and spray disinfectant in pig houses and leave to rest for at least 2 weeks before bringing in new herds.
 - b. Stop movement of pigs between houses and restrict the operating space of farm workers to their own pig house only.
 - c. Evaluate the health of the removed pigs. If there is no increase in the number of sick pigs, move them back or introduce new herds into the properly disinfected pig houses.
 - d. Evaluate the success of the operations by observing symptoms of the disease or collecting blood samples of pigs in the farm for evaluation in the following 1 and 2 months.

3. Closed Herd System

The underlying principle of this method is to introduce the pig flow management system and turn the farm into a closed farm where replacement pigs are reproduced inside the farm to eliminate problems of bringing in replacement pigs from outside.

Closed herd system is a form of long-term herd management. Farms that can effectively adopt this system must have sufficient number of breeding herd to produce replacement stock without inbreeding problems. They must also be able to produce sufficient number of replacement pigs to meet their target production goals.

Essential procedures for closed herd system:

1. Sufficiently increase the number of breeding sows.
2. Set up systematic pig lines and insemination tables to prevent inbreeding.
3. Set up mixed groups under the all-in, all-out system, possibly on a weekly basis (when there are sufficient numbers of breeding sows) or on a mixed lot basis (for small farms).
4. Proper acclimatization and immunization of replacement breeding stock.
5. Set up a biosecurity management system which includes suitable movement of pigs inside the farm, control of outside visitors and transport vehicles, establishment of the all-in, all-out system, control of farm workers' work flow, cleaning and disinfecting people, pigs, and equipment, etc.

Annex B

Individual House Herd Management

Boar house

For uninfected farms:

1. Boars must show negative ELISA test results.
2. Replacement boars must show negative ELISA test results for two consecutive tests, which are conducted at least 2 week apart, before being placed in the herds (their RT-PCR results should also be negative).

For infected farms with no symptoms

1. Working boars must be in non-infectious state with no virus shedding in semen (show no symptoms).
2. Working boars and replacement boars must undergo acclimatization process and have been in a cool down period of at least 8 weeks. This also applies to replacement gilts.

For infected farms with disease symptoms or serious stage of epidemic (Choose Clause 1 or 2 and/or Clause 3 or 4 practices)

1. Cease working and treat boars with disease symptoms. Normal boars can still be put to work.
2. Cease using all boars in the farm and use PRRS-free semen from outside boars (bought semen from herds with no symptoms).
3. RT-PCR is used to evaluate contamination conditions and/or the spread of PRRS virus through semen of boars in the herd. If any virus is detected, cease working until no virus is detected in semen.
4. Separate boar with disease symptoms from the herds/boar houses to reduce the spreading of virus throughout the herds. Give individual treatment.

Farrowing house

Farrowing house management for PRRS control

1. All farrowing houses should be managed under the all-in all-out or separate room systems. Workers in each farrowing house should be segregated and not permitted to wander into other farrowing houses.
2. Wash, clean and spray disinfectant as well as give farrowing houses sufficient rest period before moving breeding sows in for birthing.
3. Avoid unnecessary relocation of piglets. If necessary, it should be carried out within 24 hours of birth only and the entire litter should be moved together. Relocation of piglets between farrowing houses is prohibited.
4. Destroy new born piglets weighing less than 0.8 kg. to reduce the number of piglets that are highly sensitive to infection and spreading of disease. Destroy sick, unhealthy and underweight piglets, particularly those that have not responded to treatment.
5. Encourage suckling of colostrum among piglets to build up a good immune system. Colostrum may be collected and fed to abnormally small piglets.
6. Provide piglets with incubation lights and boxes to generate warmth which will produce good health and good immune system.
7. Piglets should have their ears, tails and fangs clipped at 2-3 days old.
8. Regularly monitor the health of breeding sows and piglets. Provide immediate treatment when any sign of sickness is detected.
9. For breeding sows, change syringes and vaccines after each injection of medication and vaccine. For piglets, change syringes after injection to each litter.
10. Administer antibiotics or medications to reduce fever or inflammation, to prevent sickness and treat sick sows before and after birthing. This should be carried out upon an advice of the farm veterinarian supervisor.

11. Adjust the temperature and ventilation in the farrowing houses to suitable levels. A dripping system may be installed to prevent pregnant sows from panting both before and after birthing and throughout the suckling period.

Nursery-fattening house

Management of nursery-fattening houses for the control of PRRS

1. Nursery houses must entirely adopt the all-in, all-out system, which can be a separate lot or separate room system, to prevent possible infection from direct contact. Workers in each nursery house must be segregated and not permitted to wander into other nursery houses.
 2. Wash, clean and spray disinfectant. There should be a rest period of at least 5-7 days before a new crop of weaned piglets are moved in.
 3. The nursery houses should not be too densely populated. The suitable space should not be less than 0.35 m² per piglet.
 4. Separate piglets by body sizes. For small-size piglets, the focus should be on sufficient heating and feeding stimulation.
 5. Provide nursery pigs with incubation lights and boxes to generate warmth which will produce good health and good immune system.
 6. Provide sufficient amount of feed and water. Frequently stimulate their eating.
 7. Regularly examine the health of nursery pigs. Separate sick from healthy piglets and give immediate treatment to the sick ones.
 8. Cull sick and unhealthy nursery pigs that have not responded to treatment and immediately destroy dead piglets to reduce the spread of the disease.
 9. Reduce the amount of virus in the environment by spraying with suitable disinfectant.
10. Administer highly potent antibiotics through injection, feed mixes or water soluble medication to prevent secondary bacterial infection as recommended by the farm veterinarian supervisor.

Annex C

Principles of Breeding, Nursery-Fattening Herds Vaccination

Vaccine means the vaccine used in the prevention of PRRS disease registered with the Drug and Food Administration, Ministry of Public Health.

1. For stable herd

- 1.1. No vaccination should be given to breeding herd as the herd may be subsequently at risk of infection if strict biosecurity system and breeding sow acclimatization are not properly provided.
- 1.2. Live or dead virus vaccination program is administered to pregnant sows at 4-6 weeks of pregnancy and prior to birthing (10-12 week of pregnancy) to maintain PRRS immunity among pregnant sows and to reduce the risk of future infection.

Notes:

1. Live virus vaccination in pregnant sows is considered a special procedure that can be administered only under the supervision of a farm veterinarian supervisor.
2. Live virus vaccination is not recommended in breeding herds that have never been vaccinated with live virus during the sow acclimatization process.

2. For unstable Herd

- 2.1. Mass vaccination of breeding herds with live PRRS virus vaccine once. Repeat mass vaccination in the next 3-4 weeks, using either live or dead virus vaccine.
- 2.2. Three weeks after that, enter breeding sows into a vaccination program to increase PRRS immunity levels both in the sows and their colostrum through the following practices.

- 2.2.1. Inject pregnant sows at 4-6 weeks of pregnancy and pre-birthing sows (at 10-12 weeks of pregnancy) with live or dead virus vaccines. Or
- 2.2.2. Administer mass vaccination every 3-4 months.

Notes:

1. Live virus vaccination in pregnant sows is considered a special procedure that can be administered only under the supervision of a farm veterinarian supervisor.
2. Farm veterinarian supervisors should evaluate the conditions of the herds. If they change from Unstable to Stable conditions, follow No. 1 guidelines.

3. Nursery-fattening herd (in cases of Active and Unstable Herd)

- 3.1. Live virus vaccination is not recommended in piglets born to mothers that become sick in farrowing houses and shed a large amount of PRRS virus in the farrowing crates during delivery. Some piglets may contract PRRS virus from their mothers while in the farrowing houses.
- 3.2. Inject live virus vaccine once to piglets of over 2 weeks old under the supervision of the farm veterinarian supervisor. (This vaccination aims to produce CMI immunity to reduce or prevent the presence of virus in the blood system or to reduce the severity of PRRS after infection). Pig farms should closely monitor the immunity levels of nursery-fattening herds by collecting serological profiles.

Note:

Farm veterinarian supervisors may conduct RT-PCR test on piglets' blood to confirm infection from mothers.

4. Cautions in using live PRRS virus vaccine

- 4.1. About 2-3 days before and after vaccination, administer antibiotics that can be mixed in feeds or water, such as colistin sulphate, together with amoxicillin to reduce the risk of secondary bacterial infection. Stricter water treatment measures should be introduced.

- 4.2. Live PRRS virus vaccination may induce virus shedding, especially when administered to sick and weak pigs.
- 4.3. Live PRRS virus vaccination may induce recombination effect in the PRRS virus strand found in a farm.
- 4.4. Live PRRS virus vaccination of working boars may induce sickness and virus shedding through semen.

5. Autogenous vaccine

- 5.1. Follow the same practices as in Method 1, using autogenous vaccine instead of donors.
- 5.2. Collect blood samples from piglets in farrowing houses or from nursery pigs in a specific farm, depending on the farm veterinary supervisor's judgment. Extract virus from the samples in a laboratory within 24 hours of collection. The samples must not come from unhealthy or close to death pigs. DNA sequencing must be conducted for comparison with the farm's past and future samples at least once a year. The extracted virus must be processed in a laboratory to derive pure and exact quantity of virus for seed stock collection. The following practices must be followed:
 - 5.2.1. The virus injected into the neck muscles of replacement pigs after 5-7 days of delivery to the farm must be extracted from the pigs in the particular farm. Using virus from other farms is prohibited unless it has been confirmed by a DNA sequence analysis that they are exactly the same.
 - 5.2.2. Protection against laboratory contamination and virus dispersal must be imposed during transportation of laboratory-prepared virus for pig injection. The prepared virus must be placed in sealed and sufficiently cold container during transportation.
 - 5.2.3. The amount and volume (CC) of virus for each injection must be recommended by the laboratory veterinarian and must be

administered solely under the judgment and supervision of the farm veterinarian supervisor. The virus must be depleted in one injection and returning to the freezer or reusing it is strictly forbidden.

- 5.2.4. After injection the equipment and containers used must be collected in another sealed container, then disinfected with disinfectant and destroyed by burning. For this reason, disposal equipment must be used.
- 5.2.5. Between the initial injection of virus into replacement pigs and 60 or 90 days afterward the workers, equipment or items in the houses of this herd of pigs must be strictly segregated from those from other houses. Use RT-PCR test to check blood sample results. In general, no virus will be detected in the blood within 30-60 days if there is no stress factor involved.

Annex D

Principles of Specimen Collection and Evaluation of Laboratory Test Results

1. Problem analysis

1.1. Serological analysis

1.1.1. In ELISA test, cross sectional sampling is recommended for an analysis of herd status.

1.2. Viral or antigen test

1.2.1. RT-PCR test for virus detection

- Use RT-PCR with Specific ORF1a, ORF5, ORF7 or NSP2 gene primers that are in accordance with the objectives of the viral test. Sensitivity and specificity tests of primers that have been used with domestic virus should be conducted first.
- Recommended specimens for analysis:
 - Serum from mothers with recent stillbirth or infected pigs with clinical symptoms. Pooled samples of not more than 5 samples can be used.
 - Organs of infected pigs with clinical symptoms such as lung, tonsil and lymph node.
 - Pooled sample of not more than 5 semen samples can be used.

1.2.2. Immunohistochemistry antigen test

- Specimens recommended for analysis include lung and lymph node tissues.

1.2.3. DNA sequencing

- DNA sequence analysis of the ORF5, ORF7 or NSP2 genes of the virus can be conducted, depending on the objective of the analysis.

2. Herd status analysis

ELISA is used to test for herd infection patterns and identification of donors to be used in the preparation of replacement breeding stock before placing them in the positive herd raised in one site system farms for acclimatization purpose. The analysis include tests of blood samples of breeding sow herd and nursery-fattening herds once or twice a year as deemed appropriate.

- 2.1. Conduct a test on 30 mixed samples of young sows at first pregnancy and old sows. Collect approximately 4-5 samples from each age group.
- 2.2. Conduct a test on nursery-fattening herds of 4, 8, 12, 16, and 20 weeks old. Collect approximately 4-5 samples are from each age group.

3. Disease monitoring test

- 3.1. Semen Conduct RT-PCR test on semen of boars with risk of disease and symptoms.
- 3.2. Replacement boars
 - 3.2.1. For herd with negative results, ELISA is conducted on all boars before placing them in the herds. For herd with positive results and raised in one site system, follow the same practices as those used on acclimatized replacement gilts.
 - 3.2.2. For herds with negative results, RT-PCR test is conducted on all boars before placing them in the herds.

3.3. For replacement breeding sows, follow the same practices as those used in the evaluation of immunity acclimatization in replacement breeding stock.

Note: Pigs injected with live virus vaccine will produce the immunity response that can be tested and measured by ELISA test in a similar manner as pigs that have been naturally infected for the first time. Repeated vaccination of the same vaccine may not produce the same response as found in ELISA test.

Annex E

PRRS Laboratory Diagnostic Service Providers in Thailand

| Agency – Contact Address | Test Method | | | |
|---|-------------|-------|--------|----|
| | VI | ELISA | RT-PCR | DS |
| Virology Section, National Institute of Animal Health, Department of Livestock, Ministry of Agriculture and Cooperatives. 50/2 Kasetklang, Phaholyothin Rd., Lard Yao, Chatuchuck, Bangkok 10900 Tel. 0-2579-8908-14 Ext. 422 - 429 | | ✓ | ✓ | ✓ |
| Northern Veterinary Research and Development Center, Upper zone, Department of Livestock 221 Moo 6 Lamphang-Chiang Mai Rd., Wiangtam Sub-district, Harnghat District, Lampang 52190 Tel. 0-5483-0195-6 | | ✓ | ✓ | |
| Northern Veterinary Research and Development Center, Lower zone, Department of Livestock 9 Moo 15 Phitsanulok-Lomsak Rd., Wang Thong Sub-district, Wang Thong District, Phitsanulok 65130 Tel. 0-5531-2069-72 | | ✓ | ✓ | |
| Northeastern Veterinary Research and Development Center, Upper zone, Department of Livestock. Tha Phra Sub-district, Muang District, Khon Kaen 40260 Tel. 0-4326-2050, 0-4326-1165-6 | | ✓ | ✓ | |

| Agency – Contact Address | Test Method | | | |
|---|-------------|-------|--------|----|
| | VI | ELISA | RT-PCR | DS |
| Northeastern Veterinary Research and Development Center, Lower zone, Department of Livestock Moo 9 Surin-Prasart Rd., Na Buo Sub-district, Muang District, Surin 32000 Tel. 0-4454-6104 | | ✓ | ✓ | |
| Southern Veterinary Research and Development Center, Department of Livestock 124/2 Moo 7 Thungsong-Huaiyod Rd., Teewang Sub-district, Thung Song District, Nakhon Sithammarat 80110 Tel. 0-7577-0008-9, 0-7577-0128-30 | | ✓ | ✓ | |
| Eastern Veterinary Research and Development Center, Department of Livestock 844 Moo 9 Hua Kunjae-Marbkla Rd., Klong Kiew Sub-district, Ban Bueng District, Chonburi 20220 Tel. 0-3874-2116-8, 0-3874-2120 | | ✓ | ✓ | |
| Western Veterinary Research and Development Center, Department of Livestock 126 Moo 10 Khao Cha-ngum Sub-district, Photharam District, Ratchaburi 70120 Tel. 0-3222-8419, 0-3222-8379 | | ✓ | ✓ | |
| Veterinary Diagnostic Laboratory Unit, Faculty of Veterinary Science, Chulalongkorn University, Henri Dunant Road, Wang Mai, Pathumwan District, Bangkok 10330 Tel. 0-2218-9606 | ✓ | ✓ | | ✓ |

| Agency – Contact Address | Test Method | | | |
|--|-------------|-------|--------|----|
| | VI | ELISA | RT-PCR | DS |
| Veterinary Diagnostic Laboratory Unit, Faculty of Veterinary Medicine, Kasetsart University, Kampaengsaen Campus, Nakhon Pathom 73140 Tel. 0-3435-1901-3 | ✓ | ✓ | ✓ | ✓ |
| Animal Hospital, Faculty of Veterinary Medicine, Khon Kaen University, Nai Muang Sub-district, Muang District, Khon Kaen 42000 Tel. 0-4334-3081 | | | ✓ | |
| Veterinary Diagnostic Laboratory Unit, Faculty of Veterinary Medicine, Chiang Mai University Liap Klong Cholpratam Rd., Mae Hia Sub-district, Muang District, Chiang Mai 51000 Tel. 0-5394-8041-2 | | | ✓ | |
| Veterinary Diagnostic Laboratory Unit, Faculty of Veterinary Medicine, Mahanakorn University of Technology, 140 Chuemsamphan Rd., Nongjok District, Bangkok 10530 Tel. 0-2988-3655 Ext. 5210 | | ✓ | ✓ | |
| Veterinary Diagnostic Centre, Faculty of Veterinary Science, Mahidol University, 999 Phuttamonthon 4 Rd., Salaya Sub-district, Phuttamonthon District, Nakhon Pathom 73170 Tel. 0-2441-0933 | | ✓ | ✓ | |

| Agency – Contact Address | Test Method | | | |
|--|-------------|-------|--------|----|
| | VI | ELISA | RT-PCR | DS |
| Betagro Science Center 136 Moo 9 Klong Nueng Sub-district, Klong Luang District, Pathumthani Tel. 0-2564-7932-40 Ext 206 | | ✓ | ✓ | |

Notes

| | |
|--------|--|
| VI | Viral isolation (approximately 7 days) |
| ELISA | Enzyme-linked immunosorbent assay (approximately 3-5 days) |
| RT-PCR | Reverse transcription polymerase chain reaction (approximately 2 days) |
| DS | DNA sequencing (approximately 10-14 days) |

** Diagnostic service fees are determined by an individual unit. No service fees are charged by the work units attached to the Department of Livestock. For more details please contact the addresses and telephone numbers given above.

Annex F

Cleaning and Disinfection

Daily washing, disinfection and cleaning

- Spray disinfectant along the paths between pens and connecting routes between houses on a daily basis for normal herds and 2-3 times a day for sick herds.
- Spray disinfectant (the type that is not harmful to tissues) around the pigs 1-2 times a day or after the daily showers and pen cleaning rounds.

Cleaning steps for post-weaning farrowing houses or post-sale fattening pig houses

1. Remove equipment such as incubation bins and fee trays for cleaning and disinfection.
2. Sweep off all pig stools, food scraps, and dirty items from pig houses and spray with water.
3. Spray water mixed with detergent liquid (with high-pressure pump sprayer) on walls and pen floors. Leave for 30-60 minutes.
4. Wash off with clean water and leave to dry.
5. Spray disinfectant and leave to dry.
6. The houses may be sprinkled with lime powder or sprayed with lime liquid and leave it on. Wash it off before placing pigs in the pens as lime may harm pig skins and hoofs.
7. Rest pig pens for 5-7 days. Another spraying of disinfectant should be carried out 1 day before placing new herds in the houses.

Cleaning and disinfection steps for transport vehicles of live and dead pigs

1. Sweep off pig stools, food scraps, and dirty items from vehicles and spray with water.

2. Spray water mixed with detergent liquid (with high-pressure pump sprayer) on walls and pen floors. Leave for 30-60 minutes.
3. Wash off with clean water and leave to dry.
4. Spray disinfectant and leave to dry.
5. Stop using the vehicles for at least 8 hours.

Disinfectant choice and usage

Since certain effective disinfectants against virus may cause irritation to pig tissues, farmers must select the right disinfectant for their purpose. Strong disinfectants should be used only for paths and empty pig pens while antiseptics should be used when they may come into contact with pig tissues.

The amount of disinfectant used in spraying each pig-raising area should be calculated to ensure maximum efficiency.

Table showing examples of effective disinfectant against virus

(McDonnell & Russell, Clin. Microbiol. Rev. 1999, 12 (1) : 147)

| Disinfectant group* | For general use | For paths and empty pens |
|---|-----------------|--------------------------|
| Alcohol: ethanol, isopropanol | + | |
| Aldehyde: glutaraldehyde, formaldehyde | | + |
| Biguanides: Chlorhexidine | + | |
| Halogen-releasing agents: chlorine compounds, Iodine compounds | + | |
| Peroxygens: hydrogen peroxide, peracetic acid | + | |
| Phenol and cresol | | + |
| Quaternary ammonium compounds (QAC): cetrimide, benzalkonium chloride | + | |

* Effective disinfectants for farm use must be selected on the basis of their durability against organic substance, heat, sunlight, and various environmental factors.

Annex G

Pictures related to PRRS



Clinical sign at the ear region: cyanosis



Aborted fetus at different stages



Piglets losses due to multisystemic infections: mostly respiratory disease



Biosecurity at a farm



**Clinical Practice Guideline (CPG)
for PRRS in Thailand**
ISBN 978-616-91341-2-1



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120-122 Wireless Road, Bangkok, Thailand 10330
Tel: +66 (0) 2-205-5966, <http://www.aphis.usda.gov>