AUSTRALIAN VETERINARY EMERGENCY PLAN

AUSVETPLAN

Operational Procedures Manual

Decontamination

Version 3.2, 2008

AUSVETPLAN is a series of technical response plans that describe the proposed Australian approach to an emergency animal disease incident. The documents provide guidance based on sound analysis, linking policy, strategies, implementation, coordination and emergency-management plans.

Primary Industries Ministerial Council

This operational procedures manual forms part of:

AUSVETPLAN Edition 3

This manual will be reviewed regularly. Suggestions and recommendations for amendments should be forwarded to:

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DISEASE WATCH HOTLINE

1800 675 888

The Disease Watch Hotline is a toll-free telephone number that connects callers to the relevant state or territory officer to report concerns about any potential emergency disease situation. Anyone suspecting an emergency disease outbreak should use this number to get immediate advice and assistance.

Preface

This operational procedures manual for decontamination is an integral part of the **Australian Veterinary Emergency Plan**, or **AUSVETPLAN (Edition 3)**. AUSVETPLAN structures and functions are described in the **AUSVETPLAN Summary Document**.

This manual has been produced in accordance with the procedures described in the AUSVETPLAN Summary Document and in consultation with Australian national, state and territory governments and the relevant industries. It was approved by Animal Health Committee/PIMC/Primary Industries Standing Committee.

In this manual, the placing of text in square brackets [xxx] indicates that that aspect of the manual remains contentious or is under development; such text is not part of the official manual. The issues will be worked on by experts, and relevant text will be included at a future date.

Detailed instructions for the field implementation of AUSVETPLAN are contained in the disease strategies, operational procedures manuals, management manuals and wild animal manual. Industry-specific information is given in the relevant enterprise manuals. The full list of AUSVETPLAN manuals that may need to be accessed in an emergency is shown below.

In addition, *Exotic Diseases of Animals: A Field Guide for Australian Veterinarians* by WA Geering, AJ Forman and MJ Nunn, Australian Government Publishing Service, Canberra, 1995 (to be updated) is a source for some of the information about the aetiology, diagnosis and epidemiology of the diseases.

AUSVETPLAN manuals[1]

Disease strategies
- Individual strategies for each of 30 diseases
- Bee diseases and pests
- Response policy briefs (for diseases not covered by individual manuals)

Operational procedures manuals
- Decontamination
- Destruction of animals
- Disposal
- Public relations
- Valuation and compensation
- Livestock welfare and management

Wild animal manual
- Wild animal response strategy

Enterprise manuals
- Artificial breeding centres
- Dairy processing
- Feedlots
- Meat processing
- Poultry industry
- Saleyards and transport
- Veterinary practices
- Zoos

Management manuals
- Control centres management (Parts 1 and 2)
- Animal Emergency Management Information System
- Laboratory preparedness

Summary document

[1] The complete series of AUSVETPLAN documents is available on the internet at: http://www.animalhealthaustralia.com.au/programs/eadp/ausvetplan_home.cfm

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1 Introduction

Decontamination — the combination of physical and chemical processes that kills or removes pathogenic microorganisms — is vital for disease eradication. It requires the application of appropriate strategies to reduce the microorganism load to noninfective levels. This manual provides guidelines for the decontamination of premises where animals infected with emergency animal disease (EAD) agents have been held.

1.1 Definitions

- *Decontamination* — includes all stages of cleaning and disinfection.
- *Disinfection* — the application, after thorough cleaning, of procedures intended to destroy the infectious or parasitic agents of animal diseases, including zoonoses; applies to premises, vehicles and different objects that may have been directly or indirectly contaminated.
- *Disinfectant* — a chemical used to destroy disease agents outside a living animal.
- *Sterilisation* — the removal or destruction of all forms of life. In the context of disease control, this refers to the removal or destruction of microorganisms on an item or surface.

It is rare that 100% decontamination can be attained or proved in field situations.

(Further definitions of key terms are included in the Glossary.)

1.2 Scope of this manual

This manual considers in detail 30 EADs that are included in the *Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses* (EAD Response Agreement)[2] and for which there are AUSVETPLAN **Disease Strategies**. The manual also provides information for the remaining diseases listed in the EAD Response Agreement and included in the AUSVETPLAN **Response Policy Briefs**. Table 1.1 lists all the EAD diseases and their disease agent types.

A report by Scott Williams Consulting Pty Ltd, 'Persistence of Disease Agents in Carcases and Animal Products', which was commissioned by Animal Health Australia, can be found on the Animal Health Australia website.[3]

[2] Information about the EAD Response Agreement can be found at http://www.animalhealthaustralia.com.au/programs/eadp/eadra.cfm

[3] http://www.animalhealthaustralia.com.au/fms/Animal%20Health%20Australia/AUSVETPLAN/WilliamsReport.pdf

1.3 Principles

Thorough decontamination requires close cooperation between property owners and all personnel involved in the cleaning and disinfection procedures, and will reduce the period between slaughter and restocking on contaminated and affected properties. However, natural processes and the passage of time may also help to kill microorganisms, and over-reliance on chemical decontamination is unwise.

A presumptive identification of the disease agent is fundamental for designing an appropriate decontamination strategy. A sound understanding of the agent's biological properties and how the disease spreads can then form the basis for strategic planning.

It is important to adopt the basic microbiological principles of isolation of the source of infection and decontamination of personnel, equipment, vehicles and sites. Personal decontamination procedures, when properly carried out, permit the safe movement of personnel from property to property in the extensive surveillance activities that form a large and vital part of any eradication campaign.

Preliminary cleaning is invariably needed before any chemical disinfectants are used, and this aspect cannot be overemphasised. Mechanical brushing of surfaces with a detergent solution is highly effective at removing contaminating disease agents and is fundamental for subsequently achieving effective chemical decontamination.

Decontamination is rarely the same as sterilisation; in the field, 100% decontamination is unlikely to be achieved in all situations. In many cases, gross contamination can be removed effectively, but the final phase will involve time and the natural elements of heat, dehydration and solar radiation to achieve the desired goal.

The procedures described in this manual may appear simple and tedious, but persistence and attention to detail are vital for success.

This manual concentrates on a relatively narrow range of disinfectants and other chemicals, which fit into seven general groups:

- soaps and detergents
- oxidising agents
- alkalis
- acids
- aldehydes
- insecticides
- other chemical agents.

Most of the disinfectants are effective against a broad range of viruses and bacteria and are generally available in large quantities in all parts of Australia. Clear instructions are given for the dilution and application of these disinfectants (see Table 3.1).

Note: Common chemical names are usually used because they are easily understood by all personnel with basic scientific knowledge.

1.4 How to use this manual

The manual outlines the properties of the agents involved in EADs, the disinfectants and other methods available to inactivate them, and the decontamination procedures that need to form part of a decontamination plan. The manual provides strategies for particular disease agents or groups of agents.

The manual is set out as follows:

- Properties of the EAD agents — **see Section 2**.
- Disinfectants/chemicals available, including safety concerns — **see Section 3**.
- Decontamination procedures for people, property, machinery, vehicles and other items — **see Section 4**.
- Putting it all together: for decontamination procedures for particular disease agents — **see Section 5**.

The sequence of sections and tables likely to be referred to when planning a decontamination program are shown below:

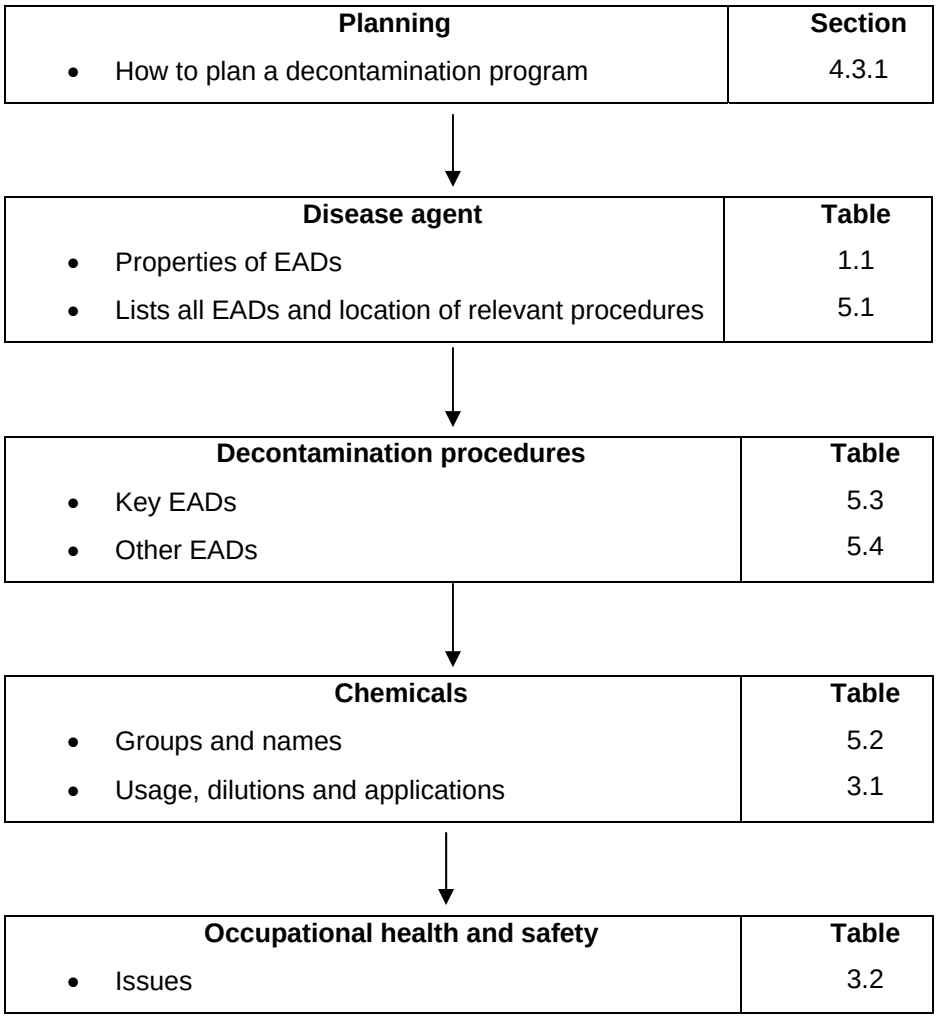

Table 1.1 Emergency animal diseases listed in the EAD Response Agreement

EAD[a]	EAD Response Agreement category[b]	Type of agent[c]	Human health risk	Main animals likely to be affected in Australia	Where to find further information on epidemiology
African horse sickness	3	Virus (C)	Nil	Horses, dogs	Disease strategy
African swine fever	3	Virus (A)	Nil	Pigs	Disease strategy
Anthrax	3 (major outbreaks)	Bacterium	Yes	All mammals (especially cattle and sheep)	Disease strategy
Aujeszky's disease	4	Virus (A)	Nil	Pigs, cattle, sheep, goats, dogs	Disease strategy
Australian lyssaviruses (including bat lyssavirus)	1	Virus (A)	Yes	Flying foxes, insectivorous bats	Disease strategy
Avian influenza	2 or 3	Virus (A)	Strain dependent	Birds	Disease strategy
Bluetongue (disease in sheep)	3 (sheep)	Virus (C)	Nil	Sheep, goats, cattle, camelids, deer, buffalo	Disease strategy
Borna disease	4	Virus (A)	Not known	Horses, sheep	Response Policy Briefs
Bovine spongiform encephalopathy	2	Prion	Yes	Cattle	Disease strategy
Bovine tuberculosis (due to *Mycobacterium bovis*), after Tuberculosis Freedom Assurance Program (TFAP) is completed (provided that no other program in respect of bovine tuberculosis is introduced in its place)	3	Bacterium	Yes	Cattle, buffalo, deer, camelids	
Brucellosis (due to *Brucella abortus*)	2	Bacterium	Yes	Cattle, horses, sheep, goats	Disease strategy
Brucellosis (due to *Brucella melitensis*)	2	Bacterium	Yes	Goats, sheep, humans	Response Policy Briefs
Classical swine fever	3	Virus (A)	Nil	Pigs	Disease strategy
Contagious bovine pleuropneumonia	3	Mycoplasma	Nil	Cattle	Response Policy Briefs

EAD[a]	EAD Response Agreement category[b]	Type of agent[c]	Human health risk	Main animals likely to be affected in Australia	Where to find further information on epidemiology
Contagious equine metritis	4	Bacterium	Nil	Horses	Disease strategy
Dourine	4	Protozoan	Nil	Horses	Response Policy Briefs
East coast fever (theileriosis)	4	Protozoan	Nil	Cattle	Response Policy Briefs
Encephalitides (tick-borne)	3	Virus (A)	Rare	Sheep, cattle, horses, pigs, deer	Response Policy Briefs
Epizootic lymphangitis	4	Fungus	Rare	Horses	Response Policy Briefs
Equine babesiosis (equine piroplasmosis)	4	Protozoan	Nil	Horses, donkeys	Response Policy Briefs
Equine encephalomyelitis (western, eastern and Venezuelan)	1	Virus (A)	Yes	Horses, donkeys, birds	Response Policy Briefs
Equine encephalosis	4	Virus (C)	Nil	Horses	Response Policy Briefs
Equine influenza	4	Virus (A)	Rare	Horses	Disease strategy
Foot-and-mouth disease	2	Virus (B)	Rare	All cloven-hoofed animals	Disease strategy
Getah virus	4	Virus (A)	Nil?	Horses	Response Policy Briefs
Glanders	2	Bacterium	Yes	Horses, donkeys	Response Policy Briefs
Haemorrhagic septicaemia	4	Bacterium	Nil	Cattle, buffalo	Response Policy Briefs
Heartwater	4	Rickettsia	Nil	Cattle, sheep goats, water buffalo	Response Policy Briefs
Hendra virus infection (formerly equine morbillivirus)	2	Virus (A)	Yes	Horses	Response Policy Briefs
Infectious bursal disease (very virulent)	4	Virus (C)	Nil	Poultry	Disease strategy
Japanese encephalitis	1	Virus (A)	Yes	Pigs, horses	Disease strategy
Jembrana disease	4	Virus (A)	Nil	Bali cattle	Response Policy Briefs
Lumpy skin disease	3	Virus (A)	Nil	Cattle, buffalo	Disease strategy
Maedi–visna	4	Virus (A)	Nil	Sheep, goats	Response Policy Briefs

EAD[a]	EAD Response Agreement category[b]	Type of agent[c]	Human health risk	Main animals likely to be affected in Australia	Where to find further information on epidemiology
Menangle virus (porcine paramyxovirus)	3	Virus (A)	Yes	Pigs, flying foxes	Response Policy Briefs
Nairobi sheep disease	4	Virus (A)	Yes	Sheep, goats	Response Policy Briefs
Newcastle disease	3	Virus (A)	Rare	Birds	Disease strategy
Nipah virus	1	Virus (A)	Yes	Pigs, flying foxes	Response Policy Briefs
Peste des petits ruminants	2	Virus (A)	Nil	Sheep, goats	Disease strategy
Porcine respiratory and reproductive syndrome	4	Virus (A)	Nil	Pigs	Disease strategy
Potomac fever	4	Rickettsia	Nil	Horses	Response Policy Briefs
Pulmonary adenomatosis (ovine)	4	Virus (A)	Nil	Sheep, goats	Response Policy Briefs
Rabies	1	Virus (A)	Yes	All mammals	Disease strategy
Rift Valley fever	2	Virus (A)	Yes	Cattle, sheep, goats	Disease strategy
Rinderpest	2	Virus (A)	Nil	Cattle, sheep, pigs	Disease strategy
Scrapie	3	Prion	Nil	Sheep, goats	Disease strategy
Screw-worm fly	2	Insect	Yes	All mammals	Disease strategy
Sheep pox and goat pox	2	Virus (A)	Nil	Sheep, goats	Disease strategy
Sheep scab	4	Mite	Nil	Sheep	Response Policy Briefs
Small hive beetle	3	Beetle	Nil	Bees	Response Policy Briefs
Surra	4	Protozoan	Nil	Horses, dogs, cats, camelids, donkeys, deer	Disease strategy
Swine influenza	4	Virus (A)	Yes	Pigs	Response Policy Briefs
Swine vesicular disease	3	Virus (B)	Nil	Pigs	Disease strategy
Teschen disease (enterovirus encephalomyelitis)	4	Virus (B)	Nil	Pigs	Response Policy Briefs
Tracheal mite tropilaelaps mite, varroa mite,	2 (tracheal mite and tropilaelaps mite), 2 or 4 (varroa mite),	Mites, insect (Braula fly)	Nil	Bees	Disease strategy

EAD[a]	EAD Response Agreement category[b]	Type of agent[c]	Human health risk	Main animals likely to be affected in Australia	Where to find further information on epidemiology
Braula fly (except in Tasmania)	4 (Braula fly)				
Transmissible gastroenteritis	4	Virus (A)	Nil	Pigs, dogs	Disease strategy
Trichinosis (trichinellosis)	3	Helminth	Yes	All mammals	Response Policy Briefs
Vesicular exanthema	3	Virus (B)	Nil	Pigs	Disease strategy
Vesicular stomatitis	2	Virus (A)	Yes	Cattle, horses, pigs	Disease strategy
Wesselsbron disease	4	Virus (A)	Yes	Sheep, goats	Response Policy Briefs

EAD Response Agreement = *Government and Livestock Industry Cost-Sharing Deed In Respect of Emergency Animal Disease Responses*
a Diseases shown in bold are those for which there is an AUSVETPLAN **Disease Strategy**. The remaining diseases are included in the **Response Policy Briefs**.
b Disease categories listed in the EAD Response Agreement (see the **Summary Document** for further information about these categories).
c Virus categories A, B and C are defined in Section 2.

2 Properties of the emergency animal disease agents

Eliminating emergency animal disease (EAD) agents from premises, clothing, vehicles, tools, carcases or the environment requires a good understanding of the general properties of each disease agent and the subtle ways each may persist in the environment and infect other animals.

Many EAD Response Agreement disease agents are viruses. Three categories of viruses can be distinguished, based on particle size and the presence or absence of lipid (Klein and DeForest 1981), which determines the viruses' susceptibility to disinfectants:

- *Category A* viruses (intermediate to large size, contain lipid) — very susceptible to detergents, soaps and all the disinfectants listed in Section 3; susceptible to dehydration and often do not persist long unless the environment is moist and cool.
- *Category B* viruses (smaller, no lipid, more hydrophilic; eg picornaviruses and parvoviruses) — relatively resistant to lipophilic disinfectants such as detergents. Although Category B viruses are sensitive to all the other disinfectants listed in Section 3, they are less susceptible than viruses in Category A. Classical bactericides, such as quaternary ammonium compounds and phenolics, are not effective against these viruses.
- *Category C* viruses (intermediate in size, no lipid; eg adenoviruses and reoviruses) — intermediate between Categories A and B in sensitivity to the best antiviral disinfectants, such as hypochlorites, alkalis, oxidising agents (eg Virkon®) and aldehydes.

The other disease agents covered by the EAD Response Agreement include:

- bacteria
- mycoplasmas
- rickettsias
- prions
- parasites of various types.

The characteristics of the disease agents, main modes of transmission and other epidemiological factors influence the need for decontamination and govern the extent of procedures to remove the EAD agent. In some areas of Australia, the disease agent may be affected by our severe environmental conditions (direct, hot sunlight and low humidity), and the scale of decontamination procedures may therefore be reduced.

Further information on each disease agent is given in the disease's individual **Disease Strategy** or in the **Response Policy Briefs.**

3 Disinfectants/chemicals for the inactivation of emergency animal disease agents

3.1 Introduction

A relatively small number of disinfectants is effective against broad groups of viruses and bacteria. Ultimately, the choice of disinfectant depends on the disease agent, availability of the disinfectant, how the disinfectant is to be applied and how an adequate wet contact time is to be maintained.

3.2 Using registered chemicals

Any chemicals or products to be used on agricultural premises for disinfecting buildings, yards, equipment, vehicles etc must be registered with the Australian Pesticides and Veterinary Medicines Authority (APVMA). Lists of registered products, active chemicals and manufacturers/sponsors are available on the APVMA PubCris database[4] of registered agricultural and veterinary chemicals. If the use is off label, an emergency permit must be issued before the product is recommended, supplied or used, unless the APVMA has declared that the active chemical ingredient has 'reserved' status.

Abattoirs and dairy factories are considered food premises, and chemicals used in those premises are not regulated by the APVMA. However, the Australian Quarantine and Inspection Service (AQIS) approves chemicals to be used in export meat establishments. Products that will be effective against the specific disease agent should be selected from products approved and routinely used in meat and dairy premises.

For personal washing and disinfection of skin and hair in an emergency animal disease (EAD) response, products should be selected from the Therapeutic Goods Administration-approved soaps, scrubs, handwashes and skin disinfectants listed in the Australian Register of Therapeutic Goods.[5] If required, citric acid to achieve a final concentration of 0.2% could be added to the final rinse for Category B virus diseases, although listed povidone iodine products could be used for those viruses.

3.3 Preparatory cleaning

Simple cleaning of surfaces by brushing with a detergent solution is effective in removing contaminating viruses and bacteria and is fundamental for achieving effective chemical decontamination.

[4] http://services.apvma.gov.au/PubcrisWebClient/welcome.do
[5] https://www.tgasime.health.gov.au/SIME/33.ARTG/ARTGPublicWeb.nsf?OpenDatabase

Preliminary cleaning work is invariably needed before any chemical disinfectants are used. Most disinfectants have reduced effectiveness in the presence of fat, grease and organic material. Every effort should be made to remove such material from all surfaces to be decontaminated. Hot water and steam are effective for cleaning cracks and crevices where pathogens are likely to linger. The inside of pipework can be cleaned effectively by steam applied long enough to bring the surface temperature close to 100°C or with a 'clean-in-place' system with an appropriate disinfectant product, as is often used in dairy factories.

3.4 Natural disinfection

The natural processes of time, dehydration, warmth and sunlight will greatly assist the decontamination operation and should be considered in planning. A hot, dry, sunny day will cause rapid natural inactivation of an agent such as Newcastle disease virus, whereas cold, damp, overcast conditions will help it persist. It follows that the natural effects of solar heat, dehydration and UV radiation will quickly decontaminate fencing and rails in the open, but that disease agents are likely to persist longer on a cold, damp floor inside a shed.

The destocking of a contaminated property for a long period after a disease outbreak is based on the same principle.

3.5 Classes of disinfectants

Disinfectants can be grouped into the following classes:

- soaps and detergents
- oxidising agents
- alkalis
- acids
- aldehydes
- insecticides.
- other chemical agents (for example biguanides, iodophores, quaternary ammonium compounds, phenolics).

These classes of disinfectants are discussed in this section.

There are also nonchemical methods of disinfection (see Section 3.6).

The disinfectants recommended in this manual are generally available in large quantities throughout Australia. Chemical names are used in this manual rather than brand names because they are easily understood by all personnel with basic technical knowledge. Brands and trade names are generally avoided because commercial products are subject to change or restriction in their distribution.

Appendix 2 provides some information on possible sources of disinfectants and associated equipment.

3.5.1 Soaps and detergents

Soaps and detergents are usually not considered good disinfectants, but they are essential for the cleaning needed before many of the decontamination procedures described below can be applied. In most cases, the primary aim is the removal of organic material, dirt or grease from surfaces to be decontaminated. Most industrial and domestic brands of soaps and detergents are satisfactory. Hot water, brushing and scrubbing enhance the cleaning action. Sellers (1968) states that the addition of soap or detergent to acids and alkalis had minimal effect on the virucidal efficacy of the chemical. Soaps and anionic detergents[6] should not be used for cleaning if a cationic detergent is to follow as the decontaminating agent, because they may effectively neutralise the agent. They also neutralise chlorhexidine and quaternary ammonium compounds.

Soaps and detergents are not consistently effective against bacteria, but are effective disinfectants in their own right for almost all Category A viruses because of their effect on the outer lipid envelope.

Many commonly used disinfectants in hospitals, surgeries, dairies and food-processing areas involve soapy combinations of phenolics or quaternary ammonium compounds (see Section 3.5.6). These agents are specifically antibacterial and are also effective against Category A viruses, but have limited activity against Category C viruses and, in many cases, no activity against Category B viruses. Therefore, although they may be useful for preparatory cleaning during an EAD outbreak, they are not recommended in this manual where more effective viral decontaminants are available.

3.5.2 Oxidising agents

Oxidising agents are the recommended disinfectants for most applications. Chlorine, a powerful oxidising agent effective in killing all virus groups (Dychdala 1991) and all bacteria, is released from hypochlorite solutions (either sodium or calcium). In test conditions, Scott (1980) found that 0.175% sodium hypochlorite was the most effective and practical broad-spectrum disinfectant of 22 products tested against a range of viruses. However, it can be difficult to accurately define active concentrations for disinfectants that release free chlorine (such as hypochlorite), so higher concentrations are recommended for non-laboratory situations.

The effectiveness of hypochlorite is highest in the pH range 6–9 and decreases markedly in the presence of organic material. Several APVMA-registered products are based on sodium or calcium hypochlorite as the principal active chemical. Hypochlorite powders are also readily available as swimming pool disinfectants or household bleaches, and can be diluted for use on site. Hypochlorite solutions are not chemically stable and decompose rapidly as temperatures rise above 15°C.

Virkon (a registered product of Dupont International) is a modern disinfectant with outstanding virucidal and antibacterial properties. It is reported to have low

[6] Anionic detergents (including soap and the largest portion of modern synthetic detergents) produce electrically negative colloidal ions in solution. Cationic detergents produce electrically positive ions in solution.

toxicity and to be effective against all viruses tested (including members of all known viral families affecting animals), but it has not been approved for use on skin. Virkon's activity is based on a buffered synergised acid peroxygen system containing a high percentage of surfactant. It is relatively safe to use and comes in a powdered form ideal for dilution at the site of an EAD outbreak. It can be sprinkled as powder over wet or boggy areas, but the concentration of disinfectant achieved in this way cannot be accurately controlled. Details of availability of this product are provided in Appendix 2.

A major concern with Virkon in a large decontamination exercise would be its expense.

3.5.3 Alkalis

Alkalis have long been used as effective disinfectants against a wide range of pathogens. Both sodium hydroxide (caustic soda) and sodium carbonate (washing soda) are widely available in large quantities at low cost, and both have a natural saponifying (soap making) action on fats and other types of organic matter, which assists the cleaning process. Because they are virucidal and antibacterial under heavy burdens of organic material, they are ideal agents for decontaminating animal housing, yards, drains, effluent waste pits and sewage collection areas.

There are many APVMA-registered products with alkali salts as the principal active chemical, often also with a detergent.

Sodium hydroxide is corrosive to aluminium and derived alloys and therefore must be avoided in some circumstances. Sodium carbonate is useful against foot-and-mouth disease virus and may be used at a 4% concentration in some situations where sodium hydroxide cannot (eg in aircraft).

Sellers (1968) states that the addition of soap or detergent to alkalis and acids had minimal affect on the virucidal efficacy of the chemical, provided that the pH was maintained.

3.5.4 Acids

Acids are generally highly virucidal. A correctly chosen acid or acid mixture can be used for widely varying tasks, from dealing with liquid effluent to personal decontamination. Many APVMA-registered products have acid, such as phosphoric acid and sulfamic acid, as the principal active chemical. Some also contain a detergent that has minimal effect on the virucidal efficacy of the chemical, provided that the pH is maintained. The key criterion for virucidal efficacy of acids is the pH achieved in the ready-to-use disinfectant solution.

Hydrochloric acid, a strong acid, is widely available from hardware stores and is less toxic than other strong acids. Citric acid, a milder acid, is available in solid form, is active against acid-sensitive viruses and can be used safely for personnel and clothing decontamination. It is particularly useful when added to detergents for the inactivation of foot-and-mouth disease virus. Citric acid is not recommended for bacteria.

The United States Environmental Protection Agency has approved a peroxyacetic acid ('peracid') product for FMD virus, but no disinfectants with this active ingredient are registered in Australia (although one product is registered for treating vegetable washing water).

Common sense must be applied when even weak acids are used. For example, galvanised containers must be avoided, and some acid solutions should not be applied to concrete surfaces.

3.5.5 Aldehydes

Several APVMA-registered products contain aldehydes as the principal active chemical.

Glutaraldehyde

Glutaraldehyde, a very effective disinfectant (Scott and Gorman 1991), is active against all virus families and other microorganisms, such as bacteria, in concentrations of 1–2%. It remains effective in moderate concentrations of organic material, is chemically stable and is only mildly corrosive of metals. However, for large-scale decontamination the cost is likely to be high.

Formalin

Formalin, a 40% aqueous solution of formaldehyde gas, is a useful disinfectant. Formalin diluted with 12 volumes of water produces 5% formaldehyde, an active disinfectant against all viruses and bacteria (but not against the prions that cause scrapie and bovine spongiform encephalopathy), and can be used to disinfect soil.

Gaseous formaldehyde

Gaseous formaldehyde can be used to decontaminate airspaces and equipment that must be kept dry (such as electronic devices), and the insides of motor vehicle cabins. However, the gas concentration, temperature, humidity, time of contact and even distribution must be carefully controlled. Under emergency conditions on an infected premises (IP), it is unlikely that all parameters could be controlled adequately. In addition, the space to be decontaminated must be completely sealed to prevent gas escape, because the most effective 'dwell' period for the inactivation is overnight (Quinn 1991). Other problems include the toxicity of the gas; the dangerous nature of its generation in nonlaboratory conditions (potassium permanganate reacts violently with formalin); the environmental protection guidelines that prevent the release of formaldehyde gas to the atmosphere; and the difficulty of completely purging residual gas from confined spaces.

Formaldehyde gas has been used for the effective disinfection of hatching eggs and hatchery equipment, as it has proved to be a very effective means of destroying microorganisms on eggshells, egg cases, chick boxes, hatching machines and other hatchery equipment, provided these items have been subjected to preliminary cleaning. The use of formaldehyde gas on rural properties is generally not recommended. Unfortunately, no satisfactory alternative to formaldehyde for gaseous decontamination is available. Use of ethylene oxide or hydrogen peroxide for gaseous decontamination must be restricted to carefully controlled laboratory environments.

No clear-cut recommendation can be made for decontaminating vehicle cabins and electronic equipment on farms, and a methodical and systematic approach based on first principles is recommended. Cleaned vehicles and other machinery left in quarantine for a week in bright sunshine are likely to decontaminate naturally for most pathogens (but not bacterial spores or prion particles). Because the

parameters for effective formaldehyde decontamination of an IP are so difficult to establish, formaldehyde gas is unlikely to produce an absolute result or to be significantly more effective than thorough cleaning. Where gaseous decontamination of equipment or machinery is considered essential, specialist advice should be sought (eg from the Australian Animal Health Laboratory) and experienced operators used, and the contaminated equipment kept in quarantine until that time.

Further information on the practicalities of using formaldehyde gas is given in Appendix 3.

3.5.6 Other chemical disinfectants

Biguanidines

Of the many biguanides available, chlorhexidine is probably one of the most commonly used. Chlorhexidine is a chlorophenol biguanidine. Chlorhexidine compounds are generally active against gram-positive and gram-negative vegetative bacteria and lipophilic (Category A) viruses. Acid-fast bacteria are generally inhibited but not killed (bacteriostatic). Bacterial spores are not killed, but germination is inhibited while spores are in contact with chlorhexidine. It is not effective against mycobacteria and non-enveloped viruses (Categories B and C). Some species of *Pseudomonas* are resistant to chlorhexidine.

Chlorhexidine has low toxicity for humans and a strong affinity for binding to skin. It also displays rapid bactericidal activity. Contact time should exceed five minutes. This makes it particularly useful as a personal decontaminating agent for susceptible organisms.

Hard or alkaline water and soaps, anionic detergents and other anionic compounds are incompatible with chlorhexidine, forming low-solubility salts that may precipitate the active ingredients.

Chlorhexidine will maintain activity in the presence of some organic matter, but prior cleaning of surfaces and skin is recommended.

Iodophors

Iodophors are organically bound iodine. They display broad activity against gram-positive and gram-negative vegetative bacteria, mycobacteria (tuberculosis) and all virus classes (Categories A, B and C). They have poor activity against bacterial spores.

Iodophores display low toxicity for humans. However, they tend to stain skin, plastics, fabrics and other synthetic materials and are corrosive to metals. For personal use, they are probably best used as hand disinfectants.

They have a rapid biocidal activity that can be increased by using them in warm, acidic water. However, such solutions are less stable. Iodophors have an inbuilt indicator — if solutions are brown or yellow, they are still active. Contact times should exceed 10 minutes.

Organic matter inactivates iodophors, especially if excessive amounts of protein are present. They show poor residual activity, necessitating repeated application if exposure continues. Solutions also need to be prepared daily.

It is difficult to define active concentrations for iodophores with certainty in all circumstances, so they are not recommended in this manual for the inactivation of viruses. Disinfectants that release free chlorine (such as hypochlorite) share this problem to a lesser degree, so higher concentrations are recommended for nonlaboratory situations.

Quaternary ammonium compounds

Quaternary ammonium compounds (QUATs) are cationic detergents with strong surface activity. They are generally active against gram-positive bacteria and Category A viruses, are less active against gram-negative bacteria, and have negligible activity against Category B and C viruses and bacterial spores. Except for some of the later generation QUATs, they have poor activity against acid-fast organisms like the tuberculosis disease agent. QUATs are a very diverse group of disinfectants. More recent generations tend to have a broader spectrum of activity. Therefore, it is advisable to consider the specific QUATs and formulations when selecting a chemical for a particular organism. Contact time should exceed 10 minutes.

QUATs generally display low toxicity for humans. Normal use dilutions are usually non-irritating to skin, but prolonged skin or eye exposure should be avoided. However, the concentrate can be highly irritating to eyes, so safety glasses and personal protective equipment (PPE) must be worn when handling concentrates.

Earlier generations of QUATs were easily inactivated by anionic soaps and detergents, organic matter and hard water. Later generations are much less susceptible to inactivation by these means.

Effectiveness is generally enhanced in alkaline pH conditions, and QUATs can be used at temperatures up to 100°C.

Phenols

Phenolic compounds are effective against gram-positive and gram-negative bacteria, Category A viruses, and mycobacteria. They are less effective against Category B and C viruses and spores and are not recommended for that purpose. They are frequently used for the decontamination of surfaces and are relatively resistant to the presence of organic matter. They are also relatively noncorrosive. Contact times should exceed 10 minutes. However, because they are absorbed by rubber and some plastics, phenolic compounds are not suitable for all surfaces.

Phenols have an unpleasant odour, are relatively toxic and can cause skin and eye irritation. They may also be absorbed through skin. Concentrates should be handled with care, and safety glasses and other appropriate PPE must be worn.

Disposing of phenolic compounds while avoiding environmental contamination also poses problems.

3.5.7 Recommended concentrations and contact times

Table 3.1 shows disinfectants that may be used to inactivate EAD agents and the required dilution or concentration.

Table 3.1 Recommended disinfectants and concentrations for the inactivation of EAD agents

Disinfectant	Usual form supplied	Recommended working strength		Contact time for inactivation	Applications
		Usual dilution	Final conc		
Soaps and detergents					
	solids or liquids	as appro-priate		10 min	Thorough cleaning is an integral part of effective decontamination. Should not be considered as disinfectants except for Category A viruses.
Oxidising agents					
Sodium hypochlorite NaOCl	conc. liquid (50 000 ppm available chlorine)	1:10	5000 ppm available chlorine	10–30 min	Use for virus categories A, B and C and all bacteria. Effective for most applications, except when in the presence of organic material. Less stable in warm, sunny conditions above 15°C.
Calcium hypochlorite $Ca(OCl)_2$	solid	7 g/L	5000 ppm available chlorine	10–30 min	NaOCl effective against prion proteins at 2% with contact time of 1 hour followed by rinsing with copious quantities of water.
Virkon	powder	20 g/L	2% (w/v)	10 min	Excellent disinfectant active against all viruses and bacteria.
Alkalis					
Sodium hydroxide	pellets	10 g/L	1% (w/v)	10 min	Very effective against virus Categories A, B and C and all bacteria. Do not use in the presence of aluminium and derived alloys.
Sodium carbonate – anhydrous (Na_2CO_3)	powder	40 g/L	4% (w/v)	20 min	Recommended for use in the presence of high concentrations of organic material. Efficacy is enhanced by addition of detergent.
– washing soda ($Na_2CO_3.10H_20$)	crystals	100 g/L	10% (w/v)	20 min	Useful against foot-and-mouth disease virus. Better disinfectants are usually available for both viruses and bacteria.

Disinfectant	Usual form supplied	Recommended working strength		Contact time for inactivation	Applications
		Usual dilution	Final conc		
Acids					
Hydrochloric acid	concentrated acid (10 molar)	1:50	2% (v/v)	10 min	Used only when better disinfectants not available. Corrosive for many metals and concrete.
Citric acid	powder	2 g/L	0.2% (w/v)	15 min	Safe for clothes and body decontamination. Especially useful for foot-and-mouth disease virus decontamination. Not recommended for bacteria.
Aldehydes					
Glutaraldehyde	concentrated solution	as appro-priate	2% (w/v)	10–30 min	Excellent disinfectant effective against all viruses and bacteria.
Formalin	40% formal-dehyde	1:12	8% (v/v)	10–30 min	Disinfectant releases irritating, toxic gas. Effective against all viruses and bacteria.
Formaldehyde gas	Special generation required.			15–24 hours	Toxic gas, recommended only if other methods of decontamination cannot be used.
Other chemical agents					
Biguanidines	Dilute according to manufacturer's instructions.			> 5 min	Gram-positive and gram-negative vegetative bacteria and Category A viruses.
Iodophors	Dilute according to manufacturer's instructions.			> 10 min	Gram-positive and gram-negative vegetative bacteria, mycobacteria and Category A viruses.
Phenolic disinfectants`	Dilute according to manufacturer's instructions.			10 min	Bacteria and Category A viruses.
Quaternary ammonium compounds	Dilute according to manufacturer's instructions. Have natural detergent properties.			10 min	Bacteria only. Less effective against some gram-negative bacteria.

w/v = weight/volume (eg 2 g/100 mL)

Notes: The advice in this table about concentrations and times is conservative and is intended to cover as many different emergency situations as possible. Temperature, the presence of organic materials, the nature of surfaces and other factors affect decontamination rates. Workers in the field are expected to apply these recommendations with common sense and professional judgment of the particular environment, agent, surface etc.

Commonly used general disinfectants, such as phenolics and quaternary ammonium compounds, are very effective antibacterials, but have limited effectiveness against Category B and C viruses. A wide variety of effective antibacterial disinfectants is commercially available, but it should be noted that bacterial spores are much more resistant than vegetative cells, so special decontamination procedures must be used for diseases caused by spore-forming bacteria.

Products effective for decontamination of viruses on the hands and the skin are limited. Virkon is reported to have low toxicity and to be effective against members of all virus families affecting animals, but it has not been approved for use on skin. Alternatively, citric acid or sodium carbonate may be added to washing water to induce antiviral conditions by lowering or raising the pH as appropriate for the agent to be inactivated.

3.5.8 Estimation of quantities required

The amount of decontaminating agent necessary for particular jobs varies considerably. For a polished, nonporous floor, 100 mL of disinfectant/chemical applied per square metre is probably sufficient. However, for porous surfaces such as concrete or wood, the volume may need to be doubled or tripled. Generalisations are not useful, because the application of liquids to ceilings or vertical surfaces cannot be controlled well.

After adequate cleaning of the contaminated surface, the most critical factor is the time the disinfectant is in contact with the surface. For most applications, disinfectant must flood the surface and keep it thoroughly wet for at least 10 minutes.

In any large-scale decontamination of an IP, the cost of disinfectants will be relatively minor. Because labour and other operational costs will be high, using disinfectants at less than the recommended concentrations would be a false economy. If disinfectants are watered down, they invariably lose effectiveness.

3.5.9 Insecticides

Insecticides are used for control of insect vectors that carry or cause EADs. For more information on vector control, see the relevant **Disease Strategy**.

Insecticides are also used for control of screw-worm fly larvae and to deter further oviposition by adult flies. For more information on this use, see the **Screw-worm Fly Disease Strategy**.

3.6 Nonchemical methods

Steam improves the cleaning and decontamination process by raising the temperature and by penetrating crevices. However, steam by itself can only be used as a decontaminant if the temperature of the surface can be raised to a sufficiently high temperature and held there long enough to inactivate the disease agent. Because of uncertainties about temperatures and times of contact, steam is recommended in this manual as an adjunct to chemical decontamination, for example through aiding the penetration of some disinfectants.

Flame guns may be useful supplements for drying decontaminated surfaces, but they are dangerous, and the risk of fire and injury must always be considered. Flame guns are not recommended as a primary means of decontamination.

3.7 Safety precautions

Chemicals usually kill microorganisms by toxic reactions, and effective disinfectants are often also toxic to animal (including human) tissues. Virtually all disinfectants have to be used with care to avoid occupational injuries or health problems. Table 3.2 provides some basic information about precautions and contraindications when using the recommended disinfectants.

If using steam or flame for decontamination purposes, safety precautions must be adhered to in order to reduce the risk of burns.

3.7.1 General safety precautions

First aid boxes must be available on every IP or dangerous contact premises (DCP) or where hazardous chemicals are being used. Such boxes must contain a supply of antidotes and treatments for the chemicals to be used. It is essential to brief workers and the property owner on safety aspects before commencing operations, including the potentially harmful effects of chemicals on animals, humans and the environment.

The use of any chemical or equipment should conform to the manufacturer's instructions and safety standards. All officers and workers must carry out their duties in accordance with current health and safety legislation. All accidents, however small, that require medical attention must be logged and their details reported back to the local disease control centre (LDCC).

When diluting concentrated chemicals, the concentrate should *always* be added to water, *never* water to concentrate. Contact with concentrates on exposed skin will cause severe burning. All workers engaged in mixing or applying disinfectants must wear boots, overalls, goggles and head covering for protection. A full face guard should be used when applying the diluted chemical. The danger of inhalation can be avoided by *not* applying a mist spray.

If skin contact occurs:

- wash with copious amounts of water immediately;
- apply vinegar to caustic alkali burns *or* apply bicarbonate of soda to acid burns; and
- refer for hospital treatment if necessary.

If eye contact occurs, the eyes should be irrigated copiously with eyewash solution and the person referred to a hospital.

Concentrate containers should be stored in one place on the property away from the main area of work in order to remove the danger of containers being ruptured inadvertently. The containers should be checked each day for spillage of concentrate.

Many jurisdictions require that material safety data sheets (MSDSs) be held where chemicals are stored or used. MSDSs are supplied by the manufacturer and contain information on the identity, physical characteristics, health hazards and precautions to be taken for safe storage, use and disposal of the chemical. These are a prime source of safety information and should be consulted before personnel use cleaning materials and disinfectants. This may involve the use of PPE, because many of these substances (or vapours from them) are irritant or harmful to people. MSDSs should always be available to laboratory staff.[7]

[7] Information on MSDSs may be found at http://www.apvma.gov.au/links/chemmsds.shtml

3.7.2 Acids and alkalis

Acid and alkali disinfectants must not be mixed. Apart from the resulting chemical reaction, the effectiveness of both chemicals would be nullified.

3.7.3 Aldehydes — formalin, glutaraldehyde and formaldehyde gas

Aldehyde disinfectants should be used *only* when no alternatives exist, and then only by experienced personnel with appropriate safety equipment. Gaseous formaldehyde is applicable to:

- enclosed spaces that can be made airtight (for example, grain bins, electrical fuse boxes covered in plastic);
- such spaces, containing electronic or electrical machinery;
- delicate equipment that can be enclosed in a plastic 'tent' and fumigated;
- some heavy vehicle cabins; and
- poultry incubator rooms and egg rooms.

The safety of the operator is of greatest importance, and the method of use of formaldehyde is based on the safety aspects (see Section 4). These substances can kill operators, and even small amounts can have a detrimental effect on living tissue. If the chemical enters the eye, a wound or an abrasion, it is extremely painful. The fumes damage all mucous membranes. A protective face guard must be worn when mixing.

This method should only be used when it is impossible to use other products/procedures. Warning notices should be fixed to the entrance of the area being fumigated. There should be two people involved in the operation — both equipped with *full face respirators* effective against formaldehyde gas.

Table 3.2 Considerations when using some disinfectants

Disinfectant	Health aspects	Environmental problems and contraindications
Hypochlorites	Toxic for eyes and skin	Strong bleach. Inhibited by high concentrations of organic matter. Corrosive for many metals.
Virkon	Reasonable care necessary	Mildly corrosive for many metals.
Sodium hydroxide	Caustic for eyes and skin	Avoid contact with strong acids. Cannot be used on aluminium or like alloys.
Sodium carbonate	Mildly caustic for eyes and skin	Avoid use with aluminium and like alloys.
Hydrochloric acid	Toxic for eyes, skin and respiratory passages	Corrosive for many metals and concrete. Avoid contact with strong alkalis.
Glutaraldehyde	Avoid eye and skin contact	
Formalin solution	Releases toxic gas; irritating for mucous membranes	
Formaldehyde gas	Very toxic for mucous membranes in concentrations down to 2 ppm	Cannot be used in presence of water, hypochlorites or chlorides. Cannot be released to atmosphere without neutralisation. Corrosive for some metals.

ppm = parts per million

3.7.4 Hand and skin care

Hands and skin can be washed safely in a wide variety of commercially available disinfectants that have been approved by the Therapeutic Goods Administration, but relatively few products with antiviral activity have been approved. Virkon is reported to have low toxicity and to be effective against members of all families of animal viruses, but it has not been approved for use on skin. Antiviral conditions may be achieved by altering the pH as appropriate for the agent by adding citric acid or sodium carbonate to washing water. Foot-and-mouth disease virus is typically inactivated by such pH adjustments.

Some people have demonstrated sensitivity to skin contact with disinfectants. Reactions tend to occur with repeated exposure or where skin has been affected by pH modifiers such as citric acid.

3.8 Environmental considerations

Although selection of the disinfection method will be undertaken primarily on the basis of effectiveness against the target EAD agent, disinfectants used in disease control programs are potentially noxious substances and may have adverse impacts on the environment. The planning process needs to consider in advance the potential environmental impact from decontamination procedures and assess whether methods for containment or neutralisation are viable and acceptable.

It is a common requirement in all states and territories that activities should not have significant detrimental impact on the natural environment. As such, the

discharge of chemicals, silt, organic matter or carcases into natural waterways or other environments may be deemed an offence. It is essential that authorities are consulted when the decontamination process is being designed and that appropriate disposal of waste materials is undertaken.

The volumes of water requiring disposal will need to be considered during planning. In some cases, it may be possible to release water into waterways following treatment to neutralise chemical disinfectants (for example, treatment of oxidising disinfectants with thiosulphate) or following a prescribed period of time that allows chemicals to dissipate to acceptable levels (for example, hypochlorite and chlorine dioxide). Other options could include discharge onto approved wasteland sites.

Thorough cleaning before disinfection, use of protective clothing and equipment, use of temporary drains to trap and divert waste, and use of lined ponds or tanks for temporary storage are all options to reduce the adverse effects of decontamination activities on the environment.

4 Decontamination procedures

4.1 Decontamination plan

In decontamination operations, the most important initial information is the (presumptive) identification of the emergency animal disease (EAD) involved. Once the disease agent's identity is established, its basic properties must be considered. What are the epidemiological characteristics of its spread? Has transmission occurred by aerosol spread, ingestion, close contact or insect vectors? Information about these issues is included in the relevant **Disease Strategy** or the **Response Policy Briefs**.

From the information gathered, a plan can be devised to establish priorities for decontamination (Prince et al 1991). Decontamination plans usually include decontamination of people and their clothing; buildings with wooden, metallic or masonry structures; equipment for use with animals; vehicles and machinery of mostly metallic components; pipework of various types; water tanks; animal food storage areas; and sewage waste. Depending on the disease agent involved, different decontamination procedures and disinfectants are likely to be used for different sites on the infected premises (IP) (Kostenbauder 1991). Section 4.3.1 details planning procedures for IP site supervisors.

Most EADs are viral diseases. Bacterial diseases can usually be approached in the same way as viral diseases, but diseases caused by insects, parasites or prions require different strategies.

4.1.1 Viral agents

Because the most appropriate disinfectant is determined by the nature of the virus particles, knowledge of the properties of the virus, as described in Section 2, is crucial in planning a decontamination strategy. The category of the virus is most important; that is:

- *Category A* lipid-containing viruses; intermediate to large size
- *Category B* no lipid in virus; small size
- *Category C* no lipid in virus; intermediate size.

Table 1.1 (Section 1) shows the EAD Response Agreement disease agents and indicates their category, from which their susceptibilities to common disinfectants can be deduced.

In some cases in which the disease agent does not spread directly from animal to animal (eg bluetongue), comprehensive decontamination of a premises is not warranted. In contrast, some viruses (such as those causing swine vesicular disease and foot-and-mouth disease) are relatively stable on inanimate objects and can be spread to remote animals on contaminated people, clothes, equipment etc. Viruses that can be spread by such contact will require the most comprehensive decontamination programs.

4.1.2 Bacterial and other nonviral disease agents

Commonly used general disinfectants, such as phenolics and quaternary ammonium compounds, are very effective antibacterials but have limited effectiveness against Category B and C viruses. Chlorhexidine is a good all-purpose antibacterial disinfectant, with activity against Category A viruses as well. Antibacterial disinfectants are also effective against mycoplasmas and rickettsias.

Prions are resistant to most disinfectants except strong alkalis. Special consideration will be necessary if a disease emergency of this type occurs.

Parasitic diseases require a different approach, and breaking the parasite's life cycle is often an effective method. Formalin solution (10%) is a recommended decontaminant.

Insecticides are used for control of insect vectors that carry or cause EADs.

For more information on parasitic and prionic disease control and decontamination, and on vector control, see the relevant **Disease Strategy**.

4.2 Personal decontamination

The aim of personal decontamination is to safely remove any contamination from the body or clothing. The process minimises the risk of cross-contamination, so that people can confidently move out of the contaminated environment with no or minimal risk of dissemination of the disease agent. Personal decontamination procedures *must* be rigorously applied. Having a personal kit, as listed in Appendix 1, in the vehicle at all times will enable correct disinfection.

Heavy personal contamination may occur while personnel are working on IPs or dangerous contact premises (DCPs) and when active disease is found by diagnostic and surveillance teams.

The heaviest contamination will occur:

- when living infected animals are physically inspected;
- when slaughtered animals are physically inspected and diagnostic samples taken;
- at the slaughter site on an IP or DCP;
- at the site of carcase disposal; and
- when removing manure, bedding and detritus from buildings that housed infected stock.

4.2.1 Personal decontamination site

A personal decontamination site (PDS) will be arranged near the exit point from the IP or DCP. The site may be moved further into the IP as necessary during decontamination. The site supervisor will be responsible for selecting the area.

Critical inspection and questioning of the owner/manager of the property will determine the extent of property contamination through animal and effluent contact. The PDS will be placed on the limit of this contamination or in an area that

can be easily and safely disinfected. The PDS may be in use over a considerable period, and the site should allow for future expansion. Once determined, the site area should be sprayed with a disinfectant applicable to the disease.

It must be possible to leave the IP directly from the PDS without becoming recontaminated. Ideally, the facility should be on an impervious surface and include a building with water supply and drainage. The building should not have been previously used by animals or have been grossly contaminated. If there is no hard standing available, an alternative method that provides an equivalent level of biosecurity should be used. Privacy for changing needs to be provided, for example through hessian sacking and star pickets around the area, tents or caravans. Each person should have a clean change of clothes kept in plastic bags or in a caravan at the outermost point of the area, with a store of clean overalls in case of mishaps.

Other, more effective tools for personal decontamination are state/territory emergency services shower vans and, in cold climates, two-room vinyl marquees that can be used for shelter, washing and privacy. Wash, shower and change room amenities blocks can also be sourced from rental companies.

The slope of the ground must be taken into consideration. Run-off water from the contaminated area *must not* flow to the clean area. If no adequate drainage is available, a pit must be dug as soon as heavy machinery arrives, to ensure that no effluent escapes from the PDS.

4.2.2 Personal decontamination procedures

The following procedures will apply to *all* personnel before they leave an IP or DCP or any quarantined area that is grossly contaminated with the disease agent.

On the arrival of personnel at the PDS, a disinfectant solution safe for skin contact should be ready in buckets that are used throughout the operation.

Antiviral disinfectants effective against all virus families and *approved for use on human skin* are not available. Therefore, warm soapy water is recommended for washing the face, hair and skin. Hair should be washed or sponged down with a shampoo. Hands must be scrubbed thoroughly.

Alternatively, the pH of the disinfectant solution can be raised (by adding sodium carbonate) or lowered (by adding citric acid) to enhance antiviral action. The latter course is recommended for the decontamination of foot–and-mouth disease virus (Table 5.3).

Approved bacteriocidal soaps, scrubs, hand cleansers etc should be used when a bacterial disease or Category A virus is involved. Note that many brand products containing quaternary ammonium compounds or phenolics are *not* active against Category B viruses.

Local disease control centre (LDCC) resource personnel are required to provide an adequate daily supply of clean overalls and other protective gear to the work site. The disposal and cleaning of these items are described below.

Heavy-gauge plastic garbage bags are used to hold disposable items that can be buried or burned on the site, or removed from the site for further disinfection and cleaning.

On returning to home or lodgings, a person who has visited an IP or DCP should have a long, hot bath or shower. People leaving an IP or DCP must not have contact with susceptible stock for a period as directed by the LDCC.

Industrial hard hats must be scrubbed and set aside. If a neck cloth or hat is worn, it must be removed and soaked in disinfectant (eg 1% Virkon for 10 minutes), wrung out and placed in a plastic bag. For this reason, fabric 'bucket hats' work well. Re-usable respirators must be decontaminated with appropriate disinfectants before drying and storage. Reusable gloves must be decontaminated before reuse.

Plastic overalls

Plastic overalls should be washed from top to toe, using a sponge or low-pressure pump, to remove gross material; particular attention should be paid to the back, under the collar, zip and fastenings, the insides of pockets, the crutch, and the inside of the bottom of the trouser legs. The overalls should then be removed and placed in disinfectant. Wellington boots should be scrubbed down, with particular attention to the soles. All matter must be removed from cleats and the tread of the boot.

If the person is returning to the site the next day, boots, hat, gloves and plastic overalls can remain on site. They should be removed from the disinfectant, placed in a clean area and allowed to dry. If the person is not returning, the items should be placed in plastic bags for removal. The outside of the bags should be disinfected.

The person should then walk across the area, change into street shoes and leave. If underclothing has been soiled, especially above boot level, it must be removed and placed in a plastic bag, the skin washed and a clean pair of overalls used for leaving the site.

Cotton overalls

Workers using cotton overalls should wear minimal underclothing and always carry clean spares. If it is cold, they should wear two sets of overalls. If possible, they should use thigh-length angler's waders, plastic trousers or a plastic apron to prevent gross contamination of the overalls.

At the PDS, the waders or boots should be cleaned, paying special attention to the soles, and then removed. Overalls and underclothes should be removed, soaked in disinfectant, squeezed out and placed in a plastic bag for removal.

The person should then wash their body, walk across the area, wash their feet in a footbath, change into clean overalls and street shoes, and leave directly without re-exposure to contaminated areas.

Disposable overalls

Disposable high-density polyethylene overalls are an excellent alternative to plastic or cotton overalls. Staff can use them when contamination is light; they are also suitable for visitors to the IP or DCP. They can be used in combination with plastic aprons in areas of high contamination.

Cleaning

The plastic bags containing used overalls and other articles should be sealed, given a second wash-down in disinfectant, and then placed at the outer limit of the area for collection by courier for cleaning. The garments should be autoclaved or treated as contaminated clothing in a hospital laundry.

4.2.3 Personal decontamination in difficult circumstances

Some situations pose particular difficulties for personal decontamination.

Visitors on premises where disease is suspected

If visitors or private veterinarians are present on a premises when a disease is suspected, every argument must be used to ensure that they remain on site until a departmental officer arrives.

Visitors who have to leave a suspect premises

There is no legal requirement forcing a person to remain on a suspect premises, but an inspector of stock can direct them to undergo disinfection if they wish to leave. If the person refuses, they could face prosecution.

If a person has to leave a suspect premises before a departmental officer can reach the scene, or has to leave to report a suspected EAD, common household chemicals can be used to reduce the likelihood of disease transmission. These circumstances are more likely to arise on extensive properties where communications are difficult.

The following information and advice can be obtained or given by phone:

- Obtain name, address and occupation of the person concerned.
- Assess the degree of contact between the person and the suspected disease agent.
- Advise a change of clothing and the use of borrowed clean clothes if possible.
- Advise that the contaminated clothes must be placed in a plastic bag for appropriate decontamination.

Where no other approved disinfectant is available, the use of the following substances as personal disinfectants can be recommended:

- domestic washing soda (10 parts in 100 parts hot water);
- soap (or household detergent) and hot (60°C) water for scrubbing; or
- household concentrated *chlorine* bleach (1 part in 3 parts water to give 2–3% available chlorine). *This is not to be used on hands, face or skin.*

Parts of a vehicle contaminated with animal matter should be washed down using one of the above solutions. Contaminated parts of the human body should be washed down with either of the first two, but not the third.

The person must be questioned in detail about their movements since the time of contact with the suspected disease agent. They must not have contact with any animal and must not visit properties with livestock until the situation has been

resolved. If the presence of an EAD on the suspect premises is confirmed, they will be directed to present their vehicle for appropriate decontamination.

The person should be asked to dryclean or wash their clothes on arriving home and to have a hot bath or shower.

Accident cases from IPs or DCPs

If a person is injured on an IP or DCP, decontamination before evacuation will depend on the extent of their injuries. Obviously, human life must not be risked, and every care must be taken to minimise discomfort or pain.

If a risk of contamination is deemed to exist because personal or vehicle decontamination in an emergency was incomplete, the LDCC must be informed and an officer dispatched to the ambulance's destination. Hospital authorities must be informed of the risk, and appropriate personal decontamination of the patient carried out as circumstances permit. Personal protective clothing worn by the casualty must be secured in plastic bags, and any area thought to be contaminated must be washed with approved disinfectant.

The ambulance wheels, underside and interior should be washed with approved disinfectant. If the ambulance staff entered the IP or DCP, their personal clothing and boots should be removed for drycleaning and disinfection. They may be requested to have no contact with susceptible animals for a period appropriate to the disease in question.

4.3 Decontamination of premises

The IP site supervisor must ensure effective property decontamination, including decontamination of people, equipment and vehicles.

4.3.1 Planning

Efficient and effective premises decontamination will only result from:

- a presumptive identification of the suspected EAD agent;
- assessment and recording of contaminated areas, animals and articles;
- the selection of the most suitable decontamination techniques for each item and area, while complying with legislative requirements;
- the acquisition of necessary equipment and materials and recruitment of personnel to undertake the tasks; and
- the adoption of an appropriate strategy.

Every consideration should be given to utilising farm owners and staff on IPs and DCPs. Their knowledge of operations on the premises is crucial, especially on intensive industry premises.

In carrying out premises decontamination, realistic goals should be set. It is not possible to achieve 100% decontamination over the entire premises, including equipment and vehicles. The type, quantity and susceptibility of the EAD agent involved should be considered. Ambient temperature, UV radiation and time are excellent tools to use if organic material has been removed from heavily contaminated areas.

The following regime is recommended.

1) Inspect the IP or DCP and prepare a map of the premises.
2) Start a logbook to record all events and recordings.
3) Indicate areas *not* requiring decontamination action.
4) Indicate areas or sites requiring specific decontamination action (consult the officers in charge of slaughter, disposal and epidemiology).
5) List the actions needed in each area, in chronological order.
6) Estimate a timeframe for the decontamination program.
7) Seek approval from the LDCC IP operations manager for the proposed program.
8) Implement the agreed decontamination plan, maintaining liaison with the IP operations manager at the LDCC and submitting a daily progress report.

A typical premises decontamination program comprises:

- presumptive identification of the EAD agent
- premises assessment
- preliminary disinfection
- cleanup
- first disinfection
- first inspection
- second disinfection
- final inspection
- a proposed timeline.

Continuous close liaison with the owner/manager is essential to achieve an effective program.

4.3.2 Premises assessment

The initial premises assessment must be detailed thoroughly, as it will be used throughout the decontamination process. Relevant details should be marked on the premises map.

Overhead high-tension electricity power poles and lines, underground cables, telephone lines, electricity fuse boxes, power points and meters should be identified. Where applicable, the appropriate authority should take meter readings of power, gas and water for compensation at a later date. Where necessary, underground water pipes should be identified.

All drains and their run-off should be located and marked. Any drains that run free must be blocked with hessian or plastic bags and only allowed to run when the effluent has been thoroughly mixed with disinfectant. If effluent is running freely into creeks or other watercourses, a pit or dam should be dug across the drainage line. *Where possible, water authority drainage maps should be checked to determine the subsequent flow of effluent*. If drainage is to a septic tank, the tank should be examined, and its spare capacity estimated and noted down. If the tank is full, the drains should be blocked.

The decontamination site should be examined. If a temporary one has been set up, it may need to be moved because of the potential increase in traffic or effluent overflow. The site must be delineated and disinfected.

An unloading area should be detailed outside the decontamination area, where materials and equipment can be unloaded without having to decontaminate vehicles.

An area where the workforce will eat or have tea breaks should also be detailed. This area should have provision for heating water and preferably cover or shade.

If there is a residence on the premises, the degree of contamination in the residence and its immediate surrounds should be estimated. Disposal operations, cleaning or both to be done in the house to remove all sources of contamination should be detailed, with special attention to verandas and the office. If it is possible, and without compromising disease control, a decontamination procedure to allow household members to safely move off and onto the premises should be arranged. This will depend on the siting of the house and the possibility of disinfecting to a point outside the designated contaminated area.

'INFECTED PREMISES' notices are to be posted at the entrance to the premises.

On intensive piggeries and poultry farms, all extractor fans should be turned off. This is particularly important for disease agents that are easily dispersed as aerosols, such as foot-and-mouth disease virus and Newcastle disease virus.

The amount of animal effluent to be removed for disposal is to be assessed, as is the amount of food that will be needed for the animals. To ensure the animals' welfare, it may be necessary to arrange delivery of more food before disposal of the stock is completed. Decontamination tasks can be minimised by restricting access of personnel and vehicles to the premises, for example by only using vehicles already present on the property and by transferring materials at the entrance of the property only.

The premises assessment should detail structures and articles that cannot be decontaminated effectively, such as wooden buildings, floors, doors and linings, roof insulation and timber cattle yards. The degree of contamination of non-animal areas — machinery sheds, workshops, grain and food stores — should be assessed. Assessments should be made of the likely contamination of animal feed, open sacks of food, loose grain stores, hay and straw stacks, especially if they are underrun by animal effluent.

The assessment should note specialist electrical and electronic equipment requiring decontamination with advice from electrical contractors.

On extensive properties, an area at the airstrip should be designated as a small decontamination site for pilots and essential visitors. This can be a scaled-down version of the PDS on the IP or DCP.

The assessment must include consideration of the impact of the decontamination process on any identified environmentally sensitive areas on, or contiguous to, the premises, such as conservation areas.

4.3.3 Preliminary disinfection

The aim of preliminary disinfection is to rapidly reduce the amount and distribution of the EAD agent on the IP or DCP, pending thorough disinfection after slaughter and disposal are completed.

Preliminary disinfection begins as soon as possible after the presence of an EAD on the premises is confirmed. Any area known to be contaminated should be sprayed with disinfectant solution to reduce the chance of inadvertent spread of the infective agent. If the disease agent is capable of airborne spread, the importance of pre-slaughter spraying cannot be overemphasised. Decontamination is continued area by area until the first cleanup operation starts. Particular attention should be paid to the roadway used for vehicle entrance and exit, overflows of animal effluent onto roadways or tracks, and the areas around dwellings.

Killing site

The killing site should be disinfected at every long break — probably five times a day. This should include buildings and pens housing animals and, as the animals are removed for killing, the area they occupied.

Disposal site

The disposal site must be decontaminated thoroughly, but only when disposal has been completed, as wetting some soils makes traction difficult.

All heavy machinery should be allowed to return to a central point on the IP. Heavy machinery not required on the premises after carcase disposal must be carefully disinfected. Personnel should spray along the track to the disposal site and follow with a heavy spray where carcases have been slashed open. Where carcases are burned, the spraying will have to wait until the fire has died down.

When all the animals have been destroyed, wood used for temporary slaughter pens must be buried or burned. All metal gates and panels at the slaughter site are to be scrubbed down with disinfectant and stacked for complete disinfection. The slaughter site can then be thoroughly decontaminated.

Rodent control

While the preliminary disinfection is being carried out, the IP site supervisor will arrange with the LDCC for the laying of baits for rodent control, if this is thought necessary to limit the spread of disease. This must be done before food stores are moved or disinfected.

4.3.4 Cleanup

The aim of the cleanup process is to remove all manure, dirt and debris and contaminated articles that cannot be disinfected. The surfaces of all buildings, pens, fittings and equipment must be exposed, ready for the first disinfection. This is the most important phase in the decontamination procedure, because the presence of organic material reduces the effectiveness of disinfectant. Encrusted dung, dirt and grease shield the underlying permanent surfaces from the disinfectant.

Large accumulations of faeces, litter and bedding should be removed. The use of water or disinfectants should be avoided at this stage to minimise the volume and weight of material to be handled. This material will have been lightly disinfected at the preliminary disinfection. The easiest method of disposal of solid and semi-solid faecal material is burial or composting. When animal houses have been cleared of dung, cleaning each building starts from the roof, working downwards.

Personnel should remove all old insulation materials (polystyrene, fibreglass and press boards) for burial or burning, unless the materials have sound, impervious surfaces that can be decontaminated effectively. All unsound, rotten or underrun wooden fittings and flooring and other structures that cannot be disinfected effectively should be removed for burning or burial. All material destroyed must first be valued.

All fixtures and fittings should be dismantled and stacked for cleaning and disinfection. All delicate electronic equipment must be protected for later specialist treatment.

Earthen floors in buildings may need to be broken up and soaked in disinfectant.

Concretions and encrustations of material on permanent surfaces are to be removed. This is most easily achieved by low-pressure spraying with water or water and detergent, using steam cleaners, or scraping with hand tools, and with particular attention to corners and wall–floor junctions. The surfaces are then washed down using a high-pressure system and plain water. All permanent surfaces must be free of visible contamination.

All feedstuff considered contaminated must be removed and buried after valuation. Feeding and water troughs are to be emptied and cleaned out.

Any effluent arising from the cleaning process needs to be contained and treated.

4.3.5 First full disinfection

The aim of the first full disinfection is to inactivate the disease agent using physical and chemical agents. *The necessity for any disinfection depends on the disease agent involved and the passage of time may be sufficient to inactivate some disease agents*. This process must be carried out systematically to ensure that areas that have been disinfected are not recontaminated by people or machinery. *A recommended order of cleaning is: roof – wall – floor, and this should be adopted in each building*. Each building or area should be cordoned off with marking tape when its disinfection is completed. Once an area is dry, it will not be obvious where the disinfected area starts and finishes.

The disposal site should be inspected periodically. Burial pits will emit large quantities of noxious gas and fluid. Once emissions have stopped, the ground around the site should be broken up and liberally soaked with disinfectant. Cremation sites are to be treated the same way. Care must be taken to disinfect personnel, machinery and vehicles close to the site and not allow recontamination of previously disinfected areas near buildings.

Excessive application of chemicals may harm the environment and may be unwarranted, given the disease agent involved, ambient temperatures, UV radiation, and the time that will elapse before the premises is restocked.

4.3.6 First inspection

The aim of the first inspection is to ensure that all tasks detailed on the premises assessment have been performed. The premises is to be inspected by the IP site supervisor or delegate from the LDCC. *Depending on the disease agent involved, the first inspection may be the only inspection.*

The inspection should determine whether:

- all contaminated woodwork not able to be cleaned and disinfected has been completely disposed of;
- all fixtures and fittings have been dismantled, where appropriate, so that no organic material is left behind them;
- there are no observable encrustations on any exposed surface;
- all contaminated feedstuff has been destroyed, and remaining material made safe;
- all grossly contaminated sites (slaughter and disposal) have been properly sealed and effectively cleaned and disinfected;
- all fluid that has been disinfected has been released into drains or a septic tank; and
- the conditions of quarantine, especially at exit/entry points, and warning notices are being maintained.

4.3.7 Preparation for second disinfection

There can be a potential residue of contamination, particularly under old, cracked concrete and under rundown buildings. An assessment of the need for a second disinfection should take into account the disease agent involved, the likelihood of its survival after the first disinfection, and the time factor.

Areas of underrun or loose concrete should be examined carefully, and a cost assessment should be made to determine whether they are to be re-rendered, repaired or destroyed. Earthen pathways and walls of animal houses that are constructed of porous brickwork or 'breeze block' should be similarly inspected and assessed.

If repair or re-rendering work is to be done, a written agreement with the owner on the work must be obtained before the work begins. The work must be finished or so nearly finished that it does not hinder the second disinfection.

4.3.8 Second full disinfection

The second disinfection is a repeat of the first. It can be started approximately 14 days after the first disinfection, depending on the disease agent involved and provided no rendering work remains to be done.

4.3.9 Final inspection

The final inspection is carried out in the same way as the first inspection. The premises must be meticulously inspected, *preferably by an experienced officer not involved in an earlier inspection*. If there are any doubts, disinfection work must be repeated.

If the final inspection is satisfactory, all equipment and personnel are disinfected at the decontamination site before leaving the premises. Reconstruction work can be carried out and the premises made re-habitable for stock.

4.4 Decontamination of vehicles and machinery

Contaminated cars, vehicles used to haul livestock, animal feed or products, and their drivers pose a disease dissemination risk. In an EAD incident, the first priority is to ensure that no vehicle leaves an IP or DCP without thorough decontamination. The second priority is to urgently trace vehicles that have been in contact with the disease agent, to take them off the road and decontaminate them thoroughly. The LDCC should make inquiries about the origin and occupation of the cars' occupants and any contact they may have had with livestock.

Most vehicles should remain off IPs or DCPs. If the number of vehicles warrants it, a local area with a hard standing, drainage and a good water supply should be designated as a local vehicle disinfection station. A carwash is ideal for decontamination of surveillance vehicles if one is conveniently located. A carwash can do the job quickly and more effectively than a team of people, and can wash under vehicles more easily. Although this cleaning may be unnecessary from an epidemiological point of view, it is very effective public relations to have clean vehicles visiting suspect private premises.

Vehicles can be divided into four broad categories:

- those that do not need cleaning and disinfection;
- those that need only the wheels cleaned;
- those that need only the outside cleaned; and
- those that need both outside and inside cleaned.

4.4.1 Cars

Where cars are to be decontaminated, rubber floor mats should be removed for scrubbing with appropriate disinfectant. The dashboard, steering wheel, handbrake, gearstick and driver's seat should be wiped liberally with disinfectant. If the boot is considered contaminated, the contents must be removed and the interior wiped with disinfectant. The contents of the boot must be treated similarly before being replaced. The wheels, wheel arches, undercarriage and bodywork of the car should be sprayed with noncorrosive disinfectant, *not* plain water. Caustic soda should not be used on paintwork.

Plain water is not to be used with power hoses, because the process will release contaminated aerosols of the pathogen. A mixture of disinfectant and water should always be used with power hoses. However, using disinfectant or soap and water with brushing to dislodge encrusted dirt and organic matter is preferable to washing with strong water streams.

Heavily contaminated vehicles should only be cleaned on the IP or DCP, because most cleaning processes, including power hoses, spread the infectious agent.

4.4.2 Livestock vehicles

In addition to trucks and semitrailers used to haul production stock, livestock vehicles include horse boxes, vehicles used to carry stud and show stock, and racing pigeon carriers. For any vehicle known to have carried stock susceptible to the EAD agent, the principles of vehicle and trailer decontamination are the same.

All solid debris, faecal matter and bedding must be removed. All water, feedstuff and litter carried in the vehicle must be disinfected and burned or buried. The vehicle should then be soaked in disinfectant using a detergent, and scrubbed down to bare metal or wood.

All fixtures and fittings must be dismantled to ensure that infected material has been removed. All surfaces must be cleaned down to metal and then disinfected. Wooden surfaces must be cleaned and disinfected, where appropriate, or valued before removal and destruction. The wheels, wheel arches, bodywork and undercarriage must be cleaned of detritus and disinfected. The driver's cabin and sleeping compartment, if fitted, also need to be cleaned and disinfected.

When the crate structure of a trailer has been decontaminated, the stock crate should be lifted free from the body. The underside of the stock crate and the parts of the trailer on which it rests should be decontaminated. The vehicle must be closely inspected to determine if there is a double layer. If this is so, the top layer of metal tread plate or wood must be removed to reach areas where contaminated material could be trapped. Any metal flooring that appears solid must be weight tested to ensure that welds are not cracked and that there is no rubbish under the flooring. Some trailers may carry extra equipment under the body; if so, this must be treated.

The outside dual wheels and spare wheels must be removed to ensure adequate decontamination of the wheel hubs and to allow inspection of the spare wheel hangers, which can be hollow and therefore could hold contaminated material.

The driver should be asked to identify the clothing and boots they were wearing when in contact with suspect stock. Those articles must be decontaminated and arrangements made for drycleaning, where applicable (see Section 4.2.2).

It is common practice for specialised vehicles to be self-contained with water, food and litter supplies for the animals. If the vehicle is known to have carried diseased or suspect stock, and such materials were removed before departmental officers identified the vehicle as being contaminated, every effort should be made to locate the discarded material. Once identified, the material must be disinfected and disposed of by burial or burning.

4.4.3 Milk tankers [TO BE UPDATED]

Milk tankers can become contaminated and disseminate disease organisms through:

- picking up infected milk from a dairy farm during the disease incubation period;
- contaminated aerosols released from the milk store; and
- mechanical means (by vehicle and driver).

Disinfectants used in milk tanks must not leave a 'taint'. Every dairy factory has a disinfection point for tankers and drivers and an approved disinfectant. The vehicles must be cleaned and disinfected at the end of each day.

When picking up milk in a control area, tankers must be disinfected off any potentially contaminated premises, with particular attention to wheels and hose inlets. An officer from the LDCC should visit all dairy factories in the control area and advise management and tanker drivers on the correct way to disinfect drivers and tankers leaving a premises.

Tanker exhaust vents must be fitted with hydrophobic membrane-type filter elements rated at 0.2 μm. The filter elements should be selected to permit adequate air displacement flow rates during tanker emptying and filling without exceeding tanker vessel design pressures. Filter housings should be selected to permit cleaning and decontamination in place. Filter housing outlets should be protected against the entry of rain, hose-down water and insects.

If the disease does not affect cattle, the decision to allow a milk tanker into a mixed animal enterprise will depend on:

- the amount of spare capacity in the bulk tank;
- the level of decontamination achieved on the premises; and
- the opinion of the IP site supervisor.

Any spillage of milk must be disinfected. The vehicle and driver must be decontaminated before leaving.

If it is determined that a tanker is carrying infected milk, the volume of milk must be determined. The correct amount of disinfectant must be mixed with the milk using a disc plunger and the tanker left standing for one hour, after which the load is to be discharged to a drain or pit.

The interior of the tanker must be decontaminated, along with all hoses and fittings. The principles of vehicle decontamination discussed in Section 4.4.2 must be observed (see the **Dairy Industry Enterprise Manual** for further details).

4.4.4 Animal feed delivery vehicles

The visits of feed delivery vehicles to an IP or DCP will be identified from the epidemiology report. The path of the vehicle through the premises must be traced, and the degree of contamination of vehicle and driver ascertained. If the vehicle has visited another premises, the path of the vehicle and driver and the area of possible contamination and contact with susceptible animals must be traced.

When a suspect vehicle has been detained, it should be decontaminated in the same way as a livestock vehicle (see Section 4.4.2). If an epidemiology report identifies contaminated bulk or bagged food (eg meat and bonemeal) that has been carried by the vehicle, residual material in the vehicle must be sprayed with disinfectant and removed for disposal. The insides of bulk trailers must be decontaminated with approved disinfectant.

If it is necessary on animal welfare grounds or in a mixed animal enterprise to allow a feed vehicle onto an IP or DCP, the driver's route within the premises

should be specified to minimise contamination of the vehicle. The vehicle and driver must be thoroughly decontaminated before being allowed to move off.

Wherever practical, animal feed should be delivered to the outer boundary of the premises and then transferred to the animals without the vehicle or driver becoming contaminated.

4.4.5 Vehicles at alternative disposal sites

Under extraordinary circumstances, carcases, offal and other contaminated material may have to be moved off the IP or DCP for disposal elsewhere. For example, this may be necessary if space on the premises is limited, the topography is unsuitable, or environmental factors preclude the use of normal disposal methods. The alternative disposal site will be as close as possible to the IP or DCP, and the access route will be chosen to minimise danger to susceptible stock. The site will be designated as a quarantined area.

The transport vehicle's container will have to be leak-proof, and preferably have a rear opening, be capable of tipping, and be capable of being sealed at the top. If the vehicle cannot tip, there must be a crane at the disposal site for lifting carcases out.

The vehicle will be loaded using a suitable 'lift' crane/cargo net or front–end loader. Once the vehicle is loaded, the carcases or contaminated material will be sprayed with disinfectant. The driver and the vehicle's body, wheels and undercarriage must be decontaminated thoroughly before departure. The cover of the container must be strapped down tightly and decontaminated.

At the disposal site, there must be sufficient equipment, water supply, drainage and materials to decontaminate the expected number of vehicles. These facilities should be arranged at a specific decontamination site. Each driver and vehicle must be decontaminated before leaving the disposal site.

On completion of disposal:

- all vehicles and equipment will be decontaminated off the site;
- the area of disposal will be soaked in disinfectant;
- the area will be securely fenced;
- after 21 days, the burial site will be revisited and the mound and surrounds disinfected again under the supervision of a departmental officer; and
- quarantine will remain in force for a period to be determined by the LDCC controller.

4.4.6 Aircraft decontamination

Aircraft construction prohibits the use of a strong alkaline disinfectant, such as caustic soda, because of severe corrosion problems with metals such as aluminium. A mild alkaline disinfectant suitable for use on aircraft is 4% sodium carbonate with 0.1% sodium silicate. Care is required with specialised equipment within the aircraft.

Note: Helicopters should not be used near IPs or DCPs where aerosol disease spread is suspected (for example, with foot-and-mouth disease virus).

4.4.7 Other machinery and vehicles

Heavy machinery used on an IP or DCP will be grossly contaminated. This includes:

- mechanised diggers for burial pits;
- bulldozers for pushing carcases;
- front-end loaders, tractors and trailers for carrying carcases and faecal and other material;
- cranes for carcase lifting; and
- chains, hooks and cargo nets.

Such equipment must remain on the IP until needed elsewhere.

Once carcase disposal has been completed, drivers and machinery must be decontaminated. Vehicles should be moved to the decontamination site for thorough decontamination. When the vehicle is moved again, the cab must not be recontaminated by the driver. All ancillary equipment will be treated similarly.

Where low-loader vehicle transporters are required, they should *not* be allowed onto the IP. Vehicles leaving the IP should be loaded outside the IP boundary.

4.5 Issues needing special consideration

4.5.1 Animal effluent

The disposal of treated effluent should be undertaken in consultation with environmental protection agencies.

Slurry

Where animal effluent is collected in a slurry tank, the amount of spare space in the tank will govern the course of action. Areas where previous loads of slurry have been spread or disposed of, and the associated disease risk, should be identified. If the slurry tank is almost full, a pit into which slurry can be pumped for treatment can be dug (and lined with plastic sheeting if necessary).

Slurry pits may be underfloor tanks within buildings, or tanks in the farmyard. Any covers should be removed, the capacity of the tanks estimated, and chemicals used to modify the pH to <2 or >11 (pH should be tested using universal indicators). The slurry should be mixed using a slurry tanker pump or agitator and kept at the required pH for seven days, after which it should be spread on ungrazed agricultural land.

The disposal of effluent from enclosed tanks or pits can be dangerous, and it is recommended that private contractors carry out the disposal. Safety considerations include:

- Agitation of effluent slurry can release a mixture of carbon monoxide, carbon dioxide, hydrogen sulphide, ammonia and methane.
- Safety aspects should be explained to workers, and only as many workers as necessary used.
- *No-one* should ever work alone in a tank.
- If work is indoors, as much ventilation as possible should be provided.
- If necessary, respirators, safety harnesses and lifelines should be worn.
- Slurry level should never be less than 30 cm from the top of the tank.
- The 'crust' on top of a tank should never be trusted to take weight.

Often it is not feasible to liquefy semisolid material in slurry tanks, and most of this material will be noninfective. Caustic soda 2% should be added to the surface and the material allowed to stand. Further additions of material to the tank must be treated. The tank should be quarantined for up to 3 months, depending on the disease agent involved.

Manure

If the volume of manure is small, the manure should be sprayed with an acid disinfectant, because manure tends to acid pH and this can be enhanced by acid treatments. Note that hypochlorite has limited effectiveness in the presence of high organic loads.

Treated manure should be removed and buried in a pit.

4.5.2 Dairy equipment and milk storage tanks [TO BE UPDATED]

There may be milk in bulk tanks on the IP or DCP. How the milk is to be treated depends on the disease.

If the milk must be disposed of, it must be made safe with a disinfectant, which is added to the milk and agitated. The milk is then held for one hour and released into a pit — *not* into the slurry tank.

Milk from properties in a restricted or control area may be removed from the properties provided that drivers and vehicles are disinfected on leaving contaminated areas and the milk is subjected to appropriate treatment for the disease.

Milking machines need to be stripped to their components and then boiled or scrubbed with disinfectant. All instruments and gauges should be removed from the milk lines and disinfected. The apertures are 'stopped' and all lines filled with nontainting disinfectant, which is left in contact for one hour. The joints of the pipeline are then loosened to allow seepage, after which the lines are run through with plain water and then with chlorine dairy detergent. Special attention needs to be given to rubber parts, which should be disposed of if cracked or worn.

4.5.3 Animal feed

When an IP/DCP contains animal feed, some may be unaffected, some may be safely decontaminated, and some may have to be destroyed. The destruction of large quantities of feed is expensive, but the labour cost of treating the feed may outweigh the benefits of keeping it. Depending on the disease agent involved, keeping the feed or treating it may be judged too great a risk. However, most EAD viruses inactivate spontaneously with time and certain temperature and humidity conditions, so in some cases feed can be quarantined for a period determined by epidemiology, and then used again with confidence.

Hay and straw stacks

The length of time the disease has been present on the premises will be determined from the epidemiology report. If hay or straw is in a new stack, it may have been contaminated by the footwear of the workers who stacked it.

Given the amount of time and labour required to treat and restack hay or straw, it may be more economical to destroy the whole stack and compensate the owner. The contaminated bales can be used by the disposal team, if appropriate. If the disease affects only one species of animal in a mixed enterprise, the stack may be used for bedding or feed until the time of the second disinfection (see Section 4.3.8).

If the material is to be disinfected, a new stack area should be designated and disinfected, and the material disinfected as it is restacked. As the new stack is built, it should be sprayed with 2% caustic soda. The stack is then left for 30 days, restacked and retreated, and again left for 30 days. The material can then be spread on arable land. If possible, it should be buried (see the **Disposal Manual**).

Grain stores

There may be many tonnes of grain on a mixed farm enterprise. The owner/manager must be carefully questioned about the likely degree of contamination on the floor before the grain 'went down', and epidemiological advice should be sought about the length of time the disease agent has been present.

If no underlying contamination exists, approximately 7 cm of the top of the grain mass should be removed, and the new surface sprayed with disinfectant. The removed grain and scrapings should be buried or burned. Grain may sprout after this treatment or go mouldy, and this must be taken into account.

Where binned grain has been incorporated into home-mixed rations, the floor of the bin can easily be contaminated by farm workers auguring out the last grain before refilling the bin. If this is found to be the case, the grain should be removed and destroyed.

Silos

Silos can hold many tonnes of grain or prepared feed. If it can be determined that there has been no disease contamination, approximately 25 kg of the contents should be removed through the chute, and the inside and outside of the chute wiped with disinfectant. The chute mouth is then enclosed with a plastic bag and secured. When the first disinfection is complete (see Section 4.3.5), the outside of the silo is sprayed with disinfectant and two 25-kg sacks of a desiccating agent (calcium chloride, 'quicklime') are placed in the top of the silo to preserve the contents.

However, if epidemiological investigations suggest that a food supply is contaminated, the silo must be emptied completely, the contents buried, and the inside and outside of the silo disinfected.

A risk assessment should be carried out, considering the attributes of the disease agent, temperature, the dry environment of a silo, and the interval until the feed will be used. It may be feasible to use formaldehyde gas for disinfection, depending on the construction of the silo outlet and whether the silo can be sealed completely (see Section 3.5.5 and Appendix 3).

Advice may also be obtained from the grain storage industry to determine the best and most efficient method to disinfect large quantities of grain.

Feed in sacks

Depending on the nature of the disease agent, opened sacks of feed or feed in closed hessian sacks may be deemed contaminated and destroyed after valuation. Porous sacks of feed for susceptible animals should always be destroyed if the disease agent is easily transmissible or resistant. Unopened paper bags can be wiped with disinfectant and restacked in an area that has been disinfected.

Silage clamps

Well-made grass silage should reach a pH of 3–4 and thus deactivate most disease agents, but above-ground silage clamps are usually close to stock animals and are therefore likely to be contaminated.

Silage clamps should be left until the first disinfection. If the face and top are not covered with plastic sheeting, the top 30 cm should be removed and buried. The newly exposed surface should be sprayed with disinfectant, ensuring that cross-contamination by the workers doing the spraying does not occur. If the surface is covered with a sheet, possible contamination at the sheet's edges should be estimated. Where there are gaps, the exposed area should be scraped, the cover removed from the edges, and the area sprayed with disinfectant.

When feed is being dealt with, it should *not* be policy to destroy everything. Considerable quantities of feed can be safely decontaminated. Decisions about treatment or destruction must be taken in consultation with the LDCC (see the **Control Centres Management Manual**, Part 1).

4.5.4 Specialised equipment

Some properties contain equipment such as control panels, electronic gear, electric motors and computerised equipment that could be damaged by some of the direct methods of decontamination discussed in this manual. If there is doubt about the effect of procedures on specialised equipment, a qualified contractor (eg an electrical contractor) should be consulted.

Electric motors and switchboards

It is unlikely that covered electrical equipment will be heavily contaminated, so decontamination of such equipment is best considered at the end of the decontamination process when specialists can be more readily consulted.

The most practical method of decontamination is to make an airtight 'tent' of plastic sheeting around the equipment. Alternatively, if the equipment can be easily dismantled, the separate parts can be placed in a small enclosed space for fumigation. Airtight items can be safely decontaminated by wiping down with disinfectant.

The only other method is to use formaldehyde gas. However, serious consideration must be given to the practical and safety aspects of this procedure (see Section 3.5.5 and Appendix 3).

Because most EAD viruses will inactivate spontaneously with time, exposure to sunlight may be a good option for complex equipment.

Radios, tape recorders and cameras

Hand-held radios, tape recorders and cameras are useful in IP/DCP operations for communication and for recording epidemiology and valuation data. All can be used while secured inside plastic bags to avoid contamination. Inexpensive waterproof cameras can be used to record lesions and symptoms.

If such equipment is to be removed from the IP/DCP, the following procedure must be carried out at the decontamination site:

- Wipe over the plastic bag and then discard the bag.
- Wipe over the body of the instrument with disinfectant.
- Replace the instrument in a watertight plastic bag for removal after the bag has again been disinfected.

Because there is a small residual risk of contamination, during the EAD outbreak these items of equipment should only be used on specific IPs or DCPs.

Captive-bolt pistols and firearms

Weapons used to destroy stock will be grossly contaminated but their mechanisms prohibit the use of many disinfectants. After completion of slaughter, they should be cleaned with a non-corrosive disinfectant and thoroughly lubricated with liquid and aerosol lubricants, especially their internal mechanisms. The woodwork should not be immersed in disinfectant as this may lead to warping or splitting. If a weapon requires servicing, it should be taken to a gunsmith in a disinfected plastic bag. The gunsmith should be made aware that the mechanism needs disinfection. The weapon can be stripped down, the parts disinfected, and the weapon serviced and re-oiled.

If the EAD incident includes a number of premises, weapons can be enclosed in disinfected plastic bags after disinfection for delivery to the next IP or DCP.

4.5.5 Wool

There are three situations in which wool and wool bales may cause problems during an EAD outbreak:

- disease diagnosed at shearing;
- disease diagnosed after shearing; and
- disease diagnosed when wool bales have left the premises and are in store.

Disease diagnosed at shearing

If disease is diagnosed at shearing, the premises will be quarantined as an IP, and the procedures detailed in this manual to deal with an IP will apply. Special considerations will be the decontamination of the shearing team, their equipment, vehicles and dogs; the disinfection of the team off the premises and their future employment; and the disposal of wool.

Disease diagnosed after shearing

If disease is diagnosed after shearing, the epidemiology report will determine whether the disease was present at shearing. If wool bales are on the premises, and it can be determined from the epidemiology report that the wool within the bales is not contaminated, decontamination would require a surface spray of the bales during the *first* and *second* premises disinfections. When quarantine is lifted, the bales may be removed.

If wool bales are on the premises and it is determined that the disease existed at the time of shearing, the bales will be destroyed by burial; it is very difficult to burn wool or the carcases of unshorn sheep.

Wool bales in store

If wool bales have left a premises that is subsequently determined to be infected, the LDCC veterinary investigations section will determine appropriate actions. If the baled wool is deemed to be contaminated, the destination of the bales will be traced and they will be removed from store, valued and destroyed.

If only the exterior of the bales is deemed contaminated, the bales will be identified in the store and sprayed with disinfectant along with neighbouring bales. Because the risk associated with hemp and synthetic wool bales (even if perforated) is not as high as the risk from perforated sacks of grain that would be exposed directly to susceptible animals in the future, destruction of the bales might not be ordered.

4.5.6 Water tanks and dams

Depending on the disease agent, various decontamination procedures are available for water tanks. In some cases, a change in pH could be effective. Calcium hypochlorite could be added in a similar way as for swimming pools. However, chlorine-based disinfectants lose effectiveness quickly in the presence of organic material and so are not recommended for earth dams.

4.6 Proof of decontamination

This manual covers only decontamination in field situations, and includes no procedures for 'proof of decontamination'. The relevant **Disease Strategy** should be referred to for recovery procedures, including conditions for restocking or alternative farm uses. The disease strategy will also address procedures for regaining recognition of health status.

It is rare that 100% decontamination can be attained or proved in field situations, and infectivity testing for EAD agents must be done at the Australian Animal Health Laboratory. In many cases, gross contamination can be removed effectively, but the final phase will involve time and the natural elements of heat, dryness and solar radiation to achieve the desired goal.

The conservative decontamination procedures recommended here are likely to be matched by the conservative approach of relevant authorities when considering restocking.

5 Putting it all together: procedures and disinfectants for particular disease agents

5.1 Introduction

The preceding sections outlined the properties of the disease agents involved in emergency animal disease (EAD) incidents (Section 2), the disinfectants and other methods available to eliminate them (Section 3) and the decontamination procedures that need to form part of a decontamination plan (Section 4). This section brings all these items together to provide strategies for specific EAD agents or groups of agents.

5.2 Summary of procedures for decontamination of specific items

5.2.1 Live animals

Refer to Tables 5.3 and 5.4 for specific disease agents.

5.2.2 Carcases

Refer to Tables 5.3 and 5.4 for specific disease agents.

5.2.3 Animal housing, equipment and environs

Conduct premises assessment, preliminary disinfection, cleanup, first disinfection, first inspection, second disinfection and final inspection as described in Sections 4.3.2 to 4.3.9. Refer to Tables 5.3 and 5.4 for procedures and disinfectants appropriate for specific disease agents.

5.2.4 Humans

Establish a personal decontamination site (see Section 4.2.1) and follow the procedures described in Sections 4.2.2 and 4.2.3.

Ensure that each person has a clean change of clothes at the personal decontamination site (see Section 4.2.2).

5.2.5 Clothing

Treat clothing (including overalls, gloves, hard hats, footwear) as described in Section 4.2.2.

5.2.6 Electrical equipment

Treat electrical equipment (including electric motors, switchboards, radios, tape recorders, cameras) as described in Section 4.5.4.

5.2.7 Water (tanks, dams)

Treat water as described in Section 4.5.6.

5.2.8 Feed

Treat feed as described in Section 4.5.3.

5.2.9 Effluent, manure, milk

Treat animal effluent (slurry and manure) as described in Section 4.5.1.

Treat drains and free-flowing effluent as described in Section 4.3.2.

Decontaminate infected milk as described in Section 4.4.3. Any spillage of milk from milk tankers must also be disinfected.

5.2.10 Human housing

Section 4.3.2 describes general procedures for assessing and dealing with contamination of dwelling houses on IPs and DCPs.

5.2.11 Vehicles and machinery (including firearms)

Thoroughly decontaminate all vehicles and machinery leaving the IP or DCP, as described in Sections 4.4 and 4.5.

5.2.12 Aircraft

Treat aircraft leaving the IP or DCP as described in Section 4.4.6.

5.3 Decontamination strategies for specific EAD agents

Tables 5.1–5.4 show how to select a disinfectant or chemical to disinfect a range of commonly contaminated items for each disease or group of diseases. The list of disinfectant groups has been kept as short and as simple as possible. All disinfectants listed in these tables are available in Australia.

In selecting suitable disinfectants, the characteristics of the disinfectant and the resistance characteristics and means of transmission of the particular EAD agent are the first considerations:

- Thirty of the EAD Response Agreement diseases are caused by Category A viruses.
- Four are caused by Category B viruses.
- Four are caused by Category C viruses, three of which are vector transmitted.
- Eight are caused by bacteria.
- Two are caused by prions.
- Most disease agents are inactivated by readily available and routinely used disinfectants.
- Many diseases are vector transmitted, which minimises the risk from direct transmission and thus the need for stringent decontamination.

Therefore, only a small number of diseases requires specialised chemicals for decontamination.

Cleaning and disinfection is a labour-intensive and potentially dangerous activity, depending on the particular disinfectants being used. All disinfectants must be handled with care, particularly when concentrated. It is critical that all safety measures are adhered to, especially during dilution and mixing of the chemicals.

It is recommended that commercial cleaning contractors with appropriate expertise be used wherever possible. They have the required equipment, trained operators and appropriate operational and occupational health and safety procedures to perform the task quickly, efficiently and effectively. Use of contractors also releases possibly limited animal health staff for tasks more appropriate to their expertise.

Where a common decontamination/disinfection strategy is recommended in the following tables, diseases are grouped. Each disinfectant table gives a list of items that could be contaminated during a disease outbreak and lists the best disinfectants or procedures to be used on each item. The list aims to give the operator more than one choice of disinfectant.

How to use the tables

- **Table 5.1** shows an alphabetical list of all the EAD diseases and indicates where to find the information about each one in Tables 5.3 and 5.4.
- **Table 5.2** is a key to the disinfectants mentioned in Tables 5.3 and 5.4.
- **Table 5.3** shows detailed decontamination plans for key EADs. Diseases/agents are grouped if they require the same or a very similar decontamination strategy.
- **Table 5.4** shows available information for the remaining EADs.

Table 5.1 Alphabetical list of emergency animal diseases and location of decontamination information

Disease	Table	Row
African horse sickness	Table 5.3	1
African swine fever	Table 5.3	2
Anthrax	Table 5.3	3
Aujeszky's disease	Table 5.3	4
Australian lyssaviruses (including bat lyssavirus)	Table 5.3	13
Avian influenza	Table 5.3	9
Bluetongue	Table 5.3	5
Borna disease	Table 5.4	1
Bovine spongiform encephalopathy	Table 5.3	6
Bovine tuberculosis	Table 5.4	18
Brucellosis (due to *Brucella abortus*)	Table 5.4	19
Brucellosis (due to *Brucella melitensis*)	Table 5.4	20
Classical swine fever	Table 5.3	2
Contagious bovine pleuropneumonia	Table 5.4	25
Contagious equine metritis	Table 5.4	21
Dourine	Table 5.4	28
East coast fever (theileriosis)	Table 5.4	29
Encephalitides (tick-borne)	Table 5.4	2
Epizootic lymphangitis	Table 5.4	22
Equine babesiosis (equine piroplasmosis)	Table 5.4	30
Equine encephalomyelitis (western, eastern and Venezuelan)	Table 5.4	3
Equine encephalosis	Table 5.4	4
Equine influenza	Table 5.3	7
Foot-and-mouth disease	Table 5.3	8
Getah virus	Table 5.4	5
Glanders	Table 5.4	23
Haemorrhagic septicaemia	Table 5.4	24
Heartwater	Table 5.4	26
Hendra virus infection (formerly equine morbillivirus)	Table 5.4	6
Infectious bursal disease (see 'very virulent infectious bursal disease')		
Japanese encephalitis	Table 5.3	10
Jembrana disease	Table 5.4	7
Lumpy skin disease	Table 5.3	11
Maedi–visna	Table 5.4	8
Menangle virus (porcine paramyxovirus)	Table 5.4	9
Nairobi sheep disease	Table 5.4	10
Newcastle disease	Table 5.3	9
Nipah virus	Table 5.4	11
Peste des petits ruminants	Table 5.3	12
Porcine respiratory and reproductive syndrome	Table 5.4	12
Potomac fever	Table 5.4	27
Pulmonary adenomatosis (ovine)	Table 5.4	13
Rabies	Table 5.3	13
Rift Valley fever	Table 5.3	14

Disease	Table	Row
Rinderpest	Table 5.3	12
Scrapie	Table 5.3	6
Screw-worm fly	Table 5.3	15
Sheep pox and goat pox	Table 5.3	11
Sheep scab	Table 5.4	33
Surra	Table 5.4	31
Swine influenza	Table 5.4	14
Swine vesicular disease	Table 5.3	8
Teschen disease (enterovirus encephalomyelitis)	Table 5.4	15
Tracheal mite, tropilaelaps mite, varroa mite	Table 5.4	34
Transmissible gastroenteritis	Table 5.3	16
Trichinosis (trichinellosis)	Table 5.4	32
Very virulent infectious bursal disease	Table 5.4	16
Vesicular exanthema	Table 5.3	8
Vesicular stomatitis	Table 5.3	17
Wesselsbron disease	Table 5.4	17

a Diseases shown in **bold** are those for which there is an AUSVETPLAN **Disease Strategy**. The remaining diseases are included in the **Response Policy Briefs**.

Table 5.2 Key to decontamination agents

No.	Decontaminant
1	Soaps and detergents
2	Oxidising agents:
	a. Sodium hypochlorite
	b. Calcium hypochlorite
	c. Virkon
3	Alkalis:
	a. Sodium hydroxide (caustic soda) (NaOH);
	b. Sodium carbonate: anhydrous (Na_2CO_3), washing soda ($Na_2CO_3.10H_20$)
4	Acids:
	a. Hydrochloric acid
	b. Citric acid
5	Aldehydes:
	a. Glutaraldehyde
	b. Formalin
	c. Formaldehyde gas
6	Insecticides:
	a. Organophosphates
	b. Synthetic pyrethroids
	c. Ivermectin
	d. Aluminium phosphide
7	Alkaline hydrolysis
8	Other chemical agents
	a. Quicklime / chloride of lime
	b. Sodium dichlorisocyanurate
	c. Activated chloramine
	d. Hydrogen peroxide
	e. Peracetic acid
	f. Biguanides
	g. Iodophors
	h. Quaternary ammonium compounds
	i. Phenolics

Table 5.3 Disinfectants and procedures for key EADs

For the key to decontamination agents, see Table 5.2

Row	Disease (agent)	Item to be disinfected	Disinfectant/procedure	
1	**African horse sickness** (Cat C virus)	Live animals	Euthanase if moribund as recovery is rare, isolate sick animals, vaccinate with insect control	
		Carcases	Bury, burn or render (not for petfood)	
		Animal housing / equipment	2, 4 (only necessary if contaminated with blood) and 6a or 6b for insect control	
		Environs	2, 4 (only necessary if contaminated with blood) and 6a or 6b for insect control	
		Humans	2c (not approved for use on skin; beware of OHS issues for skin contact); 4b	
		Electrical equipment	5 (only necessary if contaminated with blood)	
		Water (tanks, dams)	Decrease insect vector habitat	
		Feed	Bury only if contaminated with blood	
		Effluent, manure	Insect control: 6a or 6b	
		Human housing, machinery, vehicles	2, 4 if necessary (only necessary if contaminated with blood)	
		Clothing	2, 4	
		Aircraft	2c, 4b,	
2	**African swine fever (ASF)** **Classical swine fever (CSF)** (Cat A viruses)		**ASF**	**CSF**
		Live animals	Euthanase	Euthanase
		Carcases	Bury or burn	Bury or burn
		Animal housing/equipment	1, then 2 or 3	1, then 2 or 3
		Environs	Consider 6a or 6b for tick eradication, otherwise not applicable	UV radiation very effective at inactivating virus within a few days. Two species of stable fly and mosquitoes have been shown capable of mechanically transmitting CSF virus, but this method of spread is generally considered unimportant.
		Humans	1, 2c (not approved for use on skin; beware of OHS issues for skin contact)	1, 2c (not approved for use on skin; beware of OHS issues for skin contact)
		Electrical equipment	5c	5c
		Water — tanks — dams	 Drain Not applicable	 Drain Not applicable
		Feed	Bury or burn	Bury or burn
		Effluent, manure	Bury or burn, 3	Bury or burn, 3
		Human housing, machinery, vehicles, clothing	1 then 2, or 3	1 then 2 or 3
		Aircraft	1, then 2c or 3b	1, then 2c or 3b

Row	Disease (agent)	Item to be disinfected	Disinfectant/procedure
3	**Anthrax** (Gram-positive bacteria — spore forming)	Live animals	Vaccinate in face of outbreak. Treat with appropriate antibacterials
		Carcases	Bury or burn (burn is preferred) including contaminated soils/bedding etc.
		Animal housing/equipment	2b, 3a, 5, or 8 d, followed by 1, followed by 5, 8 d or 8e
		Environs	Control tabanid flies; remove dead animals promptly; 5, 3a, 2b, 8b Remove soil at site of anthrax carcase to depth of 20 cm and incinerate or saturate with 5b
		Humans	Very thorough personal decontamination through washing with soap and water. Wear personal protective equipment that can be disposed of. For contaminated skin, 2b. Use PPE to protect against skin and mucous membrane exposure during postmortems. Use respiratory PPE when in environments where dust contamination may be significant.
		Electrical equipment	5c if necessary
		Water — tanks — dams	 5a or 5b, or filter May not be practical
		Feed	5, 3a, 2b, 8b or burial with 8a
		Effluent, manure	Burn or 5, 3a, 2b, 8b
		Human housing	2a or 2b
		Machinery	8c
		Vehicles	2a, 2b, 5a or 5b
		Clothing	Burn or bury (burning is preferred), or 5
		Aircraft	1 then 2a or 2b
4	**Aujeszky's disease** (Cat A virus)	Live animals	Quarantine, then depopulation options
		Carcases	Bury or render
		Animal housing/equipment	1 then 2 or 3
		Environs	1 then 2 or 3
		Humans	1 then 2c (not approved for use on skin; beware of OHS issues for skin contact), or 3b (not concentrated)
		Electrical equipment	5
		Water (tanks, dams)	2, 3
		Feed	Bury or burn if contaminated
		Effluent	Quarantine > 3 days
		Manure	Bury

Row	Disease (agent)	Item to be disinfected	Disinfectant/procedure	
		Human housing, machinery, vehicles, clothing	1, 2 or 3	
		Aircraft	1, 2c or 3b	
5	**Bluetongue** (Cat C virus)	Live animals	See the **Bluetongue Disease Strategy**; isolate sick animals to prevent spread to others	
		Carcases	Bury, render or burn normally	
		Animal housing/equipment	6a, 6b if insect knockdown warranted	
		Environs	Decrease insect vector habitat	
		Humans	1	
		Electrical equipment	na	
		Water (tanks, dams)	Decrease insect vector habitat	
		Feed	na	
		Effluent, manure	Bury or 6a or 6b to prevent insects breeding	
		Human housing, machinery, vehicles	na	
		Clothing	1	
		Vehicles, aircraft	6a or 6b for aircraft disinfestation if necessary; spray with insecticides to eliminate vector	
6	**BSE** **Scrapie** (Prions — special inactivation necessary; see **Laboratory Preparedness Manual**)		**BSE**	**Scrapie**
		Live animals	Quarantine, then euthanase according to disease strategy	Quarantine, then euthanase according to disease strategy
		Carcases	Bury (with care for environment) or incinerate	Bury (with care for environment) or incinerate; incinerate or bury all contaminated birth materials
		Environs	Bury or incinerate animal bedding, topsoil, halters etc that are suspected of contamination	Bury or incinerate animal bedding, topsoil, halters etc that are suspected of contamination
		Animal housing/ equipment	1 then 2a or 3a with steam sterilisation	1 then 2a or 3a with steam sterilisation
		Humans	See the **BSE Disease Strategy**, Section 2.2.8	See the **Scrapie Disease Strategy**, Section 2.2.8
		Electrical equipment	na	na
		Water (tanks, dams)	na	na
		Feed	Bury or incinerate only if contaminated with carcases	Bury or burn only if contaminated with birth material, manure or carcases
		Effluent, manure	Bury or incinerate	Bury or incinerate
		Human housing	1 then 2a or 3a	1 then 2a or 3a

Row	Disease (agent)	Item to be disinfected	Disinfectant/procedure	
		Machinery, vehicles	2a (2%) with contact time of 1 hour. Rinse with plentiful amounts of water after 1 hour. 3a — use 1M concentration with contact time of 1 hour. Rinse with plentiful amounts of water after 1 hour	2a
		Clothing	Incinerate if heavily contaminated	Incinerate if heavily contaminated
		Aircraft	Clean plane with 1. Follow-up with corrosive disinfectants is inappropriate for aircraft.	Clean plane with 1. Follow-up with corrosive disinfectants is inappropriate for aircraft.
7	**Equine influenza** (Cat A virus)	Live animals	Quarantine, isolation and vaccination	
		Carcases	Bury or knackery disposal	
		Animal housing/equipment	1, 2, 3 and 6a or 6b for insect control if abundant; rodent control if abundant	
		Environs	1, 2, 3 and 6a or 6b for insect control if abundant; rodent control if abundant	
		Humans	1, 2 (2c not approved for use on skin; beware of OHS issues for skin contact), 3b	
		Electrical equipment	na	
		Water (tanks, dams)	na	
		Feed	Burn or bury only if heavily contaminated	
		Effluent, manure	6a or 6b for insect control if abundant	
		Human housing	Unnecessary	
		Machinery, vehicles	1, 2, 3	
		Clothing	1, 2	
		Aircraft	1, 2c or 3b	
8	**Foot-and-mouth disease,** **Swine vesicular disease** **Vesicular exanthema** (Cat B viruses)	Live animals	Euthanase	
		Carcases	Bury or burn, 3, 4	
		Animal housing/equipment	1 then 2c, 3 or 4 The critical requirement for inactivation is pH <3 or pH 11. (Allowance must be made for a neutralising affect of residual soiling etc). Commercial products may also include a detergent.	
		Environs	3, 4 (see above)	
		Humans	1 then 4b, or 1 then 2c (not approved for use on skin; beware of OHS issues for skin contact)	
		Electrical equipment	5c	
		Water (tanks, dams)	3 0.1% soda ash produces a pH over 11 and so is probably practical for tanks and where there is a low organic material load. Alternatively, citric acid or hydrochloric acid could be used to lower pH, but not if concrete tanks are involved.	
		Feed	Burn, bury or 5b	
		Effluent, manure	Bury or 3 or 4	
		Human housing	1 (if practical), followed by 2c, 3, 4b	

Row	Disease (agent)	Item to be disinfected	Disinfectant/procedure	
		Machinery, vehicles	1 then 2c, 3, 4	
		Clothing	2, 2c, 3, 4b	
		Aircraft	1, followed by 2c, 3b, 4b	
9	**Avian influenza (AI)** **Newcastle disease (ND)** (Cat A viruses)		**AI**	**ND**
		Live birds	Euthanase	Euthanase
		Carcases	Bury, burn, render or compost	Bury, burn, render or compost
		Eggs (intact shells)	Virus can penetrate intact shells, but eggs may be sanitised with 2a	2a
		Animal housing/equipment	1, 2a, 2b, 2c, 3, 5a	1, 2a, 2b, 2c, 3, 5a
		Environs	na	na; sunlight inactivates virus in 30 minutes
		Humans	1, 2c (not approved for use on skin; beware of OHS issues for skin contact)	1, 2c (not approved for use on skin; beware of OHS issues for skin contact)
		Electrical equipment	5c	5c
		Water		
		— tanks	Drain to pasture where possible	Drain to pasture where possible
		— dams	Drain to pasture if practicable, otherwise not applicable	Drain to pasture if practicable, otherwise not applicable
		Feed	Bury	Bury or fumigate with methyl bromide
		Effluent, manure	Bury or burn, 4, 3	Bury or burn, 3, 4
		Human housing	1, 2a, 2b, 2c	1, 2a, 2b, 2c
		Machinery, vehicles	1, 3	1, 3
		Clothing	1, 2a, 2b, 2c, 3	1, 2a, 2b, 2c, 3
		Aircraft	1, 2c	1, 2c
10	**Japanese encephalitis**	Live animals	Euthanase moribund animals; treat horses with ivermectin to disrupt transmission of the virus and lower the likelihood of infections	
		Carcases	Bury or burn	
		Animal housing/equipment	6a, 6b if insect knockdown warranted	
		Environs	Decrease insect vector habitat	
		Humans	na; use insect repellents to reduce likelihood of infection; vaccination prior to exposure	
		Electrical equipment	na	
		Water (tanks, dams)	Decrease insect vector habitat	
		Feed	na	
		Effluent, manure	Decrease insect vector habitat	
		Human housing, machinery, vehicles	na	
		Clothing	na	
		Aircraft	6a or 6b for cabin disinsectisation	

Row	Disease (agent)	Item to be disinfected	Disinfectant/procedure
11	**Lumpy skin disease** **Sheep pox and goat pox** (Cat A viruses)	Live animals	Euthanase
		Carcases	Bury or burn
		Animal housing/equipment	1 (to clean) then 2, or 3 or 4b or 5
		Environs	2 or 3 or 4b; virus susceptible to UV light
		Humans	1, 2 (2c not approved for use on skin; beware of OHS issues for skin contact), 3b or 4b
		Electrical equipment	5c
		Water — tanks, dams	Decrease insect vector habitat
		Feed	Bury or burn
		Effluent, manure	Bury and 6a or 6b for insect control
		Human housing, machinery, vehicles	1 then 2, 3 or 4b
		Clothing	Destroy if not valuable, or 2, 3 or 4b
		Aircraft	1 then 2c 3b, or 4b
12	**Peste des petits ruminants** **Rinderpest** (Cat A viruses)	Live animals	Euthanase
		Carcases	Bury or burn
		Animal housing/equipment	1 then 2a, 2b, 2c or 3 if necessary
		Environs	2 or 3 (necessary for ensuring freedom from infection)
		Humans	1, 2c (not approved for use on skin; beware of OHS issues for skin contact) or 4b
		Electrical equipment	5c
		Water (tanks, dams)	Drain to pasture where possible
		Feed	Bury or burn contaminated feed
		Effluent, manure	2, 3, 4 then bury
		Human housing	1 then 2a, 2b, 2c or 3 if necessary; fomites unlikely to play a significant role in disease transmission
		Machinery, vehicles, clothing, aircraft	1 then 2a, 2b, 2c or 3 if necessary; fomites unlikely to play a significant role in disease transmission
13	**Rabies** **Australian bat lyssavirus** (Cat A viruses)	Live animals	Destroy, if possible without damaging head. Beware of being bitten or having contact with saliva.
		Carcases	Submit head to high security laboratory (AAHL) in an appropriate infectious goods container for confirmation of infection. Burn or bury the remainder of the carcase.
		Animal products (corneas, milk etc)	Burn or bury
		Animal housing/equipment	1 then 2
		Environs	na

Row	Disease (agent)	Item to be disinfected	Disinfectant/procedure
		Humans	All people handling bats should be vaccinated against rabies and should use PPE. Thoroughly wash bites with 1, then clean with a disinfectant suitable for human wounds (see **Rabies Disease Strategy**, Appendix 5). Treat mucous membrane contamination by thoroughly flushing with water. Obtain immediate medical attention. Euthanase offending animal and send head for confirmation of infection. Unless the animal can be conclusively shown to be free from infection, start a postexposure course of human diploid cell vaccine (HDCV) and human immunoglobulin (RIGH). Wash the rest of the body that may have had contact with saliva from an infected animal with 1 then 2a or 2c (beware of OHS considerations).
		Electrical equipment, water (tanks, dams), effluent, manure, feed	na
		Machinery	na
		Human housing, vehicles, clothing,	1 (to clean) then 2
14	**Rift Valley fever** (Cat A virus)	Live animals	Quarantine, then decrease insect vectors (6a or 6b)
		Carcases	Bury or burn. Burial is preferred option to reduce likelihood of aerosolisation of virus. Take extreme care and guard against blood splash, aerosols, fomites contacting humans.
		Animal housing/equipment	1 (to clean) then 2 or 4 or 5c
		Environs	2 or 4 and insect control (6a or 6b)
		Humans	2c (not approved for use on skin; beware of OHS issues for skin contact), or 4b
		Electrical equipment	5 if necessary
		Water (tanks, dams)	Decrease insect vector habitat
		Feed	Bury feed contaminated by blood, aerosols, fomites
		Effluent/manure	Drain to pit/bury and 6a or 6b for insect control
		Human housing, clothing, machinery, vehicles, aircraft	1 (to clean) then 2 or 4
15	**Screw-worm fly** (Insect) The aim of disinfestation / decontamination procedures is to prevent larvae developing to the third instar stage, leaving the host and pupating in the ground. This table relates to handling of the first case(s), before spread.	Live animals	6a, 6b or 6c; keep on concrete platform with 150 mm lip until wounds healed to prevent escape of mature larvae
		Carcases	Treat animals with 6a, 6b or 6c. Organism will not survive outside of living warm-blooded animal, but measures must be undertaken to prevent evacuating larvae from gaining access to soil where they may pupate. Do not bury untreated carcases (see above).
		Animal housing/equipment	Clean every 3 days and burn sweepings
		Environs	na
		Humans	Refer wounds to medical practitioner; otherwise na
		Electrical equipment	na

Row	Disease (agent)	Item to be disinfected	Disinfectant/procedure
		Water (tanks, dams), feed, effluent, manure	na
		Human housing, machinery, vehicles, aircraft	Steam clean vehicles etc to remove effluent and manure. Spray vehicle with insecticide to prevent evacuating larvae from gaining access to soil where they may pupate (see **Screw-worm Fly Disease Strategy**)
		Clothing	Wash with 1
16	**Transmissible gastroenteritis** (Cat A virus)	Live animals	Quarantine, then select option (see **Transmissible Gastroenteritis Disease Strategy**)
		Carcases	Rendering or processing
		Animal housing/equipment	1 then 2, 3 or 5
		Environs	2, 3 or 5 plus vertebrate (bird) and invertebrate pest controls; decrease vector/insect habitat; UV light will inactivate virus
		Humans	1 then 2 (2c not approved for use on skin; beware of OHS issues for skin contact), 3 or 5
		Electrical equipment	5c if necessary
		Water (tanks, dams)	Decrease insect vector habitat
		Feed	Bury/burn only if heavily contaminated and disease risk outweighs replacement cost; otherwise quarantine
		Effluent/manure	Bury or burn
		Human housing, clothing, machinery, vehicles	1 then 2, 3 or 5
		Aircraft	1 then 2c or 3b
17	**Vesicular stomatitis** (Cat A virus)	Live animals	Treat those in buffer zone with 6c (to prevent insects breeding in manure) and 6a or 6b (to prevent insects biting)
		Carcases	Bury, burn, or render
		Animal housing/equipment	6a, 6b (to kill insects) 1 (to remove virus); 2, 3, 4 also effective
		Environs	6a; decrease insect vector habitat; virus sensitive to UV light
		Humans, clothing	1
		Electrical equipment	5c
		Water (tanks, dams)	Drain to pasture where possible if contaminated with saliva and vesicular fluid; decrease vector insect habitat
		Feed	6 d
		Effluent, manure	Bury or 6a
		Human housing	6a, 6b (to kill insects) 1 (to remove virus)
		Machinery, vehicles, aircraft	6b (to kill insects) 1 (to remove virus)

AAHL = Australian Animal Health Laboratory; na = not applicable; OHS = occupational health and safety; PPE = personal protective equipment; UV = ultraviolet

Table 5.4 Disinfectants and procedures for other EADs[8]

Row	Disease (agent)	Human disinfection	Fomite disinfection	Vector control	Comments
Viral diseases					
1	Borna disease (Cat A)	Thorough personal hygiene with soap and water, PPE, 1% soda ash and detergent	Alkali, phenolics	na	Little information available on decontamination
2	Encephalitides (tick-borne) (Cat A)	na; use basic personal hygiene	na	Appropriate acaricides	Vector transmission
3	Eastern, western and Venezuelan equine viral encephalomyelitis (Cat A)	na; use basic personal hygiene	na	Appropriate mosquito insecticides	
4	Equine encephalosis (Cat C)	na; use basic personal hygiene	na	Control *Culicoides* insects	
5	Getah virus (Cat A)				
6	Hendra virus infection (formerly equine morbillivirus) (Cat A)	Soaps and detergents, PPE, also see 'Comments' column	2% glutaraldehyde, 10% formalin, hypochlorites, Virkon	na	Treat bat bites immediately by thorough washing with soap and water for 5 minutes, then treat with iodine-based antiseptic or ethanol. Treat mucous membrane contamination by thoroughly flushing with water. Obtain immediate medical attention.
7	Jembrana disease (Cat A)	Soap and water — physical removal, 1% soda ash and detergent	Hypochlorites, Virkon, alkalis	Control vectors (biting insects)	
8	Maedi–visna (Cat A)	Thorough cleaning with detergents	Clean instruments and equipment with detergents; Virkon at 1:1400	na	

[8] For the key to decontamination agents, see Table 5.2

Row	Disease (agent)	Human disinfection	Fomite disinfection	Vector control	Comments
9	Menangle virus (porcine paramyxovirus) (Cat A)	Soaps and detergents, PPE, see also 'Comments' column	Sodium hypochlorite to supply 10 000 ppm chlorine, Virkon	na	Treat bat bites immediately by thorough washing with soap and water for 5 minutes, then treat with iodine-based antiseptic or ethanol. Treat mucous membrane contamination by thoroughly flushing with water. Obtain immediate medical attention.
10	Nairobi sheep disease (Cat A)	na; use basic personal hygiene	na	Control ticks, especially *Rhipi-cephalus*	
11	Nipah virus (Cat A)	Soaps and detergents, PPE	Sodium hypochlorite to supply 10 000 ppm chlorine, Virkon	na	
12	**Porcine respiratory and reproductive syndrome (Cat A)**	Detergents, citric acid (pH < 5)	Virkon at 1:700, hypochlorite, alkali (pH > 7)	na	
13	Pulmonary adenomatosis (ovine) (Cat A)	Thorough cleaning with detergents	Clean instruments and equipment with detergents	na	
14	Swine influenza (Cat A)	Detergents, 1% soda ash and detergent	Detergents, hypochlorites, alkali, Virkon	na	
15	Teschen disease (Cat B)	1% soda ash and detergent	Hypochlorites, alkali, Virkon at 1:100	na	
16	**Very virulent infectious bursal disease (Cat C)**	Soap and water, personal hygiene, 1% soda ash and detergent	Virkon at 1:250, hypochlorites, alkali	na	Very resistant to many disinfectants
17	Wesselsbron disease (Cat A)	1% soda ash and detergent, see also 'Comments' column	Alkali, phenolics	na	PPE to prevent skin, respiratory and mucous membrane exposure while doing postmortems

Row	Disease (agent)	Human disinfection	Fomite disinfection	Vector control	Comments
Bacterial diseases					
18	Bovine tuberculosis (*Mycobacterium bovis*)	Use basic personal hygiene (thorough washing), PPE; see also 'Comments' column	Land and buildings: clean, dry and spell for > 2 months Other equipment: clean and disinfect with Virkon at 1:100 (1:33 if dirty) 5% phenol, iodine solutions with a high concentration of available iodine, glutaraldehyde, formaldehyde, 1% hypochlorite if low organic matter contamination	na	Use PPE and avoid respiratory aerosols when undertaking postmortem examinations
19	**Brucellosis (due to *Brucella abortus*)**	Standard disinfectants like chlorhexidine, thorough washing with soap and water; see also 'Comments' column	Virkon at 1:100 Susceptible to many disinfectants: 1% sodium hypochlorite, 70% ethanol, iodine/alcohol solutions, glutaraldehyde, formaldehyde	na	Use PPE to avoid skin contact and reproductive secretions and aerosols
20	Brucellosis (due to *Brucella melitensis*)	Standard disinfectants like chlorhexidine, thorough washing with soap and water; see also 'Comments' column	Virkon at 1:100 Susceptible to many disinfectants: 1% sodium hypochlorite, 70% ethanol, iodine/alcohol solutions, glutaraldehyde, formaldehyde	na	Use PPE to avoid skin contact and reproductive secretions and aerosols
21	**Contagious equine metritis**	Chlorhexidine, detergents	Sodium hypochlorite (40 mL household bleach per 5 L), chlorhexidine and ionic and nonionic detergents	na	
22	Epizootic lymphangitis	Liberal washing with soap and water	1% sodium hypochlorite, glutaraldehyde, formaldehyde, phenolics	Control flies (physical vector)	Usually controlled by slaughter of infected animals and hygiene

Row	Disease (agent)	Human disinfection	Fomite disinfection	Vector control	Comments
23	Glanders	Common disinfectants such as chlorhexidine; see also 'Comments' column	Sensitive to most disinfectants. Use Virkon, hypochlorites, alkali	na	PPE to include skin and respiratory protection
24	Haemorrhagic septicaemia	Good personal hygiene and use of personal disinfectants such as chlorhexidine	Most hospital disinfectants, hypochlorites, phenolics	na	Caution is essential, although no evidence of human infection
Mycoplasma disease					
25	Contagious bovine pleuropneumonia	Citric acid, 1% soda ash and detergent	Alkali, 1% phenol for 3 min, 0.5% formaldehyde for 30 sec	na	Sensitive to disinfectants and desiccation
Ricksettial diseases					
26	Heartwater	na; use basic personal hygiene	na	Control *Ambly-omma* ticks	
27	Potomac fever	na; use basic personal hygiene	na	Control potential arthropod vectors, especially ticks	
Parasitic diseases (protozoa, helminths)					
28	Dourine	na; use basic personal hygiene	na	na	Control by testing and management and/or slaughter of breeding stock
29	East Coast fever (theileriosis)	na; use basic personal hygiene	na	Appropriate tick control agents	
30	Equine babesiosis (equine piroplasmosis)	na; use basic personal hygiene	na	Control ticks	Use disposable syringes or disinfect between animals
31	**Surra**	na; use basic personal hygiene	na	Control biting flies	
32	Trichinosis (trichinellosis)	Through personal hygiene after handling meat and carcases	Mechanical removal of pig faeces	na	Prevent ingestion of muscle tissue or pig faeces by animals
Mites					
33	Sheep scab	Shower and change clothes between properties	Treat with miticide or thoroughly clean before movement	Use appropriate miticide on stock and equipment	

Row	Disease (agent)	Human disinfection	Fomite disinfection	Vector control	Comments
34	**Tracheal mite, tropilaelaps mite, varroa mite**	Change clothes and shower to prevent physical transfer	Hot wash equipment and allow to dry 24 hours; ensure removal of bee and wax debris	na	

Appendix 1 Equipment checklist (not exhaustive)

Personal equipment

Industrial hard hat

2 plastic ground sheets (1 m x 1 m)

Knee-length wellington boots

Boot pick — eg large nail or screwdriver

Plastic jacket and trousers

Cotton or disposable overalls x 2

Disposable P2 masks x 5

Neck cloth (hand towel)

Torch and batteries

Gloves — industrial
— disposable

Citric acid (1 kg in plastic container)

2+ sachets of Virkon S

Hibitane disinfectant

Soap

Small bottle of dishwashing liquid (non-ionic detergent)

Small (500 mL) hand-held sprayer

Short-handled scrubbing brush

Nail brush

Plastic boot box with lid and 2 x 5 L buckets

Ear protectors

Goggles

Sunscreen cream

Thermometer x 4

Nose pliers and mouth gags (pieces of round dowelling 30 cm long)

Heavy-duty plastic garbage bags

Spare underclothes

Decontamination site — IP or DCP

2 plastic ground sheets (10 m x 10 m)

50 m hessian sacking

Star pickets

Caravan and portable shower units

50 m of 20 mm rope

6 x 200 L drums

Fibreglass water tanks to 2500 L

Water supply

Pumps, eg firefighting units

Hoses (spray attachments)

Disinfectant supplies (citric acid or sodium carbonate) as appropriate

Hand brushes — short and long handle

Boot trays

Buckets

Heavy-duty plastic garbage bags

Spare cotton overalls

Premises decontamination

Water supply

Portable pumps, eg firefighting pumps

Polypipe 50 mm

Fittings for pipe

Hoses

High-pressure industrial pumps and lances

Fibreglass water tanks of sizes up to 2500 L

200 L drums

Universal indicator strips

Supply of disinfectant: citric acid
sodium hydroxide
sodium carbonate
calcium hypochlorite
soap and detergent

Flame guns and fuel

Fuel for pumps and engines

Generators

Arc lamps

Electric lead and connectors

Mechanical diggers

Bulldozers

Tractor and trailers

Front-end loaders

Vehicle-mounted boom spray

Shovels

Brooms

Forks

Crowbars

Hand tools

Plastic sheeting

20 L containers (metal)

Industrial gloves

Respirators

Perspex face shields

Ear protectors

Backpack sprays

Vehicle decontamination at LDCC

Road control points, road and rail transport

Water supply and tanks for storage

Buckets

Detergent and brushes

Supply of: citric acid
sodium carbonate
sodium hydroxide for rail transport

Sponges

Tools for dismantling floor — shovels, hand brushes, scrapers

Firefighting pump

High-pressure pump

Fuel for pump engines

Perspex face shields

Personal equipment

Lifting gear for crates

The equipment above will vary with specific circumstances.

Vertebrate pest control officers and vehicles

In addition to personal equipment listed in this appendix, vertebrate pest control officers should carry:

Spade, axe

Firearm and ammunition appropriate to target species

Water containers (90 L)

Fridge

Full face mask

Sponges

Appendix 2 Suppliers of disinfectants

This manual recommends disinfectants that are effective against the EAD agents covered by the EAD Response Agreement. The manual uses well-known chemical names rather than trade names.

The major disinfectants have been chosen for the following reasons:

- They are effective against disease agents expected to be encountered on a property during an EAD outbreak.
- Most are widely available from farm supply and hardware stores or suppliers of general laboratory chemicals.
- Most are relatively inexpensive, the exceptions being glutaraldehyde and Virkon.
- Most are available in large quantities to facilitate use in large-scale outbreaks.
- All are available as powders or as concentrated liquids to allow easy transportation to an IP or DCP, followed by appropriate dilution.
- Most are effective as technical grade chemicals but, unless on the APVMA 'reserved' list, require registration or an emergency permit.

The references below indicate sources of the major disinfectants. It includes suppliers of relevant chemical products approved by the APVMA, AQIS and/or the Therapeutic Goods Administration. To ensure that personnel have access to the latest information on the sources and usage of disinfectants, they should consult the APVMA website or the Infopest Agvet CD-ROM.

The APVMA PubCris database contains details of agricultural and veterinary chemical products that are registered for use in Australia. The data includes the product name, registering company, active constituents and product category. Further information may be found at:
http://services.apvma.gov.au/PubcrisWebClient/welcome.do.

The Infopest Agvet CD-ROM is a database of all nationally registered agricultural and veterinary chemical products. It provides information on chemical usage, active ingredients and maximum residue limits. It is produced and sold by the Department of Primary Industries and Fisheries, Queensland. Currently, updates are released three times per year on CD-ROM. Further information may be found at: http://www2.dpi.qld.gov.au/infopest/

Appendix 3 Decontamination with formaldehyde gas

Warning: Formaldehyde is hazardous according to criteria of Worksafe Australia. Consult the workplace or occupational health and safety authority in your state or territory before using formaldehyde gas disinfection!

There are limited ways to decontaminate large spaces or electronic equipment on rural premises. Formaldehyde gas can be used safely only in certain environments and in the hands of experienced operators.

Effective decontamination with gaseous formaldehyde requires a favourable combination of gas concentration, temperature, relative humidity and contact time. Most usual procedures suggest formaldehyde concentrations of 2–5 g/m^3, and relative humidity values of 70%–90% at temperatures of 20°C for periods of 15 to 24 hours.

The following must be considered before attempting formaldehyde decontamination:

1) Ensure that all surfaces are clean.

2) An even dispersal of the gas within the enclosed space is essential for uniform decontamination. Electric fans are recommended to assist circulation.

3) Because formaldehyde is a very toxic gas, it must be totally retained within the space to be treated and then effectively neutralised before the space is opened. Breathing masks and special equipment for monitoring residual formaldehyde are strongly recommended.

4) Although high relative humidity is necessary for optimal activity, water cannot be present in liquid form as it will dissolve the gas and reduce its effective concentration in the gaseous phase. It is difficult to establish the required relative humidity outside a controlled laboratory situation.

5) An evenly controlled temperature is also essential for effective decontamination. If the temperature of the walls of the vessel or building falls during the decontamination, the formaldehyde will polymerise on them to form a powdery precipitate of paraformaldehyde. This reduces the effectiveness of the operation and creates problems of residual toxicity. Such conditions are likely to occur in farm buildings or vehicles during overnight decontaminations.

6) Formaldehyde will react with free chlorine or chlorides (eg hypochlorites or hydrochloric acid) to produce carcinogenic compounds, which are a potential danger.

7) Environmental release of formaldehyde is prohibited by most regulatory health agencies.

8) Mixtures of formaldehyde with air are explosive, so risks of fire and explosion are substantial.

Notwithstanding the problems associated with formaldehyde decontaminations, there are two possible ways of generating the gas in nonlaboratory situations. Formalin solution (20 mL/m^3 space) can be mixed with potassium permanganate (16 g/m^3) in a violent reaction that produces heat and boiling and is potentially dangerous. Large vessels (10 times the volume of the formalin) must be used to contain the boiling reaction. A number of smaller vessels is preferable, each of which must be in a metal tray and well clear of combustible material. The enclosure must be prepared in advance so the operator, wearing protective clothing and a full face respirator, can mix the ingredients and leave the enclosure quickly. A second person, similarly equipped, must wait at the open door to ensure that no mishap occurs. The last action in the enclosure must be to add the premeasured formalin to the potassium permanganate in each reaction vessel, commencing with the vessel furthest from the exit door.

Alternatively, paraformaldehyde powder may be sublimed by heating at 200°C in an electrically heated device such as a frypan to produce an active concentration of 5 g/m^3. This method is safer than the former, but requires a remote-controlled method of supplying the heat.

Formaldehyde gas can be neutralised after the decontamination is complete by reaction with ammonia gas produced by heating ammonium carbonate (7.5 g/m^3 space) at 120°C. Again, a satisfactory remote-controlled heating device is required. The space must be thoroughly ventilated after the decontamination and neutralisation processes are complete.

In summary, gaseous formaldehyde decontamination should only be done by experienced personnel with appropriate safety equipment. It is recommended *only* if no effective alternative is available.

Glossary

Animal byproducts	Products of animal origin that are not for consumption but are destined for industrial use (eg hides and skins, fur, wool, hair, feathers, hoofs, bones, fertiliser).
Animal Health Committee	A committee comprising the CVOs of Australia and New Zealand, Australian state and territory CVOs, Animal Health Australia, and a CSIRO representative. The committee provides advice to PIMC on animal health matters, focusing on technical issues and regulatory policy (formerly called the Veterinary Committee). *See also* Primary Industries Ministerial Council (PIMC)
Animal products	Meat, meat products and other products of animal origin (eg eggs, milk) for human consumption or for use in animal feedstuff.
AQUAVETPLAN	Australian Aquatic Animal Diseases Emergency Plan. A series of technical response plans that describe the proposed Australian approach to an aquatic animal emergency disease incident. The documents provide guidance based on sound analysis, linking policy, strategies, implementation, coordination and emergency-management plans.
Australian Chief Veterinary Officer	The nominated senior veterinarian in the Australian Government Department of Agriculture, Fisheries and Forestry who manages international animal health commitments and the Australian Government's response to an animal disease outbreak. *See also* Chief veterinary officer
AUSVETPLAN	*Aus*tralian *Vet*erinary Emergency *Plan*. A series of technical response plans that describe the proposed Australian approach to an emergency animal disease incident. The documents provide guidance based on sound analysis, linking policy, strategies, implementation, coordination and emergency-management plans.
Chief veterinary officer (CVO)	The senior veterinarian of the animal health authority in each jurisdiction (national, state or territory) who has responsibility for animal disease control in that jurisdiction. *See also* Australian Chief Veterinary Officer

Compensation	The sum of money paid by government to an owner for stock that are destroyed and property that is compulsorily destroyed because of an emergency animal disease. *See also* Cost-sharing arrangements, Emergency Animal Disease Response Agreement
Consultative Committee on Emergency Animal Diseases (CCEAD)	A committee of state and territory CVOs, representatives of CSIRO Livestock Industries and the relevant industries, and chaired by the Australian CVO. CCEAD convenes and consults when there is an animal disease emergency due to the introduction of an emergency animal disease of livestock, or other serious epizootic of Australian origin.
Control area	A declared area in which the conditions applying are of lesser intensity than those in a restricted area (the limits of a control area and the conditions applying to it can be varied during an outbreak according to need).
Cost-sharing arrangements	Arrangements agreed between governments (national and states/territories) and livestock industries for sharing the costs of emergency animal disease responses. *See also* Compensation, Emergency Animal Disease Response Agreement
Dangerous contact animal	A susceptible animal that has been designated as being exposed to other infected animals or potentially infectious products following tracing and epidemiological investigation.
Dangerous contact premises	Premises that contain dangerous contact animals or other serious contacts.
Declared area	A defined tract of land that is subjected to disease control restrictions under emergency animal disease legislation. Types of declared areas include *restricted area, control area, infected premises, dangerous contact premises and suspect premises*.
Decontamination	Includes all stages of cleaning and disinfection.
Depopulation	The removal of a host population from a particular area to control or prevent the spread of disease.
Destroy (animals)	To slaughter animals humanely.
Disease agent	A general term for a transmissible organism or other factor that causes an infectious disease.
Disease Watch Hotline	24-hour freecall service for reporting suspected incidences of exotic diseases — **1800 675 888**
Disinfectant	A chemical used to destroy disease agents outside a living animal.

Disinfection	The application, after thorough cleansing, of procedures intended to destroy the infectious or parasitic agents of animal diseases, including zoonoses; applies to premises, vehicles and different objects that may have been directly or indirectly contaminated.
Disposal	Sanitary removal of animal carcases, animal products, materials and wastes by burial, burning or some other process so as to prevent the spread of disease.
Emergency animal disease	A disease that is (a) exotic to Australia or (b) a variant of an endemic disease or (c) a serious infectious disease of unknown or uncertain cause or (d) a severe outbreak of a known endemic disease, and that is considered to be of national significance with serious social or trade implications. *See also* Endemic animal disease, Exotic animal disease
Emergency Animal Disease Response Agreement	Agreement between the Australian and state/territory governments and livestock industries on the management of emergency animal disease responses. Provisions include funding mechanisms, the use of appropriately trained personnel and existing standards such as AUSVETPLAN. *See also* Compensation, Cost-sharing arrangements
Endemic animal disease	A disease affecting animals (which may include humans) that is known to occur in Australia. *See also* Emergency animal disease, Exotic animal disease
Enterprise	*See* Risk enterprise
Epidemiological investigation	An investigation to identify and qualify the risk factors associated with the disease. *See also* Veterinary investigation
Exotic animal disease	A disease affecting animals (which may include humans) that does not normally occur in Australia. *See also* Emergency animal disease, Endemic animal disease
Exotic fauna/feral animals	*See* Wild animals
Fomites	Inanimate objects (eg boots, clothing, equipment, instruments, vehicles, crates, packaging) that can carry an infectious disease agent and may spread the disease through mechanical transmission.
In-contact animals	Animals that have had close contact with infected animals, such as non-infected animals in the same group as infected animals.

Incubation period	The period that elapses between the introduction of the pathogen into the animal and the first clinical signs of the disease.
Index case	The first or original case of the disease to be diagnosed in a disease outbreak on the index property.
Index property	The property on which the first or original case (index case) in a disease outbreak is found to have occurred.
Infected premises	A defined area (which may be all or part of a property) in which an emergency disease exists, is believed to exist, or in which the infective agent of that emergency disease exists or is believed to exist. An infected premises is subject to quarantine served by notice and to eradication or control procedures.
Job card	A written list of tasks to be carried out by an individual or group as part of an EAD response.
Lipid envelope	*See* Viral envelope.
Local disease control centre (LDCC)	An emergency operations centre responsible for the command and control of field operations in a defined area.
Monitoring	Routine collection of data for assessing the health status of a population. *See also* Surveillance
Movement control	Restrictions placed on the movement of animals, people and other things to prevent the spread of disease.
National management group (NMG)	A group established to direct and coordinate an animal disease emergency. NMGs may include the chief executive officers of the Australian Government and state or territory governments where the emergency occurs, industry representatives, the Australian CVO (and chief medical officer, if applicable) and the chairman of Animal Health Australia.
Native wildlife	*See* Wild animals
OIE Terrestrial Code	*OIE Terrestrial Animal Health Code.* Reviewed annually at the OIE meeting in May and published on the internet at: **http://www.oie.int/eng/normes/mcode/a_summry.htm**
OIE Terrestrial Manual	*OIE Manual of Standards for Diagnostic Tests and Vaccines for Terrestrial Animals.* Describes standards for laboratory diagnostic tests and the production and control of biological products (principally vaccines). The current edition is published on the internet at: **http://www.oie.int/eng/normes/mmanual/a_summry.htm**

Operational procedures	Detailed instructions for carrying out specific disease control activities, such as disposal, destruction, decontamination and valuation.
Owner	Person responsible for a premises (includes an agent of the owner, such as a manager or other controlling officer).
Premises	A tract of land including its buildings, or a separate farm or facility that is maintained by a single set of services and personnel.
Prevalence	The proportion (or percentage) of animals in a particular population affected by a particular disease (or infection or positive antibody titre) at a given point in time.
Primary Industries Ministerial Council (PIMC)	The council of Australian national, state and territory and New Zealand ministers of agriculture that sets Australian and New Zealand agricultural policy (formerly the Agriculture and Resource Management Council of Australia and New Zealand). *See also* Animal Health Committee
Quarantine	Legal restrictions imposed on a place or a tract of land by the serving of a notice limiting access or egress of specified animals, persons or things.
Restricted area	A relatively small declared area (compared to a control area) around an infected premises that is subject to intense surveillance and movement controls.
Risk enterprise	A defined livestock or related enterprise, which is potentially a major source of infection for many other premises. Includes intensive piggeries, feedlots, abattoirs, knackeries, saleyards, calf scales, milk factories, tanneries, skin sheds, game meat establishments, cold stores, AI centres, veterinary laboratories and hospitals, road and rail freight depots, showgrounds, field days, weighbridges, garbage depots.
Sensitivity	The proportion of affected individuals in the tested population that are correctly identified as positive by a diagnostic test (true positive rate). *See also* Specificity
Sentinel animal	Animal of known health status that is monitored to detect the presence of a specific disease agent.
Serotype	A subgroup of microorganisms identified by the antigens carried (as determined by a serology test).
Silage clamp	Structure in which silage is stored.

Slurry tank	A tank that contains a suspension of solids in liquid, usually animal manure.
Specificity	The proportion of non-affected individuals in the tested population that are correctly identified as negative by a diagnostic test (true negative rate). *See also* Sensitivity
Stamping out	Disease eradication strategy based on the quarantine and slaughter of all susceptible animals that are infected or exposed to the disease.
State or territory disease control headquarters	The emergency operations centre that directs the disease control operations to be undertaken in that state or territory.
Surveillance	A systematic program of investigation designed to establish the presence, extent of, or absence of a disease, or of infection or contamination with the causative organism. It includes the examination of animals for clinical signs, antibodies or the causative organism.
Susceptible animals	Animals that can be infected with a particular disease
Suspect animal	An animal that may have been exposed to an emergency disease such that its quarantine and intensive surveillance, but not pre-emptive slaughter, is warranted. *or* An animal not known to have been exposed to a disease agent but showing clinical signs requiring differential diagnosis.
Suspect premises	Temporary classification of premises containing suspect animals. After rapid resolution of the status of the suspect animal(s) contained on it, a suspect premises is reclassified either as an infected premises (and appropriate disease-control measures taken) or as free from disease.
Swill	Food scraps of placental mammal origin that have not been obtained from approved slaughter facilities or treated by an approved process.
Swill feeding	The feeding of swill to pigs; unlicensed swill feeding is illegal in Australia.
Tracing	The process of locating animals, persons or other items that may be implicated in the spread of disease, so that appropriate action can be taken.
Vaccination	Inoculation of healthy individuals with weakened or attenuated strains of disease-causing agents to provide protection from disease.

Vaccine	Modified strains of disease-causing agents that, when inoculated, stimulate an immune response and provide protection from disease.
Vector	A living organism (frequently an arthropod) that transmits an infectious agent from one host to another. A *biological* vector is one in which the infectious agent must develop or multiply before becoming infective to a recipient host. A *mechanical* vector is one that transmits an infectious agent from one host to another but is not essential to the life cycle of the agent.
Vector control area	An area in which the containment, control or reduction of specified vector populations is conducted.
Veterinary investigation	An investigation of the diagnosis, pathology and epidemiology of the disease. *See also* Epidemiological investigation
Viral envelope	The lipoprotein outer covering of virions of some viruses, derived from cellular membranes but containing virus-specific proteins, usually glycoproteins.
Wild animals	
— native wildlife	Animals that are indigenous to Australia and may be susceptible to emergency animal diseases (eg bats, dingoes, marsupials).
— feral animals	Domestic animals that have become wild (eg cats, horses, pigs).
— exotic fauna	Nondomestic animal species that are not indigenous to Australia (eg foxes).
Zoning	The process of defining disease-free and infected areas in accord with OIE guidelines, based on geopolitical boundaries and surveillance, in order to facilitate trade.
Zoonosis	A disease of animals that can be transmitted to humans.

Abbreviations

AAHL	Australian Animal Health Laboratory
APVMA	Australian Pesticides and Veterinary Medicines Authority
AQIS	Australian Quarantine and Inspection Service
AUSVETPLAN	Australian Veterinary Emergency Plan
CA	control area
CCEAD	Consultative Committee on Emergency Animal Diseases
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CVO	chief veterinary officer
DAFF	Department of Agriculture, Fisheries and Forestry (Australian Government)
DCP	dangerous contact premises
IP	infected premises
LDCC	local disease control centre
MSDS	material safety data sheet
NMG	national management group
OIE	World Organisation for Animal Health (Office International des Epizooties)
PDS	personal decontamination site
PPE	personal protective equipment
QUATs	quaternary ammonium compounds
RA	restricted area
SDCHQ	state or territory disease control headquarters
SP	suspect premises

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Video/training resources

Cleaning it up – decontamination of properties and equipment (video), AAHL 1993 (available from the Office of the Chief Veterinary Officer, Australian Government Department of Agriculture, Fisheries and Forestry, Canberra; animal health services of the state and territory departments responsible for agriculture or primary industries; or AAHL.

[See the **Summary Document** for a full list of training resources.]

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