8
ISSN 1810-1119

FAO ANIMAL PRODUCTION AND HEALTH

manual

PREPARATION OF AFRICAN SWINE FEVER CONTINGENCY PLANS

Cover photographs:

Left image: FAO/P. Ankers
Centre: FAO/I. Hoffmann
Right image: © J. Patrick J. (Fotolia.com)

8

FAO ANIMAL PRODUCTION AND HEALTH
manual

PREPARATION OF AFRICAN SWINE FEVER CONTINGENCY PLANS

Mary-Louise Penrith
Vittorio Guberti
Klaus Depner
Juan Lubroth

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2009

Authors' details

Mary-Louise Penrith
Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria
Pretoria, South Africa
marylouise@sentechsa.com

Vittorio Guberti
Animal Health Service, Food and Agriculture Organization of the United Nations
Rome, Italy
vittorio.guberti@fao.org

Klaus Depner
Animal Health Service, Food and Agriculture Organization of the United Nations
Rome, Italy

Juan Lubroth
Animal Health Service, Food and Agriculture Organization of the United Nations
Rome, Italy
juan.lubroth@fao.org

Recommended citation

FAO. 2009. *Preparation of African swine fever contingency plans.* Edited by M.L. Penrith, V. Guberti, K. Depner and J. Lubroth. FAO Animal Production and Health Manual No. 8. Rome.

ISBN 978-92-5-106426-9

Contents

Foreword

African swine fever (ASF) is one of the most serious transboundary swine diseases because of its high lethality for pigs, its crippling socio-economic consequences, its propensity for rapid and unanticipated international spread, and the absence of either treatment or vaccine.

For the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES), transboundary animal diseases (TADs) are defined as those diseases that are of significant economic, trade and food security importance for a considerable number of countries, that can easily spread from one country to another and reach epidemic proportions, and that require international cooperation for control and management, including exclusion. The World Organisation for Animal Health (OIE) *Terrestrial Animal Health Code* included ASF among its former List A diseases, which were defined as "communicable diseases which have the potential for serious and rapid spread, irrespective of national borders, which are of serious socio-economic or public health importance and which are of major importance in the international trade of animals and animal products".

This manual provides information on the nature of ASF and the principles and strategic options regarding prevention, detection, control and elimination of the disease. It provides guidelines on the formulation of overall national policy for control and eradication of a possible incursion of the disease for individual countries threatened by ASF. The manual identifies the personnel, equipment and facilities needed in a national ASF contingency plan. It suggests an outline for the format and contents of a national ASF contingency plan, which should be modified to suit the needs and circumstances of individual countries. During the preparation of this manual, consideration was given to the provisions given in the current OIE *Terrestrial Animal Health Code*. It is suggested that the manual be used together with the FAO *Manual on the preparation of national animal disease emergency preparedness plans*, revised in 2008.

Sources of information recommended for use in conjunction with this manual include:

- *Australian veterinary plan* (AUSVETPLAN) *disease strategy: African swine fever*, 2nd edition. 1996. Canberra. Agriculture and Resource Management Council of Australia and New Zealand.
- *Terrestrial animal health code: mammals, birds and bees*. 2007. Volume 2. Paris, OIE.
- *Manual on the preparation of national animal disease emergency preparedness plans*, 2nd edition. 2008. Animal Health Manual No. 6. Rome, FAO.
- *Manual on livestock disease surveillance and information systems*. 1999. Animal Health Manual No. 8. Rome, FAO.
- *Manual on procedures for disease eradication by stamping out*. 2001. Animal Health Manual No. 12. Rome, FAO.
- Penrith, M.-L., Thomson, G.R. & Bastos, A.D.S. 2004. African swine fever. In J.A.W. Coetzer and R.C. Tustin, eds. *Infectious diseases of livestock*, 2nd edition, Vol. 2, pp. 1087–1119. Cape Town, South Africa, Oxford University Press.
- *Recognizing African swine fever – a field manual*. 2000. Animal Health Manual No. 9. Rome, FAO.

This manual will be reviewed regularly and revised in the light of experience. Suggestions and recommendations for amendment should be forwarded to:

EMPRES (Animal Health)
FAO Animal Health Service
Animal Production and Health Division
Viale delle Terme di Caracalla, 00153 Rome, Italy
Tel.: (+39) 06 57054798/6772
Fax: (+39) 06 57053023
E-mail: empres-livestock@fao.org
URL: www.fao.org/ag/empres.html

Acknowledgements

This manual is a revision and update of the *Manual on the preparation of African swine fever contingency plans* (FAO Animal Health Manual No. 11, 2001), which was based on the format of the Australian Veterinary Emergency Plan (AUSVETPLAN) with some modifications.

The authors wish to thank Drs Preben Boysen, David Nyakahuma, Roger Paskin, Peter Roeder and Mark Rweyemamu, formerly of the EMPRES Livestock Unit, Infectious Diseases Group, Animal Health Service, FAO, for providing useful suggestions and comments on various drafts of the original manual. They also thank Drs Gary L. Brickler, Domenico Rutili, Salvatore Montinaro and Andrea Monaco for providing some of the photographs.

Acronyms and abbreviations

ASF	African swine fever
ASFV	African swine fever virus
AUSVETPLAN	Australian Veterinary Emergency Plan
CCEAD	Consultative Committee on Emergency Animal Diseases
CSF	classical swine fever
CVO	Chief Veterinary Officer
DCP	dangerous contact premises
DVS	Director of Veterinary Services
EDTA	ethylenediamine tetra-acetic acid
ELISA	enzyme-linked immunosorbent assay
EMPRES	Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases
FAO	Food and Agriculture Organization of the United Nations
FMD	foot-and-mouth disease
GPS	global positioning system
IATA	International Air Transport Authority
IP	infected premises
NGO	non-governmental organization
OIE	World Organisation for Animal Health *(Office international des épizooties)*
PCR	polymerase chain reaction
PDNS	porcine dermatitis/nephropathy syndrome
PRRS	porcine reproductive and respiratory syndrome
SS	Schweiger-Seidel
TAD	transboundary animal disease
TADinfo	Transboundary Animal Disease Information System
WAHID	World Animal Health Information Database
WHO	World Health Organization

Chapter 1

Suggested format and contents of a national contingency plan

An African swine fever (ASF) contingency plan should be a well-articulated strategy document that defines actions to be taken in the event of an ASF emergency. It should contain details of the resources needed to meet such an emergency, and an action plan for rapid, efficient deployment of human and material resources for effective containment of the disease and elimination of infection. *Although it is not feasible to produce a model contingency plan that would be a perfect fit for all situations, the suggested format and contents described here should serve as guidelines for national ASF contingency plans.* It is suggested that a national ASF contingency plan should include the elements outlined in the following paragraphs.

NATURE OF THE DISEASE

This section should describe the essential features of ASF, such as:

- aetiology, world evolution and distribution;
- epidemiological features;
- clinical signs;
- pathology;
- immunology;
- diagnosis: field, differential and laboratory.

Most of these aspects are generic and could be used almost unmodified, but some will likely need to be modified to reflect the prevailing circumstances in individual countries.

RISK ANALYSIS

Risk analysis is important as it provides information on how serious a threat ASF is for the country, in comparison with other animal diseases, where and how ASF might be present and what its potential consequences are. Risk analysis should indicate how much effort should be put into contingency planning and should provide the rationale for the disease control strategies selected. Risk analyses generally have four components: risk or hazard identification, risk assessment, risk mitigation measures, and risk communication to all stakeholders (producers, veterinary practitioners, trading partners, ministers, veterinarians, consumers, etc.).

Risk analyses need to be updated regularly to take account of changing internal and external circumstances, such as the national and global economy, international trade and market opportunities, swine population densities (including wild suids), tourism, changes in animal health systems and consumer demands.

PREVENTION STRATEGIES

Prevention strategies describe the quarantine, on-farm biosecurity and other measures that should be used to minimize the risk of introduction and establishment of ASF.

EARLY WARNING CONTINGENCY PLAN

Contingency plans should include all the initiatives to be taken to ensure that an incursion of ASF can be recognized and countered before it reaches epidemic proportions, and to monitor progress in elimination campaigns. It includes *definition of suspected case(s); definition of confirmed cases*; disease surveillance and epidemiological capabilities, such as emergency disease reporting mechanisms and animal health information systems; training of animal health staff, pig producers and market intermediaries in ASF recognition; and public awareness programmes.

STRATEGIES FOR CONTROL AND ERADICATION

In the absence of a vaccine, it has long been suggested that the only viable strategy for ASF eradication or elimination from a given area is stamping out. This approach to disease control is losing ground owing to ethical, environmental, financial and practical considerations. Although acceptable alternatives are still a matter of debate, it is recognized that circumstances must dictate how a country should approach control, and whether eradication is in fact an option. This section, which is the core component of the contingency plan, should describe how to approach control, taking into consideration all the factors relating to the production, distribution and management of pigs in the country, the presence of wild or feral pig populations, and the capacity to apply control measures. It must show how disease eradication should be verified, and national, zonal or compartmental freedom from ASF demonstrated to international standards.

ORGANIZATIONAL ARRANGEMENTS FOR EMERGENCIES

Generally, the administrative structures of national veterinary services have evolved to deal with routine national animal health programmes, and are often not prepared or appropriately funded for emergency disease control. This section describes the organizational arrangements to be established when there is an ASF emergency. The aim is to enable all necessary resources to be efficiently marshalled to respond to the emergency. These arrangements will vary according to the infrastructure, veterinary services capacity and bureaucratic arrangements of individual countries.

SUPPORT PLANS

Support plans underpin the technical plans. They include financial and resource plans, and legislation. They are of vital importance and key to the success or failure of control.

ACTION PLANS

Action plans describe the mechanisms for implementing the phases of a plan, from the initial investigation to the final stand-down phase, the mechanisms involved in the rehabilitation and recovery phases, and the preparation for obtaining feedback to incorporate the lessons learned into the national contingency plan.

ANNEXES

These should provide a list of names and around-the-clock contact information, including addresses, office and mobile (cellular) telephone numbers, fax numbers and e-mail addresses. Periodic updates are essential. In addition, the following should also be included in annexes to the contingency plan:

- regional and world reference laboratories for ASF;
- regional and international organizations for possible assistance.

Information on national animal health laws and other data relevant to a particular country, such as the number and distribution of pigs and the distribution of feral or wild pig populations, should be included.

It should be emphasized that the following provides only the framework for national contingency plans for ASF. Countries must take their own particular circumstances into account.

Chapter 2
Nature of the disease

DEFINITION

A highly contagious viral disease of domestic pigs, ASF manifests itself as a haemorrhagic fever with mortalities that can approach 100 percent. The catastrophic effect of this disease on pig production, from the household to the commercial level, has serious socio¬economic consequences and implications for food security. ASF is a serious transboundary animal disease (TAD) with the potential for rapid international spread.

WORLD DISTRIBUTION

First described in 1921 by Montgomery in Kenya, ASF was subsequently reported from most countries in Southern and East Africa, where the virus is maintained either in an ancient sylvatic cycle between warthogs (*Phacochoerus aethiopicus*) and ticks of the *Ornithodoros moubata* complex or in a domestic cycle that involves pigs of local breeds, with or without tick involvement.

The disease spread to Portugal in 1957, almost certainly from Angola. Although it was apparently eradicated, a second introduction in 1959 resulted in spread throughout the Iberian Peninsula and to several other countries in Europe, including France, Italy, Malta, Belgium and the Netherlands, in the following decades. However, ASF became well established only in Spain and Portugal, where eradication was accomplished some 30 years later, and on the Italian island of Sardinia, where it remains endemic. Portugal experienced an outbreak in late 1999, which was rapidly eliminated.

In 1977, ASF spread to Cuba, where it was eradicated with the loss of some 400 000 pigs. Outbreaks occurred in Brazil and the Dominican Republic in 1978, Haiti in 1979 and Cuba in 1980. Eradication from these countries was achieved only by massive depopulation of pigs. Whether these outbreaks originated in Europe or Africa has never been established. It is reported that the former Soviet Union experienced an outbreak in 1977.

The first reports of ASF in West Africa were from Senegal in 1978 and Cameroon in 1982, although it has since emerged that Nigeria experienced outbreaks in the 1970s and that Cape Verde has been infected since at least 1960. It is a matter of debate whether these infections resulted from spread from central African countries or importation from Europe. Apart from São Tomé e Principe, where it was eradicated in 1992, no other West African countries reported ASF until 1996, which saw the start of a pandemic that resulted in several countries becoming infected for the first time, as well as an upsurge in ASF in previously infected countries in both West Africa and Southern and East Africa. Madagascar has experienced ASF since 1997/1998, and Mauritius became infected in 2007. The high level of ASF activity in numerous African countries certainly poses a threat for infection of other regions.

In June 2007, Georgia reported ASF, with the majority of districts being affected. By October, ASF was confirmed in Armenia, and also in a group of wild boars that died in Chechnya (southern Russian Federation), close to the border with Georgia. In 2008, the disease was confirmed in other territories of the Russian Federation.

AETIOLOGY

The cause of ASF is a unique DNA virus that was formerly classified in the family Iridoviridae because of morphological similarities. Now considered to be more akin to members of the Poxviridae, it is currently the sole member, *Asfivirus*, of a family of ASF-like viruses, the Asfarviridae. It is unusual among the DNA viruses in behaving as a true arbovirus, able to multiply in both vertebrate and invertebrate hosts. Although there is only a single serotype, more than 20 genotypes and numerous subtypes of ASF virus of varying virulence have been identified.

EPIDEMIOLOGICAL FEATURES

Susceptible species

Only species of the pig family (Suidae) are susceptible to infection with ASF virus.

Domestic pigs are highly susceptible to ASF, irrespective of age or gender. However, in central Africa and in certain local breed populations of pigs, higher than expected survival rates have been observed, even when ASF outbreaks were caused by virulent strain. The endemic persistence of the virus may drive the selection of some inherent resistance in the exposed pig population, independent of virulence characteristics. All wild African suidae are susceptible to infection with the virus, but do not develop clinical disease. Warthogs are the major host for ASF virus. Bushpigs *(Potamochoerus porcus and P. larvatus*) and giant forest hog (*Hylochoerus meinertzhageni*) have been found to be infected with ASF virus, but their role in the epidemiology of the disease, if any, is unknown.

European wild boars (*Sus scrofa*) are fully susceptible to ASF, with a fatality rate similar to that of domestic pigs. Feral pigs in the American region, probably partially derived from European wild boar, have been shown to be highly susceptible to experimental infection, as have farmed descendants of European wild boars and domestic pigs in South Africa. The susceptibility of other wild suids in areas where ASF does not occur has not been investigated, with the exception of the collared peccary (*Tayassu tajaccu*), which proved completely resistant.

Human beings are not susceptible to ASF.

Virus survival

In the environment: In a suitable protein environment, ASF virus is stable over a wide range of temperatures and pH values. It has been shown to survive in serum at room temperature for 18 months, in refrigerated blood for six years and in blood at 37 °C for a month. Heating at 60 °C for 30 minutes inactivates the virus. In the laboratory, ASF virus remains infective indefinitely at -70 °C, but may be inactivated if stored at -20 °C for lengthy periods. In the absence of a protein medium, viability is greatly reduced. ASF virus is generally stable over a pH range of 4 to 10, but in a suitable medium (serum) has been

shown to remain active at lower and higher values for between a few hours and three days. Putrefaction does not necessarily inactivate the virus, which may remain viable in faeces for at least 11 days, in decomposed serum for 15 weeks and in bone marrow for months. On the other hand, culture of virus from decomposed samples is frequently unsuccessful, probably because of the toxic effects of the intracellular debris and enzymes on the culture system.

When not protected, ASF virus is rapidly inactivated by sunlight and desiccation. It has been shown that pigsties in tropical countries do not remain infective for more than three to four days, even in the absence of cleaning and disinfection. However, high levels of ASF virus may persist in protein-rich, moist environments such as slurry.

As a result of its tolerance to a wide pH range, only certain disinfectants are effective in the control of ASF.

In the host: After infection with ASF virus, domestic pigs may shed infective amounts of virus for 24 to 48 hours before clinical signs appear. During the acute stage of disease, enormous amounts of virus are shed in all secretions and excretions, and high levels of virus are present in tissues and blood. Pigs that survive the acute disease may remain infected for some months, but do not readily shed virus for more than 30 days. As in wild suids, infective levels of virus are found only in lymph nodes; other tissues are unlikely to contain infective levels of virus for more than two months after infection. The exact length of time over which infective levels of virus are maintained in lymphoid tissues in either wild suids or domestic pigs is unknown, and is probably subject to considerable individual variation; in domestic pigs it does not appear to exceed three to four months.

Ornithodoros ticks are remarkably long-lived and are able to maintain ASF virus for several years, with only a gradual decrease in infectivity. The role of the *Ornithodoros* ticks that inhabit pigsties in maintaining and transmitting ASF has been amply demonstrated in both Africa (Malawi) and Europe. In the Iberian Peninsula, *Ornithodoros erraticus* contributed significantly to ASF endemicity, and is likely to have been responsible for the 1999 outbreak in Portugal, when pigs were introduced into abandoned pigsties that were still inhabited by ticks. A number of species of *Ornithodoros* that occur in the Caribbean and North America are capable of maintaining and transmitting ASF virus, but ticks were apparently not involved in the Caribbean outbreaks of ASF. *Ornithodoros* does not occur in Sardinia.

As in classical swine fever (CSF), maintenance of ASF virus in domestic pigs in the absence of *Ornithodoros* probably depends on the existence of large, continuous populations of pigs whose high reproductive rate ensures a constant supply of naïve pigs for infection.

In animal products: The ability of ASF virus to remain infective in edible products such as chilled meat (at least 15 weeks, and probably much longer if the meat is frozen) and cured hams and sausages that have not been cooked or smoked at a high temperature (three to six months) has important implications for ASF spread. Undercooked pork, dried, smoked and salted pork and blood or carcass meal derived from pigs must be regarded as dangerous if fed to pigs.

Disease transmission: In the sylvatic cycle between warthogs and argasid ticks of the *Ornithodoros moubata* complex transmission occurs between ticks and neonatal

FIGURE 1
Free-ranging animals are a major concern for disease containment. In the event of a disease outbreak they can become infected and spread the disease easily

warthogs, among ticks and between ticks and domestic pigs. Adult warthogs, even if they have infective levels of ASF virus in lymph nodes, do not shed virus or develop viraemia sufficient to permit infection of other pigs or of ticks that feed on their blood. Among *Ornithodoros* ticks, ASF virus is transmitted transovarially, transstadially and sexually from males to females.

Investigation of large numbers of ectoparasites, including pig lice, mange mites and ticks other than *Ornithodoros* that feed on pigs, such as *Rhipicephalus*, has revealed their inability either to maintain ASF virus or to transmit it mechanically. Only stable flies of the genus *Stomoxys* have been shown to maintain and transmit infective levels of virus for 24 to 48 hours.

During an epizootic, direct contact is the most important route of viral transmission among infected pigs and their secretions and excretions. Infection generally occurs via the oronasal route. Unless control measures are accepted by producers and traders, pigs are moved rapidly in attempts to avoid disease and evade uncompensated compulsory slaughter.

The viral spread of ASF via fomites – contaminated vehicles, equipment, instruments and clothing – is likely when there are high levels of environmental contamination. Iatrogenic spread via contaminated needles is likely, as attempts may be made to vaccinate against CSF or to treat for bacterial diseases such as erysipelas, without adequate sterilization or replacement of needles. Although waste disposal is often via rivers and other bodies of water, waterborne transmission is most unlikely because of dilution of the virus. However, when waterways are used for disposal of carcasses, transmission through carrion feeding is highly likely; disposal in waterways is also not recommended for other hygienic and environmentally sound reasons. Aerosol transmission has been shown to occur only over very short distances.

Swill feeding, particularly of swill originating from aircraft and ships, has been incriminated as a major source of new introduction of the infection in free areas. Swill that consists of or contains large amounts of infected pork has a high potential for spreading infection and has probably contributed to many of the outbreaks that have occurred. Scavenging of offal and remnants of infected pork discarded during preparation for human consumption is probably significant in areas where pigs are not confined. When an outbreak occurs, large amounts of infected pork become available as pigs die. Surplus meat may be dried or subjected to other processes that do not inactivate the virus, and the risk that it is fed to pigs becomes even greater.

CLINICAL SIGNS

The incubation period varies from five to 15 days. Clinical disease is usually peracute or acute with a rapidly fatal outcome. Subacute and chronic forms of ASF, which have a longer duration but also inevitably end in death, have occurred in Europe and the Caribbean, owing to infection with viruses of low virulence, but are rarely seen in Africa, indicating that most of the known viruses are virulent.

High mortality among pigs of all ages is a major indicator for swine fever (ASF or CSF).

To understand and appreciate the development of clinical signs in ASF virus infection, the root causes can be attributed in large part to the systemic and local release of an inflammatory cytokine (a family of proteins released by an infected or stimulated cell) called tumour necrosis factor alpha (TNF- α). TNF- α is reported to be involved in the pathogenesis of the salient clinical manifestations of ASF, such as intravascular coagulapathy and thrombocytopaenia, local tissue injury and haemorrhage, cell death and shock.

TABLE 1
Synopsis of *Ornithodoros* species vector competencies for ASF virus transmission

Ornithodoros species	Geographical distribution	Trans ovarial	Trans stadial	To pigs	Comments
O. marocanus = *O.erraticus*	Iberian Peninsula and North Africa	No	Yes	Yes	Inhabits pigsties maintains a cycle in domestic pigs
O. porcinus porcinus	Southern and East Africa	Yes	Yes	Yes	Inhabits warthog porcinus burrows and maintains the sylvatic cycle in warthogs
O. porcinus domesticus	Southern and East Africa	Yes	Yes	Yes	Inhabits pigsties and maintains a cycle in domestic pigs
O. moubata	Southern and eastern sub-Saharan Africa, Madagascar, one record from Sierra Leone (warthog burrow)				
O. coriaceus	USA	No	Yes	Yes	
O. turicata	USA	?	?	Yes	In the laboratory it did not transmit the virus, but field-collected specimens transmitted it efficiently
O. parkeri	USA	?	?	No	Failed to transmit ASF virus, but the only specimens available for study were from a 15-year-old laboratory colony
O. puertoricensis	Caribbean	Yes	Yes	Yes	Proved an efficient vector under laboratory conditions, but no virus detected in large numbers collected in Haiti and Dominican Republic during the ASF eradication campaign
O. savignyi	Western Southern Africa	?	?	Yes	Is a desert tick not associated with pigs or warthogs
O. sonrai	Sahel in North Africa (southwards extension of range to south Senegal)				ASF viral genome detected by polymerase chain reaction (PCR) in 4/36 ticks on farms where outbreaks occurred in 2004 and 2005
Other vectors					
Stomoxys calcitrans					Can maintain ASF virus for 48 hours and transmit **it to pigs**

Peracute ASF

Pigs are usually found dead without premonitory signs. Recumbency, accompanied by high fever, indicated by flushing of the ventral area and extremities in white-skinned pigs, shade seeking, huddling together and rapid shallow breathing may be observed in some animals before death.

Acute ASF

Pigs develop a persistent fever of up to 42 °C. They become listless and anorexic, huddle together, seek shade and sometimes water and are reluctant to move. White-skinned pigs become flushed to cyanotic, particularly the ears, lower legs and ventral abdomen. Mucopurulent ocular and nasal discharges may be evident. Signs of abdominal pain such as arching of the back, uncomfortable movements and flank kicking may occur. Vomiting

FIGURE 2
Early clinical signs including fever, huddling and cyanosis

is common, and pigs may develop either constipation, with hard small faeces covered in blood and mucus, or bloody diarrhoea, with soiling of the tail and perineum. Ataxia due to hind-limb weakness usually develops. Difficult breathing, sometimes with froth that may be bloody at the mouth and nostrils, often occurs and is indicative of the lung oedema that is often the primary cause of death. Pigs that survive longer may develop nervous signs, including convulsions from viral encephalitis/vasculitis or of a terminal nature. Pin-point (petechial) to larger (ecchymotic to suggillating) haemorrhages may be visible on the mucosa and skin. Abortions may occur at any stage of pregnancy and are the result of the high fever, as vertical transmission apparently does not occur. Duration of clinical signs is generally short – two to seven days – but may be longer, and apparent recovery may be followed by relapse and death. Mortality approaches 100 percent. Pigs that recover from acute infection are generally asymptomatic.

Subacute ASF

Pigs that survive longer, typically after infection with less virulent strains, may have a fluctuant fever and usually lose condition. An interstitial pneumonia is usually present, which may result in respiratory distress and moist coughing. Secondary bacterial infection may occur. Joints may be painful and swollen. Death may occur after a variable period of weeks to months, or the pigs may recover or progress to the chronic form of the disease. Cardiac damage may result in death from acute or congestive heart failure.

Chronic ASF

Chronically infected pigs are usually severely emaciated and stunted, with a long, dull hair coat. Signs of pneumonia may be present, as well as lameness, sores and ulcers. These may be particularly prominent over bony points, because the pigs are in such poor condition. These pigs are subject to secondary bacterial infections. They may survive for several months, but recovery is unlikely.

PATHOLOGY

Gross pathology

Pigs that die of peracute ASF may show few gross lesions, apart from the blood splashing and mild accumulation of fluid in body cavities that usually accompany sudden death.

In acute ASF, the carcass is often in good condition. In white-skinned pigs, the extremities and the ventral surface may be cyanotic, and subcutaneous haemorrhage may be evident. Mucous membranes are often congested to haemorrhagic. When the carcass is opened, straw-coloured to blood-coloured fluid may be present in body cavities and the pericardium. Organs are generally congested, and haemorrhages may be evident over serosal surfaces. Pinpoint haemorrhages are often present in the renal cortex, over the splenic capsule and in the lungs, with larger haemorrhages often occurring on the epi- and endocardium and on the gastro-intestinal serosa. The spleen is slightly to considerably enlarged, soft and dark, with rounded edges. Peripheral infarcts may be present; in these cases the spleen is generally only moderately enlarged. Lymph nodes, particularly the gastrohepatic, mesenteric, renal and submandibular lymph nodes, are enlarged and

severely haemorrhagic; they often resemble blood clots. The mucosa of the stomach is often deeply congested to haemorrhagic, and sometimes necrotic; haemorrhage may be present in the gall bladder and the urinary bladder. Straw-coloured gelatinous thickening of the gall bladder walls may be seen. The lungs do not collapse and are enlarged due to the accumulation of fluid, so that interlobular septa are prominent. Fluid and froth ooze on cut surfaces, and the trachea is often filled with froth, which may be bloody. There is usually severe thrombocytopaenia, which is due to consumption coagulopathy rather than being a direct effect of the virus on megakaryocytes. Death is often preceded by disseminated intravascular coagulopathy.

The main features of subacute and chronic ASF are loss of condition to emaciation, interstitial pneumonia and enlarged lymph nodes, which may be firm and fibrous in the chronic form of the disease.

Histopathology

Pathological changes are ascribed to the effects of the virus on macrophages, which result in massive destruction of these cells, accompanied by release of cytokines.

The most striking histopathological feature of ASF is massive karyorrhexis in lymphoid tissues, often accompanied by haemorrhage. The Schweiger-Seidel (S-S) sheaths of the spleen are virtually obliterated. Blood vessel walls, especially in the lymphoid tissues, often exhibit fibrinoid change resulting from necrosis of the endothelium and leakage of inflammatory mediators. Other changes include interstitial pneumonia with accumulation of fibrin and macrophages, renal tubular degeneration with hyaline droplet absorption, and infiltration of portal tracts in the liver with macrophages and lymphocytic meningoencephalitis.

IMMUNITY

For swine that survive the peractue or acute clinical forms of the infection, antibodies against ASF are detectable in serum for seven to 12 days after clinical signs first appear, and persist for long periods, possibly for life, in both warthogs and domestic pigs. They do not protect fully against subsequent infection in domestic pigs, although a degree of immunity to infection with homologous strains of virus has been reported. Serologically positive sows transmit antibodies to piglets in colostrum. In subacutely and chronically infected pigs, virus replication continues in the presence of antibodies. The deposition of immune complexes in tissue may account for many of the lesions observed in these forms of disease.

As no vaccine is available for ASF, the detection of antibodies in pigs can be confidently attributed to exposure to natural infection. There are no known serological cross-reactions with other viruses.

DIAGNOSIS

Field diagnosis

Unusually high mortality among pigs of all age groups should lead to a strong suspicion of ASF or CSF. Additional indicators are the typical clinical signs and lesions of swine fever, failure to respond to antibiotic treatment and the fact that no other livestock species is involved. Laboratory-based differentiation among ASF, CSF and other pathologies is essential.

Differential diagnosis

Hog cholera, or CSF, is the most important differential diagnosis for ASF. Clinical signs and gross lesions may be identical, and such minor differences as have been described are not pathognomic or consistent. Lesions such as the button ulcers at the ileocaecal junction described in CSF are far from frequent, and splenic infarction possibly has a similar incidence in both diseases. Laboratory diagnosis is therefore absolutely essential in any case of suspected swine fever.

The following are several other diseases that may be confused clinically with ASF:

- Other viral diseases of pigs that have some features in common with ASF are porcine reproductive and respiratory syndrome (PRRS), which can cause high mortality, and porcine dermatitis/nephropathy syndrome (PDNS), which is one of the diseases associated with porcine circovirus 2 infection. PDNS usually affects growers and is characterized by dark-red blotchy to coalescent skin lesions, particularly over the hind limbs, and severe nephrosis. Morbidity is low, but affected pigs invariably die.
- Bacterial septicaemic diseases such as erysipelas, pasteurellosis and salmonellosis generally have a predilection for a particular age group, have lower incidence and mortality rates, respond to treatment with appropriate antimicrobials and can be confirmed on bacterial and histopathological examination. Anthrax in its acute, systemic form may be considered as a differential diagnosis, although in pigs this disease usually appears as the pharyngeal form, which is distinctive and has little in common with ASF.
- Warfarin poisoning through ingesting rat poisons causes severe haemorrhage and death; only a few pigs in a herd are likely to be affected, however, and no clotting of the blood upon necropsy is noted.

FIGURE 3
Sampling: taking blood samples is necessary for ASF diagnosis and surveillance

- Fungal poisonings caused by eating mouldy feed, such as aflatoxicosis and stachybotryotoxicosis, may cause haemorrhage, severe mortality and, in the case of stachybotryotoxicosis, marked karyorrhexis in lymphoid tissues. Although these can cause mortality in any age group, particular groups of pigs are usually exposed, as different age groups usually receive different rations. Confirmation requires analysis of the feed or liver by techniques that are not available in all diagnostic veterinary laboratories.
- Acute accidental or malicious poisoning can result in the death of pigs of all ages in a very short time, but this will generally be shorter than for ASF and the clinical signs and lesions, if any, will not be suggestive of fever. Confirmation requires toxicological analysis of gastro-intestinal content or organs.

Cases of subacute and chronic ASF are difficult to distinguish from CSF and other causes of pigs failing to thrive, and diagnosis may be complicated by the presence of secondary infections.

Laboratory diagnosis

Laboratory confirmation of a presumptive diagnosis of ASF depends on detection of the virus or detection of antibodies. As most pigs die of acute ASF before antibodies are produced, detection of the virus is the most important method of diagnosis.

Detailed instructions for laboratory diagnostic procedures for ASF are to be found in the World Organisation for Animal Health (OIE) *Manual of Standards for Diagnostic Tests and Vaccines*. The following is a summary, with an emphasis on the assays that are usually used.

Collection and transport of diagnostic specimens: Preferred samples for virus isolation/antigen detection are:

- tissue samples from lymph nodes, spleen and tonsils collected aseptically and kept chilled but not frozen;
- whole (unclotted) blood collected aseptically into ethylenediamine tetra-acetic acid (EDTA) or heparin (purple- or green-topped tubes) from febrile pigs up to five days after the onset of fever; if the samples are destined for examination by polymerase chain reaction (PCR), only EDTA should be used;
- in cases where decomposed swine carcasses are the only animals available for sampling, bone marrow is a useful tissue for performing specific tests such as PCR.

To detect antibodies, blood samples should be collected in red-topped tubes (i.e., without anticoagulant). Various methods of collecting blood using filter paper strips or capillary tubes are available. Instructions on the preferred sample should be discussed with the laboratory that is carrying out the diagnostic tests.

A range of tissues – spleen, lymph nodes, lung, liver, kidney and brain – may be collected in 10 percent buffered formalin, for histopathological examination and detection of virus by immunoperoxidase.

Whole blood and unpreserved tissue samples should be chilled and transported on water ice or frozen gel packs. If a break in the cold chain is likely, or chilling is impossible, the addition of 50 percent sterile glycerosaline solution (50 percent glycerol and 0.8 percent NaCl) will provide adequate preservation while enabling viral culture. The addition of antibiotics – 200 units of penicillin and 200 mg/ml of streptomycin – will prevent bacterial

growth. The use of formol-glycerosaline solution (50 percent of 50% glycerol solution; 50% glycerol buffered with 10% formalin) will permit the detection of viral DNA but will not permit culture Freezing is not recommended if culture is intended, as ASF virus may be inactivated at -20 °C.

Before transport, serum samples should be centrifuged, if possible, or the clot removed. After collection, blood samples destined for serology should be allowed to stand at room temperature for at least sufficient time for clotting before refrigeration. If the tubes are placed stopper-down, the blood clot can be removed easily with the stopper, and the stopper then replaced. The samples are then submitted on ice as described for tissue samples, or they may be frozen.

Unpreserved diagnostic samples should be placed in a strong watertight container, generally a plastic screw-topped jar or, for blood or serum, a vacutainer. This is wrapped in absorbent material, placed in a strong leak-proof secondary container, usually a plastic or styrofoam cold-box, and finally in a solid outer covering. The package is then labelled with waterproof ink and dispatched to a national or international reference laboratory. If samples are being transported in hot climate conditions from the field to a national laboratory, it is advisable to acquire a cold-box with ice or freezer packs. When samples are sent by air, International Air Transport Authority (IATA) rules should be followed. Information about the carrier, waybill number and time of arrival should be sent ahead to the laboratory. Prior contact with the recipient laboratory is necessary to ensure that the dispatched package is expected and the instructions followed (including export and import permits).

All specimens should be accompanied by basic information: name of owner, locality, brief history (numbers and dates of pig deaths, ages of pigs, clinical signs), date of collection, disease suspected, and tests required. If several samples are submitted, each should be labelled or given a number in waterproof ink referring to the accompanying information.

Laboratory diagnosis should only be attempted by trained personnel in well-equipped laboratories.

Virus isolation: Isolation should only be attempted in well-equipped laboratories with the ability to perform tissue culture and to maintain capacity in the absence of field samples.

ASF virus may be isolated by inoculation of primary pig leucocyte cultures and subsequent identification of ASF virus by haemadsorption or cytopathic effect. Cytopathic effect is not specific to ASF virus, and should be confirmed by other tests.

The use of live pigs for diagnostic purposes has been rendered obsolete by the existence of other methods.

Antigen detection: The following tests may be used:

- direct immunofluorescent antigen test;
- antigen capture enzyme-linked immunosorbent assay (ELISA);
- immunoperoxidase staining of histopathological specimens; this is not the test of choice, as preparation takes at least 24 hours and the test can only be done in a reference laboratory with the capacity to perform histopathology; it is, however, useful if the only specimens available have been preserved in formalin.

Detection of viral genetic material: PCR protocols are available for ASF. PCR is a highly sensitive and specific technique, and because of the possibility of cross-contamina-

tion, its use is limited to laboratories that can provide the required level of biosecurity and personnel with training and experience in the technique.

Antibody detection: Serological tests for ASF include:

- ELISA; the most commonly used test and the prescribed test for international trade because of its superior sensitivity and specificity;
- indirect fluorescent antibody test;
- immunoblotting;
- counter-immuno-electrophoresis test; the test of choice before ELISA was available.

Chapter 3
Risk analysis

INTRODUCTION

Risk analysis is often an intuitive part of people's everyday lives and professional activities. Only recently has it developed into a more formal discipline that is used increasingly in many fields of endeavour. In animal health it has perhaps been most widely applied to help determine strategies for quarantine operations and appropriate health conditions for imported animals and animal products. However, it can also be advantageously used in animal disease emergency preparedness planning.

PRINCIPLES OF RISK ANALYSIS

Risk analysis comprises four components: risk identification, risk assessment, risk management, and risk communication.

Risk identification

In this component, the possibility of a threat or threats occurring is identified and recognized, and background information obtained and studied (i.e., through scientific literature research and other data).

Risk assessment

In this component, the threats that might arise from an event or a particular course of action are identified and described. The likelihood of those threats occurring – the risk – is then estimated. The potential consequences of the threats are evaluated and used to modify the assessment of the risk. For example, an exotic disease with a high risk of entry into a country would get a low overall score on a risk assessment if the risk of its becoming established was low or if the potential socio-economic consequences for the country were only minor. A disease with a low risk of introduction but a high risk of then becoming established, or of causing severe socio-economic consequences, would be rated higher.

Risks can be assessed in a quantified, semi-quantified or qualitative way. It is inherently difficult to quantify or assign a probability number to a risk in many biological systems, because of a lack of historical precedents and the presence of serious gaps in available biological data. It is recommended that qualitative risk assessments be used for exotic diseases. The risks can be described as extreme, high, medium or low, or scored on a simple scale of, for example, 1 to 5 for the level of risk and 1 to 5 for the level of potential consequences (socio-economic consequences, effects on livelihoods and food security, effects on local and international trade, zoonotic potential, likelihood of failure to diagnose or control the threat, potential to spread to other populations, particularly wildlife, etc.).

Risk management

This is the process of identifying, documenting and implementing measures to reduce the risks and their consequences. Although risk can never be completely eliminated, the aim of this component is to adopt new or change existing procedures to reduce the level of risk to what is deemed an acceptable level.

In fact, the whole of this manual could be regarded as providing the risk management framework for ASF contingency planning.

Risk communication

This is the process of exchanging information and opinions on risk among risk analysts and stakeholders. Stakeholders in this context include all those who could be affected by the consequences of the risks/threats, everyone from farmers to politicians. It is important that risk assessment and risk management strategies be fully discussed with these people, so that they feel assured that no unnecessary risks are being taken and that the risk management costs are a worthwhile insurance policy.

To ensure ownership of decisions, risk analysts and decision-makers should consult stakeholders throughout the process of risk analysis, so that risk management strategies address stakeholders' concerns and decisions are fully understood and supported.

WHO SHOULD CARRY OUT THE RISK ANALYSIS?

The risk assessment component is best carried out by the epidemiological unit of the national veterinary headquarters as part of the national early-warning system for TADs and other emergency diseases. Risk management and risk communication are tasks for everyone, but they should be coordinated through the office of the chief veterinary officer (CVO).

It should be remembered that risks do not remain static. They change with such factors as the evolution and spread of epidemic livestock diseases internationally, the emergence of new diseases, and changing international trading patterns in the country. Risk analysis should not be seen as a once-only activity. It should be repeated and updated regularly.

RISK ASSESSMENT

As described in the previous sections, risk assessment consists of identifying the threats, assessing the likelihood that they occur, and modifying the risks by evaluating their potential consequences.

The international status and evolution of outbreaks of ASF and other important TADs, and the latest scientific findings should be constantly monitored, as a routine function of the epidemiological unit of the national veterinary services. As well as the scientific literature, the most valuable source of official information is OIE, through publications such as its weekly disease reports and the annual FAO/OIE/World Health Organization (WHO) *World Animal Health*, and through access to OIE's World Animal Health Information Database (WAHID - www.oie.int/wahis/public.php?page=home). Disease intelligence is also available from other sources such as FAO, regional organizations involved in animal production and health, agricultural attachés working abroad, e-mail news dispatches and animal health Internet sites.

Having identified and listed the exotic disease threats, the next step is to assess the seriousness of the risk of entry of each disease into the country, and the routes and mechanisms by which it may enter. Several factors should be taken into account:

- What is the current geographical distribution and prevalence of the disease (such as ASF) around the world?
- Is the distribution fairly static or has there been a recent history of spread to new countries, regions or continents?
- How close is the disease? What is the status of neighbouring countries regarding known presence of ASF, and how much confidence is there in the ability of their veterinary services to detect and control outbreaks of the disease?
- If it is present in neighbouring countries, where are the outbreaks nearest to shared borders?
- Is there a past history of introduction of ASF into the country? Is it possible that it is still present in undetected endemic pockets of infection in domestic, feral or wild pigs?
- How is the disease spread? What are the roles of live animals, genetic material, pig meat or other animal products, and of ticks and migrating animals in transmitting the aetiological agent?
- Are there significant imports of animal species, meat products or other materials with a risk factor for ASF? Do they come from endemic regions? Do quarantine import protocols conform to OIE standards? How secure are import quarantine procedures?
- How secure are barrier and border quarantine procedures for preventing unlawful entry of risk materials, including ship and aircraft catering waste, for ASF?
- Is swill feeding of pigs a common practice in the country? Are there adequate procedures for making it safe?
- Are there smuggling, unofficial livestock movements and transhumance practices that would constitute a risk for entry of ASF? In particular, is there civil unrest in neighbouring countries that might result in major movements of people and movement or abandonment of livestock?

The next step is to evaluate how serious the socio-economic consequences might be if there is an incursion of the disease. Again, there are several factors to be considered:

- Is the disease likely to become established in the country? Are there susceptible animal host populations, including wildlife?
- Does the veterinary diagnostic laboratory have the necessary equipment and trained personnel to detect the infection quickly?
- Would it be difficult to recognize the disease quickly in different parts of the country?
- How large are the domestic pig populations in the country? How important is the pig industry to the national economy? What is its importance in satisfying nutritional and other community needs?
- How is the pig industry structured within the country? Is there a large commercial pig production industry, or does it consist mainly of backyard/village production? Is production concentrated in just a few areas of the country?

- How serious would production losses be from the disease? Would food security be threatened?
- What effect would the presence of the disease have on export trade of animals and animal products? What effect would it have on internal trade?
- Are there populations of wild suid species, feral pigs or domesticated pigs that are poorly controlled and allowed to roam freely? Might these constitute reservoirs of ASF infection that are difficult to control?
- Are *Ornithodoros* spp. ticks, which could maintain and transmit the virus, present and associated with pigs in the country?
- How difficult and costly would it be to control and eradicate the disease? Would eradication be possible?

Addressing these questions and issues enables analysts to build up a risk profile for ASF and make qualitative judgements on the magnitude of the risk presented by the disease. Most important, it provides an idea of how ASF ranks in relation to other high-priority disease risks, and what resources should be devoted to preparedness for ASF in comparison with those devoted to other diseases. It also gives some idea of where the pressure points may be for entry of the disease, and how veterinary services and contingency planning for ASF may need to be strengthened. If ASF is already present in the country, the information will guide decisions regarding the most appropriate control strategy for the prevailing circumstances.

THE VALUE OF RISK ASSESSMENTS FOR CONTINGENCY PLANNING

The type of risk assessment that has been described will be of value for:

- determining where ASF ranks in the priority list of serious disease threats for the country, and what level of resources should be devoted to preparing for it in comparison with preparing for other diseases;
- determining where and how quarantine protocols and procedures need to be strengthened;
- understanding the swine industry and the methods of marketing swine and pork products throughout the regions of the country;
- determining how laboratory diagnostic capabilities need to be strengthened;
- planning training courses for veterinary staff, and farmer awareness and publicity campaigns;
- determining how and where disease surveillance needs to be strengthened;
- planning appropriate disease response strategies.

FURTHER READING ON THIS VALUABLE METHODOLOGY

MacDiarmid, S.C. & Pharo, H.J. 2003. Risk analysis: assessment, management and communication. *Rev. sci. tech. Off. int. Epiz.*, 22(2): 397–408. www.oie.int/boutique/index.php?page=ficprod&id_produit=85&fichrech=1.

Urbina-Amarís, M.E. 2003. The role of a specialised risk analysis group in the veterinary services of a developing country. *Rev. sci. tech. Off. int. Epiz.*, 22(2): 587–595. www.oie.int/boutique/extrait/23urbinaesp.pdf.

Murray, N. 2004. *Handbook on import risk analysis for animals and animal products. Vol. I, Introduction and qualitative risk analysis,* and *Vol. II, Quantitative risk assessment.* Paris, OIE.

Chapter 4
Prevention strategies

INTRODUCTION

The old maxim that prevention is better than cure is particularly relevant to ASF and other TADs. Quarantine is the first line of defence against these diseases (i.e., pre-embarkation and entry quarantines of live swine), together with movement management and control across borders (for live animals and products). All countries should devote an appropriate level of resources to implementing effective border and import quarantine policies that prevent the introduction of serious livestock diseases.

Risk analyses for ASF should provide estimates of:

- the degree of risk of introduction of the disease;
- the likely mechanisms and portals of ASF entry;
- the potential seriousness of the consequences should the disease enter the country.

These should provide the basis for designing and implementing appropriately resourced prevention strategies for ASF.

The most important resource in the prevention of ASF or other livestock diseases is the informed animal owner or manager. Pig owners at all levels of production must be able to recognize ASF and know what to do when they suspect it. This can only be achieved by intensive training of farmers, using media that are easily understood and highly visual and that will serve as a constant reminder of the disease and its importance. Such communication or awareness materials should be broad enough to capture ASF and other pathologies that may be confused with ASF, without leaving it to individual farmers to decide whether potential cases are ASF or not. Lines of communication must therefore be established between livestock owners and the veterinary services for reporting the occurrence of high fatalities in swine or the presence of any other problems that are beyond the owners' usual experience. Local authorities and agricultural personnel must be informed about ASF and should be used as intermediaries when necessary. The only people who see animals every day are their owners or managers. Informed owners therefore constitute the only really viable daily surveillance resource for animal disease.

IMPORT QUARANTINE POLICY

The OIE *Terrestrial Animal Health Code* (2007 edition, Chapter 2.6.6) provides guidelines for the safe importation of domestic and wild pigs, pig meat and meat products, pig semen, embryos and ova and other products incorporating pig tissues, such as pharmaceuticals (www.oie.int).

Attention should be paid to providing adequate quarantine and inspection services to intercept foodstuffs and other risk materials containing pig meat or products that are brought into the country at international airports, seaports and border crossing points. Any confiscated risk material should be disposed of safely by deep burial or incineration,

as should all food waste from international aircraft and ships. For example, the European Commission has established a list of Category 1 Risk Material, i.e., extremely high-risk material.

SWILL FEEDING CONTROLS

Swill feeding with food scraps, which may contain imported animal products, is a very important means by which ASF and other serious TADs such as foot-and-mouth disease (FMD), swine vesicular disease and CSF may be introduced into a country. Consideration should therefore be given to placing a ban on swill feeding or at least implementing controls that will make it safe. Every effort should be made to prevent swill feeding of food waste from international aircraft or ships, as this constitutes an extremely high risk for the introduction of ASF and other TADs into new countries. There is a high probability that the introduction of ASF into Western Europe, Latin America and Georgia occurred in this way.

A ban on swill feeding is highly desirable from the point of view of disease prevention, but it is impossible to monitor at the household level, which makes it difficult to implement. Pigs were domesticated in the first instance precisely because of their ability to convert a variety of low-grade feed, including human detritus, into high-quality protein. For many pig producers in rural, peri-urban and urban situations, economic circumstances dictate that any affordable food source should be used, and in urban and peri-urban situations this is likely to be swill. The only possible way of avoiding disease is for pig owners to understand the dangers and to opt voluntarily to boil swill before feeding it to their pigs. Where poverty prevails, the law is usually no deterrent. Awareness of risk and a practical means of overcoming it will ensure compliance with regulatory measures. In countries with a developed pig industry, farmers may be law abiding if swill is banned, but this is mainly because they appreciate that swill feeding does not achieve the best results in terms of modern production.

CONTAINMENT OF PIGS

The presence of large numbers of uncontrolled or poorly controlled pigs constitutes a high risk for the entry and rapid spread of ASF. There may be significant delays in recognition of the disease, and eradication will be more difficult. Perhaps the greatest danger is that these pigs have access to the carcasses of dead pigs in the countryside or on garbage dumps, and to the offal of pigs that have died of ASF and been prepared for human consumption. Measures should be taken to encourage the development of properly constructed pig pens and to reduce the numbers of scavenging pigs, particularly in areas that are considered to be at high risk for entry of ASF. It is well known that a very basic level of biosecurity prevents the spread of the infection, at least at the farm level. Pig farmers' groups at all levels should make every effort to improve the conditions of biosecurity under which their pigs are raised. This not only makes control of diseases such as ASF, CSF and porcine cysticercosis possible, but also improves productivity, and therefore incomes, for smallholder pig producers. The establishment of pig farming organizations to support smallholder farmers should also be encouraged.

It must be accepted, however, that traditional ways of keeping pigs in many countries will not be changed overnight, and that permanent confinement of pigs imposes feeding obligations that owners may be unable to meet. Until more research has been done on alternative feeds, many producers will not find it worthwhile to confine their pigs. The best that can be hoped for in the short term is that informed pig owners will understand the dangers of disposing of carcasses, offal and remnants of dead pigs on garbage dumps, as well as the dangers of allowing pigs to scavenge. A national policy for upgrading pig production, which includes identifying sources of feedstuffs that are readily available and affordable, should be put in place.

Chapter 5
Early warning and contingency planning

INTRODUCTION

Early warning is based on disease surveillance, rapid reporting and epidemiological analysis, leading to improved awareness and knowledge of the distribution and behaviour of disease outbreaks and infection. It encompasses regional and global scanning activities by the epidemiology unit of a veterinary service, which interprets changes that may affect risk assessment. This heightened awareness should enable rapid detection in the event of an introduction or sudden increase in the incidence of a serious disease such as ASF, before it develops to epidemic proportions and causes serious socio-economic consequences. Early warning enables forecasting of the source and evolution of disease outbreaks and monitoring of the effectiveness of disease control campaigns. (At the global level see, for example, www.fao.org/docs/eims/upload//217837/agre_glews_en.pdf.)

The success of a country's rapid detection of ASF introduction or increased incidence depends on:

- good awareness programmes for ASF and other high-threat epidemic livestock diseases, which involves improving communications between veterinary officers and farmers;
- definition and application of suspected and confirmed cases;
- training of field veterinary officers, veterinary auxiliary staff, local authorities and pig owners in the clinical and gross pathological recognition of ASF and other serious epidemic livestock diseases;
- prompt collection and transportation of diagnostic specimens;
- sustained active disease surveillance to supplement passive monitoring, based on close coordination among pig owners and field and laboratory/epidemiology veterinary services, and using participatory questionnaires, serological surveys and abattoir monitoring in addition to field searches for clinical disease;
- reliable mechanisms for emergency disease reporting to regional, national or federal veterinary headquarters;
- implementation of a computer-based disease information system, such as the Transboundary Animal Disease Information System (TADinfo) software from FAO/EMPRES;
- enhancement of laboratory diagnostic capabilities for ASF in veterinary laboratories, including their participation in regional or international ring tests;
- development of links among national laboratories and regional and world reference laboratories;
- close cooperation between the field services and the veterinary diagnostic laboratory;

- strengthened national epidemiological capabilities to support emergency preparedness and disease management;
- prompt and comprehensive international disease reporting to OIE, neighbouring countries and trading partners.

It is beyond the scope of this manual to discuss all these issues in detail. For more information, reference should be made to the *Manual on the preparation of national animal disease emergency preparedness plans* (FAO Animal Health Manual No. 6) and the *Manual on livestock disease surveillance and information systems* (FAO Animal Health Manual No. 8).

Case definition for ASF in new areas (i.e., Caucasus region)

Case definition – Suspect case

Any individual or cluster of swine that show:

1. Clinical signs:
- high fever (> 41.5 °C)
- nervous disorders
- high lethality rate (> 30 percent affecting all age classes)
- sudden death without any prior clinical signs; and

2. Pathology:
- hemorrhagic lymph nodes
- enlarged and congested spleen; and

3. A history of recent pig introduction to the holding, or the practice of swill feeding, or allowing scavenging in rubbish dumps.

Confirmed case – Laboratory

ASF antibodies detection found positive (any test) with epidemiological evidence of clinical disease; or ASFV confirmation: ASF virus (ASFV) or genetic component detection at the laboratory level.

TRAINING OF ANIMAL HEALTH STAFF IN EARLY RECOGNITION, COLLECTION AND DISPATCH OF DIAGNOSTIC SPECIMENS

In countries where ASF has never occurred, has not occurred for many years or is introduced for the first time, it is likely that few veterinarians or other animal health workers in the public or private sectors will have had any first-hand experience of the disease. This may also be true of other TADs. This deficiency should be rectified by a training programme for all the personnel who may be the first to come into contact with an incursion or outbreak of ASF or another disease. Because a disease may appear in any part of the country, and because of staff turnover, training programmes should be comprehensive and regular. Training must extend to staff in the remotest parts of the country, as well as to local authorities, pig owners and commercial intermediaries. For training, it is essential to have partnerships between the central and regional authorities (states, provinces, governorates, autonomous regions or departments), especially in countries with decentralized governments or that are constituted as federations.

It will obviously be neither practicable nor necessary to train personnel to a high level of expertise in all these diseases. In most cases, it is sufficient that trainees be familiar with the basic clinical, pathological and epidemiological features of each disease (including ASF), and know what to do if they suspect one of the diseases. Perhaps the most important thing is to inculcate the understanding that when confronted with an unusual disease outbreak in pigs, in the field or the diagnostic laboratory, staff should include ASF among the differential diagnostic possibilities and act accordingly. They should be trained in the steps to be taken to secure a confirmatory diagnosis, including collection and transport of diagnostic specimens; in the immediate disease control actions to be implemented at a disease outbreak site; and in the risk of their activities contributing to disease spread if biosecurity actions are not rigorously followed. More specialized training will be needed for the personnel nominated to specialist diagnostic teams.

The various training possibilities include:

- sending key field or laboratory staff to another country to gain first-hand experience of an ASF outbreak or to attend workshops where they can profit from the experiences of other countries in controlling an outbreak;
- international training opportunities, such as courses in exotic diseases offered by veterinary faculties, and training for laboratory staff at world or regional reference laboratories and other international organizations;
- national emergency disease training workshops – which should be the mainstay of training – directed at government field and laboratory veterinary officers, public health and quarantine veterinarians, including those stationed at abattoirs, markets, border posts, airports and seaports, veterinary practitioners and industry veterinarians; the workshops should include representatives from neighbouring countries, and cascade to the farmer level by means of workshops organized by those who have been trained;
- field diagnostic manuals, which should be simple, practical, graphic and available for quick reference at the site of a disease outbreak.

FARMER AWARENESS/EDUCATION PROGRAMMES

Farmer awareness programmes are critical, but sometimes neglected, aspects of preparedness planning for emergency diseases. They foster ownership and support for emergency disease control/eradication campaigns among livestock farmers and other stakeholders, engendering a bottom-up approach to the planning and implementation of disease control programmes, which complements the top-down approach usually adopted by governments.

Communication strategies should aim to make stakeholders aware of the nature and potential consequences of ASF and other important livestock diseases, and the benefits of prevention and eradication. They should always have an element of rallying the community to the common cause of preventing or fighting a disease epidemic, ideally resulting in the formation of sanitary defence groups and other farmers' organizations.

One of the important messages to get across is that it is essential to notify and seek help from government animal health officials as soon as an unusual disease outbreak is seen in pigs. Information about how to do so should be available. Publicity campaigns should

be directed towards farmers, local authorities and livestock traders. The existence of a fair compensation policy for farmers' losses is important for rapid reporting, and should be communicated to farmers.

Establishing a compensation policy is part of the planning process, and swine producers need to know that such a policy exists. Although agriculture or livestock departments are often left to identify compensation funds, it is important that the communication component of the risk analysis includes alerting other ministries (e.g., finance, rural affairs, environment) or the office of the Prime Minister about emergency needs in the event of the incursion of a transboundary or exotic animal disease such as ASF.

SPECIALIST DIAGNOSTIC TEAM

It is recommended that a specialist ASF diagnostic team be identified and trained, which is mobilized in the field when a suspect outbreak in pigs is reported. These arrangements should be made well in advance of any emergency, and the personnel should be available and equipped to travel to a disease outbreak site at short notice. Equipment should include everything needed for preliminary epidemiological investigation of a disease event and for the collection and transportation of diagnostic specimens.

The composition of the diagnostic team will vary according to circumstances, but may include:

- a veterinary pathologist from the central or regional veterinary diagnostic laboratory;
- a specialist epidemiologist, preferably with first-hand experience or training in ASF;
- a veterinarian with extensive experience of endemic diseases in pigs.

The team travels to a disease outbreak site, with local veterinary staff directed by the CVO and:

- makes clinical examinations;
- collects histories;
- makes preliminary epidemiological investigations, particularly in respect to:
  - *trace-backs* – have any new animals joined the infected herds in recent weeks, and where did they come from?
  - *trace-forwards* – have any animals left the infected herds in recent weeks, and where did they go to?
- performs necropsies on animals killed at an advanced stage of the disease or on animals recently dead; if possible the carcasses should be transported to a laboratory with proper necropsy facilities;
- collects diagnostic specimens appropriate to the endemic and exotic diseases included in the differential diagnosis, and transports these to the laboratory.

The team should have the authority to take any immediate disease control actions at the outbreak site, based on knowledge and definition of what constitutes an epidemiological unit (see following Box). It should report its assessment immediately to the state, provincial or regional veterinary officer and the CVO, specifying the steps taken to secure a confirmatory diagnosis and giving advice on further disease control strategies, including declaration of infected and surveillance zones.

Epidemiological unit

An epidemiological unit is a series of pig holding units linked by proximity (contiguous farms or family farms) or through commercial or production contacts, such as fattening farms, breeding farms or markets. In defining the risks of infection (upstream/trace-back and downstream/trace-forward), it is essential that the temporal relationship between history of movement and potential contact with infected animals or materials be identified, and the appearance of clinical signs and the clinical course be considered, prior to counterepizootic actions such as culling. A village may be considered an epidemiological unit, but measures for disease control must also be based on socio-economic considerations.

LABORATORY DIAGNOSTIC CAPABILITIES

Rapid and certain diagnosis of diseases can only be assured in fully equipped laboratories with a range of standard diagnostic reagents, experienced staff and a sufficient throughput of diagnostic specimens to maintain expertise. Diagnostic expertise for exotic disease tests that require handling of the live agent should only be developed in microbiologically secure laboratories.

It may be impractical and excessively costly for most countries to maintain a national veterinary diagnostic laboratory with full capability for confirmatory diagnosis of all transboundary and other emergency diseases, many of which will be exotic. However, countries with significant livestock populations should have a veterinary diagnostic laboratory equipped and competent to undertake standard techniques in pathology, virology, bacteriology and serology to the level at which preliminary identification of aetiological agents for emergency livestock diseases can be attempted. If ASF is deemed to be a high-threat disease, consideration should be given to developing capabilities for some primary key diagnostic tests, such as the direct immunofluorescent test.

Containers for transporting specimens should be kept at central, state or provincial veterinary laboratories and should be made available for field veterinary officers and specialist diagnostic teams. The containers should ideally consist of leak-proof primary vessels, such as polypropylene bottles with screw caps and rubber washers, or good-quality plastic screw-top jars or sealable bags. These are packed into leak-proof secondary larger plastic or polypropylene containers and placed in styrofoam cold-boxes, with absorbent material and icepacks. If chilling is not an initial option, 50 percent glycero-saline may be added to prevent putrefaction. The containers are finally placed in robust outer containers with clear labels. Specimens must be clearly and indelibly identified, and specimen description notes should also be provided.

INTERNATIONAL REFERENCE LABORATORIES AND COLLABORATING CENTRES

There is a worldwide network of FAO and OIE reference centres (laboratories and collaborating centres) for ASF, which provide advice and assistance. Names and contact details are given in Annex 1.

As part of their ASF contingency planning, countries should establish contact with appropriate reference centres, and determine the nature and range of diagnostic specimens or isolated agents to be sent for confirmatory diagnosis or further characterization. It is important to obtain information about transport media that may have to be added, methods of packaging, refrigeration, labelling and any necessary customs or IATA declarations. This information should be documented in plans.

It is very important that potential or confirmed aetiological agents from emergency disease outbreaks be sent to the appropriate international reference laboratory for further characterization. It is recommended that several isolates from different geographical locations and different phases of the outbreak be forwarded. Submission of samples to any laboratory outside the country of origin should always be subject to prior agreement with the recipient. Having a pre-approved export permit from the CVO's office helps avoid delays. Samples must be transported in containers that meet IATA standards.

Full use of reference laboratories and collaborating centres should be made for help with training opportunities, provision of specialized advice in planning and standardized diagnostic reagents.

Chapter 6

Early reaction contingency planning for an emergency

INTRODUCTION

This manual mainly addresses the situation when ASF invades a country or zone formerly considered free from ASF. Should such an emergency occur, all initiatives should be directed towards rapid containment of the disease to the primary focus or zone of infection and elimination within the shortest possible time, to avoid spread and possible progression to endemic status.

As stated earlier, alliances among central and regional authorities (states, provinces, governorates, autonomous regions or departments) and private interest groups are essential, especially in countries with decentralized governments or that are constituted as federations and where strategic plans can be drawn up between the public and private sectors should an emergency arise. Such task forces can serve for any emergency – human-incurred or natural disaster – including the introduction of a transboundary or exotic animal disease such as ASF. Having a compensation policy is part of the planning and contingency process, and such a policy needs to be known to the swine producers.

In certain countries, eradication of the disease is not a viable option, for example, in Southern and East African countries where the disease is entrenched in warthog and possibly other wild suid populations. This does not mean, however, that prevention measures cannot be carried out in these areas, or that ASF cannot be eliminated in domestic populations. In countries where ASF is endemic, it is possible to develop ASF-free zones or compartments through strict pig movement and quarantine controls and enhanced biosecurity of pig production units. Active surveillance involving owner observation and farm and abattoir veterinary inspection is a prerequisite for credibility.

EPIDEMIOLOGICAL FEATURES INFLUENCING CONTROL, ELIMINATION OR ERADICATION STRATEGIES

Several epidemiological and other factors influence control, elimination or eradication strategies for ASF; some are favourable but most are unfavourable.

Favourable factors:

- No domestic livestock species other than pigs is susceptible to ASF.
- Clinical signs are a prominent indicator of its possible presence.
- There is the potential for rapid recovery from its effects (i.e., swine reproductive potential is high).
- Humans are not susceptible.

Unfavourable factors:

- ASF virus is resistant to inactivation and may remain viable for long periods on fomites and in infected pig tissues, meat and processed products.
- Certain *Ornithodoros* ticks transmit ASF virus.
- ASF is a highly contagious disease in domestic pigs.
- ASF is usually clinically apparent in pigs, but may be confused with other diseases, notably CSF; low-virulent strains of the virus may be more difficult to detect.
- Pig husbandry is undertaken by a wide variety of producers, ranging from subsistence (rural and peri-urban poor) to high-end commercial interests.
- Wild and feral suid populations are susceptible.
- There is no treatment or vaccine available for ASF.

Some of these factors make ASF one of the more difficult TADs to control or eradicate. Although numerous examples from Europe, Africa and America demonstrate that ASF can be eliminated or eradicated from countries by concerted, well-organized campaigns, most of these exercises have resulted in the destruction of enormous numbers of healthy pigs and edible meat, and have arguably caused more suffering to pig owners than the disease itself did, particularly those owners who are spared the disease but lose all their pigs to pre-emptive slaughter.

STRATEGIES FOR ERADICATION

In the absence of vaccines, the only available option for ASF elimination is stamping out by slaughter and disposal of all infected and potentially infected (in-contact) pigs. This is a proven method which has succeeded in eradicating ASF and other serious TADs such as FMD and contagious bovine pleuropneumonia. However, such drastic approaches are

FIGURE 4
Farms ensuring a very basic level of biosecurity escaped the infection, even if located in the infected areas

recognized as less acceptable, particularly when large numbers of animals are involved; under certain circumstances, particularly if the disease has become widespread and there are populations of free-ranging, feral and wild pigs, they are doomed to failure.

The following are the main elements of a stamping-out policy for ASF:

- Early detection of the infection:
  - *Requirements:* Trained staff at the field level; and a proficient veterinary diagnostic laboratory.
- Enabling legislation for declaring national emergency measures:
  - *Requirements*: ASF is a notifiable disease; funding is immediately available for authorities to act rapidly and decisively; a compensation strategy is in place; and public order officials are at the service of the veterinary department to ensure compliance.
- Zoning of the country into infected zones, surveillance zones and free zones:
  - *Requirements*: Knowledge of where the disease is and where it is not (laboratory/ epidemiology unit interface); and management of animal movement (regulatory veterinary authorities acting in concert with police, customs or inspection agency or other security forces).
- Inspection and quarantine procedures to contain the disease, including pig movement controls and prohibitions on the sale of potentially infected pig products:
  - *Requirements*: Enabling legislation (and levying of fines for non-compliance).
- Enhanced epidemiological surveillance for ASF:
  - *Requirements*: Epidemiology unit within the veterinary services, with staff trained in epidemiological methods and analysis; understanding of production and market chains; producers, marketers and abattoir inspectors are aware of need for rapid reporting according to established procedures; and consideration of a national programme for rewarding those who report ASF.
- Immediate slaughter of infected and potentially infected in-contact pigs, with prompt and fair compensation to owners:
  - *Requirements*: Trained staff in approved (humane) culling methods; and national legislation for compensation.
- Safe burial or burning of carcasses and other infected materials:
  - *Requirements*: Knowledge of hydro/geographical areas, for conducting operations rapidly; and pre-emptive enabling legislation regarding environmentally sound needs in emergency situations.
- Cleaning and disinfection of infected premises:
  - *Requirement*: Updated knowledge of appropriate and approved disinfectants, and their availability/stock.
- Keeping previously infected premises/villages without pigs for a safe period (i.e., four incubation periods):
  - *Requirements*: Owner and local awareness campaigns; and consideration of rewards for reporting breaches of compliance.

One of the common denominators of these procedures is *enabling legislation*, which must be applied for long enough to prevent the disease from entering or spreading and to ensure *compliance*. Extensive public awareness campaigns directed to the different stake-

holders (producers, breeders, marketers, regulatory officials, border inspectors, police, etc.) must be effective and convincing.

Stamping out tends to be a resource-intensive method of disease elimination in the short term. Whether or not it is cost-effective depends on the size of the pig population and the degree to which ASF has spread prior to measures being applied. If effective, stamping out allows countries to declare freedom from disease in the shortest time. This may be important for international trade purposes, which will also need substantiation of the procedures undertaken. *The efficacy of a stamping-out policy is enhanced when the whole chain for eradication functions perfectly, from early detection to the stamping-out actions applied in the field. Delay in detection, case confirmation or stamping-out actions can lead to failure of the whole eradication programme*.

FIGURE 5
Humane culling and protective clothing (captive-bullet or electro-stunning)

ZONING

Zoning is the proclamation of geographical areas in which specific disease control actions are to be carried out. The zones are concentric areas around known or suspected foci of infection, with the most intensive disease control activities in the inner zones. Zoning is one of the earliest actions to be taken when there is an incursion of ASF into a country. The size and shape of the zones may be determined by geographical boundaries or by epidemiological or resource considerations. However, because ASF is spread by movement of infected swine or materials, it is important to bear in mind that transmission can occur overnight over hundreds or thousands of kilometres, through road, sea or air transport. During an epizootic, it would be short-sighted to depend on the declaration of infected zones for containing the disease, unless there is a high level of confidence that the movement of pigs or dangerous materials such

FIGURE 6
Infected area: control of movements

as pig meat from infected to free zones can be prevented by geographical barriers or control measures at the port of control (i.e., inspection, approval, confiscation and destruction).

Zoning requires secure *internal* control posts of trained veterinary authority inspectors buttressed by other security offices (if required), and review and authentication of animal health certificates and documents regarding point of origin, point of destination and purpose (slaughter, fattening or breeding). A veterinary clinical assessment at the control post is essential. Experience has demonstrated that establishment of a *cordon sanitaire* is far from simple in many countries and that such measures are easily evaded. It is certain that poorly organized pig farms distant from the zone of infection may be at greater risk than well-managed commercial farms within the infected zone.

Recognition of disease-free zones is an important principle within the OIE guidelines for national animal health status for ASF or other diseases, but it ultimately depends on the veterinary services' guarantees to its internal and external stakeholders.

Infected zones

An infected zone encompasses the area immediately surrounding one or more infected farms, premises or villages. Its size and shape are influenced by topographical features, physical barriers, administrative borders and other epidemiological considerations. OIE recommends that it should have a radius of at least 10 km around the disease focus in areas with intense livestock raising, and of 50 km in areas of extensive livestock raising. Intensive livestock raising implies confining pigs securely in premises or farms; in extensive livestock raising some pigs are allowed to roam or are poorly controlled.

When dealing with a disease such as ASF, which has no aerosol transmission, the use of radii to define infected zones may not be totally appropriate in practice. In rural areas in a number of countries, a proportion of the pigs in any area will be poorly controlled, so declaration of 50 km zones, where expensive and drastic measures will be applied, may be considered unnecessary and even impractical; each zone represents an area of 7 850 km^2, and covering it would be a daunting task for veterinary services that may be short of human and financial resources. To identify infected zones, the extent of the focus of infection must be determined, and well-managed farms that have escaped infection can be regarded as non-infected if they are open to regulatory inspection and compliance with established statutes. On the other hand, strict vigilance must be maintained over a much wider area, which may be the whole country or certain regions, depending on the known patterns of pig movements determined by marketing and other considerations.

In the initial stages of an outbreak, when its extent is not well known, it would be wise to declare large infected zones and then progressively reduce these as active disease surveillance reveals the true extent of the outbreak. If, as a result of late discovery other ASF outbreaks are identified or the original outbreak is particularly widespread, it will probably be best to consider the entire country as infected and to report this to neighbours and international organizations.

Surveillance (control) zones

These zones are geographically larger and surround one or more infected zones. They may cover a province or administrative region and often cover a whole country. Activities in the surveillance zone require:

- intensive awareness of producers, marketers, butchers, meat dealers, abattoirs and abattoir inspectors regarding disease recognition and reporting;
- augmented circulation of veterinary or para-veterinary brigades trained in investigatory and participatory methods for disease search in villages, peri-urban areas and commercial operations;
- enhanced control of entry points from known affected zones and of live or commodity markets for animals and animal products;
- greater public awareness campaigns.

ASF-free zones

A free zone is defined as an area within the country where no single pig has shown clinical infection, all the suspicious cases have been determined to be negative to ASF by approved laboratory testing, and the prevalence of ASF sero-positive individuals is below a predetermined threshold (< 1 percent at 95 percent confidence level).

In the event of an outbreak (current or historical), ASF-free zones can be demarcated in parts of the country where ASF is not active. Because of ASF's potential for wide dissemination, however, it is recommended that all parts of a country experiencing a first outbreak be placed under a high level of surveillance. The emphasis in ASF-free zones should be on strict quarantine measures to prevent entry of the disease from infected zones, and continued surveillance to provide confidence of continuing freedom. The same information on prevention and notification should be provided in these zones as in infected and surveillance zones. This information should be shared as quickly and securely as possible with neighbouring countries and trading partners.

Thorough knowledge of the commercial marketing chain for swine and pork products is essential for the identification of areas for surveillance, the inclusion or exclusion of potentially infected zones, and assurance regarding the delineation of ASF-free zones.

Compartments

It is possible that ASF-freedom may be applicable to only particular farms, which are usually those that are integrated and that practise an appropriate level of biosecurity. In this case, the zones are regarded as ASF-free *compartments*, and guidelines are provided to the farm owners to ensure that their ASF-free status is maintained. Guarantee of an ASF-free compartment requires government certification and independent inspection. Such farms are immeasurably valuable in ensuring the continuity of the pig industry, as the feed they purchase (or grow) comes from reliable and quality-assured sources, transportation on and off the farm is highly regulated, animals are separated by age group, and the all-in/all-out housing system is used in the weaning-fattening-slaughter process. It is essential that employees are well trained in the recognition of ASF and other infectious diseases and that they do not have swine of their own, which could introduce swine pathogens to the ASF-free herd. Compartments that are recognized as ASF-free are subject to monitoring by government veterinarians to maintain their accreditation. The principles of compartmentalization can be applied even on smallholder units whose owners understand the need to isolate and protect their pigs.

Infected premises and dangerous-contact premises

In this context, an infected premises (IP) means an epidemiological entity where pigs have become infected. It may be a single farm or household, an entire village or settlement, or a livestock market or abattoir. A dangerous-contact premises (DCP) is one for which there are epidemiological grounds to suspect that it has become infected, even if the disease is not yet clinically apparent. This infection might be through close proximity, and may be identified by epidemiological tracing.

ACTIONS TO BE TAKEN IN INFECTED ZONES

There are two objectives in the ASF-infected zone: 1) to prevent further spread of infection, through quarantine and livestock movement controls; and 2) to remove sources of infection as quickly as possible, through slaughter of potentially infected pigs, safe disposal of carcasses and ensuring decontamination.

The balance of actions towards these objectives depends on circumstances. If pigs are securely contained on farms, and resources for surveillance and the imposition of quarantine and movement controls are adequate, the best decision would be to slaughter all pigs only on IPs, and possibly on DCPs identified by epidemiological tracing, even if some of them look healthy. If pigs in the infected zone are not well controlled and there is a risk of further rapid spread of the disease or transfer to wild pigs, or if resources for surveillance and the imposition of quarantine and movement controls are inadequate, it may be expedient to slaughter all pigs in the infected zone or in specific areas of it.

In practice, however, the slaughter of poorly controlled pigs is far more likely to spread the disease than to control it. This will certainly be the case if market-related compensation is not paid promptly. The best option is to encourage pig owners to confine their animals, with the reassurance that the pigs will not be slaughtered unless clinical signs of ASF appear. Obtaining the full support of pig owners and their associations is absolutely vital for effective control, and so they must be convinced of the seriousness of the situation, the implications of non-compliance with the needed standing orders, and the repercussions if movement of pigs occurs. Breakdown of control measures would create further hardship for other swine producers in the region.

Plentiful supplies of an inexpensive but effective disinfectant such as 2 percent caustic soda should be made available, and owners advised to limit access to their premises and to ensure that anyone who must enter thoroughly disinfects his/her footwear on entry and departure (or is provided with a change of footwear). The final aim is to reduce the number of pigs that must be slaughtered to the absolute minimum.

Disease surveillance and other epidemiological investigations

Intensive surveillance for ASF must be undertaken, with frequent clinical examination of pig herds by trained veterinary officers or inspection teams. These officers or teams must practise good personal decontamination procedures to avoid carrying infection from farm to farm.

Trace-back and trace-forward investigations should also be carried out whenever an infected pig herd is found. Tracing back means determining the origin of any new pigs brought on to an IP in the three or four weeks before the first clinical ASF cases – as these

pigs may have been the source of infection – and inspecting the farms they came from. Tracing forward means determining the destination of pigs, their products, feed or any other potentially infected material leaving the IP prior to or after the first clinical cases. Farms that may have become infected by these pigs are then inspected. Trace-back and trace-forward investigations become complicated if pigs have transited through livestock markets or sale yards.

Quarantine of IPs and DCPs

IPs and DCPs should be quarantined immediately, and the exit of live pigs, pig meat and other potentially contaminated materials should be banned, pending further disease control action. Vehicles and other equipment should be disinfected before leaving the IP or DCP.

Movement controls

There should be a complete ban on the movement of live pigs, pig meat and pig products into and out of the infected zone. Great care is required to ensure that neither live pigs nor pig meat are smuggled out of the infected zone. Enabling legislation should include the imposition of fines for non-compliance. Because of the high risk that they constitute for spread of infection, pig markets and abattoirs in the infected zone should be temporarily closed. Recognizing that such a ban will have serious economic implications for pig producers in the infected zone, the information given to them must encourage them to respect the ban, by explaining its purpose – to control the disease as quickly as possible in order to return to normal.

Slaughter of infected and potentially infected pigs

Whatever decision is taken regarding slaughter (e.g., all pigs on IPs and confirmed DCPs, or only pigs on IPs), slaughter must be carried out immediately. DCPs should be inspected weekly or every two weeks.

Owners should be required to collect and confine their pigs the day before the slaughter team arrives. The animals should be slaughtered by methods that take account of animal welfare and the safety of operatives. Rifles or captive-bolt guns are most commonly used for pigs. Lethal injections (e.g., barbiturates) may be used for unweaned pigs or pigs of any age, if practical. When a captive-bolt weapon is used, operatives should understand that pigs may be stunned and not killed, and should use appropriate measures to ensure that animals are dead before burial or burning. Rifles should not be used in confined areas where there is danger of ricochets, and should only be used by competent and experienced marksmen to avoid compromising the safety of people and animals other than pigs.

If pigs are poorly confined or are allowed to scavenge in the surrounding countryside, it may be necessary to send out teams of marksmen to locate and shoot them. The success of such an enterprise will depend on various factors, including the terrain, and these should be considered carefully before starting.

For feral and wild pigs, and possibly free-ranging pigs that cannot be managed: Rather than shooting, the setting of baited multiple-catch traps in an area where free-ranging or feral swine are known to roam has worked well in certain countries where ASF has been

FIGURE 7
Sampling during culling: enlarged spleen (two to three times its normal size) with infarcts and typical petechiae on the cortical surface of the kidney

difficult to control. Should such a system be instituted, wildlife personnel are instrumental in providing information about feral swine behaviour, eating practices, habitat and census.

A maize-mash mix requires some five to 15 days of fermentation (depending on ambient temperatures) before it can be used as bait to lure free-ranging swine. To prepare the mash, a large closed bin (50 to 300 litres) is filled with maize grain and molasses (or other available sugar source) and kept until the fermentation process has progressed, when bubbles form and a sweet-pungent odour emanates from the enclosed bin.

If this option is to be considered, a suspect area of swine activity is identified by recent pig footprints, evidence of rutting and scats (signs of feeding, or presence or absence of moisture in pig excrement). Open areas are then baited by placing the prepared mash for three to seven days to attract feral or loose swine to a selected location. If there are signs

that the mash is being visited by free-ranging or feral swine, a multiple-trap (cage) can be constructed around the bait site with a pole/stick embedded in the pile of mash and tied to a rope that, when pulled on by the feeding pigs, loosens and shuts a trap door around the enclosed cage (3 m x 3 m). Traps should be visited daily for animal capture, sampling and replenishing of the bait.

Reference should be made to the FAO *Manual on procedures for disease eradication by stamping out* for more information on slaughter procedures. Feral and wild pig capture should be done in consultation with wildlife specialists at relevant institutes or universities.

Safe disposal of carcasses

Proper disposal of the carcasses of animals that have been slaughtered or have died naturally of the disease involves ensuring that the carcasses no longer constitute a risk for further spread of the pathogen to other susceptible animals by direct or indirect means, for example, via carrion eaters and scavengers or through contamination of food or water. Such disposal is usually done by deep burial, if the nature of the terrain and the level of water tables are appropriate, and earth-moving equipment is available; or by burning, if fuel and combustible materials such as old motor tyres are available, and the risk of starting grass or bushfires is not too high. It is ideal to dispose of the carcasses on the farm where the animals were killed, but if *in situ* disposal is not practical, it may be possible to transport carcasses in sealed (leak-proof) vehicles to an environmentally sound disposal point within the infected zone. Provision should be made for an escort vehicle to disinfect any possible leakages or, if vehicle breakdown is likely, to initiate salvage operations should a problem arise in transporting the slaughtered pigs.

Under some circumstances it may be desirable to mount a guard at the disposal site for the first few days.

Reference should be made to the FAO *Manual on procedures for disease eradication by stamping out* for more information on disposal procedures.

Decontamination

This involves thorough cleaning and disinfection of the environs of IPs, with particular attention to places where animals have congregated: animal houses, sheds, pens, yards and water troughs.

Disinfection

Disinfection is vital during the slaughter process, to reduce the risk of contaminating the environment with the ASF virus or other pathogens. Spraying contaminated material with disinfectant is ineffective; solid waste must be removed for burial or destruction before disinfection.

Potentially contaminated materials such as manure, bedding, straw and feedstuffs should be removed and disposed of in the same way as carcasses. It is recommended that poorly constructed animal housing be burned when there is a danger of virus survival or the presence of *Ornithodoros* ticks. Owners are rarely enthusiastic about this action, however, and if the housing is in a small backyard close to other buildings burning could

FIGURE 8
Deep burial is the recommended method of carcass disposal to ensure elimination of the virus from the environment

be dangerous. Spraying thoroughly with an effective acaricide as well as a disinfectant might be the only option. If ticks are absent, spraying with a disinfectant effective against ASF should be sufficient, as the virus does not remain viable for long outside a protein environment.

Appropriate disinfectants for ASF include 2 percent sodium hydroxide, 2 percent caustic soda, detergents and phenol substitutes, sodium or calcium hypochlorite (2 to 3 percent available chlorine) and iodine compounds.

Reference should be made to the FAO *Manual on procedures for disease eradication by stamping out* for more information on decontamination procedures.

Destocking period

After slaughter, disposal and decontamination procedures must be completed and the premises left destocked for a period determined by the estimated survival time of the pathogen. As a general rule, this is shorter in hot than in cold or temperate climates. OIE recommends a minimum of 40 days. A shorter period would probably be safe in tropical areas, because it has been shown that sties in such areas are safe for repopulation after five days, even without cleaning or disinfection. However, it is unlikely that definitive stamping out of a focus would be completed in less than 40 days.

If competent vectors for ASF virus are known to inhabit the area, rigorous application of effective acaracides will be required to avoid the possibility of resistance being established.

ACTIONS TO BE TAKEN IN SURVEILLANCE ZONES

The following disease control actions should be undertaken in surveillance zones:

- There should be enhanced disease surveillance for ASF. Pigs in the zone should be inspected weekly, and their owners questioned about disease occurrences, pig movements, etc. Sick pigs should be thoroughly inspected and diagnostic samples sent to the laboratory. Surveillance is easier if some of the tasks are delegated to informed and trained pig farmers.
- Movements of pigs, pig meat and pig products from infected zones should be banned. Movements from surveillance to free zones may be allowed, but only after health inspection and the issue of an authentic permit.
- Abattoirs and pig meat processing plants may be allowed to operate, but must be subject to strictly enforced zoo-sanitary codes of practice.
- Sales of healthy live pigs and wholesome pork may be allowed to continue, subject to surveillance and rigidly enforced codes of practice.

ACTIONS TO BE TAKEN IN DISEASE-FREE ZONES AND COMPARTMENTS

The emphasis in ASF-free zones is on preventing entry of the disease and accumulating internationally acceptable evidence that the zones are indeed ASF-free.

Entry of pigs or pig products from infected zones should be banned; from surveillance zones it may be allowed, subject to official permits and only for specific destinations. Well-managed pig farms that are recognized as ASF-free compartments within infected zones should be treated as if they were epidemiologically and sanitarily encompassed in surveillance zones. Compartments should be inspected by individuals or teams that have not visited infected premises for at least 72 hours beforehand, in case there has been a breach of contamination procedures. A registry of these inspections should be in duplicate (owner and authorities).

REPOPULATION

At the end of the agreed destocking period, pigs may be reintroduced to previously infected farms or villages if there is reasonable certainty that these farms/villages will not be re-infected. Restocking to full capacity should only take place after sentinel pigs have been introduced at approximately 10 percent of the normal stocking rate on each previously

infected farm. These sentinel pigs must be observed daily for six weeks to ensure they stay free of ASF before full repopulation. Owners must understand the benefits of following established biosecurity principles, and the repercussions if these are not adhered to. After repopulation, intense surveillance for the disease should be maintained in the area, at least until declarations of freedom can be made.

It is essential that pigs used for repopulation come from known ASF-free zones or ASF-free countries. If pigs are imported from other countries, the disease status of these countries with respect to other important diseases of pigs must be known. It would be disastrous to replace ASF with another disease, which might take years and great expense to control or eradicate.

In the aftermath of an ASF elimination campaign, the opportunity could be taken to upgrade the pig genetic stocks in the area as part of the repopulation programme, provided that:

- the pigs come from reliable sources, such as local commercial farms that have remained uninfected or from abroad;
- the producers' and the market's preference are for a more modern type of pig;
- enhanced livestock husbandry practices and basic biosecurity measures are promoted through extension services;
- the level of management is appropriate for modern breeds of pigs.

One of the most important actions during repopulation is to encourage safer pig farming through confining pigs in pig-proof sties or camps and either not feeding swill or ensuring that it has been boiled for 30 minutes and cooled before feeding.

CRUCIAL FACTORS FOR THE SUCCESS OF A CONTROL/ERADICATION CAMPAIGN

Public awareness and education

Public awareness and education campaigns should be considered as essential elements of disease control and eradication campaigns. They should mainly target smallholder rural and peri-urban communities affected by the disease and by ASF control actions. Radio programmes and community meetings are the most appropriate means of communication. Meetings are particularly suitable, as they allow community involvement and the opportunity to ask questions and disseminate materials such as pamphlets and posters that reinforce the information.

The campaign should inform people of the nature of the disease and what to do if they see suspect cases, what they can and cannot do during the eradication campaign and why, and the benefits of getting rid of ASF. It should emphasize that ASF control primarily benefits pig producers, and not the government. The impact will be lost if unnecessarily harsh control measures result in economic losses greatly in excess of those that might have been caused by the disease.

The actions and good practices of pig owners for preventing ASF from entering their farms will also prevent any of the other swine pathogens.

Compensation

It is essential that farmers and others who have had their pigs slaughtered, their pig meat products confiscated or their property destroyed as part of an ASF eradication campaign should be fairly compensated at the current market value of the animals and goods. Compensation for consequential rather than direct losses is difficult to administer and may be inappropriate. Compensation should be paid without delay. Inadequate or long-delayed compensation is inherently unfair, and counterproductive to the campaign because it fosters resentment, lack of trust and unwillingness to cooperate and encourages farmers to hide the presence of the disease. It also acts as a spur to illegal smuggling and clandestine sale of pigs out of infected areas, to avoid losses. Ideally, the market value of the pigs or goods should be paid. Valuation for compensation purposes should be undertaken by experienced, independent evaluators, as long as such people are immediately available. Alternatively, generic valuation figures could be agreed for categories of pigs, pig meat and other materials. In countries where different breeds of pigs are used, the fairest way of determining compensation for slaughtered pigs is to weigh them and pay a uniform, realistic price per kilogram, thus avoiding problems created by breed differences in age/weight groups. If acceptable to owners, replacement of breeding stock may be offered in lieu of monetary compensation. Evaluators should include individuals from the private or non-government sector, for two reasons: (1) balance of views/price, and (2) peer trust.

Social support and rehabilitation

ASF itself, ASF control measures and an ASF eradication campaign are likely to produce hardship for affected farmers and communities during the epizootic and recovery phases. Government support to affected groups should therefore be considered. There may be food shortages, particularly in infected zones, and it may be desirable to provide supplementation, in the form of either pig meat or other types of animal protein from disease-free zones. Affected farming communities may need rehabilitation support to help them get back to normal at the end of the campaign. Assistance should be given to farms that have escaped infection but are unable to sell pigs because of bans on movement or closure of abattoirs, and that have large numbers of pigs growing and eating on their farms. Where controlled slaughter for sale and consumption is not a possibility, assistance in the form of subsidized feed should be considered. It must be recognized that farmers who have avoided infection in the face of an epizootic are a national resource and should be rewarded rather than penalized.

VERIFICATION OF ERADICATION AND NATIONAL, ZONAL OR COMPARTMENTAL FREEDOM FROM THE DISEASE

International requirements

The OIE *Terrestrial Animal Health Code* specifies that a country may be considered free from ASF when it has been shown that ASF has not been present for the previous three years. This period is reduced to 12 months for previously infected countries in which a stamping-out policy has been practised and it has been demonstrated that the disease is absent from domestic and wild boar or other wild suid populations. However, it is highly recommended

that virological targeted surveillance be instituted to substantiate confidence of freedom and provide reliable information for trading partners and neighbouring countries.

The same conditions apply for ASF-free zones. A zone of a country may be considered free from ASF when the disease is notifiable in the whole country but no clinical, serological or epidemiological evidence of it has been found in domestic or wild pigs in the zone during the past three years, or 12 months for a previously infected zone in which a stamping-out policy has been practised and where it can be demonstrated that the disease is absent from domestic or wild boar populations. Again, virological targeted surveillance is recommended, so that confidence of freedom in the zone is substantiated and information available for trading partners and neighbouring areas and countries.

The free zone must be clearly delineated. Animal health regulations preventing movement of domestic or wild pigs into the free zone from an infected country or zone must be published and rigorously implemented. Pig movements in the free zone should be regularly inspected and supervised to ensure freedom from ASF.

OIE introduced the concept of compartmentalization relatively recently to permit the recognition of production units or chains as free from particular diseases. The guidelines have not been finalized, but are based on instituted biosecurity measures (representing a producer investment) and surveillance with a certification or note of compliance (a regulatory mandate). As part of its contingency plan, each country should have a set of guidelines based on the way in which ASF is transmitted, which can be used to identify and maintain free compartments during an outbreak. These guidelines should be set out in an annex to the contingency plan.

Proof of freedom

An internationally accepted protocol has not yet been established for verification and proof of freedom from ASF, unlike rinderpest, FMD, contagious bovine pleuropnemonia or bovine spongiform encephalopathy, for which there are accepted OIE pathways for demonstration of disease freedom.

Evidence that could be used to gain international acceptance of regained national or zonal ASF freedom might include documentation showing that:

- the country has an effective national veterinary service able to prevent re-entry or extension of ASF, detect outbreaks and take prompt action against them;
- there is an effective disease surveillance system in place, with regular searches for ASF by field, laboratory and abattoir regulatory veterinary services, in conjunction with wildlife authorities where wild populations exist;
- suspected cases of ASF are fully investigated, with documentation, including the final diagnosis of the disease incident;
- comprehensive random, stratified serological surveys have been carried out, with negative results.

Wild pig populations must have been examined for evidence of ASF infection. This could be done by targeted hunting of some animals in representative areas and examination of their tissues for ASF antigen and sera for antibodies. In most countries, there is a hunting season, during which arrangements can be made to obtain samples of the blood and organs of wild pigs shot for trophy purposes and meat. Serological evidence is sufficient

FIGURE 9
Catching wild boars: piglets (< 30 kg) are contained in a wooden box, but adult animals must be anesthetized

proof of past infection, so where funds are available, bleeding tranquillized wild pigs would suffice. Because European wild boars, unlike African wild pigs, are not resistant to ASF, surveillance for dead animals and determination of the cause of death would be of great importance in areas where they occur after the introduction of ASF.

Chapter 7

Organizational arrangements during an emergency campaign

RESPONSIBILITIES AND COMMAND STRUCTURES

The national CVO, or equivalent such as a director of veterinary services (DVS), should have overall technical responsibility for ensuring preparedness for and management of ASF emergencies. The appropriate government minister will be ultimately responsible.

In recent years, the national veterinary services of many countries have been restructured and rationalized. This has included regionalization and devolution of veterinary services, privatization of veterinary services or downgrading of government services, separation of policy functions from operational functions, and separation of the administrative responsibilities of veterinary laboratories and veterinary field services.

These new structures have evolved to meet the demands of delivering routine animal health services. However, they are often unsuitable for managing a major animal health emergency, when rapid decisions are needed, based on analysis of the best information available from all sources. It must be possible to convert these decisions into clear orders that can be conveyed to those responsible for carrying them out. There must be means of knowing that orders have been carried out and with what results. In short, there must be efficient mechanisms in place for the transmission of information and instructions from the national veterinary services headquarters to the front line of the disease eradication campaign in the field and laboratory, and for feedback of information to headquarters.

It is clear that for these things to happen quickly and efficiently in an emergency, a country's veterinary services must have an organized command structure or line-management system, at least for the duration of the emergency response to an ASF outbreak.

There should be forward planning so that appropriate structures and lines of responsibility can be rapidly and efficiently put in place when an ASF emergency arises. This may include organizing one or more of the following, well in advance of any emergency:

- agreement that animal health emergencies will be handled at the national level and that the CVO will assume overall responsibility for responding to the emergency and be directly answerable to the minister;
- a mechanism for cooperation among ministries and other agencies, such as the police, army, finance, wildlife services, education, media and health, which may necessitate the establishment of an inter-ministerial/interagency committee; it is advisable that such a committee exist permanently, to avoid the bureaucracy involved in establishing one in an emergency;
- agreement with regional or provincial authorities that their veterinary staff will come under the line management of the national CVO for an animal health emergency

response programme, with arrangements to ensure that regional field and laboratory veterinary services are fully involved in emergency preparedness planning and training activities;
- collaboration with national veterinary headquarters to provide early warning of emergencies, including emergency disease reporting to national headquarters;
- arrangements for essential government veterinary services, including the central veterinary laboratory, to come within the command structure of the CVO for the emergency response;
- contracts with private sector veterinary organizations, universities and other academic institutions and research institutes to provide essential services during an animal health emergency;
- negotiation of terms and conditions for hiring private sector veterinarians as temporary government veterinary officers if needed;
- negotiation with other countries to provide technical or operational assistance (human resources) in the event of an emergency.

In many countries, the private veterinary sector is small or non-existent, and it may be necessary to rely on non-veterinary assistance for disease control. There should therefore be a mechanism to mobilize the resources available in related sectors such as agricultural extension or community-based animal health workers, with appropriate training. In controlling animal diseases, it is vital to identify all potential participants and ensure that they are prepared to act immediately in the event of an epizootic.

CONSULTATIVE COMMITTEE ON EMERGENCY ANIMAL DISEASES (CCEAD)

Countries may find it very useful to establish a CCEAD that can be convened as soon as there is an ASF (or other TAD) emergency and that can meet regularly during the emergency response. This would be an essentially technical committee, whose role is to review epidemiological and other disease control information, recommend the activation of contingency plans, oversee the campaign, and advise the CVO and the minister on future planning of the campaign.

A CCEAD might be composed of:
- CVO (chairperson);
- director of field veterinary services/director of disease control;
- head of the epidemiological unit;
- directors of state, provincial or regional veterinary services;
- director of the national veterinary laboratory;
- directors of regional veterinary laboratories covering outbreak areas;
- representatives of farmers' groups or organizations;
- representatives of other key groups, such as national veterinary associations or universities;
- technical experts as required, such as wildlife personnel and entomologists, including if possible retired veterinarians with experience of the disease, as observers.

If a command structure cannot be implemented, it is essential that a CCEAD be established, so that there can be a consensus approach to the conduct of the emergency campaign.

When no emergency response operation is under way, it is strongly urged that simulation exercises be conducted (table-top workshops or field test exercises) to ensure that communication and operational plans are functional and the link with the productive sector (commercial or local) is sound. Prior to a simulation exercise, neighbouring countries and international or regional organizations should be forewarned so that negative repercussions can be avoided

NATIONAL ANIMAL DISEASE CONTROL CENTRE

Countries should establish permanent national animal disease control centres. In the event of an outbreak of ASF or other emergency animal disease, the centre should be responsible to the CVO for coordinating national emergency disease control measures. The centre should be located at the national veterinary services headquarters, and the national epidemiology unit should be attached to it or work in close collaboration with it. The CVO may delegate day-to-day responsibilities for implementing policy to the head of the centre, who would normally be a senior government veterinarian. The responsibilities of a national animal disease control centre in an emergency response would include:

- implementing disease control policies agreed by the CVO and the CCEAD;
- directing and monitoring the operations of local animal disease control centres;
- maintaining up-to-date lists of personnel and other resources, with details of where further resources may be obtained;
- deploying staff and resources to local centres;
- ordering and delivering supplies (including vaccines for diseases other than ASF);
- monitoring the progress of the campaign and providing technical advice to the CVO;
- advising the CVO on the definition and proclamation of disease-control zones and compartments;
- maintaining up-to-date lists and contact details of high-risk enterprises at or causing risk;
- liaising with groups involved in the emergency response, including those activated as part of the national disaster plan;
- preparing international disease reports and cases to obtain recognition of zonal or national freedom from the disease;
- managing farmer awareness and publicity programmes, including press releases;
- general and financial administration and record-keeping.

The national animal disease control centre should be fully equipped with maps of the country at 1:50 000 scale (or a computer mapping database that can zoom into areas of concern beyond this scale) and communication equipment for liaison with regional veterinary services or local animal disease control centres and veterinary laboratories, including telephone, radio, e-mail and fax. The centre should be linked to the emergency disease information system.

LOCAL ANIMAL DISEASE CONTROL CENTRES

During an ASF emergency, district offices of the veterinary or agricultural extension services closest to the infected foci act as local animal disease control centres. Teams should be able to travel in one day to and from any site for surveillance or other disease control activities.

Locations for temporary local disease control centres, such as local government offices, should be negotiated in advance.

Regional and district veterinary officers should be in charge of disease control operations in their areas, with the right to enter farms, collect samples and take measures to prevent movement of pigs and pig products within and out of the areas under their control. They should be provided with materials for collecting and transmitting samples, a refrigerator for short-term storage, protective clothing, stores of disinfectant, a vehicle and fuel, and means to contact the CVO. Public structures should enable them to enlist the cooperation of other services, such as the police, public works departments and the media, to help prevent dissemination of disease. They should be provided with materials to carry out public information campaigns and intensive training and information campaigns for farmers. Above all, they should always have accurate information about the status of the disease and, when applicable, slaughter and compensation levels.

Chapter 8
Support plans

Support plans provide the backing to enable implementation of an ASF or other emergency disease contingency action plan.

FINANCIAL PLANS

Delay in obtaining finances is a major constraint to rapid response to emergency disease outbreaks. Immediate application of even modest funds can save major expenditure later. Forward financial planning is therefore an essential component of preparedness.

Financial plans need to be developed to guarantee the immediate provision of contingency funds to respond to disease emergencies. These funds are for required expenditure over and above normal operating costs for government veterinary services. Financial plans should be approved by government departments, including economic planning authorities and the department of finance.

Contingency funds may cover the cost of the whole control/eradication campaign. However, more often they are a ready source to enable the veterinary department to leap into action and cover the initial phases of the campaign, and commission a review of the outbreak situation and the control programme. Once the field situation is better understood and has been reported to government departments, additional funds should be made available to finalize eradication.

The conditions under which funds may be released should be specified in advance. Funds would normally be provided to the CVO when:

- ASF or another emergency disease has been diagnosed or suspected;
- the outbreak can be controlled or eradicated;
- there are approved disease control plans in place.

The funds may be held as special funds allocated to the purpose, or as drawing rights to an agreed amount against a government account.

In some countries, it may be desirable for the government and private sector to provide funds for emergency programmes against ASF and other diseases, as agreed after reviewing the nature and proportion of public and private benefits derived from elimination of each disease. A funding formula may be agreed, based on payment by each sector of a fixed percentage of the total cost of the campaign, or on each sector paying for specific components. If the private sector is to contribute, it must be determined who benefits from component(s) and therefore who should share the costs. This may include processing industries, traders and farmers' organizations. It must also be determined how private sector funds will be raised. This could be done by livestock industry levies, perhaps on livestock transactions or slaughter, held in secure funds, or industry insurance. Voluntary individual insurance policies are satisfactory for insuring against losses from a disease or disease control actions, but are unsatisfactory for raising campaign funds.

Funding of the whole emergency disease eradication campaign may be beyond national resources. In this case, forward planning should be carried out to identify potential international donors, including emergency support from FAO or other international agencies. Procedures for applying for funding and requirements for submitting applications should be determined in advance.

The financial plan should include provisions for compensating owners for livestock or property destroyed as part of the disease eradication campaign, subsidizing feed for farmers with healthy pigs affected by sales bans, and providing emergency assistance to people suffering serious consequences such as food shortages as a result of the disease or the control measures.

Such financial planning should go beyond the agricultural or livestock departments, and obtain support from other relevant ministries (e.g., finance, commerce, rural development, the Prime Minister).

RESOURCE PLANS

The first step in preparing a resource plan is to make a resource inventory. This is a list of the resources needed to respond to a moderate-sized outbreak of ASF or another high-priority emergency disease, including the personnel, equipment and other materials. The following resource lists should be regarded as indicative rather than exhaustive.

National animal disease control centre

- Senior disease control veterinarians and epidemiologists.
- Veterinary or wildlife biologists.
- Entomologists.
- Operations, logistics, financial and administrative officers.
- Staff for recording and processing epidemiological and other information.
- Maps of scale 1:50 000 and 1:10 000.
- Computers and related equipment.
- Equipment for communicating with local headquarters, such as telephone, fax and e-mail.
- Petty cash funding (accountable).

Local animal disease control centres

- Senior disease control veterinarians and epidemiologists.
- Technical support, operations and administrative officers.
- Offices.
- Office equipment.
- Maps.
- Telephone and fax.
- Petty cash funding (accountable).
- *Pro formas* for disease control operations.

Under some circumstances, computers with e-mail may be available.

Diagnostic laboratories

- Trained laboratory staff.
- Standard laboratory equipment in good working condition.
- Specialized equipment for key emergency diseases, in good working condition.
- Diagnostic reagents for the tests performed.
- Internationally approved containers for shipment of samples to a reference laboratory.
- Protocols for shipment of samples to a reference laboratory.

Diagnostic/surveillance

- Veterinarians and support veterinary auxiliary staff.
- Transport.
- Maps.
- Communication equipment, including global positioning system (GPS) devices.
- Leaflets or posters on the disease(s).
- Equipment for collecting and transporting diagnostic samples:
  - blood sampling equipment;
  - necropsy kit;
  - ice-box;
  - approved disinfectants, soaps and detergents;
  - scrubbing brushes.
- Pig restraint equipment.

Slaughter, burial and disinfection

- Supervising veterinarian and other personnel.
- Transport.
- Equipment for the approved means of killing pigs.
- Protective clothing.
- Animal restraint equipment.
- Front-end loaders and earth-moving equipment.
- Approved disinfectants, soaps and detergents.
- Scrubbing brushes.
- Shovels and scrapers.
- High-pressure spraying equipment.
- Quick-lime to cover carcasses if they are not to be incinerated.
- Fuel for incineration, generally diesel mixed with a small amount of petrol, and old tyres to expedite burning by encouraging air circulation and maintaining high temperatures.

Quarantine and livestock movement controls

- Enforcement teams.
- Transport.
- Road blocks.
- Signs and posters.

A list of existing resources should be prepared, including specifications, quantities and locations. A register of specialist staff should be maintained, with their qualifications and experience of ASF. Resource lists and staff registers should be updated annually (at least) at the national disease control centre and regional offices.

Comparison of the lists of necessary and available resources will highlight any deficiencies. The resource plan should identify how these deficiencies can be rectified in an emergency. Investment in simulation exercises would also uncover gaps and deficiencies in the resource plan, which can be rectified.

There are various options for obtaining the necessary extra resources:

- a list of places where essential equipment and stores may be purchased, hired or borrowed;
- a central store of hard-to-obtain items, such as disinfectants, and items that take time to prepare, such as *pro formas*;
- arrangements for the supply of personnel and equipment from other government agencies, such as earth-moving equipment from the department of works and transport, and communications equipment from defence forces;
- arrangements with veterinary associations for the temporary employment or secondment of veterinary practitioners or veterinary students in the event of an emergency.

Supply of diagnostic reagents presents special problems, as international sources are limited. An international reference laboratory for ASF should be consulted about sources of reliable diagnostic agents (www.oie.int/ or http://empres-i.fao.org/empres-i/home).

It should be noted that to maintain adequate diagnostic capacity and ensure competence, laboratories should routinely perform basic tests on specimens of known and unknown status, and send test samples to OIE and FAO reference laboratories from time to time to cross-check even negative results. Participation in ring tests organized with neighbouring countries and a reference laboratory is highly desirable. Contact the FAO e-mail address empres-shipping-service@fao.org to facilitate sample submission to OIE or FAO reference centres for confirmatory ASF diagnosis or virus characterization.

The resource plan and inventory lists should be updated annually.

LEGISLATION

Acts of parliament or government regulations that provide the legislative framework and powers to carry out disease control actions need to be put in place as part of preparedness planning. This may include legislation to:

- make ASF and other priority animal diseases compulsorily notifiable;
- allow entry of officials or other designated personnel to farms or other livestock enterprises, for disease surveillance, including collection of diagnostic specimens, and to implement disease control;
- authorize the proclamation of infected areas and disease control zones;
- authorize the quarantining of farms or other livestock enterprises;
- authorize bans on movements of livestock, livestock products or potentially contaminated materials, and issue permits for movement under specified animal health conditions;

- authorize compulsory destruction and safe disposal of infected or potentially infected animals and contaminated or potentially contaminated products and materials, subject to fair compensation;
- authorize other disease control actions;
- provide compensation to owners of livestock and property destroyed as part of disease control programmes, and define standards for such compensation;
- allow codes of practice to be mandated for high-risk enterprises and livestock markets, abattoirs and knackeries, and authorize disease control actions for these;
- authorize compulsory identification of animals, where appropriate.

For countries that operate under a federal system of government, there should be harmonized, consistent legislation for animal disease emergencies throughout the country. The same should apply among countries in regions where free trade pacts allow unrestricted exchange of livestock and animal products, such as in the European Union.

Chapter 9
Action plan

The action plan is a set of instructions covering controls to be implemented during an ASF emergency, from first suspicion of the disease to final eradication. It details actions to be taken from the first report of suspected ASF.

This chapter provides a general guide to actions to be carried out during each phase of an outbreak of ASF, but the veterinary regulatory structure differs from country to country. Each country should therefore develop its own action plan, which identifies the individuals responsible for each action. Lines of communication among pig owners and field and national veterinary services must also be identified and made known to all parties. These communication lines underpin the chain of command that will be activated in the event of suspicion of ASF (or another animal disease emergency). The success of the action plan depends on each link in the command chain functioning as specified.

Countries are expected to prepare detailed generic operating procedures applying to ASF and other epidemic diseases. Additional manuals may be required to cover the zoosanitary code of practice in high-risk enterprises such as animal transport, meat processing plants or livestock markets.

When faced with a national or regional emergency, countries may wish to consult existing and tested contingency/emergency plans on control centre management, decontamination, animal destruction and disposal procedures, public relations, valuation and compensation, laboratory preparedness, artificial insemination, dairy processing, meat processing, feedlots, sale yards and transport (i.e., the Australian Veterinary Emergency Plan [AUSVETPLAN]). However, the standards that can be attained will vary from country to country, and it is advisable for countries or regions to develop their own enterprise manuals based on local conditions. Such plans should be reviewed and revised as often as needed.

INVESTIGATION PHASE

The investigation phase starts when a report of probable ASF is received by the veterinary services. It should be a clearly understood legal obligation of any citizen suspecting the presence of ASF or another serious animal disease to report to a member of the veterinary or animal health services, either directly or via another channel such as the district authority. A suspicious index case (exceptionally high mortality among pigs) is most likely to be reported to the local veterinary authorities by animal health officers, abattoir or meat hygiene officers, farmers and livestock owners, community leaders, private veterinary practitioners, or representatives of non-governmental organizations (NGOs) involved with livestock.

Once a report of suspected ASF is received, the following actions must be taken during the investigation phase:

- investigation of the report by trained national veterinary authorities, including collecting specimens for dispatch to laboratories;
- laboratory testing;
- prevention of spread of the disease; whether legal powers exist or not, every effort must be made to obtain community cooperation to prevent movement of pigs and pig products, pending confirmation of ASF;
- communication of clinical and epidemiological findings to central and regional veterinary authorities;
- reporting of laboratory results as they become available, to all those concerned (central and local);
- continuous evaluation of the evidence presented during the investigation, by personnel with sufficient knowledge of ASF to make informed decisions as to whether to proceed to the alert phase or halt further operations.

After a visit to potentially infected premises, the team leader should ensure that proper disinfection procedures are carried out to prevent the investigators from taking the disease off the premises.

Specimens – chilled or preserved – should be delivered with minimum delay to a laboratory with the capacity to carry out the diagnosis. In countries without laboratory diagnostic capacity for ASF, specimens should be sent to an internationally recognized reference laboratory.

If the investigation *in situ* indicates other foci of infection as either the source or the recipient of infected material, these foci should be investigated immediately, provided that the diagnostic samples from the index case have been delivered. The same procedure should be followed as for the index case.

Lines of communication from the farm level to the national veterinary authority may contain few or many links, depending on the size of the country and the veterinary hierarchy. When there is the possibility of ASF, reports should reach the DVS as soon as possible. Investigating false alarms may result in inconvenience and unnecessary expenditure, but the consequences of missing the index case because somebody with imperfect knowledge of the disease was not sufficiently convinced can result in catastrophe. In countries previously uninfected, it is most unlikely that the index case will be the first to have occurred.

If the investigation shows that the circumstances are not suggestive of ASF, or if an alternative diagnosis can be made, a false alarm may be declared and operations wound down. Declaration of a false alarm should always be accompanied by an expression of public gratitude to those who reported the suspect case, to encourage people to report cases compatible with ASF without fear of being proved wrong. To control important diseases of livestock, it is most important to develop a culture of reporting suspicious cases, based on syndromic events rather than specific diseases (for instance, *swine haemorrhagic-enteric syndrome* for ASF, CSF and bacterial sepsis; or, *vesicular disease* for FMD, swine vesicular disease and vesicular exanthema).

ALERT PHASE

If clinical and epidemiological results are highly indicative of ASF, particularly if large numbers of pigs of all ages die in a short period, the main actions required are:

- laboratory diagnosis confirmation;
- prevention of spread from the identified focus of infection;
- identification of other possible foci;
- reporting and dissemination of the event to authorities at directorates of veterinary services.

The DVS or CVO should:

- ensure that measures are in place to enforce control at the local level, i.e. quarantine of infected premises and prohibition of movement of pigs and pig products;
- activate the national emergency preparedness plan for ASF on laboratory confirmation – or at least prepare for its activation if there is a high probability of occurrence (clinical and epidemiological evidence);
- initiate access to contingency funds (in an ideal situation) or make arrangements to ensure that funds are available to cover additional field investigations for determining the extent of outbreak areas;
- ensure that equipment, materials and transport are available;
- appoint and dispatch an ASF expert team, which should include an epidemiologist, a laboratory diagnostician and a control officer, with operational and technical support;
- alert police, army and other government departments, by convening a meeting of the interagency committee if this is a prerequisite for cooperation;
- define zones of control and surveillance;
- alert provincial and regional CVOs, given the potential of ASF to spread rapidly over long distances.

DVS in neighbouring countries should be alerted about the occurrence of a disease of swine that may affect their livestock. Because of the potential for rapid transboundary spread of ASF in countries with porous borders, a measured statement and alert is likely to be highly appreciated by neighbouring veterinary services, even if diagnosis has not yet been confirmed.

If national and local pig farmers' associations exist, alerting them to the situation as soon as possible will help ensure their support and cooperation should ASF be confirmed, and will have a beneficial effect on quarantine enforcement.

OPERATIONAL PHASE

The operational phase is initiated when ASF occurrence has been confirmed and an ASF emergency is declared. Immediate actions required are:

- international reporting of ASF infection;
- obtaining political support for control activities;
- meeting of the interagency committee;
- a public awareness campaign;
- timely destruction of infected and in-contact pigs, with compensation, and decontamination of premises (one week);
- prevention of movement of pigs and pig products from infected foci;
- institution of national surveillance for ASF.

INTERNATIONAL REPORTING

The declaration of infection should be sent by the DVS to global authorities such as OIE and FAO and regional organizations, and should be officially communicated to neighbouring countries and trading partners.

Delay in reporting to neighbouring countries can have serious consequences for ASF control and political relations.

OBTAINING POLITICAL SUPPORT

Before any outbreak occurs, the minister responsible for the veterinary department should have been made aware of the significance of the most important epidemic diseases that can have an impact on livelihoods, commerce and economic growth, or directly affect humans. On confirmation of ASF, an interview should be arranged immediately, to brief the minister about the current situation, salient facts about the disease, legislation affecting disease control and the budget for disease control measures. This should be accompanied by a realistic estimate of the cost to the country should control fail; this estimate should be prepared in advance and regularly updated to accommodate inflation and changing circumstances, such as growth and modernization of the pig industry. Permission to mobilize the emergency fund for ASF control (or other emergency disease support financial system) should be obtained.

PUBLIC AWARENESS CAMPAIGN

An effective, organized public awareness campaign is probably the most important aid in controlling ASF, and must be an intrinsic part of the action plan. Countries' specific characteristics determine the type of campaign that will succeed best, but certain basic rules apply to all countries:

- Make use of multiple media. The best penetration into remote communities is often achieved by radio programmes, because people may only receive newspapers days after publication, and may lack television. However, announcements via television and newspapers are also needed. SMS alerts on mobile telephones may also have potential.
- Widespread dissemination of eye-catching posters and pamphlets reinforces the campaign.
- Avoid sensationalism and untrue statements, for example that ASF causes human disease. Concentrate on real disadvantages, such as an increase in the price of feeding the family.
- Public meetings are an effective way of informing people about the disease, enabling them to ask questions and offer information.
- Draw on the experiences of other countries, to underline the severe consequences of ASF.
- Keep the public informed about the progress of the campaign by means of regular updates.
- Keep in mind that it is often better for a non-veterinarian to broadcast messages from the CVO rather than for the CVO to be the spokesperson.

If there are national and local pig farmers' associations, it is politically wise to ensure that they are kept informed of the situation.

SLAUGHTER, DESTRUCTION AND DECONTAMINATION

Destruction of infected and in-contact pigs should be carried out by a team equipped to destroy pigs in a humane manner acceptable to owners, dispose of carcasses in a way that prevents retrieval and consumption of meat, and decontaminate premises and themselves. For carcasses and infected material such as bedding and residual feed, disposal by deep burial or incineration is recommended. This should take place on the affected premises or as close as possible to them. Transport of potentially infected carcasses to distant sites is not recommended, as dangers such as spillage of infected fluids, breakdown of vehicles and theft may make matters worse. Informed pig farmers do not want vehicles carrying potentially infected material in the vicinity of their properties. In addition, removal of carcasses to distant burial sites contravenes the ban on movement of pigs within and from infected areas and sets a bad public example. Depopulation of pig farms should be immediately followed by cleaning and disinfection, with destruction of all material such as faeces, bedding and residual feed, and cleaning and disinfection of water and wooden feed troughs. Disinfection may be carried out with 2 percent sodium hypochlorite, 2 percent sodium hydroxide or a detergent-based virucidal agent. Teams should wear protective clothing and clean and disinfect themselves, particularly their hands and boots, after each operation.

Before destruction is attempted, owners must be assured of compensation at market-related prices. One such system could encompass the weighing of the destroyed pigs in the presence of owners to demonstrate the fairness of the price offered; another system uses a three-tier classification of piglet, juvenile, or adult. Genetic stock or prized animals can be handled by an agreed scheme developed between the public and private sectors before the emergency actions need to be applied.

PREVENTION OF MOVEMENT

Management and prevention of pig and product movement is often one of the most difficult aspects of control. It is usually based on:

- legislation that either specifically refers to epidemic diseases or becomes active when a state of emergency is declared; such legislation is supported by the forces of the law, including veterinary authorities, police and army;
- cooperation by producers and the public to prevent movement when conventional methods fail;
- compensation for compulsory slaughter to avoid illegal movement and clandestine transactions;
- compliance and the institution of effective penalties for non-compliance.

Any national action plan should include innovative measures to support movement control or movement management, which could include the participation of pig industry representatives in road blocks, the dissemination of pamphlets and posters illustrating the consequences of illegal movement, and incentives for reporting illegal movement that outweigh the advantages of ignoring it.

If road blocks are to support control, they must be effective and include searches for pork products as well as for live pigs. If wheels of vehicles are to be disinfected, this must be done effectively. However, except over short distances in wet conditions, wheels are unlikely to remain contaminated with ASF virus for long.

SURVEILLANCE

Surveillance for ASF and other syndromes that can be confused with ASF should be carried out by local animal health officers, who should enlist the support of pig producers and any other appropriate stakeholders, and should identify clear lines of reporting and communication. This is facilitated by holding public information days in infected foci and areas most likely to become infected. Pig farming records that constitute the inventory of the national herd should be updated. After the introduction of sentinel swine or restocking, all pig producers, especially in the areas surrounding previously ASF-infected foci, should be visited at least twice, with a two-week interval between visits, to ensure that no untoward deaths have occurred (and this should be reported – "negative reporting" or zero is better than *blank*). Veterinary officials versed in the clinical signs of ASF should carry out inspections at all livestock markets and abattoirs and question the sellers. They should have powers to detain pigs showing suspicious signs of disease or originating from farms that have experienced increased mortality or are situated in or close to infected areas. Blood and organs from slaughtered pigs may be submitted to the national diagnostic laboratory for ASF testing. Regular reporting and dissemination of information, for example by a weekly or two-weekly epidemiological report, should be encouraged.

Surveillance may be reinforced by local, regional and national workshops on recognition and management of ASF. These should be held at regular intervals to ensure that new entrants are informed and trained. Considerable refreshment of past training is also likely to be required, especially if there is no disease outbreak for a long period.

STAND-DOWN PHASE

When ASF is not confirmed, the DVS should inform all parties that the emergency situation has ceased to exist. If ASF had been confirmed, the stand-down phase begins when the DVS is satisfied that all operations for containment, control and elimination of infected foci have achieved their goals. How soon this occurs after the initial outbreak depends on circumstances, including whether other foci were discovered, their extent and the success of the control/stamping-out measures. In general, if no further outbreaks have occurred for a two-month period after the initial outbreak, normal trade in pigs and pig products can be resumed, although this should be subject to intense veterinary surveillance for at least the first month or two. Sentinel pigs may be introduced into formerly infected premises 40 days after depopulation and disinfection, or earlier if the premises are isolated and there are no active foci in the area. If these pigs do not develop signs of disease within two or three weeks of introduction there is a strong likelihood that the outbreak has been controlled.

Chapter 10

Training, testing and revision of contingency plans

SIMULATION EXERCISES

Simulation exercises are useful for testing and refining contingency plans in advance of any disease emergency. They are a valuable means of building teams for emergency disease responses and of training individual staff.

Realistic disease outbreak scenarios should be devised for the exercises, using real data where possible, for such elements as livestock locations, populations and trading routes. A scenario may cover one or more of the phases or a real outbreak, and illustrate a range of possible outcomes. Neither the scenario nor the exercise should be too complicated or long, however. It is best to test one system at a time, for example operation of a local disease control centre. Simulation exercises may be done as paper exercises (table-top), through mock activities (field tests) or as a combination of both. At the completion of each simulation exercise, there should be an assessment of the results, to identify areas where plans need to be modified and further training provided.

A full-scale disease outbreak simulation exercise should only be attempted after individual components of the disease control response have been tested and proved. Exercises attempted before this will likely be counterproductive. Care must be taken that simulation exercises are not confused with actual outbreaks by the media and the public, so they and neighbouring countries should be alerted beforehand. Notifying OIE of a planned simulation exercise a few weeks before it is launched can avoid misrepresentation of the fictitious disease event.

As ASF is a TAD, simulation exercises with neighbouring countries are extremely useful, but should be conducted only after the national plans have been practised to an advanced degree.

TRAINING

Staff should be thoroughly trained in their roles, duties and responsibilities in an ASF emergency. Those in key positions will need more intensive training. It should be borne in mind that any staff member, from the CVO downwards, may be absent or may need to be relieved during a disease emergency. Back-up staff should therefore be trained for each position.

REGULAR UPDATING OF CONTINGENCY PLANS

Contingency plans should not be treated as static blueprints, but as documents that need regular review and updating to reflect changing circumstances. When reviewing and updating ASF contingency plans, the following factors should be taken into account:

- changing epidemiological situations in and outside the country;
- new ASF threats;
- changes in livestock production systems and internal and export trade requirements;
- changes in national legislation or in the structure or capabilities of government veterinary services or other government establishments;
- experiences in the country and neighbouring countries, results from training or simulation exercises, and feed-back from major stakeholders, including farmers.

Annex 1

FAO and OIE reference laboratories

This list is valid as at the end of 2008. It may be subject to alteration in future years. The FAO and OIE websites should be consulted for their most recent lists of reference laboratories, which are available in the latest online version of the *Manual for diagnostic tests and vaccines* (www.oie.int).

Centro de Investigación en Sanidad Animal Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (CISA-INIA)
Dr C. Gallardo
28130 Valdeolmos
Madrid - ESPAÑA
Tel.: (+34) 91 6202300
Fax: (+34) 91 6202247
E-mail: gallardo@inia.es

Ministerio de Educación y Ciencia, Facultad de Veterinaria, Universidad Complutense de Madrid
Dr J.M. Sánchez-Vizcaíno
Avda Puerta de Hierro s/n 28040
Madrid - ESPAÑA
Tel.: (+34) 91 3944082
Fax: (+34) 91 3943908
E-mail: jmvizcaino@vet.ucm.es

Institute for Animal Health Pirbright Laboratory
Dr C. Oura
Ash Road, Surrey GU24 ONF
Pirbright - UNITED KINGDOM
Tel.: (+44) 14 83232441
Fax: (+44) 14 83232448
E-mail: chris.oura@bbsrc.ac.uk

ARC-Onderstepoort Veterinary Institute
Dr A. Lubisi
Private Bag X5, Onderstepoort 01 10
SOUTH AFRICA
Tel.: (+27) 12 5299101
Fax: (+27) 12 5299543/95
E-mail: lubisia@arc.agric.za

FAO ANIMAL PRODUCTION AND HEALTH MANUALS

1. Small-scale poultry production, 2004 (E, F)
2. Good practices for the meat industry, 2006 (E, F, S, Ar)
3. Preparing for highly pathogenic avian influenza, 2006 (E, Ar, S[e], F[e], M[e])
4. Wild Bird HPAI Surveillance – A manual for sample collection from healthy, sick and dead birds, 2006 (E, F, R, Id, S[e], Ar[e], C[e], Ba**)
5. Wild birds and Avian Influenza – An introduction to applied field research and disease sampling techniques, 2007 (E, F, R, Id, Ba, S**)
6. Compensation programs for the sanitary emergence of HPAI-H5N1 in Latin American and the Caribbean, 2008 (E[e], S[e])
7. The AVE systems of geographic information for the assistance in the epidemiological surveillance of the avian influenza, based on risk (E[e], S[e])
8. Preparation of African Swine Fever contingency plans (E)

Availability: October 2009

Ar	-	Arabic	Multil	-	Multilingual
C	-	Chinese	*		Out of print
E	-	English	**		In preparation
F	-	French	[e]		E-publication
P	-	Portuguese			
R	-	Russian			
S	-	Spanish			
M	-	Mongolian			
Id	-	Bahasa			
Ba	-	Bangla			

The *FAO Animal Production and Health Manuals* are available through the authorized FAO Sales Agents or directly from Sales and Marketing Group, FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy.

FAO ANIMAL HEALTH MANUALS

1. Manual on the diagnosis of rinderpest, 1996 (E)
2. Manual on bovine spongifom encephalophaty, 1998 (E)
3. Epidemiology, diagnosis and control of helminth parasites of swine, 1998
4. Epidemiology, diagnosis and control of poultry parasites, 1998
5. Recognizing peste des petits ruminant – A field manual, 1999 (E, F)
6. Manual on the preparation of national animal disease emergency preparedness plans, 1999 (E)
7. Manual on the preparation of rinderpest contingency plans, 1999 (E)
8. Manual on livestock disease surveillance and information systems, 1999 (E)
9. Recognizing African swine fever – A field manual, 2000 (E, F)
10. Manual on Participatory Epidemiology – Method for the Collection of Action-Oriented Epidemiological Intelligence, 2000 (E)
11. Manual on the preparation of african swine fever contigency plans, 2001 (E)
12. Manual on procedures for disease eradication by stamping out, 2001 (E)
13. Recognizing contagious bovine pleuropneumonia, 2001 (E, F)
14. Preparation of contagious bovine pleuropneumonia contingency plans, 2002 (E, F)
15. Preparation of Rift Valley fever contingency plans, 2002 (E, F)
16. Preparation of foot-and-mouth disease contingency plans, 2002 (E)
17. Recognizing Rift Valley fever, 2003 (E)

African swine fever (ASF) is a viral haemorrhagic disease of swine generally characterized by high morbidity and high mortality. The disease is known to have devastated swine farming in highly industrialized, small commercial and backyard swine holdings, with concomitant closure of animal and meat export markets, ravaged swine populations, and destroyed individual and family livelihoods. ASF is one of the more difficult transboundary animal diseases to control as no successful vaccine has yet been developed; it is transmitted by direct contact between infective and susceptible swine, and by infected soft ticks of the *Ornithodoros* genus; and it has several wildlife reservoirs in areas where it is endemic. The ASF virus can last for long periods in contaminated environments or cured pork products, which can be a source of infection or introduction of the disease to distant areas.

The disease, present in most of sub-Saharan Africa, made its way to Europe in the late 1950s, where campaigns for its eradication on the mainland took more than 30 years to conclude. In the 1970s and 1980s, the disease was introduced several times into a few countries in the Americas, with eventual elimination only after national and international concerted action. In mid-2007 ASF was first reported in the Caucasus and spread within the region, causing concern to swine producers in Eastern Europe and beyond.

This manual is based on the manual on ASF (FAO Animal Health Manual No. 11) published in 2001, updated to capture new knowledge and adapted to cover European settings.

ISBN 978-92-5-106426-9 ISSN 1810-1119

I1196E/1/10.09/1100