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Guidelines for
African swine fever (ASF)
prevention and control in
smallholder pig farming in Asia

FARM BIOSECURITY, SLAUGHTERING AND RESTOCKING



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African swine fever (ASF)
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smallholder pig farming in Asia

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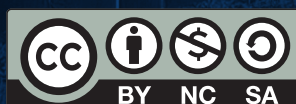
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The definition of a smallholder pig farm is not applied consistently across all countries in the Asia-Pacific region. While these guidelines present materials targeted to smallholders, all measures described in these guidelines are applicable for reducing the risk of African swine fever (ASF) in all pig farming enterprises.

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Abbreviations and acronyms

ASF African swine fever

ASFV African swine fever virus

DEFRA Department for Environment Food and Rural Affairs, United Kingdom

FAO Food and Agriculture Organization of the United Nations

IP Infected premises

NGOs Non-governmental organizations

OIE World Organisation for Animal Health

Summary of key points

1.

Introduction

These guidelines on biosecurity, restocking and slaughter practices in smallholder pig farming systems are designed for use by national/central veterinary authorities (to be referred to as veterinary authorities), farmers and relevant stakeholders of the Southeast Asian pig industry. They provide guidance on the best biosecurity management practices and related activities in smallholder premises or villages, such as movement and slaughter of pigs to prevent and control the spread of the African swine fever virus. The recommended minimum best practices reflect the intricacies of the smallholder pig marketing chains, taking into account socio-economic factors and behaviours that may affect their uptake. It is expected that applying these measures together with existing standards for infectious disease prevention and control will result in an overall increase in agricultural productivity and improve livelihoods.

The high pig density and associated predominant smallholder pig production in Southeast Asia create suitable conditions for the spread of African swine fever (ASF). This is confirmed by the socio-economic impact of the recent introduction and spread ASF virus (ASFV) in the region. In the absence of any effective treatment and vaccine, implementing effective prevention and control strategies presents the only solution. Applying biosecurity measures, educating and creating awareness among key actors along the smallholder value chain is critical in the successful prevention and control of ASF in Southeast Asia. However, most smallholder producers have limited financial resources and are unlikely to take up expensive biosecurity recommendations. To incentivize smallholder producers in adopting recommended biosecurity measures in the context of smallholder pig systems, consideration must be given to feasibility, sustainability and cost-effectiveness.

1.1. Definition of biosecurity

- Biosecurity refers to the set of management and physical measures intended to mitigate the risk of introduction, maintenance and dissemination of animal diseases, infections, or infestations to, from and within animal populations.

- Biosecurity has three main overlapping components forming the basis of on-farm biosecurity practice:
 - Bio-exclusion – biosecurity measures aimed at preventing ASFV entry into a pig farm, e.g. fencing, footbaths, personnel traffic control and quarantine;
 - Bio-management – biosecurity measures that control and maintain the sanitary conditions of the pig farm, e.g. cleaning and disinfection, clean and dirty area demarcations and waste management;
 - Bio-containment – measures that prevent the leakage of ASFV and other pathogens from a pig farm to other farmers, e.g. fencing prevents free-roaming pigs from spreading pathogens.

2.

Roles and responsibilities of stakeholders in the Southeast Asia pig industry on ASF biosecurity

- Effective biosecurity for prevention and control of ASF at the smallholder level requires an effective collaboration between all actors in the pork value chain and veterinary authorities.
- Biosecurity practices must be aligned with the motivations of all relevant stakeholders, i.e. smallholder pig producers, veterinarians, veterinary authorities, cooperative societies and market actors in the smallholder pig value chain. The roles and responsibilities of some key stakeholders include:
 - National/central veterinary authorities;
 - Develop, maintain and enforce practical biosecurity measures in partnership with the primary implementers and actors along the pig value chain at the farm, regional and national levels.
 - Producer associations and non-governmental organizations (NGOs);
 - Train and assist primary implementers on biosecurity measures recommended by the veterinary authorities.
 - Veterinarians and field officers;
 - Provide expert opinion on the risk of ASFV to farms within their zones based on the assessment of farm sites, exposure to risk factors and health management of pig herds; and
 - Advise farmers on best measures, such as cleaning and disinfection, to help manage risks and to help secure the farmer's investment.
 - Smallholder producers (farmers);
 - Ensure that biosecurity best practices are implemented on their farms to protect their investments.

- Paraprofessionals (village veterinary workers, community animal health workers);
 - Attend to the needs of smallholder producers as needed and can assist with administering drugs or vitamins;
 - Give advice and training on biosecurity and herd management to farmers;
 - Report unusual animal health findings to the veterinary authorities; and
 - Assist veterinary authorities in activities as surveillance, disease detection, disease control, restocking etc.

3.

ASF minimum biosecurity requirements for smallholder pig farms

The minimum recommended biosecurity practices to be implemented on smallholder farms is not a 'one size fits all' solution to mitigating ASFV risks. Each farm must consider its unique ASFV risks and all possible routes of ASFV entry to the farm before choosing the most appropriate measures to implement. Some key biosecurity points to note are:

3.1. Introduction of new pigs into a herd

- To minimize the risk of introducing ASFV into the herd, smallholder farmers should limit the frequency of introduction of new pigs into existing herd. If possible, farmers can structure their farms and plan in such a way that pigs are brought in batches, reared and sold out.
- Farmers should obtain as much as possible replacement pigs from trusted ASF-free sources. The veterinary authorities should provide a list of free genetic companies or suppliers in good standing.
- New arrivals should be isolated in a different pen or area on the farm/house premises and observed for signs of disease for a period of 14–30 days. Good health management practices include keeping daily records of morbidity and mortality. After the farmer is satisfied with the pigs' health status, they can be added to the main herd.

3.2. Feed and water

- Feed material could easily be contaminated if not stored properly. Wild boars and free-range pigs, birds, rodents and other wildlife may access and contaminate the pigs. This could serve as a point of introduction and transmission of infectious pathogens.

- Feed material transported to the farm should be delivered at a designated area that is at the front door of the house or storage area. Feed bags brought directly from the supply store by the smallholder farm should be brought directly to the storage area.
- Under circumstances where swill has to be used, it must be cooked to boiling point for at least 30 minutes to inactivate the any potential virus and then cooled down before feeding to the pigs. The veterinary authorities or the paraprofessionals (like the community animal health workers) should provide training for farmers on practical ways of preparing swill or forages for their pigs.
- Ensure access to clean water source, and if water is to be stored, storage containers must be covered tightly.

3.3. Bedding

- As much as possible, do not source straw or bedding material originating from an area where ASF has been reported. If ASF is endemic in the area, source the material on site or as close as possible of the farm.
- Bedding must be stored away from the open weather and be out of reach of wild boar, free-ranging pigs and insects. Bedding may be packaged in sacks or bags, sealed or tied strongly and stored on a roof or wall.

3.4. Vehicles and equipment

- Veterinary authorities must collaborate with stakeholders involved in the local pig value chain to offer training on biosecurity measures for drivers and middlemen. This training should include proper disinfection methods and safe farm-to-farm movement to prevent the spread of ASFV.
- Vehicles, motorbikes, carts and all other means of transport need to be cleaned and disinfected before and after each day's use.
- All instruments or equipment, such as restraint snares, sharp objects, feeding and water troughs, that are likely to come into contact with pigs and their secretions should be maintained at the farm and not moved or shared between farms.

3.5. Deliveries and supplies

- Where the farm premises allow, appropriate demarcations must be made for the arrival of supplies in wheelbarrows, trucks, car boxes, motorbikes etc.
- Smallholder farmers should ensure that non-organic supplies either bought or received are safely sprayed with a disinfectant.

3.6. Personnel and training

- Movement of people in and out of the farm areas, including family members and other caretakers, increases the risk of transferring ASFV into holding units.
- Family members or workers and visitors must be made aware of biosecurity measures in place to minimize the risk of ASFV introduction into the farm. This can be done by placing visible signposts with appropriate messages at suitable locations. The messages should be in local languages, and images should be striking so as to attract attention.
- Outsider farmworkers and family members who tend to the pigs must keep separate clothing and shoes on the farm and change into these when on farm. Where possible, a changing area must be located under or at the back of the house of the farmer. A demarcation must be visible to prevent any overlap of the dirty and clean area. Farmworkers and family members who tend to the pigs must then wash their hands with soap and water to ensure that no tool or animal is handled with contaminated hands. If the pig living area overlaps human living area, it is recommended to use of footbaths at all entrances at all times.

3.7. Wildlife, insects and hunting

- Soft ticks have yet to be implicated in the ASFV spread in Asia. However, it is recommended that smallholder farmers put in place prevention or control measures against ticks as good herd management.
- Best practices for keeping ticks out of pig holding facilities include maintaining facilities in good repair and good sanitation together with tick control.
- Free-roaming domestic animals, mostly poultry and livestock, could potentially come into contact with ASFV-infected food materials or carry ASFV on their coats, hooves, pads, claws, etc., and spread the disease to pigs. Pig holding units and pastures must be adequately secured, preventing access to companion, wild and free-ranging animals.
- As a preventive measure, calcium hydrate (slake lime) may be spread around the perimeter of the farm premises, especially if free-ranging pigs and wild boar are prevalent in the locality. The slake lime powder that has been spread should be continuously checked and renewed (Matsuzaki *et al.* 2021).

3.8. Manure management

- ASFV can remain viable for long period in oronasal fluids, urine and faeces. Therefore, careful disposal of pig manure must be considered when designing and implementing biosecurity programmes.

- Transformation of pig manure in biogas on site is encouraged.
- Manure should not be stored nor spread outside the farm. Proper manure management and slurry treatment involve safe transport to crop farms or dumping and covering up in dugouts.

3.9. General cleaning and disinfection

- For prevention of ASFV introduction, cleaning to remove all organic matter such as manure, urine, straw and bedding, etc., is an important step prior to disinfection.
- Veterinary authorities at all levels and farmer cooperatives or producer associations should invest in training smallholder farmers in this regard. It is essential that a detailed approach to the cleaning process is taken. Each piece of equipment, holding unit and hidden areas should be thoroughly cleaned of all organic matter using detergent where necessary before applying disinfectants.

4.

Biosecurity recommendations during an outbreak (for veterinary authorities)

Biosecurity protocols are essential in controlling and containing ASF outbreak situations. ASF-outbreak response may involve engagement with ASFV-infected, ASFV-contact or non-infected premises within a country or zone. It is essential that response personnel are careful not to spread the virus. Individual countries may follow their national ASF-response plans where they exist. However, the biosecurity protocols implemented must be tailored to smallholder pig production units, considering all transmission-risk pathways along the pork value chain.

4.1. Identification of infected areas, premises or zones

- After infected premises in an ASF outbreak are identified, all control efforts and measures must be focused on these locations in a rapid containment effort.
- Strict measures in infected premises and their surrounding areas should target smallholder systems, especially in preventing contact between free-roaming pigs and wild boars.
- Where holding units are lacking, practical and humane tethering methods may be used. These are vital in order to prevent contact with free-roaming pigs, wild boars and soft ticks. Smallholder farms with fencing should reinforce their confinement during outbreaks.

4.1.1. Zoning

-

- Whatever control strategy is used, measures must be taken to ensure that maximum cooperation from farmers is achieved. This is key to minimizing the occurrence of smuggling of pigs and pig products that may be potentially infected with ASFV.
- The veterinary authorities should make it possible for premises with no epidemiological links to the infected, dangerous-contact premises and high-risk premises to obtain special permits to move pigs to slaughterhouses under strict biosecurity conditions.

4.3. Pre-movement recommendation for live pig transport

- Only pigs from ASFV-free zones, areas or premises, including control areas with the appropriate permit, may be transported to other farms. Prior to transport, pigs should be segregated for a minimum of 15 days to assure freedom from ASFV. This is essential as sub-clinical signs may be missed.
- Farm of origin of pigs, however, should ensure that the minimum biosecurity conditions are met during transport under the strict supervision of the veterinary authorities.
- Trucks must only use routes designated by the veterinary authorities, if any, and keep stoppages at a minimum, if at all.

5.

Recommendations for pig slaughter in infected areas

- Slaughter activities during and related to active ASF outbreaks have the potential to increase the rate of ASFV spread, especially in the absence of meat inspection services by the veterinary authorities.
- Slaughterhouse workers, butchers providing services to individuals, and smallholder farmers who slaughter their own pigs could be contaminated, therefore act as fomites for ASFV spread.
- Slaughter points should be located sufficiently away from pig holding units and be part of a process with a one-way flow from dirty areas (where pigs are stunned and slaughtered) to clean areas (final dressing and cutting).
- The veterinary authorities should ensure that carcasses intended for sale are distinctly marked with a seal and awareness created in the general public. This will help control the panic-slaughter of infected pigs for meat.

- At household slaughter points, farmers should be persuaded through effective awareness creation and training on the identification of clinical signs before slaughter.
- Slaughterhouses must ensure the thorough cleaning and disinfection of all transport vehicles (inside and outside) that bring pigs to their premises, paying special attention to the wheels, internal surfaces in cabs, hidden areas and undersides.
- Slaughterhouses must control access and movement of personnel within their premises. Staff should be prohibited from visiting pig farms and hunting.

5.1. Household slaughter

- Veterinary authorities should ensure that all meat for human consumption originates from animals slaughtered in approved slaughterhouses, under the supervision of a field officer.
- The practice of local butchers who move from one premise to another to slaughter pigs should be avoided. During village festivities, each household usually slaughter a pig for home consumption and a local butcher can be called in to service these households. A village plan can be designed to call in a veterinary authorities to inspect the pigs and plan how home slaughter would proceed to include regulating the movement of the butcher or designate more butchers to service one household at a time.
- Home slaughter of pigs (more than one head) for commercial sale should be strictly prohibited.
- Smallholders who home slaughter for their own consumption should ensure that:
 - only healthy pigs with no clinical signs are slaughtered;
 - slaughter takes place at a sufficient distance from pig holdings on a hard surface that is easy to drain, clean and disinfect;
 - cleaning and disinfection occur following slaughter; and
 - no illegal movement of the carcass or meat occurs.
- The smallholder farmers, butchers, middlemen and buyers must be trained to raise awareness of why home slaughter for commercial sale is prohibited and that continuing this practice has possible consequences on disease spread.
- The veterinary authorities should make the process for registration of slaughter establishments practical and feasible to ensure uptake by local traders.

5.2. Transport to slaughter points

- Smallholder farmers who have a direct link to slaughterhouses and who transport pigs directly should obtain the necessary certification from the veterinary authorities.
- Trucks, trailers and bicycle-powered carts should be thoroughly cleaned and disinfected in between transport uses.
- Destination slaughterhouse should have a layout that makes delivery possible with minimal to no contact with other trucks. The unloading points at the slaughterhouses should not be a mixing point for various vehicles, drivers and pigs.
- If possible, slaughterhouses should provide a means of disinfection for every vehicle before entry to the unloading area as well as at the exit.
- Transport vehicles must be thoroughly inspected by the farmer or a dedicated helper at the designated loading area. Farmers, drivers and their helpers must be made aware of the movement limitations in place, if any, and the approved routes that preferably avoid infected zones. The origin farm must be in constant communication with the destination slaughter point until safe arrival.

5.3. Disinfection of slaughter points

- It is essential that education and training programmes specific for slaughterhouses and ASFV biosecurity are organized for all workers and management of slaughterhouses.
- The management of a slaughterhouse should document their biosecurity routine into a detailed cleaning programme which takes into account the particular context of the slaughterhouse, including ensuring:
 - There is a dedicated cleaning and disinfection team with everyone clear on their roles and responsibilities.
 - There are appropriate channels for reporting and restoring irregularities.
 - Clear principles of cleaning and disinfection are outlined.
 - All workers are involved during and after carcass processing.
- Slaughterhouse management should ensure cleaning and disinfection (no skipping of these processes). Due consideration should be given to energy requirements depending on the slaughterhouse type. Home and open slaughter areas may often use manual cleaning.
- Staff and cleaning personnel should be properly trained on the appropriate cleaning and disinfection process, especially on how to use existing tools and equipment.
- Specific cleaning and disinfection procedures should be established into a routine that follows from pre-cleaning, cleaning and disinfection, and post-cleaning and disinfection activities.

6.

Restocking in infected and dangerous-contact premises

- Following the identification of infected and dangerous-contact premises, all pig populations within the area must be slaughtered immediately, followed by appropriate carcass disposal and decontamination procedures.
- The veterinary authorities must show, with reasonable certainty, that these previously infected and contact premises are no longer at risk of ASFV.
- The infected and contact premises must then be left empty for at least 40 days if no vectors are linked to the outbreak in those premises.
- After the destocking period elapses, farmers may, under the supervision of the veterinary authorities, then restock their farm premises with healthy ASF-free pigs as per restocking procedures.
- The veterinary authorities may introduce sentinel pigs at 10 percent of the normal stocking capacity of these premises to minimize the risk of ASFV recurrence. Where this is not possible, farmers should be allowed to purchase the number of sentinel pigs they can afford.
- These sentinel pigs must be monitored by the veterinary authorities for ASFV for at least six (6) weeks before the green light for full restocking. ASFV surveillance of fully restocked farms should continue as long as the risk of virus reintroduction is possible.
- In ASFV situations where investigations have established the involvement of soft tick vectors (not proved yet in SEA), repopulation should be restricted until a veterinary authority has supervised the total elimination of soft ticks and other vectors from the premises.
- Restriction on restocked farms should only be eased, when all decontamination and sentinel surveillance have been validated by the veterinary authorities, with a minimum of 60 days after restocking.

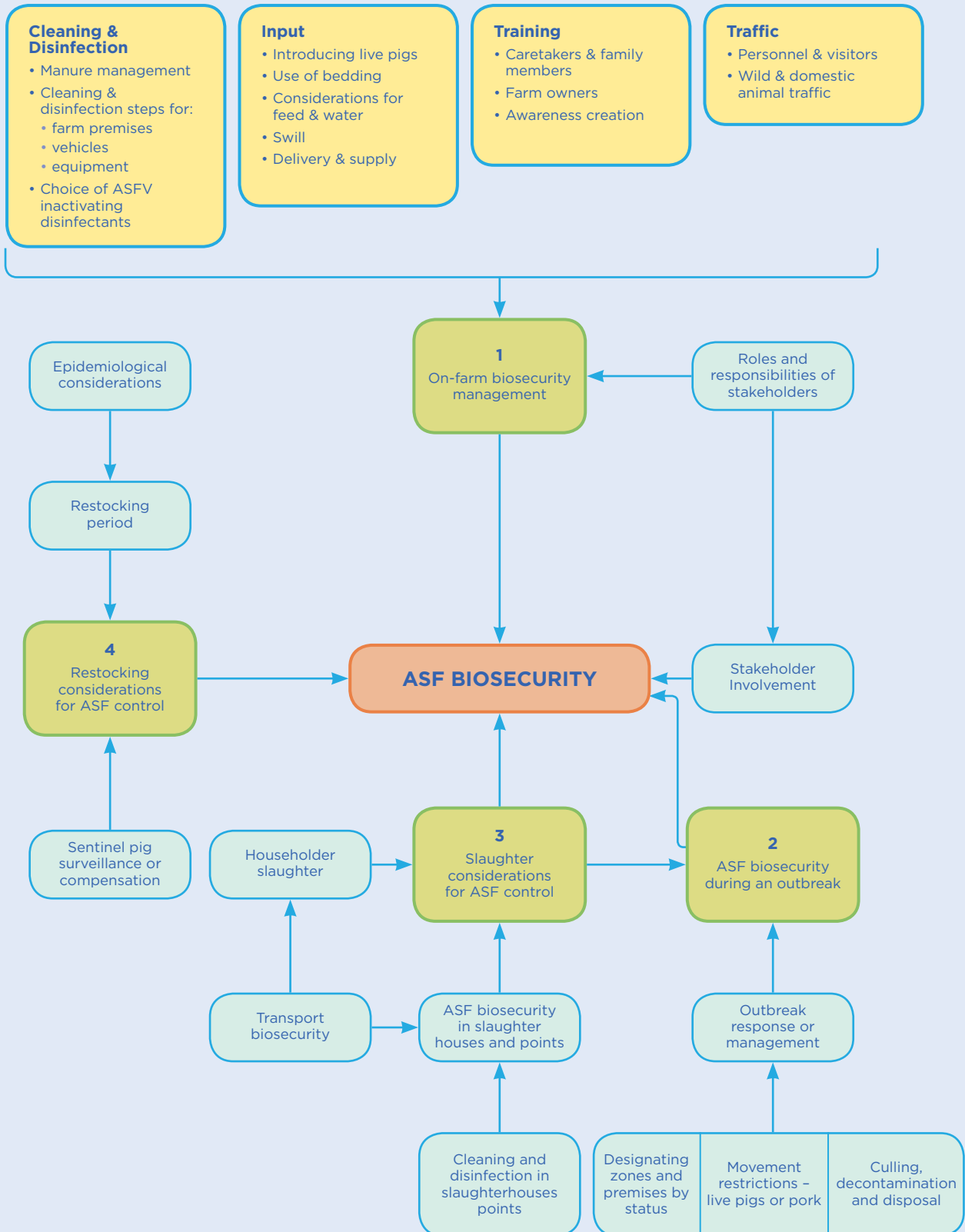
7.

Future considerations for sustainable ASFV biosecurity

These guidelines on biosecurity, restocking and slaughter practices in smallholder pig farming systems are designed for use by national or central veterinary authorities (to be referred to as veterinary authorities), farmers and relevant stakeholders of the Southeast Asian pig industry.

They provide guidance on the best biosecurity management practices and related activities in smallholder premises or villages, such as movement and slaughter of pigs to prevent and control the spread of the African swine fever virus. The recommended minimum best practices reflect the intricacies of the smallholder pig marketing chains, taking into account socio-economic factors and behaviours that may affect their uptake. It is expected that applying these measures together with existing standards for infectious disease prevention and control will result in an overall increase in agricultural productivity and improve livelihoods.

Mindmap





1 Introduction

Biosecurity practices are essential for maintaining a healthy pig herd in smallholder systems, and for disease control and elimination purposes. Although existing basic biosecurity measures may protect against other infectious diseases, the prevention of the introduction and spread of ASFV along the pork value chain requires more robust biosecurity measures (FAO, 2010). These measures should be feasible, cost-sensitive and implementable by smallholder pig farmers and associated actors along the pork value chain (FAO, 2010).

Good biosecurity measures are developed based on knowledge of the disease's epidemiology (Bellini *et al.*, 2016). These include the biology of the pathogen, the environmental survivability of the pathogen, modes of infection and duration of the shedding of the pathogen (Bellini *et al.*, 2016; FAO, 2010). General biosecurity principles apply to all farming systems and diseases. However, to be efficient for prevention and control purposes, practical biosecurity measures must take a targeted approach considering the disease, livestock species and the farming system involved (Bellini *et al.*, 2016; FAO, 2010). Implementation of biosecurity measures in smallholder production settings is particularly challenging. Generally, the uptake of good biosecurity practices is mostly influenced by the socio-cultural characteristics of the target audience.

Since 2009, the Food and Agriculture Organization of the United Nations (FAO) has supported the development of biosecurity guidelines specific to pig production to help control infectious swine diseases in developing countries. These include *Good Practices for Biosecurity in the Pig Sector* published by FAO, World Organisation for Animal Health (OIE) and the World Bank, and the three-volume *Swine Health Management*, which was published to improve the efficiency of swine diseases management in smallholder settings in Asia (FAO, 2012). This is in keeping with the FAO's mandate to ensure agricultural productivity, food security and improved local economies and livelihoods. Subsistence, smallholder pig production systems are essential to the socio-cultural identity of Southeast Asia (FAO, 2012, 2020). This makes the impact of ASFV on the region's pig population particularly devastating, with far-reaching global consequences for food security (FAO, 2020). The abundance of smallholder systems in the region, often with minimal to no biosecurity, sustains the spread of ASFV. Therefore, it is imperative that prevention and control efforts at the smallholder farming systems are focused on ASF-specific biosecurity practices (FAO, 2012).

1.1. Definition of biosecurity

Biosecurity refers to the set of management and physical measures intended to mitigate the risk of introduction, maintenance and dissemination of animal diseases, infections, or infestations to, from and within animal populations (OIE, 2019c). At the smallholder pig production level, the concept of biosecurity translates into any practice that protects farmers' investments by preventing diseases in their pig herds. Basic biosecurity is essential for sustainable livestock production and food security. By undertaking good biosecurity routines, smallholder pig farmers can sustain their market chains while contributing to the national ASF control strategy (Deka *et al.*, 2014; FAO, 2010).

Biosecurity involves strategic decision making, investment, management and the use of equipment and personnel (USDA & CFSPH, 2016). It requires the oversight of veterinary authorities for enforcement, training, and motivation of farmers and relevant stakeholders. In accordance with the Terrestrial Animal Health Code, an effective biosecurity measure capable of protecting a herd against infectious diseases will require a strategic plan (OIE, 2019c). The plan must provide solutions to managing high-risk entry -routes, attitudes, practices and behaviours that favour disease entry, maintenance and dissemination (Bellini *et al.*, 2016; Jurado *et al.*, 2018).

ASF control is especially problematic in countries with complex internal trade networks (Bellini *et al.*, 2016). Moreover, the existence of porous land borders permits illegal cross-border movement of pigs and pig products (Deka *et al.*, 2014).

This document outlines practical biosecurity measures that can be applied in smallholder pig productions to the minimize ASFV spread across Southeast Asia. These measures aim to keep ASFV out of farms, prevent it from circulating within farms and finally prevent the virus from spreading to neighbouring holdings if present. The three overlapping components of biosecurity: bio-exclusion, bio-management and bio-containment constitute the main principles underpinning the measures recommended in these guidelines. Practical recommendations adapted to the needs of smallholder pig production are outlined below.

Bio-exclusion

Bio-exclusion is concerned with the practical measures taken to prevent the introduction of ASFV into a pig farm (Levis & Baker, 2011). For most livestock producers, bio-exclusion is the principal focus when implementing biosecurity measures. The measures are based on the entry pathways of pathogens. While some pathways are common between pathogens, some are specific to ASFV. Therefore, bio-exclusion can be more specialized by identifying specific routes of ASFV entry. This document provides practical bio-exclusion recommendations applying for ASFV. This enables them to identify possible pathways of disease entry and appropriate mitigation measures. Appropriate fencing, use of footbaths, personnel control and isolating new stock are typical bio-exclusion examples (Levis & Baker, 2011).

Bio-management

The bio-management component of biosecurity deals with controlling the immediate farm environment to prevent the establishment of a pathogen or to preserve the sanitary conditions of the farm premises (Levis & Baker, 2011). It may be considered the internal biosecurity of the farm. Bio-management is comprised of several measures, such as cleaning and disinfection, demarcation of clean and dirty areas, and proper waste management, that may be implemented together or in isolation (Levis & Baker, 2011).

Bio-containment

The most neglected of the biosecurity components, bio-containment ensures that the spread of the disease agent to neighbouring farms is prevented. Implementation of bio-containment measures will limit the spread of diseases to other farms in a locality (Levis & Baker, 2011). In smallholder pig production settings, such as a village, bio-containment is an essential practice that benefits all farmers. Measures used to ensure bio-containment on a small-scale farm include fencing and safe transport of pigs from one holding to another (Levis & Baker, 2011).



2 Roles and responsibilities of stakeholders in ASF biosecurity in the Southeast Asian pig industry

Effective biosecurity geared towards the prevention and control of ASF at the smallholder level will require an effective collaboration between all actors in the pork value chain and veterinary authorities (FAO, 2017). Enrolment of pig farmers into national ASF biosecurity programmes will contribute towards prevention and control of the disease both at the national and international levels. Farmers should be also enrolled in community-based biosecurity programmes and/or clean chain systems. This will allow smallholder farmers to benefit from the resulting improvement in pig production and trade opportunities mostly at the local level (Deka *et al.*, 2014).

The implementation of biosecurity practices suitable for smallholder pig producers is a complex process of education leading to the adoption of behavioural changes that will mitigate ASF risks (Deka *et al.*, 2014; FAO, 2010). Biosecurity practices must be aligned with the motivations of all relevant stakeholders, i.e. smallholder pig producers, veterinarians, veterinary authorities, cooperative societies and market actors in the smallholder pig value chain. Biosecurity practices must be presented in such way that it offers clear short-term risk management benefits that stimulate interest in their application while encouraging investments (FAO, 2010).

2.1. National/central veterinary authorities

The role of the national/central veterinary authority (to be referred to as veterinary authorities) is to develop, maintain and enforce practical biosecurity measures in partnership with the primary implementers and actors along the pig value chain at the farm, regional and national investments (FAO, 2010).

Roles of of the veterinary authorities at the smallholder pig production level

Specific roles of the veterinary authorities at the smallholder pig production level include (OIE, 2017):

- 1 Responsibility for developing biosecurity programmes with clear and simple risk-management measures. The programmes must offer immediate and sustained benefits.
- 2 Development of promotional messages on main biosecurity measures such as farm hygiene, routine quarantine of new introductions, isolation of sick animals, managing the risks of feeding uncooked food scraps to pigs and promotion of the importance of keeping accurate records of animal health events.

- 3 Responsibility for encouraging local collaboration between government veterinarians, field officers, farmers and producer associations. This should create an avenue for relevant stakeholders to build capacity on acceptable smallholder biosecurity practices. This includes the training of trainers who will then pass on the knowledge to primary implementers of biosecurity measures.
- 4 Assessment and sharing of lessons learned regarding best practices of on-farm biosecurity across countries, including the benefit of stakeholder collaboration.
- 5 Responsibility for the control measures following an outbreak of ASFV. The veterinary authority designates zones and premises as infected, dangerous-contact or free, and ensures that sanitary standards are enforced.

2.2. Producer associations and non-governmental organizations

Smallholder farmers typically do not belong to production associations or quality assurance schemes and are mostly non-professional producers (Correia-Gomes *et al.*, 2017). This directly results in limited knowledge and awareness of the legislation and statutory requirements put in place by veterinary authorities. The absence of strict quality assurance obligations at this level means that some farmers are not convinced of the importance of implementing biosecurity and management practices (Correia-Gomes *et al.*, 2017). To increase adoption of biosecurity measures, NGOs may organize sessions to train farmers on the biosecurity measures recommended by the veterinary authorities. Farmers must also be encouraged to join local producer associations or clean chain systems, which serve as peer support systems that influence farmers to implement appropriate biosecurity measures.

2.3. Veterinarians and field officers

Government veterinarians or field officers (or provincial officers or technicians) represent the veterinary authorities at the local level and assist farmers on the implementation of biosecurity measures (OIE, 2017). They provide expert opinion on the risk of ASFV to farms within their zones based on the assessment of farm sites, exposure to risk factors and health management of pig herds. They also advise farmers on the best measures for practices, such as cleaning and disinfection, to help manage risks and help secure the farmers' investments.

Some veterinarians, especially those in private practice or extension workers, represent production associations to ensure that quality assurance schemes are in place. In such cases, veterinarians and paraprofessionals may work directly with the veterinary authorities to ensure that farmers are adequately trained and that ASFV transmission risks are reduced between farms. As veterinary field officers may be in short supply in some countries within Southeast Asia, veterinary authorities may liaise with NGOs to help train local farmers on the sustainable implementation of biosecurity good practices at the smallholder level.

2.4. Smallholder producers (farmers)

Farmers at the smallholder production level are at the centre of the collaboration between the veterinary authorities, producer associations, veterinarians and paraprofessionals. They are primarily responsible for protecting their pigs from ASFV and are generally the principal biosecurity officers for their farms. Smallholder pig farmers aim to ensure their investments are secure from the risks of ASFV by implementing ASFV-specific biosecurity guidelines issued by the veterinary authorities. The farmers must ensure that they and their helpers receive regular training on practical biosecurity measures.

Practical biosecurity measures at the smallholder level must consider the nature of the production system, the behavioural pattern of the local farmers, cost and, finally, the ease of implementation to be effective (FAO, 2010). However, in the event of an ASF outbreak, there will be a need for more aggressive measures by the veterinary authorities to ensure appropriate control. By accepting and implementing biosecurity programmes, smallholder pig farmers contribute to the control of ASFV and other endemic pig diseases at the national level, thereby contributing to productivity and economic stability.

2.5. Paraprofessionals (village veterinary workers or community animal health workers)

Paraprofessionals, commonly known as village veterinary worker or community animal health workers in several Southeast Asian countries, are trained in extending animal health assistance to smallholder farmers. They are considered private practitioners attending to the needs of smallholder producers whether in administering drugs or vitamins, giving advice and even reporting unusual animal health findings to the veterinary authorities. Paraprofessionals visit several households in a village in one day to earn adequately from the services extended to farmers. With ASF, visits should be limited to observing proper downtime (48-hour break) with proper biosecurity measures observed during the visit so as not to spread the disease to other farms.



3 ASF minimum biosecurity requirements for smallholder pig farms

ASFV-specific biosecurity plans for smallholder pig production settings encompass appropriate bio-exclusion, bio-containment and bio-management measures (Delsart *et al.*, 2020). The measures outlined below constitute the main biosecurity recommendations for smallholder pig farms. However, this is not exhaustive, as biosecurity does not have a 'one size fits all' solution. Locations, premises and behaviours may differ between smallholder farms; hence, there is the need to adapt these and other recommendations to each specific farm setting, taking into account the prevailing ASF risks. Potential ASFV sources as a threat to smallholder pig systems are presented as below:

Potential ASF virus sources as a threat to smallholder pig systems.



3.1. Introduction of new pigs into a herd

- Farmers should obtain as much as possible replacement pigs from trusted ASF-free sources (Bellini *et al.*, 2016; Jurado *et al.*, 2018; SPS, 2019). The veterinary authorities should be able to provide a list of recommended ASF-free genetic companies or suppliers in good standing.

- Good biosecurity measures must be ensured before, during and after transportation from the supplier to farmers. Vehicles, motorcycles and pig cages used must be cleaned and disinfected thoroughly (SPS, 2019).
- If space is available, smallholder farmers should designate an area well outside of the pig yard for offloading. If no space is available, transport carts and pigs should be cleaned before bringing them to the designated pens.
- New arrivals should be isolated in a different pen or area on the farm or house premises and observed for signs of disease for a period of 14–30 days (DEFRA, 2020; SPS, 2019). Good health management practices include daily record keeping of morbidity and mortality. After the farmer is satisfied with the new arrivals health status, they can be added to the main herd (Levis & Baker, 2011).
- Ideally, no more additions should be made to newly introduced pigs until the period of quarantine elapses.
- To minimize the risk of introducing ASFV into the herd, smallholder farmers should limit the frequency of introduction of new pigs into existing herd (SPS, 2019). If possible, farmers can structure their farms and plan in such a way that pigs are brought in batches, reared and sold out.
- Use of shared boars is not recommended except in a clean chain system. In such a system, the measure for the introduction of a new pig into a herd should be implemented at each movement of the shared boar.

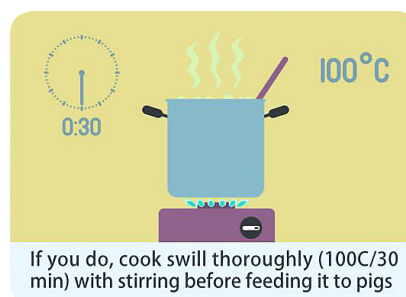
KEY POINT

New arrivals should be isolated in a different pen and observed for signs of disease for a period of 14–30 days. Good health management practices include daily record keeping of morbidity and mortality. After the farmer is satisfied with the new arrivals health status, they can be added to the main herd.

3.2. Feed and water

- Feed material could easily be contaminated if not stored properly. Wild boars, free-ranging pigs, birds, rodents and other wildlife may access and contaminate the supply. This can serve as a point of introduction and transmission of infectious pathogens (Bellini *et al.*, 2016; FAO, 2010; Jurado *et al.*, 2018).
- Bagged feed should be placed in sealed containers or in storage areas that rodents cannot access (Bellini *et al.*, 2016; Jurado *et al.*, 2018).
- Measures must be in place to ensure that spillage is cleared immediately to minimize the attraction of rodents and other wildlife (FAO, 2010).
- Feed material such as grains, crops, vegetables, hay and straw have minimal risk of ASFV contamination. However, if the local situation raises concerns of ASFV risks, then it is not recommended to use fresh feed material. Feed material should be sun-dried for at least 30-days to deactivate the wildlife (FAO, 2010).

- Feed materials transported to the farm should be delivered to the designated area (Bellini *et al.*, 2016), which is usually at the front door of the house or storage area. Feed bags brought directly from the supply store by the smallholder farmer should be brought directly to the storage area.
- As much as possible, the veterinary authorities and the paraprofessionals should encourage smallholder farmers to use feed from reputable companies (European Commission, 2020).
- Smallholder farmers must be encouraged to use agricultural waste or by-products to feed their pigs instead of resorting to swill.
- Under circumstances where swill has to be used for feed, it must be cooked at the boiling point for at least 30 minutes to deactivate the virus (European Commission, 2020) and then cooled down before feeding to the pigs.
- The veterinary authorities or the paraprofessionals should provide training for farmers on practical ways to prepare swill or forages for their pigs.
- Veterinary authorities must collaborate with local authorities to put measures in place that ban farmers from allowing their pigs to roam to feed. Pastures and forages used by free-ranging pigs are dangerous areas and may be contaminated with virus (European Commission, 2020).
- Ensure access to a clean water source and, if water is to be stored, storage containers must be covered tightly (FAO, 2010; Jurado *et al.*, 2018).



KEY POINT

Feed material such as grains, crops, vegetables, hay and straw have minimal risks of ASFV contamination. However, if the local situation raises concerns of ASFV risks, then it is not recommended to use fresh feed material. Feed material should be sun-dried for at least 30-days to inactivate the virus.

3.3. Bedding

- Bedding material for confined pigs, much like feed and water, can introduce ASFV into a healthy herd. It is established that sawdust, wood shavings and straw can carry other pathogens as tightly (European Commission, 2020).
- Bedding must be stored away from the open weather and be out of reach of wild boar, free-ranging pigs and insects. Bedding may be packaged in sacks or bags, sealed or tied strongly, and stored on a roof or wall.
- If a straw is used as bedding, the farmer should be sure of the origin. Preferably coming from a source that is not exposed to wild boars, free-ranging pigs, or other livestock.
- Likewise, if bedding is to be purchased, the farmer should be aware of its origin to ensure that the suppliers have trucks or trailers dedicated to bedding transport (Levis & Baker, 2011).
- If possible, avoid sourcing straw or bedding material originating from an area where ASF has been reported (European Commission, 2020). If ASF is endemic in the area, source the material on site or as close as possible of the farm.

3.4. Vehicles and equipment

- Drivers and their vehicles used for transporting pigs or feed items constitute a significant risk for the spread of ASFV.
- Veterinary authorities must collaborate with stakeholders involved in the local pig value chain to offer training for drivers and middlemen on biosecurity measures. This should include proper disinfection methods and safe farm-to-farm movement to prevent the spread of ASFV.
- Drivers should be responsible for strictly adhering to standard biosecurity routines and have proper measures in place when transporting pigs to farm premises.
- Drivers should stay at the house entrance of farms or in areas away from where the pigs are kept when making deliveries. If it becomes necessary to interact with farmers, it should be done at a safe distance to prevent close contact.
- Vehicles, motorbikes, carts and all other means of transport need to be cleaned and disinfected before and after each day's use.
- All instruments or equipment that are likely to come into contact with pigs and their secretions, such as restraint snares, sharp objects, and feeding and water troughs, should be maintained at the farm and not moved or shared between farms.
- Where some equipment has to be shared by farmers, it needs to be thoroughly cleaned and disinfected between uses.

KEY POINT

All instruments or equipment that are likely to come into contact with pigs and their secretions, such as restraint snares, sharp objects, and feeding and water troughs should be maintained at the farm and not moved or shared between farms.

3.5. Deliveries and supplies

- Smallholder farms should ensure that non-organic supplies bought and/or received is safely sprayed with disinfectant.
- Where the farm premises allow, appropriate demarcations must be made for the arrival of supplies in wheelbarrow, trucks, car boxes, motorbikes etc.
- Smallholder farmers should consider allocating part of their home for supplies and consumables where they can be inspected and disinfected before safe biosecure transport to the farm premises.
- Smallholder farmers may not own most general tools and equipment needed by service personnel; hence they must ensure that all tools and equipment of service personnel are cleaned and disinfected.

3.6. Personnel and training

- Movement of people in and out of the farm premises, including family members and other caretakers, increases the risk of transferring ASFV into holding units.
- Family members or workers and visitors must be made aware of biosecurity measures in place to minimize the risk of ASFV introduction to the farm. This can be done by placing visible signposts with appropriate messages at suitable locations. The messages could be in local languages, and images should be striking to attract attention.
- Directional sign posts indicating where to walk could also be posted so that caretakers do not go back and forth from one pen to another.
- Access to the farm and holding units should be largely limited to the farmer and caretakers. These key workers must understand their actions are important in preventing transmission of ASFV. They should be reminded to desist from visiting other pig farms, hunting and avoid handling pigs from other farms.
- Footbaths should be provided at the entrance of the farm and at the holding units. Signposts should be at these entrances directing people to dip their foot into a disinfecting bath. If signs are not available, caretakers should make sure to instruct individuals to do so.
- Anyone entering the farm should not have been in contact or entered another pig holding unit within the last 48 hours. Paraprofessionals should be reminded of this important protocol.
- Admission of visitors into the pens should be prohibited.
- For visits aimed at pig buying purposes, the farmer may meet the buyers at his house entrance or at a distance from the farm. Buyers are likely to be moving from farm to farm and pose a high risk if allowed into the premises. With the advent of technology, farmers could take or even livestream pictures of pigs for sale for viewing by the buyer.
- Outside farmworkers and family members who tend to the pigs must keep separate clothing and shoes on the farm and change into these when on farm. Where possible, a changing area must be located under or at the back of the house of the farmer. Helpers from out the farm must wash their hands with soap and water before entry to ensure that no tool or animal is handled in a way that could introduce infection.

- If the pig living area overlaps human living area, it is recommended to use of footbaths at all entrances at all times.
- Veterinary authorities and producer association training programmes should emphasize these measures involving personnel in their biosecurity training programmes. Farmers must be trained on proper cleaning and disinfection procedures for their footwear and equipment after working in the pig farms.



KEY POINT

Outside farmworkers and family members who tend to the pigs must keep separate clothing and shoes on the farm and change into these when on the farm. Where possible, a changing area should be located under or at the back of the house of the farmer. Outsiders must then wash their hands with soap and water before entry to ensure that no tool or animal is handled in a way that could introduce infection.

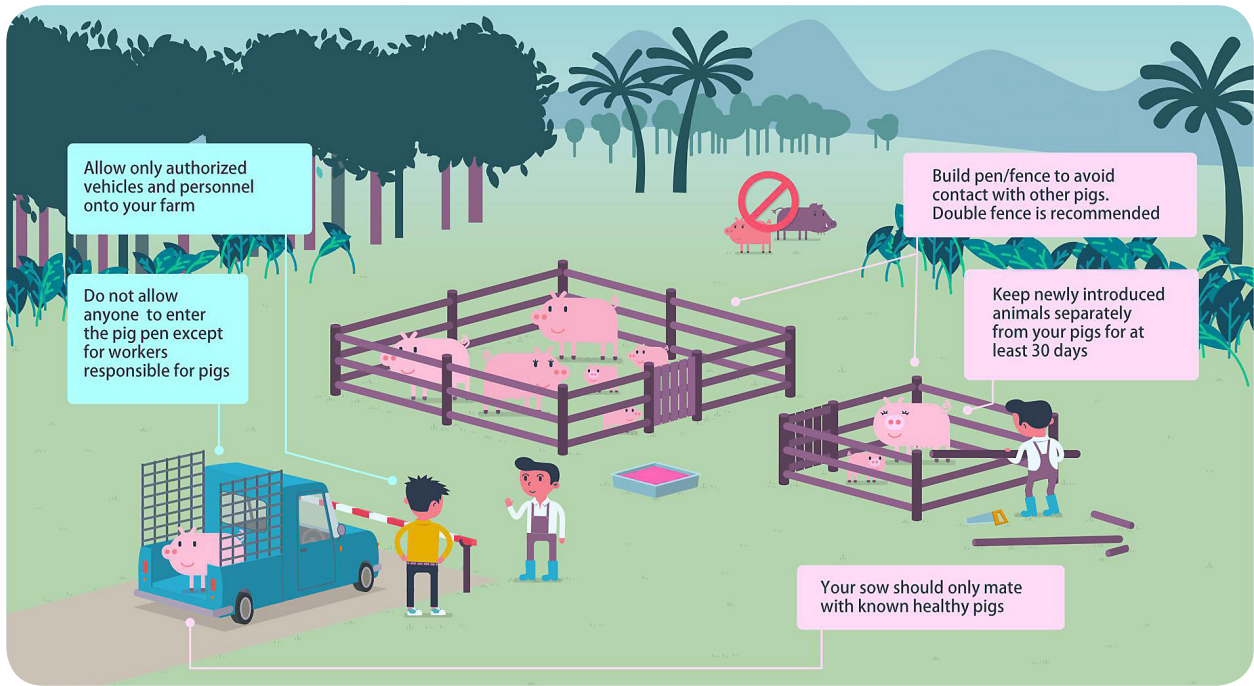
3.7. Wildlife, insects and hunting

- Soft ticks can harbour ASFV for several months to years after feeding on an infected (viraemic) pig. This makes soft ticks capable of sustaining long-term transmission cycles.
- Soft ticks have yet to be implicated in the ASFV spread in Asia. However, it is recommended that smallholder farmers put in place prevention or control measures against ticks as good herd management.
- Best practices for keeping ticks out of pig holding facilities include maintaining facilities in good repair and good sanitation together with tick control.

- Chemical control with topical ectoparasiticides, such as organophosphates (coumaphos, dichlorvos, pirimiphos), pyrethroids (cypermethrin, deltamethrin, flumethrin), macrocyclic lactones (ivermectin) and formamidines (amitraz), is encouraged. Some of the products could be used for bathing or applied as ‘pour-on’ or ‘spot-on’ for the pigs. The advice of a veterinarian must be sought before application.
- Some ectoparasiticides can be formulated for spraying cracks and crevices where ticks may be hiding.
- Farmers should read product labels carefully or consult veterinary officers before using ectoparasiticides.
- Free-roaming domestic animals, mostly poultry and livestock, could potentially come into contact with ASFV-infected food material or carry ASFV on their coats/feathers, hooves, pads, claws, etc., and spread the disease to pigs. Pig holding units and pastures must be adequately secured, preventing access to companion, wild and free-ranging animals.
- If wild boars or other wild roaming suids exist in the locality, farmers or helpers must wash down thoroughly and change clothing and footwear after hunting activities and before going near pig holding units.
- Farmers could alternate with helpers, so those who go on a hunt do not come into contact with domestic pigs for at least 48 hours. Hunting dogs must not be allowed near the pig facility.
- Wild boar slaughter for which its meat is either sold or distributed for consumption must be avoided.
- As a preventive measure, calcium hydrate (slake lime) may be spread around the perimeter of the farm premises, especially if free-ranging pigs and wild boar are prevalent in the locality. Slake lime powder spread should be continuously checked and renewed.

KEY POINT

Soft ticks have yet to be implicated in the ASFV spread in Asia. However, it is essential that smallholder farmers put in place prevention or control measures against ticks. Chemical control with topical ectoparasiticides, such as organophosphates (coumaphos, dichlorvos, pirimiphos), pyrethroids (cypermethrin, deltamethrin, flumethrin), macrocyclic lactones (ivermectin) and formamidines (amitraz), is encouraged. Some of the products could be used for bathing or applied as ‘pour-on’ or ‘spot-on’ for the pigs. The advice of a veterinarian must be sought before application.



3.8. Manure management

- ASFV can remain viable for long period in oronasal fluids, urine and faeces. Therefore, careful disposal of pig manure must be considered when designing and implementing biosecurity programmes.
- Pig manure should not be discharged from holding units into the environment.
- Manure handling equipment should not be shared between farms and sites as it increases the risk of ASFV transmission.
- Manure should not be stored nor spread outside the farm. Proper manure management and slurry treatment involve safe transport to crop farms or dumping, and covering up in dugouts.
- Pig manure can be used to produce biogas. Small biogas plant can be built on the premises (separated from the pig pen/area) or at the village level. The installation of these plants should be done with a training of the farmers to use them efficiently (Roubík *et al.*, 2018).
- All vehicles and equipment used in manure management must be thoroughly cleaned and disinfected. Personnel must clean and wash down appropriately.
- Veterinary authorities should collaborate with NGOs and the government to train farmers on the appropriate use of pig manure for purposes such as crop fertilizer and biogas generation.

KEY POINT

Manure should not be stored nor spread outside the farm. Proper manure management and slurry treatment involve safe transport to crop farms or dumping, and covering up in dugouts. All vehicles and equipment used in manure management must be thoroughly cleaned and disinfected. Personnel must clean and wash down appropriately.

3.9. General cleaning and disinfection procedures

- For prevention of ASFV introduction, cleaning to remove all organic matter, such as manure, urine, straw and bedding, etc., is an important step prior to procedures (FAO, 2010; Levis & Baker, 2011; SPS, 2019).
- Veterinary authorities at all levels and farmer cooperatives or producer associations should invest in training smallholder farmers in this regard. It is essential that a detailed approach to the cleaning process is taken. Equipment, holding units and hidden areas should be thoroughly rid of all organic matter using detergent where necessary before applying disinfectant.
- It is essential that following cleaning and disinfection, equipment or facilities are left to thoroughly dry before use, as ASFV may survive in pockets of moisture and go on to infect pigs.
- Farmers should be encouraged to use concrete floors as it helps to eliminate wastewater and makes disinfection easy.
- Only approved disinfectants should be used and in accordance with the manufacturers' instructions. Veterinary authorities and producer associations or cooperative societies should organize training programmes on the proper use of approved disinfectants capable of eliminating ASFV.
- As accessing disinfectants effective against ASFV may be difficult in rural areas, the veterinary authorities may recommend effective disinfectants and if possible, make them available in the local markets.

KEY POINT

Only approved disinfectants should be used and in accordance with the manufacturer's instructions. Veterinary authorities and producer associations or cooperative societies should organize training programmes on the proper use of approved disinfectants capable of eliminating ASFV.



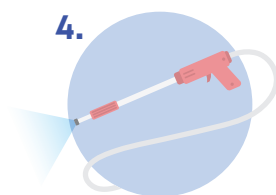
1. Prepare all materials for cleaning and disinfection



2. Remove dirt and grime



3. Scrub using detergent and water



4. Spray with disinfectant



5. Wash all equipment and boots after cleaning and disinfection

THIS IS THE PROPER WAY TO CLEAN AND DISINFECT YOUR FARM

3.9.1. Considerations for cleaning and disinfection

Disinfection will not be effective if the appropriate chemicals are not used. Availability of such chemicals may vary by country. However, veterinary authorities should ensure that chemicals approved by in-country regulatory authorities are available locally and promoted.

Key steps in cleaning and disinfection include (FAO, 2010):

- 1 The premises must be emptied prior to cleaning. Organic materials such as soil, manure, bedding and feed debris must be removed from premises by means such as sweeping, brushing and scrubbing. Organic materials may absorb and reduce the contact area available for the disinfectant to act. Their presence will render the disinfection process ineffective.
- 2 For enclosures with concrete floors, a good drainage system or channels must be in place for the outflow of wastewater.
- 3 Where enclosures have bare ground as the floor, the surface must be rid of as much organic matter as possible, e.g. straw bedding, faecal matter etc.
- 4 Boots should be washed thoroughly to remove all organic material when entering and exiting the pig area. If a footbath is present, the disinfectant solution should be changed frequently.
- 5 For optimal effectiveness, sufficient contact time must be allowed following application of disinfectants. Information on contact time duration should be available on the product's label.
- 6 Effectiveness of disinfectants is generally compromised during the rainy season where the rains can dilute the disinfectant concentration especially if used in footbaths. On the other hand, during the hot season (or summer), disinfectants can evaporate or dry up very quickly. It is good practice to ensure that the footbath is checked regularly.
- 7 It is bad practice to mix on site different disinfectants. Aside from safety concerns, effectiveness will be compromised.
- 8 Safety measures are encouraged at all times when using disinfectants. For example, mixing alkaline and acid disinfectants will neutralise their effect. Instructions given should be followed carefully to avoid injury to self and animals. Rubber gloves and face masks must be worn at all times when using chemicals.
- 9 Following disinfection, holding units should be aerated and left to dry before allowing pigs to enter.
- 10 Allow reasonable downtime following cleaning and disinfection after the last batch of pigs leave before restocking.

3.9.2. Key recommendations for ASFV disinfection

ASFV can remain viable for long periods in blood, faeces, secretions and animal tissue. This must be taken into consideration when choosing a disinfectant effective against ASFV. The aim of disinfection is to deactivate the virus. This can be achieved by physical (heat) or chemical means or a combination of both. The following disinfectant chemicals can be used to disinfect material and hard building structures after thorough cleaning of organic matter. The choice of the chemical will depend on the availability, the cost and the presence of appropriate equipment to apply the chemical. Veterinary authorities or paraprofessional can advise and train farmers.

ASF disinfectant chemicals

Disinfectant	Other specifications
<p>Sodium hydroxide (NaOH); Caustic Soda</p>	<ul style="list-style-type: none"> ■ This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200). ■ Hazards <ul style="list-style-type: none"> □ Causes severe skin burns and eye damage □ May be corrosive to metals □ May cause respiratory irritation ■ Precautions <ul style="list-style-type: none"> □ Wear protective gloves/protective clothing/eye protection/face protection □ Use only outdoors or in a well-ventilated area ■ Environmental considerations <ul style="list-style-type: none"> □ Do not empty into drains. Contains a substance which is harmful to aquatic organisms and hazardous for the environment. Soluble in water. Persistence is unlikely based on information available. Will likely be mobile in the environment due to its water solubility
<p>Hypochlorite (NaOCl, Ca(ClO)₂)</p>	<ul style="list-style-type: none"> ■ Chlorine is effective against ASFV at concentrations of 0.03% to 0.0075%, and a dose response is observed. ■ Category 1 hazard identification ■ Hazard <ul style="list-style-type: none"> □ Hazard statements: may be corrosive to metals □ Causes severe skin burns and eye damage □ Causes severe eye damage ■ The toxicity and corrosivity of Sodium Hypochlorite is a function of concentration. Industrial grades of higher concentrations than household bleach are more toxic and corrosive. ■ Environmental considerations <ul style="list-style-type: none"> □ This material is inorganic and not subject to biodegradation. This material is believed not to persist in the environment. This material is not expected to bioconcentrate in organisms. This material is harmful to fish, invertebrates, amphibians, and plants.

ASF disinfectant chemicals (continued)

Disinfectant	Other specifications
<p>Povidone iodine</p>	<ul style="list-style-type: none"> ■ Povidone iodine 5% is an antiseptic microbicide containing povidone iodine to prevent bacterial infections. Antiseptic microbicide: helps reduce bacteria and viruses. ■ This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200) ■ Hazards <ul style="list-style-type: none"> □ Causes damage to organs through prolonged or repeated exposure □ Causes serious eye irritation □ Causes skin irritation □ Harmful if inhaled □ Harmful if swallowed □ Harmful in contact with skin □ May be corrosive to metals □ May cause drowsiness or dizziness □ May cause respiratory irritation
<p>Potassium tetraglycine triiodide (I3K)</p>	<ul style="list-style-type: none"> ■ Iodine is very effective against ASFV at concentrations of 0.015% to 0.0075%, but a dose response is not observed ■ Hazards <ul style="list-style-type: none"> □ Avoid breathing vapours, mist or gas. Ensure adequate ventilation. ■ Hazardous decomposition products formed under fire conditions. ■ Environmental considerations <ul style="list-style-type: none"> □ Acute aquatic toxicity (Category 3) □ Harmful to aquatic life □ Avoid release to the environment □ Hazardous to the aquatic environment, acute hazard □ Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.
<p>Alkylbenzene sulfonate (C18H29NaO3S): Detergent</p>	<ul style="list-style-type: none"> ■ A detergent is a surfactant or a mixture of surfactants with cleansing properties in dilute solutions. ■ Biodegradability is affected by isomerization, in this case, branching. The linear compound biodegrades far more quickly than the branching compound, making it the safer choice over time. ■ It is biodegraded rapidly under aerobic conditions with a half-life of approximately 1-3 weeks; oxidative degradation initiates at the alkyl chain. ■ Under anaerobic conditions it degrades very slowly or not at all, causing it to exist in high concentrations in sewage sludge, but this is not thought to be a cause for concern as it will rapidly degrade once returned to an oxygenated environment.

ASF disinfectant chemicals (continued)

Disinfectant	Other specifications
<p>Sodium hydroxide and polyethylene oxide mixture</p>	<ul style="list-style-type: none"> ■ Sodium hydroxide 5-10%, Polyethylene Oxide 2.5-5% ■ It is a highly alkaline blend of non-ionic and amphoteric surfactants in an aqueous solution incorporating a sequestrant for superior hard water performance. ■ Hazards <ul style="list-style-type: none"> □ Causes severe skin burns and eye damage. □ Causes severe burns ■ Hazardous decomposition products in fire: Carbon dioxide (CO₂), Carbon monoxide ■ Environmental considerations <ul style="list-style-type: none"> □ The formulation is usually designed for their environmental profile, such as biodegradability. The formulation complies with the biodegradability requirements laid down by the European regulation on detergents (648/2004/EC). □ Do not contaminate surface water. Do not let product enter drains. ■ Disposal: Dilute small quantities to waste water, via a foul sewer or other treatment facility in accordance with local water authority regulations.
<p>Oxone mixture (2KHSO₅·KHSO₄·K₂SO₄)</p>	<ul style="list-style-type: none"> ■ Contains oxone (potassium peroxymonosulfate), sodium dodecylbenzenesulfonate, sulfamic acid, and inorganic buffers ■ The peroxygen-based chemistry provides for a continuously evolving broad spectrum of efficacy against current and emerging disease-causing organisms with specific focus on viral pathogens such as ASF, FMD, and specific strains of HPAI. ■ Hazards <ul style="list-style-type: none"> □ Powder is corrosive. Causes skin burns and irreversible eye damage. Harmful if swallowed, absorbed through skin, or inhaled. ■ Environmental considerations <ul style="list-style-type: none"> □ Biodegradable. No effect on waste treatment plants.
<p>Quarternary ammonium compounds (didecyldimethylammonium chloride)</p>	<ul style="list-style-type: none"> ■ Quarternary ammonium compound is very effective in low concentration of 0.003% against ASFV ■ Components <ul style="list-style-type: none"> □ Didecyldimethylammonium chloride is readily biodegradable □ Alkyl dimethyl benzyl ammonium chloride is readily biodegradable □ Tetrasodium ethylene diamine tetraacetate is not readily biodegradable. □ Ethyl alcohol is readily biodegradable ■ Hazards <ul style="list-style-type: none"> □ Causes serious eye damage □ Causes severe skin burns and eye damage □ Flammable liquid and vapor □ Harmful if swallowed □ Harmful in contact with skin ■ Environmental considerations <ul style="list-style-type: none"> □ Outside of normal use, avoid release to the environment. No adverse impact to the environment is expected when used according to label directions.

ASF disinfectant chemicals (continued)

Disinfectant	Other specifications
Sodium dichloroisocyanurate (C₃Cl₂N₃NaO₃): Bleach	<ul style="list-style-type: none"> ■ Hazards <ul style="list-style-type: none"> □ Causes serious eye damage □ Causes severe skin burns and eye damage □ Harmful if swallowed ■ May intensify fire; oxidizer ■ Environmental considerations <ul style="list-style-type: none"> □ Very toxic to aquatic life with long lasting effects □ Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided. □ Do not release into the environment. Prevent flow of material into water source and begin monitoring available chlorine and pH immediately. Notify all downstream users of possible contamination
Citric Acid (C₆H₈O₇)	<ul style="list-style-type: none"> ■ Hazards <ul style="list-style-type: none"> □ Causes serious eye damage □ Causes skin irritation □ May cause respiratory irritation ■ If this product is involved in a fire, carbon monoxide and carbon dioxide can be released ■ Environmental considerations <ul style="list-style-type: none"> □ Do not allow material to be released to the environment without proper governmental permits. Do not allow undiluted product or large quantities to reach ground water, water course or sewage system. Avoid transfer into the environment.
Formic acid (HCOOH)	<ul style="list-style-type: none"> ■ This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200) ■ Hazards <ul style="list-style-type: none"> □ Causes severe skin burns and eye damage □ Flammable liquid and vapor □ Harmful if swallowed □ May cause respiratory irritation □ Toxic if inhaled ■ Hazardous Combustion Products: Carbon monoxide (CO) Carbon dioxide (CO₂) Hydrogen Thermal decomposition can lead to release of irritating gases and vapors ■ Strong reducing agent. Fire and explosion risk in contact with oxidizing agents. Hygroscopic. heat sensitive. Decomposes to water and carbon dioxide. ■ Keep away from open flames, hot surfaces and sources of ignition. Avoid exposure to moist air or water. ■ Environmental considerations <ul style="list-style-type: none"> □ Contains a substance which is harmful to aquatic organisms. □ Miscible with water. Persistence is unlikely based on information available □ Will likely be mobile in the environment due to its water solubility

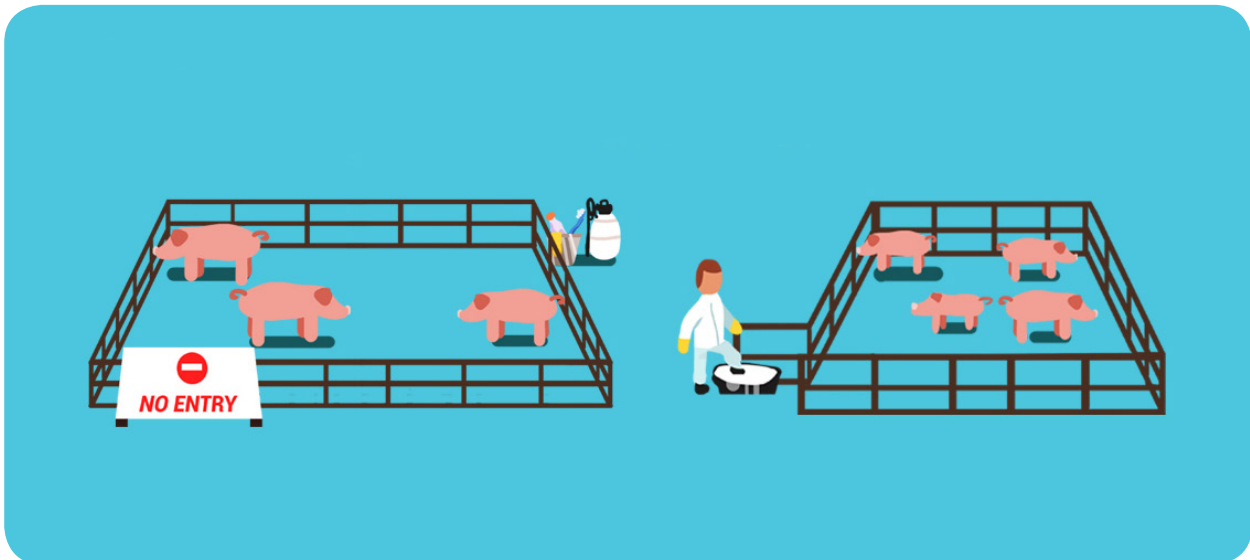
Disinfection of farm premises/pens

- Waste should be promptly removed from the pens to improve the hygiene and sanitation of farm premises.
- There should be a designated area, as far from the pens as possible or a container if space is limited, to temporarily store waste for disposal. If possible, dispose of the garbage right away, or at least every morning.
- The farm premises with its pens, overalls, boots and equipment must be regularly cleaned and disinfected. Usually farmers wear plain house clothes when tending to the animals. After working, farmers should change and place their used work clothes immediately for laundry.
- Applied disinfectants should be allowed enough contact time, taking into account the ambient temperature and safety measures to ensure that disinfection will deactivate the virus.
- Feed waste, manure, bedding must be removed and properly disposed of (refer to the second bullet above) as they may contain high levels of contamination. If not, they may interfere with the action of disinfectants.
- Equipment occupying spaces should be removed, cleaned and disinfected separately as outlined above. The floor beneath must be thoroughly cleaned, washed with detergent and then disinfected.
- Turnover and drain all feeders to allow the surface beneath to be sanitized appropriately.
- If possible, thorough cleaning with hot soapy water with a pressure wash before disinfection is preferable to remove all residues. Alternatively, a good brushing with soap and water could be used.
- Appropriate disinfectants must be used on all equipment and surfaces with which pigs may come into contact.
- A sufficient time must be allowed between cleaning and disinfection of premises before the introduction of new pigs. During the drying period, the use of natural sunlight can enhance the destruction of pathogens hiding in wet, dark crevices.
- Cleaning, laundry of farm clothing and washing of boots should be routine to eliminate stains from blood, faeces, discharges etc.
- All equipment used on sick, isolated animals must be cleaned and disinfected prior to use for a healthy herd.

Footbaths

- Farmers must ensure boots are clean and rid of all organic matter before stepping into disinfectant solutions while entering farm premises. Ideally, 5 minutes in a footbath is enough to guarantee the efficacy of virus deactivation.
- Farmers and their workers must avoid stepping briefly into footbaths and immediately stepping out too quickly (counting down from 60 to one while stepping into a footbath may be a practical way of ensuring that minimum time is spent disinfecting boots while entering farm premises). In many smallholder farms, footbaths are poorly maintained. If footbaths can not be maintained properly, change of footwear at the entrance of the pen should be done. The procedure for using footbaths include:

- Avoiding the use of leaky boots;
- Physically marking and enforcing clean and dirty areas around footbaths; and
- Pre-clean organic matter off boots before stepping into the footbath (using brushes and water). This can help manage the cost, as the disinfectant solution will need to be changed less frequently.



Disinfection of trucks/vehicles/motorbikes

Vehicles, trucks and other means of transport for feed, bedding, live pigs, etc., together with their drivers, present a risk of introducing ASFV into destination farms. These may be privately owned or be commercially running vehicles. The danger occurs when vehicles are used as transport for various supplies between farms. Cleaning and disinfection procedures for different means of transport include:

- All means of transport that come to the farm must be loaded and unloaded at a reasonable distance from the farm perimeter.
- If possible, an area with a hard surface outside must be designated as a cleaning area for all returning vehicles and equipment if privately owned.
- Commercial vehicles should be encouraged to disinfect their wheels between farms using an appropriate disinfectant spray.
- All privately-owned vehicles that are to be parked at a designated part of the household and equipment brought therein must be cleaned, washed and disinfected appropriately and allowed to dry in between uses.
- Areas of vehicles in contact with live pigs during transport must be well-cleaned including wheels, underside and hidden areas.

- The household member or caretaker who does the cleaning and disinfection must not work in the pig pens. If this cannot be avoided, then that worker must wash down, change clothes and disinfect before entering the pens.
- Interior of transport vehicles may be challenging to clean. Farmers may consider using plastic floor mats that are easy to clean, wash and dry. Appropriate disinfectants must be used taking into consideration the material, type and porosity of the vehicle, e.g. wooden, metal or plastic surfaces.
- Smallholder farmers may not be in the position to ask for transport vehicles to be cleaned and disinfected before arriving at the farm premises. The village chief, however, could outline required procedures for cleaning and disinfection at a designated village area that covers the smallholders within that village (Figures 10 and 11). Since a village consists of several households raising pigs, a collective approach led by the village chief could engage with swine traders and other allied groups to cooperate in practicing simple biosecurity measures.

KEY POINT

Smallholder farmers may not be in the position to ask for transport vehicles to be disinfected before arriving at the farm premises. The village chief, however, could outline required procedures for cleaning and disinfection at a designated village area that covers the smallholders within that village. Since a village consists of several households raising pigs, a collective approach led by the village chief could engage with swine traders and other allied groups to cooperate in practicing simple biosecurity measures.



VEHICLE CLEANING PROCEDURE

STEP 1

Wear appropriate personal protective equipment (coveralls, personal protective eye wear, boots and gloves)



STEP 2

Scrape and brush internal and external surface of vehicle, including floor, ceiling, sidewalls and division gates



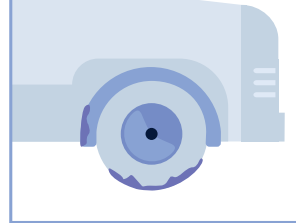
STEP 3

Scrape and the brush surface of loading area/ equipment / cage (if any)



STEP 4

Remove any deposits of mud, straw, etc., from wheels, wheel arches, mudguards and exposed chassis



DETERGENT WASH AND HIGH PRESSURE RINSE

STEP 1

Clean the outside from top down, with attention to wheels, arches and mudguards



STEP 2

Wash internal and external surface of vehicle, including floor, ceiling, sidewalls and division gates



STEP 3

Wash loading area/equipment (if any)



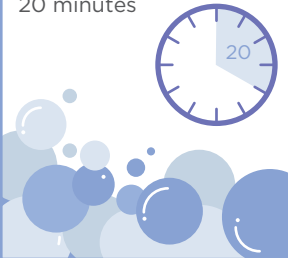
STEP 4

Wash all vehicle equipment and tools



STEP 5

Use detergent to clean the vehicle and leave it on for at least 20 minutes



STEP 6

Rinse all surfaces and equipment with clean water (recommend with high pressure if possible)



STEP 7

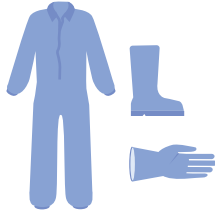
Inspect all internal and external surfaces to ensure they are thoroughly clean



VEHICLE DISINFECTION PROCEDURE

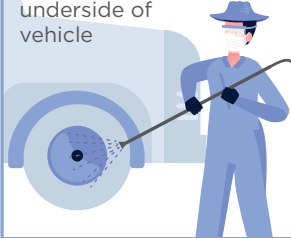
STEP 1

Wear appropriate personal protective equipment (coveralls, personal protective eye wear, boots and gloves)



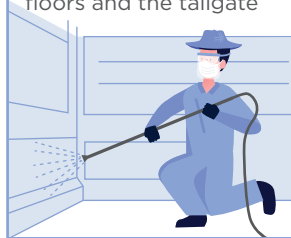
STEP 2

Clean the outside from top down, with attention to wheels, arches and mudguards and underside of vehicle



STEP 3

Inside, starting on top deck and working down, disinfect ceiling, sidewalls, division, floors and the tailgate



STEP 4

Disinfect all vehicle equipment and tools



CAB DISINFECTION AND FINAL STEPS

STEP 1

Remove mats and brush debris and organic matter into a refuse sack for disposal



STEP 2

Wash the cab floor, mats and vehicle pedals



STEP 3

Using a clean cloth soaked in disinfectant solution, disinfect cab floor, mats and floor pedals



STEP 4

Park vehicle on a slope to drain and dry



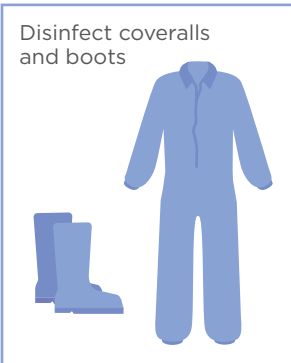
STEP 5

Once the vehicle has been removed, wash away any remaining debris from the area



STEP 6

Disinfect coveralls and boots



3.10. Characteristics of key recommended on-farm ASF-specific biosecurity measures for smallholder pig systems

Biosecurity measures	Effectiveness		Feasibility/practicality		Sustainability	
	Potential effect on reducing risk	Duration/persistence of effect	Potential for rapid and easy implementation	Cost of implementation	Potential to disrupt production	Local acceptance
Introduction of new pigs						
Obtain replacement pigs only from trusted ASF-free sources	+++	+++	++	\$\$\$	--	+++
Clean and disinfect vehicles and carriers before and after pig transport	+++	++	++	\$\$\$	--	++
Designate area for loading and offloading	++	++	+	\$	-	+
Isolate new pigs in a different pen	+++	+++	+	∅	-	++
No new introductions until quarantine period for previous addition elapses	++	+	+	\$\$	---	+
Limit frequency of introduction of new pigs	++	+	+	\$	---	+

+++ Strong positive effect ++ Moderate positive effect + Weak positive effect
 - Weak positive effect -- Moderate negative effect --- Strong negative effect
 \$\$\$ High cost \$\$ Moderate cost \$ Low cost ∅ Minimal cost ? Unknown

3.10. Characteristics of key recommended on-farm ASF-specific biosecurity measures for smallholder pig systems *(continued)*

Biosecurity measures	Effectiveness		Feasibility/practicality		Sustainability	
	Potential effect on reducing risk	Duration/persistence of effect	Potential for rapid and easy implementation	Cost of implementation	Potential to disrupt production	Local acceptance
Feed and water						
Prevent rodents from accessing stored feed	+	+	++	\$\$	-	+++
Avoid feed spillage/clear spillage immediately	+	+	+++	∅	-	+++
Sun-dry forages	++	++	+	∅	-	++
Use feed from reputable sources	++	+	+	\$	---	+
Deliver feed at designated area	++	++	+++	\$	-	+
Avoid feeding swill or boil swill for at least 30 minutes	+++	+++	+	\$	-	++
Confine pigs and prevent them from roaming to feed	+++	+++	+++	\$\$	-	+++
Ensure access to clean, covered and stored water	++	++	+++	\$	-	++

+++ Strong positive effect ++ Moderate positive effect + Weak positive effect
 - Weak positive effect -- Moderate negative effect --- Strong negative effect
 \$\$\$ High cost \$\$ Moderate cost \$ Low cost ∅ Minimal cost ? Unknown

3.10. Characteristics of key recommended on-farm ASF-specific biosecurity measures for smallholder pig systems *(continued)*

Biosecurity measures	Effectiveness		Feasibility/practicality		Sustainability	
	Potential effect on reducing risk	Duration/persistence of effect	Potential for rapid and easy implementation	Cost of implementation	Potential to disrupt production	Local acceptance
Bedding						
Store bedding away from open weather	++	++	+++	∅	-	++
Assure origin of ASF-free bedding	+++	++	++	\$	-	+
Vehicles and equipment						
Offer training for personnel in the pork value chain	+++	+++	++	\$\$\$	-	++
Ensure drivers follow biosecurity measures	+++	+++	++	\$\$	--	++
Clean and disinfect vehicles, motorbikes and carts	+++	+++	++	\$\$	--	++
Avoid sharing instruments and equipment	+++	+++	+++	\$	-	++
Demarcate an area for cleaning and disinfection of vehicles and equipment	++	++	++	\$	-	++

+++ Strong positive effect ++ Moderate positive effect + Weak positive effect
 - Weak positive effect -- Moderate negative effect --- Strong negative effect
 \$\$\$ High cost \$\$ Moderate cost \$ Low cost ∅ Minimal cost ? Unknown

3.10. Characteristics of key recommended on-farm ASF-specific biosecurity measures for smallholder pig systems *(continued)*

Biosecurity measures	Effectiveness		Feasibility/practicality		Sustainability	
	Potential effect on reducing risk	Duration/persistence of effect	Potential for rapid and easy implementation	Cost of implementation	Potential to disrupt production	Local acceptance
Deliveries and supplies						
Disinfect all supplies received at an appropriate entry point	+++	+++	++	\$\$	-	++
Appropriate demarcation for arrival of supplies to farm	++	++	+++	\$	-	++
Clean and disinfect tools and equipment used by service personnel before entry into farm	+++	++	++	\$\$	-	++
Personnel and training						
Control personnel traffic	+++	++	++	\$	-	++
Availability of clear signs with appropriate biosecurity warnings	+++	+++	+++	\$	-	++
Direct flow of work for caretakers and workers	+++	+++	++	\$	-	+
Make footbaths available at farm and pen entrances	+++	+++	++	\$\$\$	-	++

+++ Strong positive effect ++ Moderate positive effect + Weak positive effect
 - Weak negative effect -- Moderate negative effect --- Strong negative effect
 \$\$\$ High cost \$\$ Moderate cost \$ Low cost Ø Minimal cost ? Unknown

3.10. Characteristics of key recommended on-farm ASF-specific biosecurity measures for smallholder pig systems *(continued)*

Biosecurity measures	Effectiveness		Feasibility/practicality		Sustainability	
	Potential effect on reducing risk	Duration/persistence of effect	Potential for rapid and easy implementation	Cost of implementation	Potential to disrupt production	Local acceptance
Put protocols in place for collectors and middlemen	+++	+++	+	\$\$	--	++
Ensure appropriate dressing and washing protocol for workers before entering farm	+++	+++	++	\$\$	-	++
Ensure cleaning and disinfection training for farmers and workers	+++	+++	++	\$\$\$	--	++
Wildlife, insects and hunting						
Measures in place to control ticks on farm	++	++	+	\$\$\$	--	+
Chemical control measures for ticks	++	+++	+	\$\$\$	--	+
Maintain good sanitation on farm premises	+++	+++	++	\$	-	++
Measures to keep poultry and livestock away from pens	+++	+++	++	\$	--	+
Measures to ensure that hunters wait at least 48 hours before attending to pigs	+++	+++	++	\$	-	++

+++ Strong positive effect ++ Moderate positive effect + Weak positive effect
 - Weak positive effect -- Moderate negative effect --- Strong negative effect
 \$\$\$ High cost \$\$ Moderate cost \$ Low cost ∅ Minimal cost ? Unknown

3.10. Characteristics of key recommended on-farm ASF-specific biosecurity measures for smallholder pig systems *(continued)*

Biosecurity measures	Effectiveness		Feasibility/practicality		Sustainability	
	Potential effect on reducing risk	Duration/persistence of effect	Potential for rapid and easy implementation	Cost of implementation	Potential to disrupt production	Local acceptance
Manure management						
Measures to ensure appropriate management of manure	+++	+++	++	\$	-	++
Build a biogas plan to manage the manure	+++	+++	+	\$\$	-	++
Appropriate cleaning and disinfection of vehicles used to transport manure	+++	+++	++	\$\$\$	-	++

+++ Strong positive effect ++ Moderate positive effect + Weak positive effect
 - Weak positive effect -- Moderate negative effect --- Strong negative effect
 \$\$\$ High cost \$\$ Moderate cost \$ Low cost ∅ Minimal cost ? Unknown



4 Biosecurity recommendations during an outbreak (for veterinary authorities)

Biosecurity protocols are essential in controlling and containing ASF outbreak situations (USDA & CFSPH, 2016). In some instances, the measures used may be part of a national contingency plan aimed at elimination in the event of an outbreak. ASF outbreak response may involve engagement with ASFV-infected, contact or non-infected premises within a country or zone, so it is essential that response personnel are careful not to spread the virus. In all situations, biosecurity measures employed are intended to ensure ASFV is contained within infected premises whilst preventing onward spread to non-infected premises (USDA & CFSPH, 2016).

A geographical area may be designated as infected or not infected, and control measures instituted if a farm within the area is infected (USDA & CFSPH, 2016). Following a report and identification of an outbreak, tracing protocols will enable the swift establishment of 'Infected' and 'Dangerous-contact' premises. Tracing should identify all movement of pigs and pig products to and from Infected Premises, and is typically traced back to the last 30 days (FAO, 2009; USDA & CFSPH 2016). Individual countries may follow their national ASF-response plans if they exist. However, the biosecurity protocols implemented must be tailored to smallholder pig production units, considering all transmission risk pathways along the pork value chain. Cleaning and disinfection will be vital steps in the practical biosecurity protocols employed during an outbreak.



4.1. Identification of infected areas, premises or zones

After infected premises in an ASF outbreak are identified, all control efforts and measures must be focused on these locations in a rapid containment effort (FAO, 2009). Experience from European and now Asian smallholder pig production systems have proven that the smallholder system sustains ASFV spread. Therefore, particular attention should be given to these production systems during outbreaks. Depending on the country-specific ASF situation, elimination of ASF in countries with many smallholder pig farms might not be practical. It is essential, then, that countries develop smallholder-specific control measures in addition to existing sanitary measures as part of their national ASF contingency plan. Some key biosecurity recommendations to be observed during active outbreaks for veterinary authorities and field officers include:

- Strict measures in infected premises and their surrounding areas should target smallholder systems, especially in preventing contact between free-roaming pigs and wild boars.
- It is essential that free-roaming pig control is undertaken before outbreaks occur; however, in the event of an ongoing outbreak, farmers should be persuaded to confine their pigs.
- Where holding units are lacking, practical and humane tethering methods may be used. These are vital in order to prevent contact with free-roaming pigs, wild boars and soft ticks. Smallholder farms with fencing should reinforce their confinement during outbreaks.
- If smallholder farmers can afford improvement, double fencing of open-confined pigs may be employed. Other farmers with secure holding structures made of cement or wood may use single fencing.
- Sanitary measures to be put in place on smallholder premises during an outbreak include:
 - Increased frequency of cleaning and disinfection;
 - Confinement of poorly housed and free-roaming domestic pigs; and
 - Do not introduce new pigs.

4.1.1. Zoning

A zone refers to a part of a country or territory marked by natural or administrative boundaries where the animal population or sub-population is defined by the veterinary authorities to possess a specific health status with respect to a disease (e.g. ASFV) for the purpose of prevention, control or international trade (OIE, 2019a). During an ASF outbreak, the geographical area with defined boundaries where infected premises are identified are designated as infected with intensive containment measures (FAO, 2009; OIE, 2019a). The infected zone normally spans across a specified radius from the suspected infection premises or could be set by the basic epidemiological unit, which is a village where the infection occurred. This is usually done when

the radii of the infections overlap each other, more so if it goes beyond the other municipal boundary. Administrative boundaries or other epidemiologically relevant measures may be used in identifying zoning extent (OIE, 2019a). Practical control measures within such infected zones should target busy roads close to slaughter points, areas with high pig density, highways and railways. In smallholder production systems, it might not be enough to designate infected zones as farmers and middlemen may still be involved in the illegal movement of infected pigs and pig products (USDA & CFSPH, 2016). The veterinary authorities must liaise with security officials within the country to enforce containment efforts. Security officials must ensure that unconventional routes, especially those plied by motorbikes, are patrolled if the resources exist. Mounting of roadblocks, temporary closure of roads and intensified inspection of vehicles may reduce the frequency of panic sales, slaughter and transport in the event of an ASF outbreak. These activities constitute the reasons why smallholder pig farms have successfully sustained ASF spread. Outbreak situations and their definitions are presented in Table 1.

Simple logistics such as markers, maps, cardboards (signs), writing material, etc., may be enough to initiate the planning and appropriate designation of areas and their relevant control measures (FAO, 2019).

Table 1. Definition of zone designations (USDA Foreign Animal diseases preparedness and response plan)

Zone	Definition
Infected Zone (IZ)	The zone that immediately surrounds Infected Premises.
Buffer Zone (BZ)	The zone that immediately surrounds an Infected Zone or Contact Premises.
Control Area (CA)	Consists of the Infected Zone and Buffer Zone.
Surveillance Zone (SZ)	Zone outside and along the border of the Control Area.
Free Area (FA)	The area outside the Control Area.

Source: USDA & CFSPH, 2016

Infected Zones

An infected zone is one within which an infection with ASFV has been confirmed (OIE, 2019a). This could be a zone within an ASFV-infected country where other zones remain free of ASFV or a zone within an ASF-free country where a recent incursion or re-introduction of ASFV has occurred (USDA & CFSPH, 2016; OIE, 2019a). During an active outbreak, an infected zone is determined to be the area that is immediately surrounded by identified infected farms, households or villages. The boundaries are determined by the veterinary authorities and take into account the prevailing epidemiological situation, social factors, geographical or administrative demarcations (USDA & CFSPH, 2016). The use of radii in determining zones might not be practical due to the nature of ASFV transmission during outbreaks (USDA & CFSPH,

2016). However, key points within smallholder pork value chain networks should be included in designated infection zones as these may drive spread even from distant locations from infected zones (FAO, 2009). *Article 15.1.3* of the *Terrestrial Animal Health Code* of the OIE provides recommended steps to achieving freedom following loss of freedom status (OIE, 2019b). At the start of the outbreak, the designated infected zones should be extended to account for uncertainties in the extent of spread. This should then be progressively reduced, as more information becomes available (USDA & CFSPH, 2016).

ASF-endemic countries may gradually create ASF-free zones within them by enforcing strict biosecurity and sanitary measures, starting from smaller geographic areas known to be ASF-free. Aside from intensive surveillance, sanitary measures in such areas would include quarantine and movement controls as well as strict supervision of live-pig markets as well as home and abattoir slaughter. The biosecurity considerations outlined in this document, if adopted by farmers, will make this possible.

Buffer Zones

This is the zone that immediately surrounds a designated infected zone (USDA & CFSPH, 2016).

Control Zones

This is the infected and its buffer zone combined (USDA & CFSPH, 2016).

Surveillance Zones

The immediate area outside and along the border of the control zone. This covers a large area and may span across many administrative areas (USDA & CFSPH, 2016).

ASF-free Zones

ASF-free zones will comprise the whole area outside of the control zone, including the surveillance zone (USDA & CFSPH, 2016). In the event of an outbreak, this zone will also benefit from a high alert for possible ASF entry. Countries experiencing an ASF outbreak for the first time should increase surveillance activities within their ASF-free zones while enforcing strict quarantine and biosecurity measures in infected zones.

4.1.2. Designation of smallholder premises during outbreaks

During an active ASF outbreak, premises such as households, farms or even whole villages will be considered as the epidemiological units of interest for control purposes. Depending on their epidemiological links to other premises already determined to be infected with ASFV, these premises may be designated as Infected Premises, Dangerous-contact Premises, At-Risk Premises, Monitored Premises or Free Premises (USDA & CFSPH, 2016). These are defined in Table 2.

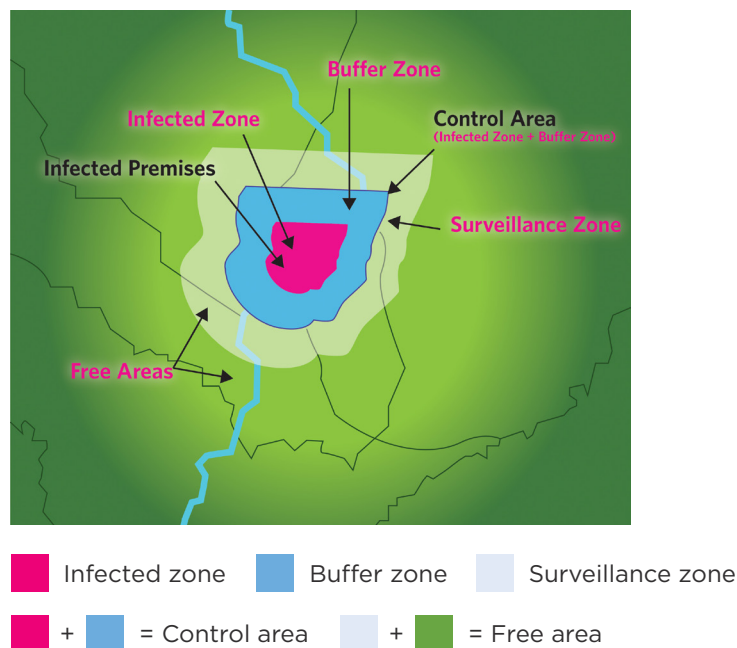
Table 2. Definition of premises designations

Premises	Definition	Zone
Infected Premises (IP)	Premises where a presumptive positive case or confirmed positive case exists based on laboratory results, compatible clinical signs, ASF case definition, and international standards.	Infected Zone
Contact Premises (CP)	Premises with swine that may have been exposed to ASF, either directly or indirectly, including but not limited to exposure to animals, animal products, fomites, or people from Infected Premises.	Infected Zone, Buffer Zone
Suspect Premises (SP)	Premises under investigation due to the presence of swine reported to have clinical signs compatible with ASF. This is intended to be a short-term premises designation.	Infected Zone, Buffer Zone, Surveillance Zone
At-Risk Premises (ARP)	Premises with swine, but none of those swine have clinical signs compatible with ASF. Premises the objectively demonstrates that it is not an Infected Premises, Contact Premises, or Suspect Premises. At-Risk Premises may seek to move susceptible animals or products within the Control Area by permit. Only At-Risk Premises are eligible to become Monitored Premises.	Infected Zone, Buffer Zone
Monitored Premises (MP)	Premises that objectively demonstrate that they are not Infected Premises, Contact Premises, or Suspect Premises. Only At-Risk Premises are eligible to become Monitored Premises. Monitored Premises meet a set of defined criteria in seeking to move susceptible animals or products out of the Control Area by permit.	Infected Zone, Buffer Zone
Free Premises (FP)	Premises outside of a Control Area and not a Contact or Suspect Premises.	Surveillance Zone, Free Area

Source: USDA & CFSPH, 2016

Designation zones during ASF outbreaks

Zones and areas



Source: USDA & CFSPH, 2016

4.2. Movement control during an outbreak

Quarantine and movement control measures during an ASFV-outbreak response are essential to the success of any control effort (USDA & CFSPH, 2016; Geering *et al.*, 2001). Movement of potentially infected pigs, contaminated products, and human and transport traffic from infected zones quickly spread ASF. The objective of ASFV-control efforts is to prevent the virus from gaining access to susceptible live pigs and wild boars by eliminating the source of infection. This may involve the destruction of exposed and/or infected pigs and trade bans from infected areas. Since carcass disposal in abundant smallholder territories may not be feasible, alternative control strategies should be promoted. For example, a modified stamping out or a test and slaughter control strategy may be used in suspected and high-risk premises instead of stamping out (FAO, 2017).

The veterinary authorities backed by existing legislation should immediately issue strict sanitary measures to temporarily hold, quarantine or restrict movement into and out of control zones and associated contact premises (SPS, 2019). It is recommended that the veterinary authorities outline movement control plans for smallholders in their national ASF control plan. Ideally, there should be a clearly outlined organizational structure, identifying clearly the role of all trained responding officers. The appropriate authorities mandated by legislation to help enforce these measures should be activated immediately (USDA & CFSPH, 2016). In the absence of clear, enforceable legislation, the veterinary authorities should have a ready communication plan in which one of the components is to ensure smallholder participation in the control efforts. The plan should take into consideration the country context and what will work to ensure cooperation. This is essential as smuggling of home-slaughtered infected pigs and live pigs are likely to continue regardless of ongoing restrictions on movements.

Veterinary authorities, as part of their response, will concurrently assess transmission risks between zones and neighbouring countries. Smallholder premises designated as suspected or high-risk premises should be banned from receiving or transporting pigs to the slaughterhouses or other premises. However, the veterinary authorities should make it possible for premises with no epidemiological links to the infected, dangerous-contact premises and high-risk premises to obtain special permits to move pigs to slaughterhouses under strict biosecure conditions (SPS, 2019). The veterinary authorities must undertake a cost-benefit analysis of intended control measures to be applied during ASFV outbreaks in specific regions or zones before rolling out such measures.

4.3. Pre-movement recommendation for live pig transport

- Only pigs from ASFV-free zones, areas or premises including control areas with the appropriate permit may be transported to other farms. Prior to transport, pigs may be segregated for a minimum of 15 days to assure freedom from conditions (OIE, 2019d; SPS, 2019). This is essential as sub-clinical signs may be missed.
- Farm of origin of pigs, however, should ensure that the minimum biosecurity conditions are met during transport under the strict supervision of the veterinary authorities.
- Transport trucks should use routes as directed by the veterinary authorities, ensure short humane transport of pigs and finally head straight to destination farms without stopping at any pig markets or other farms.
- Transport trucks must carry enough feed and water from destination farms to avoid stopping to source food en-route to the destination.



5

Recommendations for pig slaughter in infected areas

Hygiene and biosecurity standards vary widely between slaughtering facilities depending on the type and capacity. In addition, many pigs are slaughtered at home for local consumption with no formal meat inspection. This is likely to increase the risk of ASFV spread if the meat is shared between distant family members or illegally sold at wet markets. Slaughterhouse workers, butchers providing services to individuals, and smallholder farmers who slaughter their own pigs could be contaminated and act as fomites for spread. It is unlikely, however, that ante-mortem and post-mortem services will be provided during such slaughter. Some recommendations to decrease slaughter-related ASFV spread include:

- Access to slaughter areas on smallholder premises should be controlled to ensure that visitors and other domestic animals are not contaminated (Skaarup, 1985; Wirtanen & Salo, 2014).
- Slaughter points should be sufficiently located away from pig holding units with the process involving a one-way flow from dirty areas (where pigs are stunned and slaughtered) to clean areas (final dressing and cutting) (Chenais *et al.*, 2017).
- Strict measures should be enforced by field officers to prevent the feeding of by-products from slaughterhouses, such as blood and offal, to pigs as they are associated with significant ASFV risks.
- Involvement of the local government in enforcing environmental protection within slaughter points and houses can minimize ASFV risks as hygiene and sanitation improve. Also, better waste management including adequate disposal, drainage, water supply and manure treatment and transport may significantly reduce ASF transmission risks.
- Slaughterhouses also serve as a point of dissemination of ASFV as pigs from different administrative regions and holders converge for slaughter and processing. This is often associated with heavy traffic of vehicles and people increasing the risk of ASFV transmission.
- In larger slaughter facilities, the veterinary authorities enforce the slaughter of pigs from ante-mortem to post-mortem, ensuring that no diseased animal is slaughtered.
- At household slaughter points, farmers can only be persuaded through effective awareness creation and training on the identification of clinical signs before slaughter.
- Slaughterhouses must ensure that processing areas are cleaned and disinfected at the end of each working day to remove any manure, hair and debris that may be contaminated.

- Slaughterhouses must ensure the thorough cleaning and disinfection of all transport media that bring pigs to their premises, paying special attention to the wheels, hidden areas and underside.
- Slaughterhouses must control access and movement of personnel within their premises. Staff should be prohibited from visiting pig farms and hunting.
- Slaughterhouses must ensure maximum control of pests and proper waste management.

5.1. Household slaughter

Household slaughter refers to the slaughter of pigs on the premises of the smallholder farmer, usually for their own personal or immediate family's consumption (FSA, 2020). For the purpose of ASFV prevention and control, we can include pig owners who send live pigs to slaughterhouses to be slaughtered for meat. To improve hygiene and disease prevention:

- Veterinary authorities should ensure that all meat for human consumption originates from animals slaughtered in approved slaughterhouses, under the supervision of a field officer (FSA, 2020).
- If pigs are to be transported to slaughterhouses and destined for the market, they should be segregated for 15 days without any clinical signs. If individual separation is not practical, the farmer should avoid the introduction of new pigs in the herd during these 15 days.
- Home slaughter is only allowed if it involves one pig for home consumption.
- The practice of local butchers who move from one premise to another to slaughter pigs should be avoided. During village festivities, each household usually slaughter a pig for home consumption and a local butcher can be called in to service these households. A village plan can be designed to call in the veterinary authorities to inspect the pigs and plan how home slaughter would proceed including how to regulate movement of the butcher or designate more butchers to service one household at a time.
- The veterinary authorities with the appropriate disease prevention and control legislation should ensure that the slaughter of pigs for sale to markets would occur in approved slaughterhouses. Home slaughter of pigs (more than one) for commercial sale is strictly prohibited.
- Smallholders who home slaughter for own consumption should ensure that (Chenais *et al.*, 2017):
 - only healthy pigs with no clinical signs are slaughtered;
 - slaughter takes place at a sufficient distance from pig holdings on a hard surface that is easy to drain, clean and disinfect;
 - cleaning and disinfection occurs following slaughter;
 - no illegal movement of the carcass or meat occurs unless certified for the local market;
 - offal and waste are properly disposed of;
 - family members who take care of live pigs should not be the same ones to slaughter the pigs. If this must happen, at least 48 hours must elapse before they can take care of the pigs again;

- a clear demarcation of clean and dirty areas on the farm or household premises should be indicated, and slaughter process restricted to a one-way flow from dirty areas where the pig is held for slaughter and processing environment where the carcass is dressed. The butcher and the farmhand with their tools must do the same and move from the dirty area to the clean area; and
- slaughter areas and equipment must allow easy cleaning and disinfection.
- Smallholder farmers, butchers, middlemen and buyers must be trained to have an awareness of why home slaughter for commercial sale is prohibited, and of why this has possible consequences on the spread of the disease.
- The veterinary authorities should make the registration process for slaughter establishments practical and feasible to ensure uptake by local traders.
- Safe slaughter on a smallholder pig farming premises in an ASF-infected or endemic area can be challenging, as strict biosecurity requirements are needed to reduce the risk of ASF spread.

Recommended slaughter process flow at slaughterhouse



5.2. Transport to slaughter points

- Smallholder farmers with a direct link to slaughterhouses who transport pigs directly should obtain the necessary certification from the veterinary authorities.
- Farmers should establish a routine and ensure that constant communication exists between them and destination slaughterhouses.
- Practical steps must be undertaken to ensure a biosecure loading and unloading while minimizing contamination and cross-contamination during transport.

- Trucks, trailers and bicycle-powered carts should be thoroughly cleaned and disinfected in-between rounds of transport.
- The vehicle must be thoroughly inspected by the farmer or a dedicated helper at the designated loading area. Farmers, drivers and their helpers must be made aware of the movement limitations that exist if any, and the approved routes preferably avoid infected zones.
- Destination slaughterhouses should have layouts that make delivery with minimal to no contact with other trucks possible. The unloading points at the slaughterhouses may be a mixing point for various vehicles, drivers and possibly pigs.
- If possible, slaughterhouses should provide a means of disinfection for every vehicle before entry to the unloading area and at the exit.
- All slaughter points, whether industrialized or not, should be thoroughly inspected by the veterinary authorities, enforcing at least the minimum biosecurity standards.

5.3. Disinfection of slaughter points

The management of a slaughterhouse is responsible for establishing routine cleaning and disinfection measures for their slaughterhouse. These measures must be economically feasible considering the capacity of the slaughterhouse, and meet the water, energy, chemical and labour needs for effective cleaning and disinfection.

- It is essential that education and training programmes specifically addressing slaughterhouses and ASFV biosecurity are organized for all workers and management.
- The management of a slaughterhouse should document their biosecurity routine into a detailed cleaning programme that takes into account the particular context of the slaughterhouse, including ensuring:
 - There is a dedicated cleaning and disinfection team with everyone clear on their roles and responsibilities.
 - Appropriate channels exist for reporting and restoring irregularities.
 - Clear principles of cleaning and disinfection are outlined.
 - All workers are involved during and after carcass processing.
- The management must also make clear the frequency at which cleaning and disinfection should be carried out. It is recommended that thorough cleaning and disinfection be carried out at least once each day.
- Best cleaning and disinfection practices will ensure that a well-planned programme results in minimizing the contamination of pigs, personnel, equipment, carcasses and surfaces.
- An efficient cleaning programme consists of a series of rinsing followed by detergent and disinfectant applications in the appropriate dilution with consideration for ambient conditions, e.g. temperature. Colder temperatures may interfere with disinfectant action. Detailed instructions should be given regarding:
 - clearance of processing equipment and its environment for cleaning;
 - assembly for cleaning;

- removal of solid waste from the environment;
- dismantling and removal of solid waste from the equipment;
- pre-rinsing with water;
- cleaning and rinsing of the environment;
- application of detergent to the equipment;
- low-pressure rinsing of the equipment;
- disinfection of the equipment;
- post-rinsing of the equipment with potable water followed by post-treatment such as assembly of equipment; and
- finally the disassembly of cleaning equipment and fog disinfection of rooms with good ventilation possibilities.

Cleaning and disinfection procedure for slaughterhouses

Points to remember

- The management of the slaughterhouse must give specific instructions for specific areas or equipment that must be cleaned, e.g. lairages. Different areas are soiled differently, for example cleaning of manure at lairages versus cleaning of bloodstains at the processing area.
- If equipment is used, the cleaning and maintenance instructions from the manufacturers must be used as much as possible. Cleaning for expensive equipment may be scheduled at appropriate intervals but must be regular.
- Cleaning and disinfection responsibilities must be shared. If possible, each staff member must be assigned to a specific area, especially their own working spaces after work. One person must lead the cleaning activity. Cleaning immediately after work makes the process easier.
- The duration of the whole cleaning process may depend on the prevailing environmental conditions. Adequate time should be given to cleaning and disinfection.
- Slaughterhouse management should ensure cleaning and disinfection – this should not be skipped. Due consideration should be given to energy requirements depending on the slaughterhouse type. Home and open slaughter areas may often use manual cleaning.
- Staff and cleaning personnel should be properly trained on the appropriate cleaning and disinfection process, especially on how to use existing tools and equipment.

Pre-cleaning preparation

- The cleaning procedure begins with the removal of carcasses from the processing area.
- Items that may hinder an efficient cleaning process or which become water-damaged should be moved. Electric outlets should be covered and secured to protect from water. Non-movable equipment should be properly covered to protect against water penetration. Mobile equipment in the area may be cleaned at a designated cleaning area.
- Following the removal of carcasses and other equipment, all needed cleaning materials should be prepared and assembled for ease of access. This should include preparing detergents, disinfectant solutions, water tanks etc.

- Cleaning materials for slaughterhouses should be appropriate for the type of slaughter facility, e.g. open slaughter, mobile slaughter, home slaughter etc. Ordinary materials such as barrels, pails, brooms, brushes, detergents, etc., may be used to achieve efficient cleaning and disinfection.
- Appropriate cleaning materials to be assembled should take into consideration the kind of soiling to be cleaned, e.g. blood, fluid, fat, etc., as well as the ambient temperature.

Cleaning and disinfection

- Following the clearing and assembly of cleaning materials, solid waste should always be removed before using water. If possible, all the solid waste in the facility should be removed first.
- First, the environment should always be cleaned thoroughly, before the equipment. If possible, the equipment should be dismantled for efficient cleaning. The solid waste on equipment must be removed first before pre-rinsing with water. Removing solid waste decreases the pre-rinsing period and saves water.
- It must be ensured that all solid waste is removed and material/equipment/surfaces pre-rinsed before the application of detergent. If a cleaning surface was soiled with fat and greasy dirt, hot water may be used for the pre-rinsing. If cold water is used for pre-rinsing fat-soiled surfaces, then a thorough cleaning process should follow.
- Slaughterhouses that use pressure systems for rinsing should not exceed 30 bar (3 000 kPa), as higher than this might damage surfaces or aerosolize pathogens on soiled surfaces, which can increase the risk of spread.
- Alternative cleaning arrangements should be made in case any of the cleaning equipment becomes non-functional, and plans need to be made to get the equipment repaired.
- For slaughterhouses using pressure systems, low pressure between (20 to 30 bar) flowing at a rate of 18 to 20 litres per minute is recommended. Acute water pressure angles give high pressures and should be avoided.
- Following removal of solid waste and pre-rinsing, detergents may be applied.
- Cleaning or spraying from unclean to clean areas should be avoided.
- Water and detergent solutions should be changed when moving to different areas.
- Following a thorough cleaning procedure, disinfection should take place. Ensure that all areas are covered thoroughly with the solution, meeting the contact time for the type of disinfectant used (from 15 seconds to 10 minutes). Applied detergent and disinfectant must be rinsed off thoroughly to eliminate chemical residues.
- In the processing environment, solid waste that is soiling surfaces should be removed by scraping, brushing or vacuuming where possible, with visible remaining residues should be pre-rinsed with low-pressure water.
- Use of detergents helps to remove solid waste particles and microbes that remain adhered to surfaces after solid waste removal.

- Disassembly following cleaning may include emptying of containers and cleaning of cleaning equipment for storage as well. Disinfect after cleaning needs to follow after the necessary contact time for the type of disinfectant used.
- Special attention should be given to processing tools, such as neck cutting machines, knives, conveyor belts, etc., as they can be difficult to clean and disinfect.
- Tools, equipment or machines should be regularly maintained and cleaned thoroughly, as they are mostly in contact with blood, tissue and other fluid from carcasses.

Post-cleaning and post-disinfection

- Cross-contamination with pathogens should be avoided by ensuring that cleaning materials such as brushes, scrubbing pads and mops are kept clean after every cleaning and disinfection process. They should be properly stored.
- Following, assembly of cleaning materials, removal of solid waste, pre-rinsing with water, application of detergent followed by cleaning and post-rinsing, there must be a post-treatment process that involves the return of cleaning materials back to storage and proper treatment of effluence from cleaning and disinfection.



6

Restocking infected and dangerous-contact premises

- Following the identification of infected and dangerous contact premises, all pig populations within the area must be slaughtered immediately, followed by appropriate carcass disposal and decontamination procedures (Penrith *et al.*, 2013; Skaarup, 1985).
- The infected and dangerous-contact premises must then be left empty for at least 40 days if no vectors are linked to the outbreak in those premises.
- After the destocking period elapses, farmers may, under the supervision of the veterinary authorities, then restock their farm premises with healthy ASF-free pigs.
- The veterinary authorities must show, with reasonable certainty, that these previously infected and dangerous-contact premises are no longer at risk of ASFV.
- The veterinary authorities may introduce sentinel pigs at 10 percent of the normal stocking capacity of these premises to minimize the risk of ASFV recurrence. Where this is not possible, farmers should be allowed to purchase the number of sentinel pigs they can afford.
- The sentinel pigs need to be monitored by the veterinary authorities for at least six weeks under a sentinel animal surveillance to ensure they are free of ASFV before the premises may be restocked to full capacity.
- Following restocking at full capacity, surveillance on these premises should continue for a reasonable period depending on the national ASF control objectives.
- Only pigs from known ASF-free zones or countries must be used for full restocking after the sentinel surveillance period.
- The risk of introduction of other transboundary animal diseases should be assessed to ensure that ASFV is not replaced by another disease.
- As a production improvement strategy, relevant stakeholders may use the restocking as an opportunity to ensure that local farmers improve on their genetic stock, procuring live pigs from ASFV-free genetic or commercial farms.

Restocking procedure

- The veterinary authorities should review the local situation and risk of ASFV recurrence before gradually relaxing ASFV control and restocking restrictions in infected and dangerous-contact premises. This can be done in phases over a period of at least six months allowing restocking in contact premises then later in infected premises.
- The veterinary authorities must be convinced the risk of ASF recurrence in assessed infected and contact premises is minimal before restocking can be allowed.
- Restocking with sentinel pigs should always precede full restocking in premises with acceptable risks of ASFV recurrence. This must be done at least 40 days after decontamination (FAO 2017). As indicated earlier, the number of sentinel pigs used should depend on what the veterinary authorities and/or the farmer's can afford (if there is a joint agreement) and the normal stocking capacity of the premises.
- As part of a compensation scheme, the veterinary authorities or the relevant department may absorb the cost of the use of sentinel pigs in lieu of compensation following depopulation.
- It is practical that genetically bred sentinel pigs be maintained on the same smallholder premises as the restocking batch if they are free of ASFV after the sentinel surveillance period; however, they must remain in separate holdings for at least 30 days. The veterinary authorities should consider integrating the sentinel animal surveillance into some form of compensation scheme as part of the restocking oversight.
- Sentinel pigs must undergo constant monitoring and observation during sentinel surveillance by trained caretakers, and at the end of the period, they must test negative for ASFV antibodies by the veterinary authorities.
- In ASFV situations where investigations have established the involvement of soft tick vectors, repopulation should be restricted until the veterinary authorities has supervised the total elimination of soft ticks and other vectors from the premises.
- The veterinary authorities must be able to show that the threat of ASFV recurrence remains minimal.
- Restrictions on restocking of ASFV-infected and dangerous-contact premises should only be removed where all decontamination have been achieved, sentinel surveillance implemented, and risk of reinfection determined to be reasonably low.

Sentinel pigs

Where national veterinary services may afford, sentinel pigs may be used as part of their restocking procedure in a combined surveillance and compensation scheme. When used, sentinel pigs need to be monitored by the veterinary authorities with the help of caretakers and smallholder farmers for at least 45 days under a sentinel animal surveillance to ensure they are free of ASFV before the premises may be restocked to full capacity. This protocol increases the confidence of the absence of viable ASFV in the holdings; however, the pigs should be subjected to serological tests at the end of the sentinel surveillance. Considerations for the use of sentinel pigs include:

- The veterinary authorities must determine the appropriate period for sentinel pigs use; if no ASFV signs are detected during the period, full restocking should be allowed.

- The veterinary authorities must certify the quality and source of sentinel pigs to be used; these may be bred locally from genetic stock companies or sourced internationally.
- The veterinary authorities shall determine the minimum number of sentinel pigs to be used on each premise to be able to detect any viable ASFV particles on the premises. These may be stocked at 10 percent of the normal stocking capacity of the premises.
- The sentinel pigs to be used must test negative for ASFV antibodies or come directly from ASF-free premises with high biosecurity such as an ASF-free compartment.
- ASFV monitoring by the veterinary authorities will include final serology of sentinel pigs done at least 45 days after the arrival of the last sentinel pig onto the premises.
- Pre-stocking with sentinel pigs in batches on any premises should be complete within 20 days, subsequent batches will not be allowed inside the premises.
- The cost involved in the use of sentinel pigs, including all tests, must be discussed between the veterinary authorities and the smallholder farmer or stakeholders. The veterinary authorities may arrange for genetic stock producers of sentinel pigs to double as sources for restocking pigs after the sentinel surveillance period. This reduces the need for monetary compensations following depopulation as part of ASFV control and considerably reduces the period between depopulation and restocking.



7

Future considerations for sustainable ASFV biosecurity

The recommendations for ASFV on-farm biosecurity best practices made in this document attempt to reflect the intricacies of the smallholder farming and value chain in Southeast Asia.

However, pork value chains in practice differ between administrative regions and even villages and may be vulnerable to changes in local disease statuses as well as anthropological factors. It is imperative therefore, that this document is considered living and the recommendations made subject to feasibility test for constant improvement in line with best available science and improved understanding of the local socioeconomy. Specific considerations in making this document futuristic include;

1 The development of new or modified recommendations.

Transforming generic biosecurity practices and making them practical and specific to ASFV control for implementation in smallholder systems will always be challenging. Veterinary authorities are encouraged to therefore engage with stakeholders in the smallholder system in an attempt to constantly assess their understanding, compliance and constraints slowing the uptake of biosecurity recommendations. Suggestions of a regional approach to ASF control should make this possible through interdisciplinary approach to research where intergovernmental organisations and non-governmental organization contribute funds to veterinary institutions in the region for research and development on ASFV prevention and control.

2 Capacity building for biosecurity enforcement

In addition to recommendations for continual training of smallholder farmers and value chain stakeholders for the purpose of increasing uptake of biosecurity recommendations; veterinary authorities, intergovernmental organizations and non-governmental organisations should ensure that national veterinary services personnels are appropriately trained and staffed to a capacity reasonable to meet the demands of biosecurity enforcement and extension services. Veterinarians and paraveterinarians are scarce in most developing countries so there should be training schemes available to allow the general public to enroll as community animal health workers.

Recommendations made in this document are mostly straightforward and in some instances backed by appropriate illustrations. To maximize effects and improve uptake however, there is the need for trained community animal health workers, representatives from non-governmental organisations and management of contract farms or contractors and other production cooperatives to educate smallholder farmers through on-farm demonstrations. These may take place during focused group discussions and arranged training workshops. It may be beneficial if exemplary farmers are used as role models and allowed to demonstrate to the village how exactly they are implementing the recommendations this document makes. Veterinary authorities are encouraged to take the initiative to document best practices as made in these guidelines from other countries within the region in short, captioned video formats for dissemination among smallholder farmers.

3 Awareness creation

The above recommendation on demonstrations in a sense contribute to awareness creation. However since the prevention and control of ASFV considers all other anthropological factors of the locality, it is essential that the general public is sensitized to the impact of ASFV on the local economy and the existing measures in place to shield them against same. Veterinary authorities should endeavor to make use of mass communications during religious gatherings, social gatherings, radio and television communications and posters in creating ASFV awareness in villages. These may target specific risk factors but should consider targeting all other actors along the smallholder pork value chain. Veterinary authorities are not to downplay the impact of social media on social behaviours and are encouraged to make best use of this medium through catchy graphics and short text communications.

These awareness of biosecurity recommendations specific to ASFV will also contribute to the management of other endemic diseases of pigs, leading to the general improvement in productivity and hence livelihood of smallholder pig producers.

4 Development of concise self-assessment checklists for smallholders

On-farm biosecurity requires sustained efforts from the pig farmers. Notably, most smallholder setting farmers may not receive adequate support from veterinary professionals due to limited resources or unavailable services. Therefore, self-assessment of farm biosecurity would help to mitigate this gap by providing concise checklists. There are some self-assessment checklists on pork production biosecurity available. However, most of them were designed for commercial farms, and may be hard to apply in smallholder pig farms. Based on this document's key recommendations, further work needs to be done to develop concise self-assessment checklists for smallholder pig farmers. Using innovative technologies to make a user-friendly checklist is something that it will be worthwhile to explore in the future, such as using mobile apps or interactive voice response (IVR).



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Glossary

Biosecurity

A set of management and physical measures designed to reduce the risk of introduction, establishment and spread of animal diseases, infections or infestations to, from and within an animal population.

Culling

The removal of an animal population from a particular area to control or prevent the spread of disease.

Disinfectant

A chemical used to destroy disease agents outside a living animal.

Disinfection

The application of procedures intended to destroy the infectious agents of animal diseases applies to premises, vehicles and different objects that may have been directly or indirectly contaminated.

Disposal

Sanitary removal of animal carcasses and other relevant materials by an appropriate process to prevent the spread of disease.

Groundwater

Any water contained in an aquifer.

Infected premises

A defined area which may be all or part of a property that animals meeting the ASF case definition are/were present; or ASFV is present; or there is a reasonable suspicion that ASFV is present subject to decision of the veterinary authority.

Leachate

Liquid impurities resulting from decomposition with the potential to percolate through soil.

Premises

A tract of land including its buildings, or a separate farm or facility that is maintained by a single set of services and personnel.

Remediation

The remedying of a site to reverse or stop damage to the environment.

Sentinel pigs

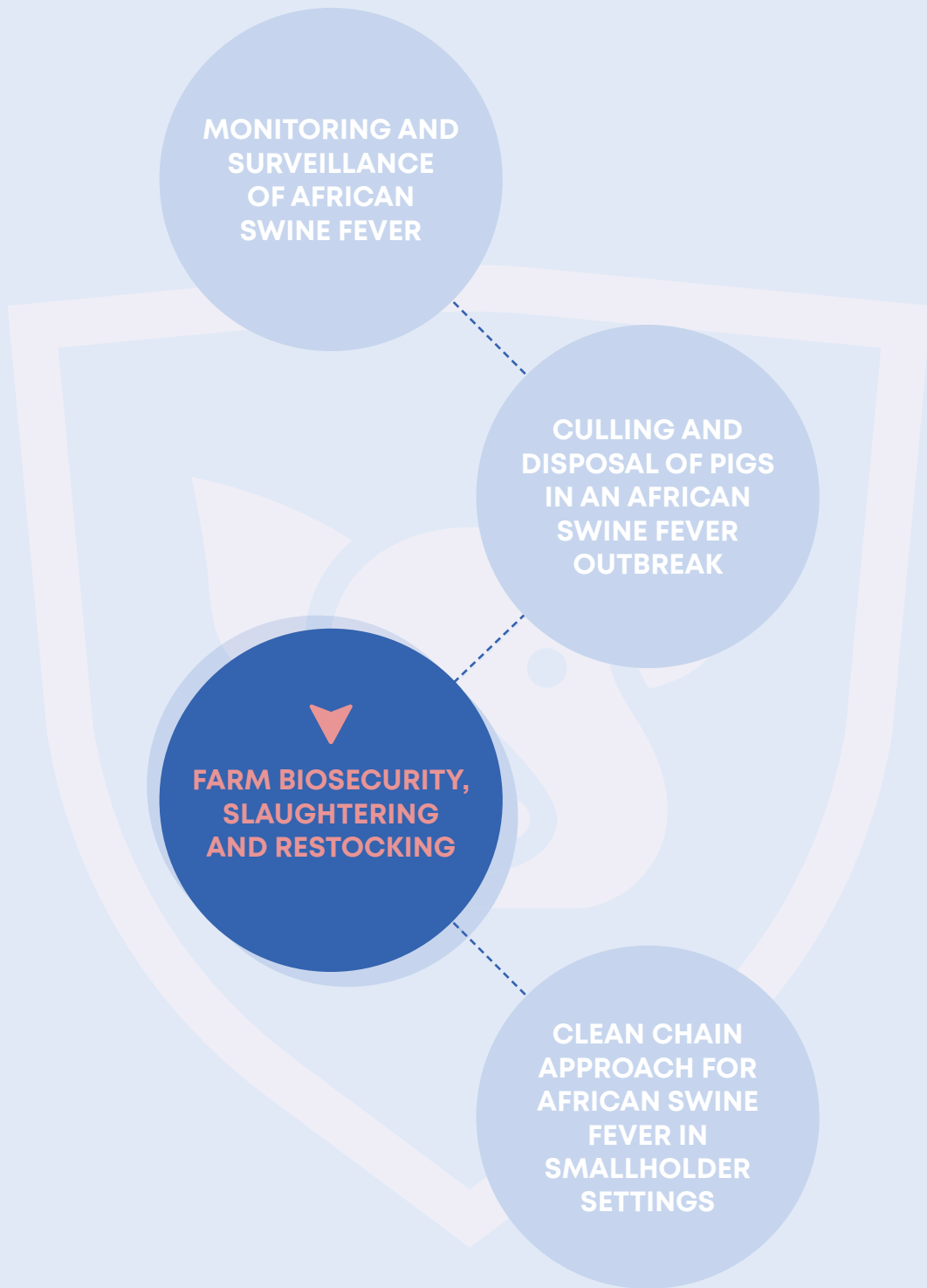
Pigs of known health status that are monitored to detect the presence of a particular disease (i.e. ASFV)

Susceptible animals

Animals that can be infected with a particular disease (i.e. ASF).

Vector

A living organism (e.g. arthropod) that transmits an infectious agent (i.e. ASFV) from one host to another.



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