AUSTRALIAN VETERINARY EMERGENCY PLAN

AUSVETPLAN

Operational manual

Decontamination

Version 5.1

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.

National Biosecurity Committee

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Text under development

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

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EMERGENCY ANIMAL DISEASE HOTLINE: 1800 675 888

The Emergency Animal Disease 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.

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1 Introduction

1.1 This manual

This operational manual on decontamination is an integral part of the Australian Veterinary Emergency Plan, or AUSVETPLAN (Edition 5). AUSVETPLAN structures and functions are described in the **AUSVETPLAN *Overview***.

This manual has been produced in accordance with the procedures described in the **AUSVETPLAN *Overview*** and in consultation with Australian national, state and territory governments and the relevant industries.

1.1.1 Definitions

Definitions integral to understanding this manual include:

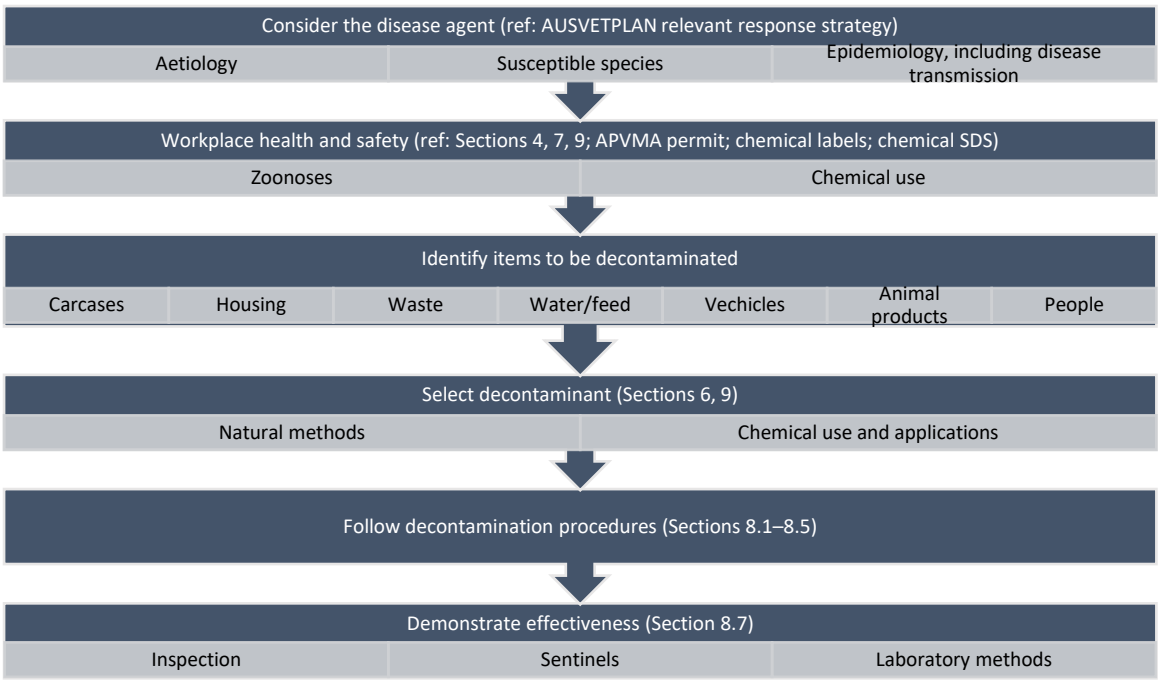
- decontamination — the combination of physical and chemical processes that kills or removes pathogenic microorganisms (includes all stages of cleaning and disinfection)
- cleaning — the process of removing unwanted substances, such as organic and inorganic material, infectious agents and other impurities, from an object or environment
- 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 objects that may have been directly or indirectly contaminated)
- disinfectant — a chemical used to destroy disease agents outside a living animal
- disinsection — the destruction of insect pests, usually with a chemical agent
- 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.

1.1.2 Purpose

Decontamination is a vital part of 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, vehicles, equipment, machinery and people where emergency animal disease (EAD) agents are known or suspected to be present.

This manual should be used to plan decontamination activities on a contaminated premises in the event of an EAD. It extends to decontamination of vehicles, equipment, machinery and personnel, while also providing guidance on topics that need special consideration such as animal effluent, animal feed, milk and specialised equipment.

Figure 1.1 shows the broad sequence of activities and sections within this manual that are likely to be referred to when planning a decontamination program. Section 3 provides more guidance.



SDS = safety data sheet

Figure 1.1 Sequence of activities in decontamination planning

1.1.3 Scope of this manual

This manual only considers EADs that are included in the Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses (EAD Response Agreement (EADRA))[1] and for which there are **AUSVETPLAN disease-specific response strategies**.

This manual covers only decontamination in field and farm situations and includes no procedures for processing facilities, veterinary clinics or for 'proof of decontamination'. Processing facilities (eg abattoirs, milk processing facilities, egg grading facilities) are likely to have decontamination procedures or plans that may be used with this manual when developing processing facility EAD decontamination plans (see Section 8.3.1).

1.1.4 Other documentation

This manual should be read and implemented in conjunction with:

- other AUSVETPLAN documents, including the response strategies, enterprise manuals and management manuals, and any relevant guidance and resource documents. The complete series of manuals is available on the Animal Health Australia website[2]
- relevant nationally agreed standard operating procedures (NASOPs).[3] These procedures complement AUSVETPLAN and describe in detail specific actions to be undertaken during a response to an incident. NASOPs have been developed for use by jurisdictions during responses to EAD incidents and emergencies

[1] https://animalhealthaustralia.com.au/eadra/
[2] https://animalhealthaustralia.com.au/ausvetplan/
[3] https://animalhealthaustralia.com.au/nationally-agreed-standard-operating-procedures/

- relevant jurisdictional and industry policies, response plans, standard operating procedures, safety data sheets and work instructions
- relevant Commonwealth and jurisdictional legislation and legal agreements (such as the EADRA), when applicable.

1.1.5 Principles

Successful decontamination requires close cooperation between property owners and all personnel involved in cleaning and disinfection procedures. 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 EAD 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 operational 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 must be strongly emphasised. Mechanical brushing of surfaces with a detergent solution is highly effective at loosening debris that contains disease agents, and rinsing with clean water removes the loosened debris and detergent from the surface. This action is necessary if later chemical decontamination is to be effective. Any cleaning agents used must be effective at removing organic matter that can protect infectious agents from the action of chemical disinfectants. A risk assessment should be conducted before decontamination is begun to minimise the potential for any spread of pathogen that could result as a direct consequence of the actions involved in decontamination. In addition, the potential for chemicals to impact on the environment, including plants and wildlife, must be considered.

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.

This manual concentrates on a relatively narrow range of disinfectants and other chemicals, which fit into the following broad groupings:

- soaps and detergents
- oxidising agents
- alkalis
- acids
- aldehydes (eg Terminator)
- quaternary ammonium compounds (which are often combined with glutaraldehyde)
- peroxymonosulfate compounds
- other chemical agents (eg bisbiguanides, iodophors, phenolics).[4]

As noted, other agents or methods of decontamination such as desiccation and sunlight may also help kill microorganisms and should be considered as part of a decontamination plan.

[4] Insecticides are also mentioned in this manual with respect to disinsection; however, detailed use and application methods are not within the scope of this manual.

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, as part of the product label and package inserts, are given for the dilution and application of these disinfectants by the manufacturer. Consideration must always be given to the safe use of chemicals used.

Note: This manual mostly uses common and generic names for chemicals and active ingredients, as opposed to trade names, because they are easily understood by personnel with basic scientific knowledge and their use avoids any misrepresentation of preference of one brand over another.

2 Nature of the disease agent

Many emergency animal diseases (EADs) are caused by viruses. However, bacterial and fungal EADs can usually be approached in the same way as viral diseases. Diseases caused by insects, parasites or prions require different strategies. It is important to understand the properties of the target pathogen and the disinfection processes that are likely to be effective, because pathogens vary greatly in their susceptibility to decontaminants.

Decontamination of premises, clothing, vehicles, tools, carcasses or the environment in an EAD event requires an understanding of the:

- general properties of each disease agent
- epidemiology of the disease, including transmission pathways
- persistence of the disease agent outside the live host (eg within the environment or within animal waste or products)
- susceptibility of the infectious agent to cleaning and chemical disinfectants.

Table 2.1 shows the Emergency Animal Disease Response Agreement (EADRA)-listed diseases and the type of disease-causing agents, from which their susceptibilities to common chemicals can be deduced. More information on disease control, including vector control and decontamination, is provided in the relevant **AUSVETPLAN disease response strategy.**

2.1 Viruses

Three categories of viruses can be distinguished based on particle size and the presence or absence of lipid (Klein & 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 6; 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 6, 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 peroxymonosulfate compounds) and aldehydes.

2.2 Bacteria and other nonviral agents

Besides viruses, emergency animal-disease-causing agents include:

- bacteria, including mycoplasma and rickettsia
- prions
- parasites.

Commonly used general disinfectants, such as phenolics and quaternary ammonium compounds, are very effective antibacterials. Chlorhexidine is a good all-purpose antibacterial disinfectant, with activity against Category A viruses as well. Antibacterial disinfectants are also effective against mycoplasma and rickettsial organisms.

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

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

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

Table 2.1 EADRA-listed EADs

EAD	**Type of agent[a]**	**Zoonotic**	**Main animals likely to be affected in Australia**
African horse sickness	Virus (C)	Nil	Horses, dogs
African swine fever	Virus (A)	Nil	Pigs
Anthrax	Bacterium	Yes	All mammals (especially cattle and sheep)
Aujeszky's disease	Virus (A)	Nil	Pigs, cattle, sheep, goats, dogs
Australian bat lyssavirus	Virus (A)	Yes	Flying foxes, insectivorous bats
Avian influenza	Virus (A)	Strain dependent	Birds
Bluetongue	Virus (C)	Nil	Sheep, goats, cattle, camelids, deer, buffalo
Borna disease	Virus (A)	Not known	Horses, sheep
Bovine spongiform encephalopathy	Prion	Yes	Cattle
Bovine tuberculosis (due to *Mycobacterium bovis*)	Bacterium	Yes	Cattle, buffalo, deer, camelids
Brucellosis (due to *Brucella abortus*)	Bacterium	Yes	Cattle, horses, sheep, goats
Brucellosis (due to *Brucella melitensis*)	Bacterium	Yes	Goats, sheep, humans
Classical scrapie	Prion	Nil	Sheep, goats
Classical swine fever	Virus (A)	Nil	Pigs
Contagious bovine pleuropneumonia	Mycoplasma	Nil	Cattle
Contagious equine metritis	Bacterium	Nil	Horses
Dourine	Protozoan	Nil	Horses
East coast fever (theileriosis)	Protozoan	Nil	Cattle

EAD	Type of agent[a]	Zoonotic	Main animals likely to be affected in Australia
Encephalitides (tickborne)	Virus (A)	Rare	Sheep, cattle, horses, pigs, deer
Epizootic lymphangitis	Fungus	Rare	Horses
Equine babesiosis (equine piroplasmosis)	Protozoan	Nil	Horses, donkeys
Equine encephalomyelitis (western, eastern and Venezuelan)	Virus (A)	Yes	Horses, donkeys, birds
Equine encephalosis	Virus (C)	Nil	Horses
Equine influenza	Virus (A)	Rare	Horses
Foot-and-mouth disease	Virus (B)	Rare	All cloven-hoofed animals
Getah virus	Virus (A)	Yes	Horses
Glanders	Bacterium	Yes	Horses, donkeys
Haemorrhagic septicaemia	Bacterium	Nil	Cattle, buffalo
Heartwater	Rickettsia	Nil	Cattle, sheep goats, water buffalo
Hendra virus	Virus (A)	Yes	Horses
Infectious bursal disease (hypervirulent form)	Virus (C)	Nil	Poultry
Influenza A viruses in swine	Virus (A)	Yes	Pigs
Japanese encephalitis	Virus (A)	Yes	Pigs, horses
Jembrana disease	Virus (A)	Nil	Bali cattle
Lumpy skin disease	Virus (A)	Nil	Cattle, buffalo, camels
Maedi–visna	Virus (A)	Nil	Sheep, goats
Menangle virus (porcine paramyxovirus)	Virus (A)	Yes	Pigs, flying foxes
Nairobi sheep disease	Virus (A)	Yes	Sheep, goats
Newcastle disease	Virus (A)	Rare	Birds
Nipah virus	Virus (A)	Yes	Pigs, flying foxes
Peste des petits ruminants	Virus (A)	Nil	Sheep, goats
Porcine epidemic diarrhoea	Virus (A)	Nil	Pigs
Porcine respiratory and reproductive syndrome	Virus (A)	Nil	Pigs
Potomac fever	Rickettsia	Nil	Horses
Pulmonary adenomatosis (ovine)	Virus (A)	Nil	Sheep, goats

EAD	Type of agent[a]	Zoonotic	Main animals likely to be affected in Australia
Rabies	Virus (A)	Yes	All mammals
Rift Valley fever	Virus (A)	Yes	Cattle, sheep, goats
Rinderpest	Virus (A)	Nil	Cattle, sheep, pigs
Screw-worm fly	Insect	Yes	All mammals
Sheep pox and goat pox	Virus (A)	Nil	Sheep, goats
Sheep scab	Mite	Nil	Sheep
Surra	Protozoan	Nil	Horses, dogs, cats, camelids, donkeys, deer
Swine vesicular disease	Virus (B)	Nil	Pigs
Teschen disease (enterovirus encephalomyelitis)	Virus (B)	Nil	Pigs
Transmissible gastroenteritis	Virus (A)	Nil	Pigs, dogs
Trichinosis (trichinellosis)	Helminth	Yes	All mammals
Vesicular exanthema	Virus (B)	Nil	Pigs
Vesicular stomatitis	Virus (A)	Yes	Cattle, horses, pigs
Wesselsbron disease	Virus (A)	Yes	Sheep, goats

a Virus categories A, B and C are defined in Section 2.1.

3 Planning

3.1 Key issues when developing a decontamination plan

Key issues to be considered when developing a decontamination plan include:

- the legislative requirements in each jurisdiction
- identification of the suspected emergency animal disease (EAD) agent
- identification of the epidemiological characteristics of the EAD agent including ways in which the pathogen may be spread (eg movements of animals and fomites) and whether the agent is zoonotic
- identification of appropriate chemicals to inactivate the EAD agent and whether they are registered for use against that agent or in the manner proposed, as well as if they are available in the quantities required
- accreditation, licences and permits required for chemicals to be used
- identification of personnel or contractors who are registered/authorised to use these products and complete decontamination activities (ie have the necessary skills, capabilities and workforce)
- relevant work health and safety requirements for each chemical used
- the type of premises involved (including species and numbers of animals) and its use and function (eg food producing facility)
- the amount and type of contaminated areas, types of material and equipment that require decontamination
- potential pathogen load
- ambient temperature and sunlight exposure — relevant for natural decontamination processes
- weather as it affects the practicality of undertaking decontamination
- protection of the environment, including management of animal and decontamination waste including chemical disinfectants reaching waterways or accumulating in the soil, or on surfaces
- liaising with human health and environmental agencies as required
- disposal of animals and disinfection of disposal sites
- biosecurity principles relevant to the types of equipment and resources needed to carry out the procedures
- potential for community concern around the use of large amounts of disinfectants and the need for clear communication.

The information gathered will help establish priorities for decontamination (Prince et al 1991). Depending on the disease agent involved, different decontamination procedures and chemicals may need to be used for different sites, equipment, vehicles, machinery etc on the contaminated premises (Kostenbauder 1991). It is also noted that destruction of some materials and commodities may be more cost-effective than attempting decontamination (eg this may be relevant to contaminated animal feed).

Furthermore, for diseases not spread directly from animal to animal (eg vectorborne diseases such as bluetongue), comprehensive decontamination of a premises may not be 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 on contaminated people, clothes, equipment etc.

Viruses that can be spread by such fomites require the most comprehensive decontamination programs.

3.2 Items to be decontaminated

The planning stage should include assessment of the physical characteristics of structures, equipment and other items requiring decontamination. A list of all items to be decontaminated should be developed that includes details of the materials involved, their surface porosity, potential for damage to surfaces and the ability to access areas that need to be decontaminated.

The level of surface contamination should be assessed to identify the amount of initial cleaning that will be required before disinfection can begin. For example, if heavy faecal soiling is present, specialised tools may be required for initial removal of gross contamination.

The type of surface requiring decontamination will play a role in the effectiveness of decontamination. Hard, nonporous materials such as metal, plastics and sealed concrete will be easier to decontaminate than rough, pitted surfaces. Absorbent material such as wood and unsealed concrete will be more difficult to decontaminate.

Some items that are very difficult to decontaminate may need to be disposed of if they cannot be adequately disinfected.

3.3 Using appropriate chemicals

A relatively small number of disinfectants are 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 contact time is to be maintained.

Outside of EAD responses, any chemicals or products to be used as disinfectants on agricultural premises such as buildings, yards, equipment and vehicles 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.[5]

When managing EADs, chemicals must be approved for use or have an APVMA permit specific to the EAD. The directions on the APVMA-approved label or instructions on an APVMA permit must be adhered to when using products for decontamination in EAD responses.

Products for personal decontamination of skin and hair in an EAD response should be selected from the Therapeutic Goods Administration–approved soaps, scrubs and handwashes listed in the Australian Register of Therapeutic Goods.[6]

3.4 Natural decontamination

The natural processes of time, drying, heat and sunlight (ie solar radiation) 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 radiation

[5] http://services.apvma.gov.au/PubcrisWebClient/welcome.do
[6] https://www.tga.gov.au/resources/artg

will quickly decontaminate fencing and rails in the open, whereas 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.

The removal of gross contamination (eg mud, dust and manure) through initial cleaning is likely to hasten and improve the decontamination outcomes of these natural processes.

3.5 Nonchemical methods

Nonchemical methods may include:

- application of steam
- application of heat
- burning and flaming
- exposure to ultraviolet light
- application of drying and sunlight
- composting.

Steam improves the cleaning process by raising the temperature, penetrating crevices and removing organic matter. However, steam may not raise temperature of surfaces for long enough to inactivate the EAD agent. Steam may aid in the penetration of some disinfectants.

Heat can be used to deactivate many disease agents but the time and temperature required will depend on the susceptibility of the disease agent. Small items may be placed in a heating receptacle or heat may be increased inside whole buildings for a longer period (as is done in thermal decontamination). Vehicles and machinery can be placed inside heat sheds, if they are available, as a secondary method of decontamination. For example:

- thermal decontamination is a process of increasing the heat inside a poultry shed to above 38 °C (typically 38 to 48 °C) for 7 days[7]
- flame guns may be useful supplements for drying decontaminated surfaces or removing organic matter. Fire risks must be considered and flame guns are not recommended as a primary means of decontamination.

UV light boxes may be used to disinfect small or delicate items, while UV wands may be used in aircraft decontamination.

Drying and sunlight may be a useful secondary method of decontamination of outside areas and equipment, depending on weather conditions.

3.6 Workplace health and safety

All people involved in performance of, or supervision of, decontamination procedures are responsible for ensuring that all reasonable measures are taken to maintain a safe working environment.

The planning stage should include a risk assessment of all activities involved in the decontamination process. Any unacceptable risks must be mitigated. Measures must be put in place to reduce risks to an appropriate level. If the risk cannot be managed, then alternative procedures must be considered.

[7] www.aphis.usda.gov/sites/default/files/heattreatment.pdf

Hazardous operations that may occur include:

- handling corrosive or irritant chemicals
- use of hot-water and high-pressure cleaners
- lifting of heavy equipment or structures
- working in confined and/or hot places
- working at elevated heights (eg tiered poultry cage systems).

Safety data sheets for all chemical agents used onsite must be readily available, and an appropriate eye wash and place for washing skin with soap and water should be provided. The hazards in the safety data sheet may also identify other facilities that must be provided. More details on safety considerations are provided in Section 6.4.

When transporting, storing or handling chemicals for premises decontamination, it is important for the handler to ensure they are familiar with responsibilities identified in the *Australian Dangerous Goods Code*[8] or any subsequent updated legislation or codes associated with the transporting, storing and handling of chemicals. Refer to specific jurisdictional guidelines and jurisdictional work health and safety legislation for further information.

3.7 Environmental considerations

Although selection of the decontamination method will be undertaken primarily based on effectiveness against the target EAD agent, chemicals used in disease control programs are potentially noxious substances and may have adverse effects on the environment. The APVMA, when approving use of a specific chemical for a specific EAD, undertakes an environmental assessment that includes examination of the hazards and risks associated with the proposed use. The planning process must consider the APVMA requirements and potential environmental impacts of decontamination procedures, and assess whether methods for containment or neutralisation are viable and acceptable. The procedures and chemicals used must also comply with local, state and national environmental regulations and requirements.

All states and territories require that activities should not have significant detrimental effects on the natural environment. Therefore, the discharge of chemicals, silt, organic matter or carcasses into natural waterways or other environments may be an offence. It is essential that authorities, including state and local environmental protection agencies, are consulted when the decontamination plan is being designed and that appropriate disposal of waste materials is undertaken.

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

[8] www.ntc.gov.au/codes-and-guidelines/australian-dangerous-goods-code

4 Decontamination (cleaning and disinfection) overview

Effective cleaning must always precede disinfection. If completed correctly, more than 90% of the pathogen load may be removed by cleaning (Fotheringham 1995ab). The aim of cleaning is to remove gross contaminants that may reduce the efficacy of many chemical disinfectants or protect the emergency animal disease (EAD) agent from their action (Figure 4.1).

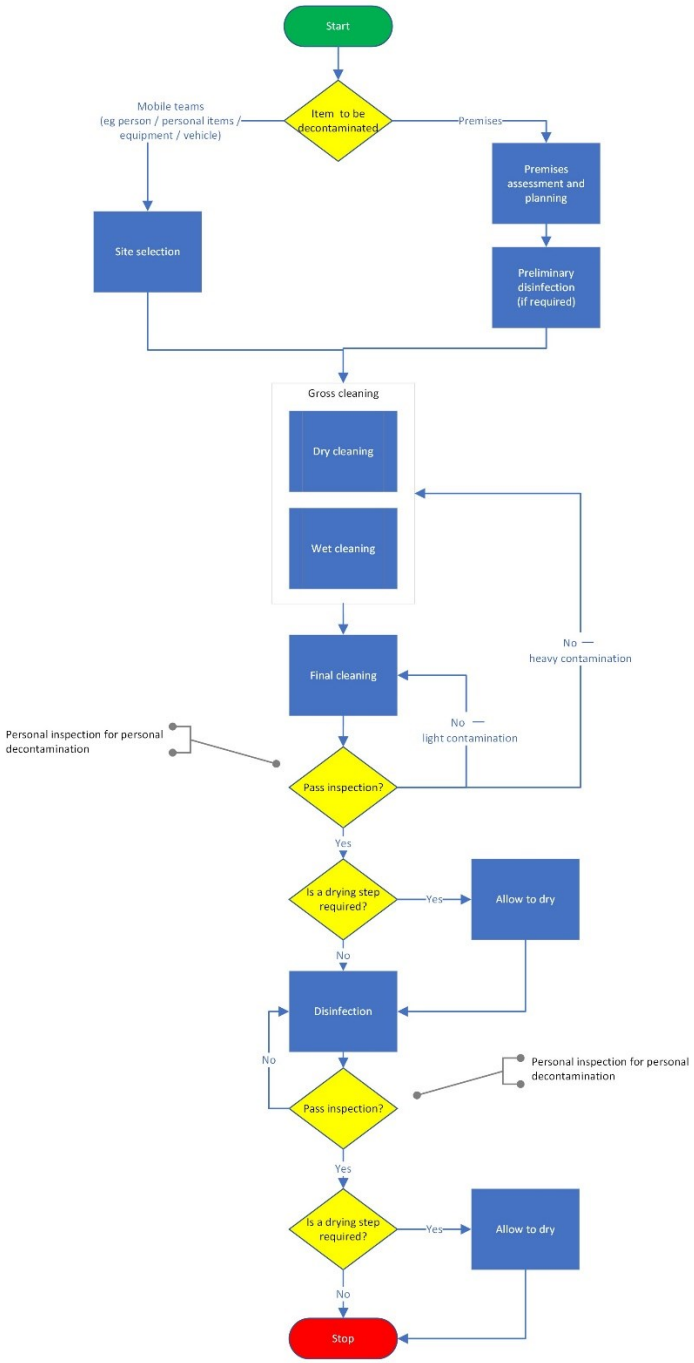


Figure 4.1 Decontamination procedure overview

During the decontamination process, it is important to complete the following steps:

- **Gross cleaning** — as much organic material (faeces, animal feed, water, bedding etc) as possible should be removed from the contaminated surfaces and disposed of in the appropriate manner. This will enable disinfectants to be more effective during the final decontamination step.
    - The gross cleaning stage may include a preliminary disinfection step, which involves saturating the affected areas with a disinfectant known to be effective against the relevant pathogen. This will minimise the spread of the pathogen at the gross contamination stage, noting that there are some limitations to this because many disinfectants have reduced effectiveness in the presence of fat, grease and organic material.
    - The gross cleaning stage may also use dry cleaning methods (ie 'dusting' — like removal of cobwebs etc) and/or thermal methods such as hot water and steam, which are effective for cleaning cracks and crevices where pathogens are likely to linger.
- **Final cleaning** — an appropriate chemical should be used to remove all residual physical evidence of gross contamination.
- **Drying** — a drying step may be required.
- **Inspection** — the final cleaning (and drying) step will be followed by an inspection step.
    - If any heavy contamination is identified, then the gross cleaning step should be repeated.
    - If any light contamination is identified, then the final cleaning step should be repeated.
    - If no contamination is visible, then a final disinfection step can be completed.
- **Disinfection** — an appropriate chemical or method should be used to remove or inactivate EAD agents.
- **Drying** — a drying step may be required, but only after the chemical has been allowed to be in contact with the surfaces for the time required to be effective.

Any structures and equipment that cannot be effectively cleaned and/or disinfected (eg very porous surfaces) should be disposed of or decommissioned in an approved manner.

For animal pens and other structures, the preference is to clean these without dismantling. If this is not possible, they should be dismantled before cleaning and disinfection (if needed).

All machinery and tools used to remove carcasses and organic material must also be cleaned and disinfected.

The inside of pipework can be cleaned effectively by the application of steam 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.

Biofilms can harbour pathogens and make decontamination difficult in some circumstances. Such films may be found on any surface including floors, walls and pipes, as well as on any material including glass, stainless steel, aluminium, plastic, rubber and wood (Butucel et al 2022). Careful attention should be made to ensuring biofilms are removed during cleaning.

Refer to Section 8.1 for details on selecting decontamination sites and Section 8.2 for personal decontamination.

5 Cleaning

5.1 Water for cleaning purposes

Potable water is ideal for cleaning and disinfection; however, the water quality requirements depend on the application and purpose.

Before use, it is important to determine what onsite water sources are available (eg town water, bore water, dam water) and locations (tanks, taps, hoses etc). This will provide important information that contributes to a risk assessment and may affect determination of the most suitable location for the decontamination site(s).

Bore water should be suitable but care should be taken if using alkaline bore water to make up disinfectants, such as a citric acid solution, because the alkalinity may raise the pH above the effective level. Assess the pH of all water before use.

Organic matter in water may inactivate some disinfectants. If in doubt about water quality, water testing may be undertaken.

If suitable water is not available onsite, it can be trucked in and stored in collar tanks or water holding receptacles as required.

5.2 Cleaning products

It is important to be aware that the efficacy of cleaning products such as soaps and detergents can be diminished if used with poor-quality water (eg hard water — water with high mineral content — or water with a low or high pH). Any issues with the quality of the water to be used must be addressed before cleaning can commence.

Label directions must be followed for all cleaning products, including the use of appropriate personal protective equipment (PPE) to ensure they are effective, safe to the handler and do not cause damage to, or contamination of, the environment.

5.2.1 Soaps and detergents

Soaps and detergents are essential for cleaning before disinfection. In most cases, the primary aim is to remove organic material, dirt and grease from surfaces to be disinfected. Most industrial and domestic brands of soaps and detergents are satisfactory. Hot water, brushing and scrubbing enhance the cleaning action — but it is important that the water is not so hot that it effectively bakes the organic material onto the surface being cleaned. A delivery temperature of approximately 50 °C is appropriate. Once the surfaces have been cleaned, soaps and detergents should be rinsed off. The removed material must be disposed of in an approved manner to prevent contamination of the environment and recontamination of the cleaned item.

Soaps and detergents are not consistently effective against bacteria but may be effective for many Category A viruses because of their effect on the outer lipid envelope.

Many commonly used products for disinfection in hospitals, surgeries and food-processing areas involve soapy combinations of phenolics or older generation quaternary ammonium compounds (see

Section 6.1.5). For dairies, abattoirs and egg processing facilities, all products used must be food safe and must not contribute to residues. 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 emergency animal disease outbreak, they are not recommended as viral disinfectants.

6 Decontaminants and techniques

A key part of the disinfection process is the choice of a suitable disinfectant. The following criteria should be considered when selecting a disinfectant:

- the emergency animal disease (EAD) agent of concern
- what needs to be disinfected
- toxicity of the disinfectant and other safety issues
- method of use of the disinfectant
- stability, corrosiveness and penetration of the disinfectant
- environmental persistence
- price and availability.

6.1 Classes of disinfectants

Types of disinfectants that may be used during an EAD include:

- oxidising agents
- alkalis
- acids
- aldehydes
- quaternary ammonium compounds
- peroxymonosulfate compounds
- other chemical agents (eg bisbiguanides, iodophors, phenolics).

There are also nonchemical methods of disinfection (see Sections 3.4, 3.5 and 6.2).

6.1.1 Oxidising agents

Most oxidising agents are relatively fast acting and very effective disinfectants for a large range of microorganisms when they are used under appropriate conditions, at a suitable concentration and with acceptable contact times (Center for Food Security & Public Health 2023).

Hypochlorite compounds are the most widely used chemicals for disinfection purposes. Hypochlorite solutions release chlorine in the form of hypochlorite ions and hypochlorous acid, which are the active disinfecting agents. Hypochlorite ions have much weaker biocidal action than hypochlorous acid.

The effectiveness of hypochlorite is highest in the pH range 6–9 and decreases markedly in the presence of organic material. Several Australian Pesticides and Veterinary Medicines Authority (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 onsite. Hypochlorite solutions are not chemically stable and decompose rapidly at temperatures above 15 °C.

6.1.2 Alkalis

Alkalis have long been used as effective disinfectants against many 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 (Center for Food Security & Public Health 2023), they are ideal agents for decontaminating animal housing, yards, drains, effluent waste pits and sewage collection areas.

Strong alkalis, at pH 12 or more, have excellent activity against all categories of viruses but are very slow acting compared with oxidising agents.

There are many APVMA-registered products with alkali salts as the principal active chemical, often also with a detergent.[9]

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

6.1.3 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 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 especially useful when added to detergents for the inactivation of foot-and-mouth disease virus. Citric acid is not recommended for bacteria.

Acids are commonly used in heated water for disinfection of pipework in dairies, a process that may also have some application in the disinfection of hatchery pipework.[10,11] 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.

As with alkalis, all acid solutions (except for peracid solutions — see Section 6.1.6) are slow acting. Acids should not be mixed with alkali solutions as the effectiveness of both chemicals would be nullified.

Glycolic acid may be used as a bactericidal, yeasticidal and fungicidal fumigant for use in poultry and egg facilities, animal feed facilities (eg silos) and laboratories. It acts by disrupting the bacterial or fungal cell membrane. Glycolic acid, as the active constituent, is exempt from APVMA approval[12]; however, use of glycolic acid–containing chemicals must still be registered with the APVMA and approved for use, or have an APVMA permit specific to the EAD.

[9] https://www.apvma.gov.au/registrations-and-permits/search-registered-chemical-products-and-permits
[10] Australian dairy hygiene handbook — https://www.dairyaustralia.com.au/resource-repository/2020/09/01/australian-dairy-hygiene-handbook
[11] AUSVETPLAN enterprise manual *Dairy (cattle) industry* — https://animalhealthaustralia.com.au/ausvetplan
[12] https://www.apvma.gov.au/chemicals-and-products/active-constituents/exempt#G

6.1.4 Aldehydes

Aldehyde disinfectants are highly effective against a broad range of pathogens and act by damaging the proteins of organisms. The 2 types of aldehyde compounds registered for used in the animal industries are glutaraldehyde and formaldehyde. The main advantages of aldehydes are that they maintain their activity in the presence of organic matter and are only mildly corrosive on surfaces. The main disadvantages are that they require significantly more safety controls when used (eg respiratory protection and use in a well-ventilated area), are relatively slow in their action and can be expensive.

6.1.4.1 Glutaraldehyde

Glutaraldehyde is active against all virus families and other microorganisms, such as bacteria, at a recommended concentration of 2% (Stonehill et al 1963, Borick et al 1964, Babb et al 1980; Scott et al 1991, 2001; Russell 1994, Hanson et al 1994). 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.

In Australia, glutaraldehyde is only available in combination with quaternary ammonium compounds (QACs). This combination increases the efficacy of the disinfectant, especially when combined with second and third generation QACs.

6.1.4.2 Formalin

Formalin, a 40% aqueous solution of formaldehyde gas, is a useful disinfectant. A 5% formalin solution is an active disinfectant against all viruses and bacteria (but not against prions) and can be used to disinfect soil. Although formalin was previously a popular disinfectant, there are now many human health and safety, and environmental concerns. Long periods of exposure to formaldehyde are carcinogenic to humans (Motta et al 2021, Protano et al 2021), and aqueous forms of formaldehyde such as formalin are no longer commonly used as disinfectants.

6.1.4.3 Gaseous formaldehyde

Gaseous formaldehyde can be used to decontaminate airspaces and equipment that must be kept dry (such as electronic devices). Due to the toxic nature of the gas, gaseous formaldehyde should only be used when it is impossible to use other products and procedures. Warning notices should be fixed to the entrance of the area being fumigated. More information is provided in Appendix 2.

6.1.5 Quaternary ammonium compounds

QACs 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 (Smith 1950; Spaulding 1968; Petrocci 1983; Springthorpe et al 1986; Terleckyj & Axler 1987; Petrocci 1983, Sattar et al 1991; Best et al 1990ab; Mbithi et al 1990; Rutala et al 1991; Silverman et al 1999; Doultree et al 1999). Except for some of the later generation QACs, they have poor activity against acid-fast organisms like mycobacteria (Best et al 1990b, Rutala et al 1991). QACs 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 QAC and formulations when selecting a chemical for a particular organism. Contact time should be informed by the label instructions.

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

Earlier generations of QACs were easily inactivated by anionic soaps and detergents, organic matter and hard water. Later generations (third and fourth generation QACs) are much less susceptible to inactivation by these means, and have stronger antimicrobial activity compared to their first and second generation single-chain predecessors. The later generation QACs also have improved tolerance to anionic surfactants, protein, soil and water hardness salts.

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

6.1.6 Peroxymonosulfate compounds

Peroxymonosulfate compounds have outstanding virucidal and antibacterial properties. They are reported to have low toxicity and to be effective against a wide range of EAD viruses.[13,14] They may be irritating to skin[15] and therefore their use on skin is contraindicated.

Commercially available formulations of these chemicals are relatively safe to use and come in powdered forms ideal for dilution at the site of an EAD outbreak. A major concern with formulations of these chemicals in a large decontamination operation is the expense.

6.1.7 Alcohols

Ethyl alcohol (ethanol) and isopropyl alcohol (isopropanol) are the most frequently used disinfectants based on alcohol. Their hydroxyl functional group (-OH) interacts with proteins and lipids in microorganisms' membranes causing disorganisation, membrane damage and lysis (destruction of the cell through membrane rupture). These substances also modify the environment's pH (Center for Food Security & Public Health 2023).

Alcohols are considered fast-acting, broad spectrum antimicrobial agents. Alcohols can kill most bacteria within 5 minutes of exposure and are also effective against acid-fast bacteria such as mycobacteria. Fungi can be inactivated with extended contact times. Virucidal activity varies with the product. Ethanol is considered virucidal, but isopropanol is not effective against non-enveloped viruses, especially small ones. Alcohols alone are not effective against spores, but they can enhance the sporicidal effect of some halogen-based products like iodines (Center for Food Security & Public Health 2023).

Alcohols are used for disinfecting surfaces and for hand sanitation when provided in hand lotions. They are often included in disinfectant formulations for improved efficacy and have been used in combination with phenols, QACs and chlorhexidine. Alcohols can be used to disinfect small areas and items like mobile phones, keyboards, and stethoscopes, but they evaporate quickly, making extended exposure time difficult (Center for Food Security & Public Health 2023).

[13] https://syndel.com/wp-content/uploads/2019/01/Virkon-S-Information-Page-Lanxess.pdf
[14] https://lanxess.com/en-US/Products-and-Brands/Brands/Virkon-S
[15] https://www.gemmchemicals.com.au/wp-content/uploads/2020/04/203300-VIRKON-S-AUSTRALIA-SDS.pdf

The effectiveness of alcohols is limited in the presence of organic matter, so surfaces must be cleaned before application. This class of disinfectants can damage rubber and plastic with frequent or extended use (Center for Food Security & Public Health 2023).

In terms of health and safety, alcohols can be very irritating to injured skin. They are highly flammable, so products must be stored in a cool, well-ventilated area and used with caution.

Water is necessary for alcohol efficacy, so alcohol concentrations of 60–90% are recommended. Most rubbing alcohol (isopropanol) is 70% and hand sanitisers are typically 62%. Higher concentrations (95%) are less effective because some degree of water is required to denature proteins (Center for Food Security & Public Health 2023).

6.1.8 Other chemical disinfectants

6.1.8.1 Bisbiguanides

Chlorhexidine is a cationic bisbiguanide with broad antimicrobial activity that acts by rupturing cell membranes (Gilbert & Moore 2005). Chlorhexidine compounds are generally active against gram-positive and gram-negative vegetative bacteria. Acid-fast bacteria are usually inhibited but not killed (bacteriostatic). Bacterial spores are not killed, but germination is inhibited while spores are in contact with chlorhexidine. Chlorhexidine is not effective against mycobacteria or viruses. While not EAD agents, some species of *Pseudomonas* are resistant to chlorhexidine and increasing resistance to chlorhexidine is being identified in gram-positive and gram-negative bacteria, including S*taphylococcus aureus, Klebsiella pneumoniae*, *Mycobacterium* spp.*, Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Escherichia coli*, *Enterococcus faecalis*, *Candida albicans*[16] and *Serratia marcescens* (Keck et al 2020).

Chlorhexidine has low toxicity for humans and a strong affinity for binding to proteins in human skin, resulting in prolonged antimicrobial activity as the agent is slowly released. It also displays rapid bactericidal activity. Contact time should exceed 5 minutes. This makes it very useful as a personal decontaminating agent (eg handwash) 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. Iodine inactivates chlorhexidine.

6.1.8.2 Iodophors

Iodophors are organically bound iodine in combination with a solubilising agent or carrier that provides a sustained release reservoir of iodine. The most commonly used iodophor is povidone-iodine, a combination of polyvinylpyrrolidone and iodine. Iodophors work by penetrating the cell wall of microorganisms and disrupting proteins and nucleic acids. They display activity against gram-positive and gram-negative vegetative bacteria, mycobacteria and some viruses. The efficacy of iodophors is increased in products with higher levels of free iodine. They have poor activity against bacterial spores.

[16] https://www.safetyandquality.gov.au/sites/default/files/2023-04/guidance_for_health_service_organisations_-_appropriate_and_safe_use_of_chlorhexidine_in_health_care_settings.pdf

Iodophors 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 must be prepared daily.

It is difficult to define active concentrations for iodophors with certainty in all circumstances, so they are not recommended for the inactivation of viruses.

6.1.8.3 Phenols

Phenolic compounds are effective against gram-positive and gram-negative bacteria, some Category A viruses, and mycobacteria. They are not effective against Category B and C viruses (non-lipid enveloped 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. Because they are absorbed by rubber and some plastics, phenolic compounds are not suitable for all surfaces.

Phenols may be derived from coal tar, synthetic formulations or various homologues, such as cresols, xylenols and ethylphenols (Center for Food Security & Public Health 2023). 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.

6.1.9 Disinfectant concentrations, contact times and characteristics

Table 6.1 shows disinfectants that may be used to inactivate EAD agents and the required dilution or concentration. Table 6.2 outlines the characteristics of different disinfectant chemical groups.

For more detailed information refer to APVMA-approved permits[17] and the manufacturer's label and package insert.

[17] https://portal.apvma.gov.au/permits

Table 6.1 Recommended disinfectants and concentrations for the inactivation of emergency animal disease agents

Disinfectant	Usual form supplied	Recommended working strength		Contact time for inactivation	Application
		Usual dilution	Final conc.		
Oxidising agents					
Sodium hypochlorite 125 g/L	Liquid	40 ml/L	0.5%	15–30 min	Effective for most applications, except in the presence of organic material. Less stable in warm, sunny conditions >15 °C.[a]
Calcium hypochlorite 700 g/kg	Solid granular	7.2 g/L	0.5%	10–30 min	
Alkalis					
Sodium hydroxide 400 g/l[b]	Liquid	50 ml/L	2%	10 min	Effective against many viruses and bacteria. Avoid use on aluminium and similar alloys.
Sodium carbonate — anhydrous	Powder	40 g/L	4%	20 min	Effective against many viruses and bacteria. Avoid use on aluminium and similar alloys
Sodium carbonate — washing soda	Crystals	100 g/L	10%	30 min	
Acids					
Citric acid	Powder	30 g/L	3%	15 min for nonporous surfaces 30 min for porous surfaces	Effective against many Category A viruses and some Category B viruses Not recommended for bacteria
Aldehydes					
Glutaraldehyde 150 g/L combined with 100 g/L quaternary ammonium	Liquid	133 ml/L	2%	10–20 min	Effective against many viruses and bacteria
Glutaraldehyde 107 g/L combined with 78 g/L	Liquid	10 ml/L	1%	>10 min	Effective against many Category A

Disinfectant	Usual form supplied	Recommended working strength		Contact time for inactivation	Application
		Usual dilution	Final conc.		
and 170 g/L quaternary ammonium					viruses and some Category B viruses
Formaldehyde gas		Special generation by approved person required		15–24 hr	Toxic gas, recommended only if other methods of decontamination cannot be used.
Other chemical agents					
Peroxymonosulfate compounds	Powder	20 g/L	2%	10 min	Effective against all viruses and bacteria
Bisbiguanides (chlorhexidine)	Liquid	Not applicable — only recommended as a sanitiser and cleaner; eg hand sanitiser		>5 min	Gram-positive and gram-negative vegetative bacteria
Iodophors	Liquid or powder	Dilute according to manufacturer's instructions. Only recommended as a sanitiser and cleaner		>10 min	Gram-positive and gram-negative vegetative bacteria, mycobacteria
Phenolic disinfectants	Phenol 120 g/L	167 ml/L	2%	15 min	Bacteria and some Category A viruses

a Causes chlorate and perchlorate residues if used in dairy processing.

b In dairy milking machines, milk storage tanks on farm and processing facilities, 0.8–1.2% sodium hydroxide, a temperature of 60–85 °C and a pH greater or equal to 13 is effective against emergency animal diseases that may be found in milk (*Bacillus anthracis, Brucella abortus*, foot-and-mouth disease virus and lumpy skin disease virus).

Note: 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 concentrations and contact time. Workers in the field are expected to apply these recommendations with common sense and professional judgment of the environment, agent, surface etc.

Table 6.2 Characteristics of disinfectant chemical groups

	Alcohols[a]	Chlorine based compounds[a]	Peroxygen compounds[a]	Peroxymonosulfate compounds	Phenols (unchlorinated)[a]	Iodophors	Tar acids	QACs	GlutQAC	Chlor-hexidine	Acids[a]	Alkalis	
Example trade names[b] (APVMA approved)	Ethanol Isopropyl alcohol	Zydox Vibrex Bleach	Hyperox Proxitane	Virkon S® Viraban® ViralFX™ Virkon Aquatic® BioVX	Polyphen	Agriphor AgriDyne	Ag Black Extreme Black Virkill™ Farmfluid S	Detsan Virogard Ambicide® Agriguard™ Biosolve®-HD Growers Virusan	Virkill™ GQ Actisan Terminator Virocid®	Hibitane	Citric acid	Sodium hydroxide	Sodium carbonate
Can be used in aerosols	Yes	Few	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
Form	Liquid	Liquid or tablet	Liquid	Powder or tablet	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Powder	Pellet	Powder or crystals
Corrosive to metal or rubber	Yes	Yes	No	No Rinse off	Yes	Yes	Yes	No Rinse off	No Rinse off	No	No Rinse off	Yes	Yes
Dangerous goods	Yes	Yes	Yes	No	Yes	Yes	Yes	Some	Yes	Some	No	Yes	Some
Detergent action	No	No	Yes	Some	No	Yes	Some	Yes	Some	Some	No	No	No
Effectiveness in the presence of organic matter	Limited	Moderate	Yes	Yes	Yes	Moderate	Yes	No	Yes	Yes	Low	No	Yes
Persistent residues	No	No	No	No	Yes	No	Yes	Yes	Yes	No	No	No	No
Speed of action	Fast	Fast	Fast	Fast	Moderate	Moderate	Fast	Moderate	Moderate	Moderate	Moderate	Fast	Slow
Staining	No	Some	No	No	Yes	Yes	Some	Some	Some	No	No	No	No
Bacteria	Yes	Moderate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Viral categories[c]	Variable/ limited	A & B	A, some B	A, B, C	A	Some B	Some B	A	A and some B	Relatively ineffective	A & some B[d]	A & B	A
Spores	No[e]	Some	No[f]	No	No	No	No	No	Yes	No	No	No	No

	Alcohols[a]	Chlorine based compounds[a]	Peroxygen compounds[a]	Peroxymonosulfate compounds	Phenols (unchlorinated)[a]	Iodophors	Tar acids	QACs	GlutQAC	Chlor-hexidine	Acids[a]	Alkalis	
Suitability for foot bath	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
Toxin or irritant	Yes	Yes	No	No	Yes	Some	Yes	No	Yes	No	Yes	Yes	Yes
Level of PPE required & hazards[g]	Low 	High 	High 	Low 	High 	High 	Moderate 	Moderate 	High 	Low 	Low 	Low 	Low 
Environmental impact	Low	High	Low	Low	High	Low	High	Moderate	High	Low	Low	High	High

APVMA = Australian Pesticides and Veterinary Medicines Authority; QAC = quaternary ammonium compound

a https://www.cfsph.iastate.edu/Disinfection/Assets/characteristics-of-selected-disinfectants.pdf, with reference to:

- Fraise AP, Lambert PA et al. (eds) (2015). *Russell, Hugo & Ayliffe's principles and practice of disinfection, preservation and sterilization*, 5th edn, Wiley-Blackwell, Ames, IA.
- McDonnell GE (2007). *Antisepsis, disinfection, and sterilization: types, action, and resistance*, ASM Press, Washington DC.
- Rutala WA, Weber DJ & Healthcare Infection Control Practices Advisory Committee (HICPAC). 2008. *Guideline for disinfection and sterilization in healthcare facilities,*: https://www.cdc.gov/infectioncontrol/guidelines/Disinfection
- Quinn PJ, Markey BK, Leonard FC, Hartigan P, Fanning S & Fitzpatrick ES (eds) (2011). *Veterinary microbiology and microbial disease*, 2nd edn, Wiley-Blackwell, West Sussex, UK, pp 851–889.

b The use of trade names serves only as examples and does not signify endorsement of any product.

c See Section 2.1.

d Hu et al (2024)

e https://www.cdc.gov/infectioncontrol/guidelines/disinfection/disinfection-methods/chemical.html

f Peracetic acid is sporicidal (https://www.cfsph.iastate.edu/Disinfection/Assets/characteristics-of-selected-disinfectants.pdf)

g All pictograms referenced from https://www.safeworkaustralia.gov.au/safety-topic/hazards/chemicals/classifying-chemicals/using-ghs.

Note: This table is a guide only always read the chemical label or permit before any use.

Special approval will be required (eg APVMA emergency use permit approval, chief veterinary officer approval) to use disinfectants against disease agents that do not have current APVMA permits or registration approval for the proposed use. Check the APVMA website[18] for new or additional products and label applications and permits.

6.2 Thermal decontamination

Thermal decontamination is the inactivation of disease agents using heat, either through active application of a heating system or through passive ambient heat.

6.2.1 Management of high pathogenicity avian influenza

In Australia, the traditional method of decontaminating poultry sheds following diagnosis of an EAD has been to first clean the sheds (removal of gross contamination through dry and wet processes), then dry them out thoroughly and apply wet chemical disinfection.

The United States Department of Agriculture (USDA) has accepted the use of thermal decontamination (in conjunction with wet or dry cleaning) of poultry sheds as a more cost-effective option in the elimination of high pathogenicity avian influenza (HPAI). Thermal decontamination was used successfully for decontaminating poultry sheds in the USA 2015/16 HPAI response.[19]

The advantages of using thermal decontamination include:

- reduced need for the use of chemicals, and the management of runoff associated with wet cleaning (ie reduced environmental contamination)
- the ability of heat to reach all components of poultry sheds if they are consistently heated for an appropriate time
- reduced need for in-shed labour, thereby reducing human viral exposure and fomite transfer risks associated with movements into and out of a contaminated shed
- reduced risks associated with chemical use during shed decontamination
- reduced water use
- potential cost savings from using fewer chemicals and human resources
- reduced adverse effects of chemicals and water on infrastructure — for example, reduced corrosion of metal
- during warm seasons in Australia, the time and temperatures required may be partly provided by passive heat and closing of the sheds
- passively reducing the overall viral load, especially when dealing with zoonoses.

There is limited research to support the use of heat decontamination for diseases other than avian influenza. Even when using the method for avian influenza, the following points should be considered, because they may make heating an impractical or ineffective decontamination technique:

- avian influenza viruses remain viable in dried egg white
- additional decontamination measures may be required for certain equipment such as egg conveyor belts
- extra heat-producing equipment (eg heating infrastructure and temperature sensors) may be needed.

[18] https://www.apvma.gov.au/registrations-and-permits/search-registered-chemical-products-and-permits
[19] https://www.aphis.usda.gov/sites/default/files/heattreatment.pdf

Notwithstanding the above, in 2022, the Animal Health Committee endorsed the use of thermal decontamination of sheds as a viable method of decontamination for avian influenza and some other EAD outbreaks, subject to a risk assessment at the time.

Some of the considerations that must be included in a risk assessment are:

- the type of production system must be one that facilitates thermal decontamination (eg sheds that can hold the required temperature for the required length of time)
- cleaning methods will need to be rigorously applied in high-risk areas (eg where there may be egg whites and egg substrates) before thermal treatment is applied
- outdoor environmental temperatures may affect the ability to maintain the required shed temperature (eg winter compared with summer)
- whether suitable heat-producing equipment is available
- the ease of application of the method, and/or availability of suitably trained technicians
- whether there is a need and capability to verify virus inactivation
- cost.

Although thermal decontamination will not always be appropriate for every EAD situation, having it endorsed as an alternative option provides flexibility for decision makers in an EAD response.

6.3 Insecticides

Insecticides may be used to control insect vectors such as flies, mosquitoes, ticks and beetles that either carry an EAD agent themselves or are acting as a mechanical vector (fomite) potentially spreading pathogens between animal production areas or premises. Insecticides may play a significant role in the control or eradication of some diseases (eg screw-worm fly) or may form a lesser part of a cleaning and disinfection operation such as the control of darkling beetle in poultry sheds following a HPAI diagnosis.

For more detailed information on insect vector control, refer to the relevant **AUSVETPLAN disease-specific response strategies**.

7 Safety precautions

The following general safety information and instructions should be considered when carrying out decontamination procedures:

- Personnel must have read all labels, instructions, product information and safety advice for the chemicals used. Safety data sheets for the chemicals should be available at all sites where the chemicals are used.[20,21] Staff purchasing, handling, and applying chemicals must be suitably accredited and licensed, and trained in accordance with state requirements.[20] A minimum Chemcert AQF3 is the requirement in most states for unsupervised use of S7 chemicals.
- Personnel handling chemicals should be appropriately trained, briefed and supervised. Verify that they understand the potential hazards, health risks, safety information and instructions.
- Personnel must be issued with and use appropriate safety equipment, including personal protective equipment (PPE). They must be competent in its use and adhere to the safety procedures.
- Use of any chemical or equipment should conform to the manufacturer's instructions, safety data sheets and safety standards. All officers and workers must carry out their duties in accordance with current work health and safety legislation.
- First aid kits and supplies must be available on every premises where hazardous chemicals are being used. Supplies must also include those that are specific to the possible hazards of the chemicals (eg spill kits).
- If a worker is exposed to hazardous chemicals or is injured, reference the label, seek medical advice, administer first aid and, when required, follow decontamination principles to ensure that their or others health and safety is not adversely affected.
- All accidents, incidents and near misses must be logged and their details reported back to the local control centre (LCC).

7.1 Personal protective equipment

Appropriate PPE must be determined based on a risk assessment, which should consider the disease agent, including whether it is zoonotic, the chemicals to be used, the tasks to be performed and risks posed by other potential hazards such as weather conditions and the operating environment.

Principles of PPE selection are:

- they can protect the worker from injuries and other hazards such as infection with a zoonotic disease (ie they are fit for purpose)
- they can be safely disposed of onsite or disinfected/decontaminated before leaving the premises so as not to spread the disease agent.

During an emergency animal disease (EAD) response, suitable PPE will be provided to personnel by the jurisdictional authorities as part of normal operational and associated logistics functions. Response personnel who are required to undertake disease investigation activities are required to

[20] https://www.chemcert.com.au/resources/state-legislation
[21] https://www.safeworkaustralia.gov.au/safety-topic/hazards/chemicals/safety-data-sheets

prepare or have access to an individual or team decontamination kit that is readily available as needed (see Appendix 1.1).

The following sections provide an overview of types of PPE and associated considerations. Always refer to equipment manufacturers' specific instructions and guidance before using any PPE.

7.1.1 Respiratory protection

Types of respiratory protection[22] include the following respiratory protective devices (RPD):

- surgical and dust masks
- disposable respirators (P2 or N95 rated)
- nondisposable respirators (half and full face)
- powered air purifying respirators (PAPRs)
- self-contained breathing apparatus.

Respiratory protection is essential in the following circumstances:

- when there is a risk of zoonotic disease or biological hazard, or contaminated dust or aerosol
- when there is a risk of exposure to chemical hazards, such as noxious or toxic gases or chemical vapours, including some disinfectants such as formaldehyde.

If either of the above circumstances apply, personnel should refer to their respiratory management programs[23] and follow the program as part of the risk assessment and mitigation process.

7.1.1.1 Respiratory considerations associated with decontamination

Decontamination sites are high-risk areas, especially the initial wash-down sites where gross contamination is removed before disinfection. Splash and aerosols generated by cleaning represent exposure risks, and respiratory protection must be worn at these sites and during all decontamination activities.

RPDs are usually suitable for decontamination and reuse (eg PAPRs and full-face negative-pressure respirators), whereas others are disposable (eg P2/N95 disposable respirators).

Filters in PAPRs and half-face and full-face negative-pressure respirators must be replaced between premises because the filters cannot be decontaminated effectively.

All filters and P2/N95 disposable respirators, must be kept dry at all times, and are not effective if they become wet (eg from exhaled breath or splashes).

7.1.2 Coveralls selection and waterproof clothing

Disposable coveralls are classified into 6 categories, based on the level of protection that they provide and in accordance with a range of international standards (AS/NZS4501.1-2008). These standards cover a wide range of individual performance tests that check for:

- resistance to abrasion and cracking

[22] Note — the types of filters on respirators may need to be determined based on the disease agent or environmental conditions at the time.
[23] The respiratory management program should be consistent with AS/NZS 1715 and 1716.

- tensile strength and tear resistance
- resistance to punctures
- resistance to chemical permeation
- liquid repellence
- resistance to spray and aerosols
- resistance to ignition.

The 6 types include;

- type 1 — a coverall designed to protect against dangerous gases and liquids (may also feature an air line)
- type 2 — a coverall that retains positive pressure, but is not gas tight (offers protection against liquids, vapours and dust)
- type 3 — a coverall that is liquid tight (seams are sealed rather than stitched)
- type 4 — a coverall that protects against chemical sprays (similar to type 3, but not as heavy-duty)
- type 5 — a coverall that prevents the ingress of dust and airborne particles, including asbestos (provided disposable coveralls are used)
- type 6 — a coverall that protects against light spray and chemical splashes (offers a lower level of chemical protection than types 3 and 4)

Coveralls made from laminated film provide better protection from both liquid and particulates than do those without laminate film. However, if increased breathability is needed and the risk assessment does not require increased protection from liquids and particulates, a multilayer spunbond-meltblown-spunbond (SMS) fabric may be more suitable.

Consideration should be given to what must be worn underneath the coveralls before entering a premises. Unnecessary clothing and other personal items should be minimised to reduce the requirement for decontaminating. The type and intensity of work and existing weather conditions will influence how much clothing and PPE is required to remain both comfortable and safe. Multiple pairs of coveralls may be required in colder conditions.

Waterproof clothing may be required when working in wet weather or when staff are involved in cleaning and disinfecting activities and the available coveralls do not give adequate protection. Some wet weather gear can be used as an outer layer of protection when using chemicals or operating a high-pressure washer. Always check the labels on wet weather gear to determine what type of protection it provides (ie waterproof, water resistant, chemical resistant).

7.1.3 Gloves

Types of protective gloves include:

- disposable (nitrile, latex, surgical gloves)
- chemical-resistant gloves
- ‘rigger’ or safety gloves for hand protection (some nonleather gloves are washable)
- thermal
- cut resistant
- chainmail mesh.

Protective gloves should be worn wherever there is an identified human health risk associated with an activity. This could include the handling of animals for clinical inspection, testing or destruction,

manual handling of carcasses and other waste products (litter, manure) and the use of equipment and chemicals for decontamination activities.

The type of protective glove used will be determined by the activity and risk. If chemicals are involved, refer to the approved label. Industry guidelines such as Ansell glove guides[24,25] are also valuable references.

Disposable gloves are commonly used by operational field teams as they are relatively inexpensive and can be easily disposed of. Disposable nitrile gloves are preferred to latex gloves because they are stronger and are less likely to cause allergic responses.

In situations where disposable gloves are prone to damage, double gloving and/or the use of heavy-duty rubber gloves is preferred; however, heavier gloves may affect the dexterity of the user. Double gloving has been shown to provide more protection from needlestick injuries and reduce exposure to potentially infectious fluids.

Chainmail gloves may be worn to add an additional level of cut protection. They can be readily decontaminated after use, although take care to remove tissue and other substances during the cleaning process.

7.1.4 Foot protection

Foot protection is a critical safety requirement for operational activities and will be dictated by the type of activity that is being carried out.

Types of foot protection include:

- leather work boots
- steel-capped or safety boots
- rubber boots
- disposable boot and shoe covers.

Although there are advantages in having footwear that is easily cleaned and disinfected off properties (ie rubber boots), there are often safety requirements and practicalities that dictate otherwise. The primary concern for footwear is safety followed by the ease of decontamination. Mechanical spread of disease through contaminated footwear is a serious risk and should be managed appropriately, especially in heavily contaminated environments. Disposable boot covers can be effective in reducing the level of decontamination in some settings. For extended operations, having separate work boots for onsite use may be preferred; however, this will not be practical for all situations.

7.1.5 Eye, face and ear protection

Eye and ear protection should be fit for purpose and, if reusable, able to be decontaminated following working in contaminated environments. The standard AS/NZS 1336:2014 sets out requirements and recommended practices for the protection of the eyes and face against hazards such as flying particles, dust, splashing materials and molten metals, harmful gases, vapours and aerosols, solar radiation and high-intensity radiation generated during operations such as welding and furnace work.

[24] https://assets.thermofisher.com/TFS-Assets/ANZ/brochures/ansell-glove-guide.pdf
[25] https://ehs.sfsu.edu/sites/default/files/documents/Glove%20Chemical%20Resistance%20Guide%20-%20Ansell.pdf

In the context of an EAD response, protection against particles, dust, splashes, harmful gases, vapours and aerosols may include:

- face shields
- non-fog goggles
- safety glasses
- earmuffs or ear plugs
- full-face respirators
- PAPRs.

7.1.6 Head protection

Head protection includes:

- hard hats
- cloth hats (bucket hats, caps etc)
- some PAPRs
- overalls hoods.

Hard hats must be decontaminated inside and out. Cloth head protection (eg hats and caps) must be removed and soaked in a suitable disinfectant for reuse or disposed of. Overalls hoods will be managed through disposal as part of personal decontamination processes.

Headwear that cannot be decontaminated (eg leather, fur and straw hats) is not suitable for disinfection and should not be worn in situations that may require decontamination. Reusable respirators (eg PAPRs) must be decontaminated with appropriate disinfectants before drying and storage.

8 Decontamination procedures

Standard operating procedures and work instructions for decontamination activities can be accessed through jurisdictional response agencies. Industry guidelines and practices should also be taken into consideration when planning decontamination activities to streamline the process and reduce the likelihood of duplication of effort.

Tables 9.1–9.4 provide advice on the appropriate decontaminant and processes for the range of Emergency Animal Disease Response Agreement (EADRA)-listed EADs.

8.1 Decontamination site

On known contaminated premises, the decontamination site(s) must facilitate the movement of people, vehicles, plant, equipment and in some cases nonsusceptible live animals (pets, livestock) on to and off the premises without becoming recontaminated and potentially spreading the pathogen. A site supervisor and/or government officer will be responsible for selecting the site, ideally in consultation with the premises owner/occupier.

A decontamination site may be a defined single site where all decontamination processes are undertaken, or may be split into 2 separate sites depending on the primary purpose and the layout of the premises. For example, there may be a location within the premises where gross cleaning is undertaken, and a second site where final cleaning and disinfection occurs. It is necessary to clearly identify demarcated 'clean' and 'dirty' areas within decontamination sites to avoid cross-contamination.

The location of decontamination sites will depend on site-specific factors such as the layout of the premises (eg where animals are housed in relation to the site), access to water and the existing entry and exit points of the premises (eg driveways). Environmental effects must also be considered when selecting a site, such as the wash-down drainage, chemical toxicity and any environmentally sensitive areas near the site (eg dams, waterways, gardens).

The size and requirements of the decontamination sites should be determined based on the frequency of use, amount of movement through the sites and expected duration of operation. For example, a small personal decontamination site may be established to enable the entry and exit of 2 or 3 people to conduct a field investigation, whereas a large decontamination site may be established for entry and exit of multiple people, personal equipment and, as necessary, vehicles and equipment over a period of weeks.

The main cleaning and disinfection site should preferably be inside or on the property boundary, away from livestock and any contaminated or potentially contaminated areas.

Sites for gross cleaning and subsequent or final cleaning and disinfection should:

- be on a hard surface to prevent bogging (eg cement slab or a gravel pad)
- be of sufficient size to accommodate the required or anticipated decontamination operations (eg it may need to include portable toilets, showers and changing rooms)
- have access to a reliable supply of clean, preferably potable water and, if necessary, power
- enable the appropriate control of waste (eg access for waste collection and disposal)
- be minimally affected by adverse weather
- be able to be successfully decontaminated at nominated frequencies and at the end of operations

- consider prevailing winds
- consider any relevant Nationally Agreed Standard Operating Procedures (NASOPs) or jurisdictional decontamination SOPs.

8.2 Personal decontamination

The aim of personal decontamination is to safely remove any contamination from the body, clothing and personal equipment (eg stethoscopes, thermometers, personal respiratory protective devices). The process minimises the likelihood of cross-contamination, so that people can confidently move into and out of the contaminated, or potentially contaminated, environments without spreading the pathogen. Personal decontamination procedures must be rigorously applied. Having a personal decontamination kit (see Appendix 1.1) will enable establishment of a personal decontamination site (see Figure 8.1) and provide the necessary resources to enable effective personal decontamination. Appendix 1.2 identifies equipment that may be used to establish a temporary personal decontamination site for use by multiple personnel.

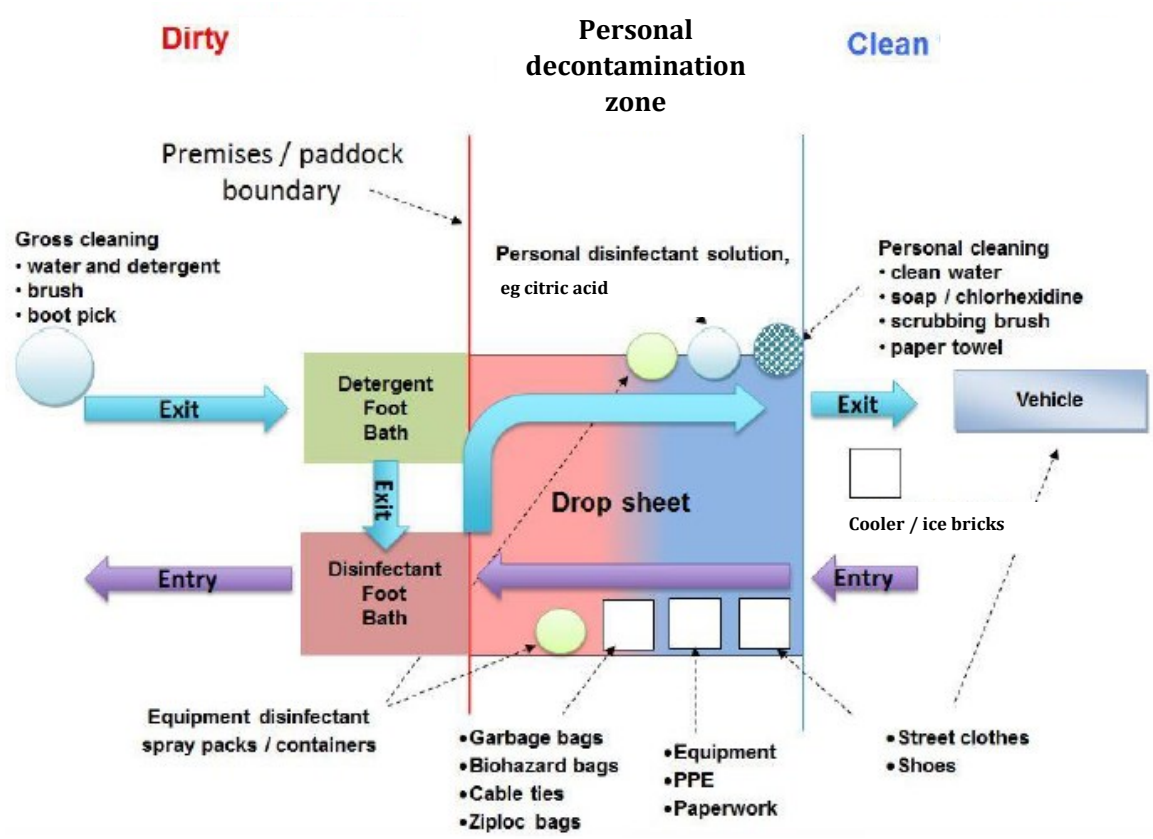
Personal contamination will/is likely to occur:

- when animals are inspected and diagnostic samples are collected
- at the animal destruction site on a contaminated premises
- at the site of carcass disposal
- when handling or removing manure, effluent, bedding and detritus from buildings that housed infected animals.

The following resources provide personal decontamination advice:

- work instruction: *Biosecure premises entry-exit and personal decontamination: without a respiratory protective device*[26]
- *Biosecure premises: entry and personal decontamination* — YouTube[27]
- *Biosecure premises: entry and personal decontamination* — YouTube[28]
- NASOP *Personal decontamination — entry and exit procedure*[29]
- relevant jurisdictional decontamination SOPs.

[26] https://www.publications.qld.gov.au/dataset/fmd-veterinary-training-resources/resource/d03dd4da-6dab-4866-bc98-4b1ab14103cb
[27] https://www.youtube.com/watch?v=l5lsaJZV0ds
[28] https://www.youtube.com/watch?v=mjA_3_RtPFM
[29] https://animalhealthaustralia.com.au/nationally-agreed-standard-operating-procedures



PPE = personal protective equipment
Source: Image adapted from https://www.publications.qld.gov.au/dataset/fmd-veterinary-training-resources/resource/a06baf8f-0530-44f2-a3c2-162516ec21d6.

Figure 8.1 Example of a personal decontamination site

8.3 Decontamination of premises

The site supervisor of contaminated premises must ensure effective property, people, equipment and vehicle decontamination.

8.3.1 Planning

Efficient and effective premises decontamination will only result from:

- consideration of the EAD agent
- assessment and recording of contaminated areas, animals, equipment, vehicles and other articles
- the selection of the most suitable decontamination agents and techniques for each item and area, while complying with legislative and safety requirements
- the acquisition of necessary equipment and materials and recruitment of skilled and capable personnel to undertake the tasks
- consideration of available written resources such as premises-specific standard operating procedures and plans for decontamination
- the development and adoption of an appropriate decontamination plan.

Every consideration should be given to using farm owners and staff on sites to be decontaminated. 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 to decontamination should be considered. Ambient temperature, solar radiation and time are excellent tools to use if organic material has been removed from heavily contaminated areas.

The following approach is recommended.

- inspect the premises and prepare a map of the premises
- start a logbook to record all events and recordings
- indicate areas not requiring decontamination
- indicate areas and sites requiring specific decontamination action (consult the officers in charge of infected premises, destruction, disposal, decontamination and epidemiology)
- list the actions needed in each area, in chronological order
- estimate a timeframe for the decontamination plan
- seek approval of the proposed decontamination plan from the local control centre (LCC) infected premises operations team manager; items (ie property) requiring disposal rather than decontamination should be clearly identified to the LCC and the owner of the item (property)
- confirm contractual arrangements with contractors, if used
- implement the agreed decontamination plan[30]
- submit a daily progress report to the LCC Operations function
- modify activities according to observations, practicalities and limitations to adapt to the situation as the response progresses.

A typical premises decontamination program comprises many of the same steps identified in Section 1.5, Section 4 and Figure 4.1:

- consideration of the EAD agent
- premises assessment
- preliminary disinfection
- gross clean (dry clean and wet clean)
- first disinfection
- first inspection
- second disinfection
- final inspection
- a proposed timeline.

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

Appendix 1.3 identifies equipment that may be used in premises decontamination.

[30] If decontamination/disinsection is required on an operational infected premises (IP), the infected premises site supervisor will assume management of the LCC Decontamination/Disinsection teams. For decontamination or disinsection not on an IP with an infected premises site supervisor, management will be maintained by the LCC Decontamination/Disinsection function.

8.3.2 Premises assessment

The initial premises assessment must be detailed thoroughly, as it will assist in planning decontamination of a premises and be used throughout the decontamination process. Photographs and videos are beneficial in capturing an accurate assessment of the premises to understand the extent of contamination and the appropriate decontamination approaches before decontamination procedures begin. Relevant details should be both documented and marked on the premises map and should include, but may not be limited to:

- all service utilities including overhead and underground cables and meter boxes; if appropriate, authorities should take meter readings for compensation purposes
- water supply
- drainage
- effluent systems including septic tanks
- decontamination sites both for personnel and vehicles/large equipment
- designated staff rest and eating areas
- residential areas, including offices and ablution facilities
- property entrance and exit points
- fodder stores
- specialist electrical equipment
- clean areas for unloading and transferring equipment
- structures and other items that may not be able to be decontaminated
- vehicles and equipment already on farm that may be used in the destruction, disposal and decontamination processes
- livestock handling facilities
- destruction and disposal sites
- prevailing winds and weather conditions
- environmentally sensitive areas.

The premises assessment should identify and record:

- what requires decontamination
- what does not require decontamination
- delineation between dirty and clean areas, where possible
- the condition of equipment, structures, vehicles and machinery (for compensation purposes)
- items that will be destroyed
- safety hazards
- items requiring special attention (see Section 8.5).

A thorough premises assessment will assist in planning decontamination of a premises.

It is important to clearly document the condition of the equipment and facilities before decontamination (or disposal if items cannot be decontaminated) is carried out. This may need to be undertaken by a qualified assessor or valuer.

8.3.3 Preliminary disinfection

The aim of preliminary disinfection is to rapidly reduce the amount and distribution of the EAD agent on contaminated premises, pending thorough disinfection after destruction and disposal are completed. The need for preliminary disinfection should be considered on a case-by-case basis and

may be undertaken when a risk assessment indicates benefits of spraying with a disinfectant to reduce the likelihood of inadvertent spread of the pathogen.

When applied, appropriate preliminary disinfection, and vector control should begin as soon as practicable after confirming presence of an EAD agent on the premises. Consideration should be given to the individual premises and include:

- the pathogen being targeted
- priority items for preliminary disinfection
- hazard identification and safety of undertaking the activity
- likely effectiveness of preliminary disinfection
- adverse effects of undertaking the activity
- management of owner or community perceptions
- resource requirements
- cost.

Preliminary disinfection may need to be undertaken in stages commensurate with risks and timing of planned decontamination activities. Attention must be paid to the roadway used for vehicle entrance and exit, overflows of animal effluent onto roadways or tracks and the areas around dwellings.

8.3.4 Gross cleaning

The aim of gross cleaning is to remove all organic matter (eg faecal material and dirt), 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 matter reduces the effectiveness of disinfectants. Encrusted faecal material, dirt and grease shield the underlying surfaces from the disinfectant.

Where appropriate, dry surfaces may be first vacuumed to remove dust and loose debris. Vacuum filters should be appropriately disposed of and the vacuum decontaminated following use.

Lightly soiled dry surfaces may be cleaned using a light application of water and detergent, with appropriate rinsing with clean water and drying. For specialised or sensitive electrical equipment, see Section 8.5.8.

Accumulations of faecal material, animal feed, litter, bedding and other gross contamination should be removed. This material will have been lightly disinfected if a preliminary disinfection was carried out. Gross cleaning of each building should start from the roof, working downwards.

All old insulation materials (eg polystyrene, fibreglass and press boards) should be removed for disposal, 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 disposal. All items 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 decontamination treatment.

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 foam-based cleaning products, using steam cleaners and scraping with hand tools while paying close 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 from visible contamination. Subject to risk assessment, earthen floors in buildings may need to be treated with disinfectant.

Animal feed and water troughs are to be emptied and cleaned out. Any effluent resulting from the cleaning process must be contained and managed.

8.3.5 First full disinfection

The need for disinfection depends on the EAD agent involved. Time, temperature and presence of ultraviolet light exposure (eg sunlight) may be sufficient to inactivate some EAD agents.

Where chemicals are to be used for the first full disinfection to inactivate the EAD agent, the process must be carried out systematically to ensure that areas that have been disinfected are not recontaminated by people or machinery.

The order of disinfection may depend on the type of product being used and the method of application. Industry standards should be followed. Use best practice in the application of disinfectants.

For example, for the initial, first disinfection, it is recommended to use a foam-based product because it allows for easy visual confirmation of coverage. The application sequence should proceed from high to low areas, starting with the roof, then the walls and floors, working from the farthest end of the building towards the entrance to minimise the risk of recontamination. Once a specific area has been treated and dry, it will not be obvious where the disinfected area starts and finishes. Each building or area should be cordoned off with marking tape and signage when disinfection is completed.

8.3.6 First inspection

The aim of the first inspection is to ensure that all tasks detailed in the premises assessment have been performed. The premises is to be inspected by the infected premises site supervisor or delegate. Depending on the EAD agent involved and the thoroughness of the first full disinfection, the first inspection may be the only inspection required.

The inspection should determine whether:

- all contaminated woodwork not able to be decontaminated has been completely disposed of
- all fixtures and fittings have been dismantled, if appropriate, so that no organic material remains
- there are no observable encrustations on any exposed surface
- all contaminated animal feed has been destroyed, and remaining material made safe
- all grossly contaminated sites (eg destruction and disposal sites) have been properly decontaminated
- all fluid that has been decontaminated has been appropriately disposed of
- decontaminated areas are appropriately identified
- the conditions of quarantine — especially at exit and entry points — and warning notices are being maintained.

At this first inspection, it is important to assess whether any biofilms or organic matter are likely to be present. If so, another decontamination process will be needed.

At this stage, environmental sampling (see Section 8.7.1) to assess the level of residual contamination may be considered. If contamination is still present, another decontamination process may be needed.

8.3.7 Second disinfection

An assessment of the need for a second disinfection should consider the EAD agent involved, the likelihood of its viability after the first disinfection, and any natural decontamination processes that may have inactivated the EAD agent.

If it is considered necessary, a second disinfection should be undertaken.

8.3.8 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, authorised officer not involved in an earlier inspection.

If there is evidence of residual contamination, remedial measures should be undertaken.

If the final inspection is satisfactory, the decontamination process is considered complete.

8.4 Decontamination of vehicles, equipment and machinery

In an EAD incident, the priority is to ensure that no vehicle leaves a contaminated site without an appropriate level of decontamination.

For most EADs, vehicle movement onto and off contaminated sites should be minimised, because contaminated vehicles used to haul livestock, waste items and animal feed or products can spread the disease, as can their drivers. Vehicles that have already left the premises or have been in contact with the disease agent should be identified and, if required, decontaminated.

If the number of vehicle movements on and off a contaminated site warrants it, a local site with a hard standing, appropriate wastewater containment or drainage and a reliable good water supply should be designated as a local vehicle disinfection station. Provided appropriate biosecurity measures can be put in place, a car or truck wash is ideal for secondary decontamination of vehicles if one is conveniently located.

Vehicles can be divided into 4 broad categories:

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

Generally, the procedure to be followed is:[31]

- undertake a risk assessment in terms of work health and safety and appropriateness of decontamination measures to be undertaken
- familiarise staff with vehicles, equipment and machinery to be decontaminated and the areas that need special attention
- remove excess soil and organic matter from the vehicle

[31] Nationally Agreed Standard Operating Procedure — Decontamination of large equipment

- undertake preliminary disinfection of external surfaces of the vehicle, if warranted
- remove remaining gross contamination from the vehicle
- undertake cleaning, starting at the top and working down, depending on the equipment or machinery and noting that some vehicles (eg milk tankers) may require specialised equipment to enable a thorough clean
- vacuum the vehicle floor and spray and wipe all cabin surfaces with appropriate disinfectant
- apply insecticide to the inside of the cabin, if applicable
- apply disinfectant to the remaining parts of the vehicle and leave disinfectant for recommended contact time before rinsing with clean water
- inspect vehicles, equipment and machinery for appropriate decontamination.

Jurisdictional standard operating procedures should be consulted for detailed plans and procedures. Appendix 1.4 identifies equipment that may be used to decontaminate vehicles.

8.4.1 Livestock vehicles

Vehicles used to transport susceptible livestock present a high potential for pathogen dissemination because of high levels of gross contamination. Vehicles used to transport infected animals present an especially high risk of spreading pathogens between premises.

For any vehicle known to have carried susceptible livestock, the principles of decontamination are the same as outlined in Section 8.4.

Livestock transport vehicles require special attention and may require dismantling or specialist equipment or mechanical services for thorough decontamination. Specific vehicles may require SOPs and risk assessments to be developed.

Specialist advice may be required for sensitive electrical or mechanical parts.

8.4.2 Milk tankers

Milk tankers can become contaminated and disseminate disease organisms through:

- picking up infected milk from a dairy farm during the disease incubation period
- mechanical means (by vehicle and driver)
- spillages of milk from the hose fitting during collection at the farm or delivery at the factory.

Every dairy factory has a disinfection point for tankers and drivers. Disinfectants used during routine cleaning include alkalis (sodium hydroxide and potassium hydroxide), acids (nitric acid, phosphoric acid, sulfamic acid) and chemical sanitisers (peracetic acid and hydrogen peroxide). Cleaning and sanitisation protocols with specific chemical concentrations and temperatures follow food safety standards.[32]

Most company food safety programs require the tanker to be cleaned at least once every 24 hours when in use and be rewashed before use if it sits idle for more than 18 hours or after carrying a contaminated load. The tankers have automatic internal washing mechanisms, typically employing a range of alkaline and acid detergents and sanitisers. This process must have regular maintenance every 6 months. The external surfaces of the tanker must be cleaned every 24 hours or more frequently as required using truck wash facilities.

[32] https://www.foodstandards.gov.au/publications/aguidetostandard424p5768

When picking up milk in a designated area, tankers must be cleaned and disinfected on and off any potentially contaminated premises, with particular attention to wheels and hose inlets. Tanker exhaust vents must be fitted with hydrophobic membrane-type filter elements rated at 0.2 µm to prevent aerosolisation of milk.

Any milk spillage must be confined, cleaned and disinfected. The vehicle and driver must be decontaminated before leaving a premises.

If it is determined that a tanker is carrying EAD-contaminated milk, the milk must be treated accordingly. In the case of foot-and-mouth disease virus, approved heat treatments include 72 °C for at least 15 seconds, applied once if the pH is less than 7.0 and twice if the pH is greater than 7.0 (World Organisation for Animal Health (WOAH) Article 8.8.35).[33]

However, if it is decided that this milk may not be processed, the tanker must be unloaded at an approved disposal site, the milk decontaminated (treated or otherwise processed to inactivate the disease agent) at the disposal site and the exterior of the tanker decontaminated. The interior of the tanker along with all hoses and fittings must also be decontaminated at an approved site. Disposal of waste must be in accordance with a protocol that has been approved by the relevant response agency.

The principles of vehicle decontamination provided in Section 8.4 must be observed (see also the **AUSVETPLAN enterprise manual *Dairy (cattle) industry***).

8.4.3 Animal feed delivery vehicles

The visits of animal feed delivery vehicles to a contaminated premises will be identified from tracing or 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, the area of possible contamination and contact with susceptible animals may need to be identified.

When a vehicle has been detained because of potential contamination, it should be decontaminated in the same way as a livestock vehicle (see Section 8.4.1). If a tracing or epidemiology report identifies contaminated bulk or bagged animal feed that has been carried by the vehicle, residual material in the vehicle must be removed for treatment and/or disposal and the vehicle decontaminated.

If it is necessary on animal welfare grounds or in a mixed animal enterprise to allow an animal feed vehicle onto a contaminated, or potentially contaminated, premises then, depending on the pathogen and if 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. Where this is not practical, the driver's route within the premises should be specified to minimise contamination of the vehicle and, if appropriate, the vehicle and driver must be thoroughly decontaminated before being allowed to move off.

8.4.4 Aircraft decontamination

The type of aircraft, its use, and risk assessment will determine if it needs decontamination. Advice from aircraft manufacturers and use of specialist cleaning contractors may be required.

[33] https://www.woah.org/fileadmin/Home/eng/Health_standards/tahc/2016/en_chapitre_fmd.htm#article_fmd.35.

A recent advancement in the aviation industry has been the use of ultraviolet light wands to aid in the disinfection of internal surfaces of aircraft The UV wand uses 222 nanometre UVC light, which has been shown to effectively inactivate pathogens everywhere the light can reach.[34]

The wands can pass UV light over high-touch surfaces and specialised equipment and may have applications for other industries, including agriculture.

8.4.5 Machinery and equipment

Specialist advice from machinery and equipment manufacturers, contractors or owners may be required to determine the most appropriate method of decontamination.

Secondary decontamination may need to occur offsite. Disassembly may be required for thorough decontamination, and the impact of decontamination on machinery servicing should be assessed.

Thermal and natural decontamination in lieu of chemical decontamination may be considered for some diseases.

8.5 Issues needing special consideration

8.5.1 Animal destruction site

The animal destruction site will likely have a high level of pathogen contamination. Animal destruction sites may include permanent or temporary pens, stockyards, crushes and buildings. More information on animal destruction sites is available in the **AUSVETPLAN operational manual *Destruction of animals***.

The purpose of decontaminating the animal destruction site is to reduce the overall pathogen load and therefore reduce the opportunity for the pathogen to be moved off the premises through mechanical or aerosol spread. The frequency and intensity of disinfection will be determined by an ongoing risk assessment considering many factors including necessity, cost, time to complete, available infrastructure, chemical cleaners and disinfectants, weather and safety.

An important consideration when decontaminating destruction areas is not to render the area unsafe for ongoing destruction operations (eg by creating slippery surfaces).

Infrastructure used for carrying out the destruction operation must be either disposed of or decontaminated (eg contaminated hay/straw bedding will need to be disposed of, whereas metal animal holding yards can be cleaned and disinfected).

8.5.2 Disposal site

The disposal site will also likely have a high level of pathogen contamination and will require active management as part of decontamination activities. The method of disposal and risk assessment will dictate the frequency, type and intensity of decontamination required.

[34] https://faruv.com/boeing-and-far-uv-technologies-enter-a-licensing-agreement-for-ultraviolet-wand-technology/#:~:text=The%20far%20UV%20wand%20is,nanometer%20UVC%20inactivates%20pathogens%20effectively

For example, burial sites may require some spraying of disinfectant in areas where carcasses have come in contact with the ground. The carcasses may be lightly sprayed at the end of each day (ie top of the burial pit) before being backfilled with soil or some absorbent carbon material.

On-farm burning and composting activities will also require some general decontamination of access roads and work areas but because they rely on pathogen inactivation by heat (albeit differing temperatures) the requirement will be different.

A broad general disinfection of the disposal site and access roads may also occur at the completion of the disposal process to reduce the overall likelihood of potential pathogen spread.

8.5.3 Pest and wild animal control

While decontamination is undertaken, pest control (eg rodents, insects, pest animals, wild animals) may be implemented if it is thought necessary to limit pathogen spread.

8.5.4 Animal effluent

Animal effluent can be categorised as liquid animal effluent or solid animal effluent. Liquid animal effluent is defined as faeces and urine from animals, mixed with process water, wash-down water, contaminants and sludge but excluding solid animal effluent. It is frequently referred to as slurry. Liquid animal effluent is usually associated with intensive animal industries such as dairy and pig industries.

Solid animal effluent includes solid excreta from animals. Such material cannot be pumped and sprayed. It includes bedding material and manure but not dead animals or animal parts.

The treatment and disposal of animal effluent should be undertaken in consultation with environmental protection agencies.

8.5.4.1 Liquid animal effluent (slurry) — general considerations

An epidemiological risk assessment will guide the appropriate approach to manage liquid animal effluent. In many cases the most practical approach will be to allow for natural decontamination to occur through the passage of time, exposure to environmental elements and natural degradation through biological processes. This approach may be most attractive where the cleaning and disinfection, sentinel animal, and 'fallowing' phases of a disease eradication campaign may take several months.

When chemical or heat treatment is required, the volume and nature of the effluent should be assessed, (temperature, pH, major nutrients, level of organic matter) in conjunction with forecasted environmental conditions and existing infrastructure to determine the most practical options. Consideration should be given to the effect chemical decontaminants may have on the resultant microbial activity and whether the effluent would recover sufficiently to be active for use once restocking is allowed, or whether the effluent would need to be disposed of. Guidance should be sought from the jurisdictional environmental protection authority, land manager and subject matter experts. Consideration must be given to the final product characteristics (eg pH, water content, solid content) and the proposed disposal method and location.

Details on inactivation of specific pathogens is provided in Section 9 and in specific **AUSVETPLAN response strategies**.

8.5.4.2 Effluent vessels (ponds, slurry tanks, pit drains etc)

Where liquid animal effluent is collected in an effluent pond or other vessel, the most practical approach will likely be to allow for natural decontamination/degradation processes. The length of time will depend on the disease agent, so refer to individual **AUSVETPLAN response strategies**. This natural degradation process could occur within the effluent pond or other vessel or when applied onto land through existing irrigation infrastructure, provided that the potential for pathogen spread can be appropriately mitigated, including with respect to wild and feral animals. Dilution of effluent water with clean irrigation or wash-down water should also reduce the likelihood of disease spread.

Before using chemicals for decontamination, consideration must be given to chemical availability, cost, effectiveness, approvals for use (ie Australian Pesticides and Veterinary Medicines Authority permit), facilities, ability to achieve chemical homogeneity throughout the vessel, disposal and environmental issues, application requirements and workplace health and safety. The implications of any of these issues may mean chemical use is not feasible.

Discharging manageable quantities of effluent into vessels where chemicals can be evenly applied may be a theoretical option, however, this would require case-by-case assessment and may be impractical from a time, cost or effort perspective.

If it is decided to treat effluent, the amount of spare vessel space and accessibility will inform the course of action. If the vessel is almost full, a secondary vessel into which slurry can be pumped for treatment can be used. Solids and suspended matter should be separated using screens and sediment traps or multiple vessels.

When mixing chemicals with slurry, a slurry tanker pump or agitator should be used, with the slurry kept at the required condition (eg temperature, pH, chemical concentration) for the appropriate time to inactivate the pathogen.

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 the following:

- agitation of effluent slurry can release a mixture of carbon monoxide, carbon dioxide, hydrogen sulfide, 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 levels 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.

Wastewater may require chemical treatment or decanting into a second vessel to allow natural decontamination to occur. Solid matter, including residual vessel sludge, may be chemically treated or disposed of at an approved disposal site. Composting offers a viable onsite or offsite disposal option for such solids.

Areas where contaminated slurry has been spread or disposed of prior to disease recognition on the premises, and the associated potential for pathogen spread, should be identified.

8.5.4.3 Solid animal effluent (manure)

An epidemiological assessment will guide the appropriate approach to management of manure.

Allowing manure to remain in situ may be adequate for decontamination by natural means. Similarly, spreading of manure on land for natural decontamination may be considered, provided the potential for pathogen spread can be appropriately mitigated, including with respect to wild and feral animals.

Manure may be decontaminated as part of the disposal process — for example, through composting. High pathogenicity avian influenza virus (H7N1) can be inactivated within the first 24 hours of composting (Elving et al 2012). Similarly, heat treatment has been demonstrated (through heat treatment of manure in transport trailers) to be effective for inactivating some viruses such as porcine reproductive and respiratory syndrome (PRRS) virus (Linhares et al 2012). Similarly, Turner et al (1998), reported that African swine fever virus levels in swine slurry were reduced to below detectable levels within 90 seconds at 56 ˚C.

Other means of decontaminating manure (eg aerobic digestion/aeration and anaerobic digestion) should be assessed on their known or anticipated efficacy.

8.5.5 Dairy equipment and milk storage tanks

Decontamination methods for milk held in bulk tanks on contaminated premises depends on the disease. Dairy technical specialists may be consulted to determine an appropriate approach to decontamination of specialist dairy equipment.

If the milk must be disposed of, it should be made safe with a disinfectant, which is added to the milk and agitated. The milk is then held (while agitating to prevent coagulation and enable chemical homogeneity) to achieve the desired pH, temperature or chemical concentration before being disposed of. Refer to Section 9 for details of specific diseases, and see the **AUSVETPLAN operational manual *Disposal*** for further information on milk disposal.

Milking machines should be cleaned using a 'clean-in-place' chemical cleaning regime using chemicals, heat. pH modifiers and mechanical actions (eg surged air wave formation), and can be followed by sanitiser. Exteriors of units can be cleaned with sanitiser if there is a need to remove external contamination (such as organic matter).

8.5.6 Milk

Milk may need to be decontaminated in the management of foot-and-mouth disease (FMD), lumpy skin disease (LSD) and *Brucella abortus*. Milk does not pose a disease transmission risk for other EADs.

With respect to anthrax, in milk, the vegetative organism of *Bacillus anthracis* dies spontaneously; it is not able to sporulate (Minett 1950, Turnbull et al 1991, Bowen & Turnbull 1992, Lindeque & Turnbull 1994). Vegetative bacilli die out in milk over a period of 24 hours at 5–9 °C, and faster at higher temperatures. They cannot sporulate in milk (Bowen & Turnbull 1992).

For FMD, LSD and brucellosis, further details on milk decontamination are provided in Table 9.3.

8.5.7 Animal feed

An epidemiological and risk assessment will assist with determining if animal feed needs to be decontaminated or disposed of. Factors to consider are timing of harvest, types of storage and access or exposure to contamination by people, animals and machinery.

The destruction of large quantities of animal feed is expensive, but the labour cost of treating the animal feed may outweigh the benefits of keeping it. Depending on the disease agent involved, keeping the animal feed or treating it may be judged too great a risk, especially when the source of the disease is unknown and contaminated animal feed cannot be ruled out as the origin. However, most EAD agents degrade under natural conditions, so in some cases animal feed can be effectively decontaminated through quarantine for a period and under conditions determined by epidemiology.

8.5.7.1 Hay and straw

In some cases, contaminated hay or straw may be used to complement onsite disposal activities through its use as a carbon source for composting or as an adsorbent when incorporating with carcasses for on-farm burial.

8.5.7.2 Grains

Grain storage specialists may be consulted to determine appropriate decontamination methods and safety aspects associated with operations. A risk assessment should consider the type of storage system, timing of harvest and storage and the intended end use of the stored grain (eg for animal feed versus for other use). The Grains Research and Development Corporation's grain storage fact sheet provides a guide to grain fumigation.[35] Fumigants may include formaldehyde gas (see Appendix 2) and glycolic acid (eg Fumagri® HA).

For bagged animal feed, the likelihood of contamination will depend on whether bagged animal feed has been opened, the type of packaging material used (eg porous or nonporous) and where and how animal feed has been stored.

For grain silos, a risk assessment should be carried out. It should consider the attributes of the disease agent, temperature, the dry environment of a silo, and the interval until the animal 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 6.1.4 and Appendix 2).

If epidemiological investigations suggest that the grain may be contaminated and cannot be repurposed, the silo must be emptied completely, the contents disposed of, and the inside and outside of the silo decontaminated.

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

8.5.7.3 Silage bales and clamps

Well-made grass silage should reach a pH of 3–4 and thus inactivate most EAD agents; therefore, sealed silage bales and clamps should not require extensive decontamination. A risk assessment

[35] https://www.grdc.com.au/__data/assets/pdf_file/0025/142567/grdc-gsfs-14_grainfumigationguide_lr-pdf.pdf.pdf

should determine the level of contamination of exposed silage clamp faces. In some cases, removing and disposing of the exposed silage face and resealing may be adequate.

8.5.8 Specialised equipment

Some premises 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. If there are concerns about the use of chemicals on equipment, consideration should be given to the use of nonchemical decontamination — for example, thermal inactivation (natural or introduced), exposure to sunlight, a UV wand that uses 222 nanometre UVC light and the passage of time.

8.5.8.1 Electric motors and switchboards

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

A practical method of decontamination is to make an airtight fumigation '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 6.1.4 and Appendix 2).

Because many EAD viruses will eventually inactivate via natural decontamination processes, this may be the most practical and possible option for complex equipment.

8.5.8.2 Small electrical equipment including mobile phones

Small electrical items, including mobile phones, are useful on contaminated, or potentially contaminated, premises operations for communication and for recording epidemiology and valuation data. All can be used while secured inside plastic watertight bags to avoid contamination. Inexpensive waterproof cameras can be used to record lesions and other clinical signs of disease.

If such equipment is to be removed from a contaminated, or suspect contaminated premises, 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 equipment with disinfectant
- place the equipment in a new watertight plastic bag for removal after the surface of the bag has been disinfected.

Because there is a small residual risk of contamination, these items of equipment should only be used on specific premises.

8.5.8.3 Captive-bolt devices and firearms

Captive-bolt devices and firearms that have been used in destruction operations may retain remnants of EAD pathogens and will require careful decontamination. To ensure the ongoing safety and integrity of these tools, the manufacturer's instructions must be followed for any cleaning and disinfection, as opposed to using the general disinfectant advice options for the specific pathogen. The cleaning process for the removal of dirt and carbon residue will ensure that the likelihood of pathogen spread is reduced. Captive-bolt devices may be banned in some situations — for example. when prions are suspected.

When captive-bolt devices and firearms are required on multiple properties, they can be cleaned, bagged or double-bagged, disinfected (on the outside of bags) and then safely moved to the next premises. If disinfectant/alcohol wipes are used for cleaning and disinfecting such surfaces, these surfaces must be properly oiled using oil recommended by the manufacturer. When devices cannot be safely cleaned using chemical disinfectants, alternative treatments such as drying or heating in the sun should be considered.

8.5.9 Wool, hides and skins

8.5.9.1 Wool

Wool itself, and any material in which it is packed for transport and storage, presents a potential risk for the transmission of certain EAD pathogens (albeit a very low risk). The diseases of greatest concern are FMD, sheep and goat pox, peste de petit ruminants (PPR), Rift Valley fever, and anthrax.

There are 3 situations in which wool and wool bales may require consideration for decontamination during an EAD response:

- disease diagnosed at shearing
- disease diagnosed after shearing
- disease diagnosed when wool bales have left the premises and are in transport, in store or otherwise held.

8.5.9.2 Disease diagnosed at shearing

If disease is diagnosed at shearing, the premises will be managed as an infected premises (IP), and the procedures detailed in this manual to deal with an IP will apply. The main considerations will be:

- decontamination of the shearing shed infrastructure
- management of animal waste (eg manure)
- disposal/appropriate treatment of contaminated wool
- decontamination of shearing teams, vehicles, clothing, PPE, equipment and dogs
- managing the biosecurity risks of the shearing team's future work commitments.

8.5.9.3 Disease diagnosed after shearing

If disease is diagnosed after shearing, an epidemiological assessment 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, no further decontamination

action is required. When movement controls allow, the bales may be removed from the premises as per the movement controls specific to the relevant EAD response.

If wool bales are on the premises and it is determined that the disease existed at the time of shearing, the bales must be decontaminated, destroyed or stored in a secure, isolated area onsite to limit the potential of further pathogen spread.

8.5.9.4 Wool bales in store

If baled wool is deemed to be contaminated, the source and destination of the bales (if moved) will be subject to appropriate controls to limit the potential of further spread and inactivate the EAD agent.

Wool bale decontamination guidance is found in the **AUSVETPLAN resource document *Operational guidance on the decontamination of wool and wool facilities*** and the **AUSVETPLAN enterprise manual *Wool industry*.** The 5 key processes and activities that may be undertaken to decontaminate wool and wool packaging are:

- storage
- scouring[36]
- fumigation
- chemical treatment
- bale spraying.

Decontamination methods for wool facilities should include options suitable for the buildings and all equipment used for wool handling or that comes in contact with wool.

8.5.9.5 Hides and skins

Decontamination methods for hides and skins on premises known or suspected to be contaminated depends on the disease. In many cases, the usual chemical and mechanical processes used in the tanning industry will be sufficient to inactivate EAD-causing agents. The WOAH *Terrestrial animal health code*[37], relevant **AUSVETPLAN response strategies** and the Scott Williams report[38] provide guidance for the effective decontamination of many EAD agents in hides and skins.

8.5.10 Water tanks and dams

Risk and epidemiological assessments will guide the appropriate approach to management of water tanks and water-filled dams.

In some cases, no action will be required other than to allow for natural decontamination. Decontamination through disposal or dispersal of water through regulated pathways (eg through town water sewage systems or by land application respectively) may be a practical approach on the advice of regulatory agencies, including environmental protection agencies.

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[36] For FMD and PPR viruses, scouring should be as in accordance with the WOAH *Terrestrial animal health code* Articles 8.8.32 and 14.7.24 respectively. The time to undertake the scouring may vary between processors, but as an indicator, a 6-bowl scour takes 1 minute per bowl with a 15 second 'squeeze' between bowls (Dawes, personal comm. 2023).

[37] https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=sommaire.htm

[38] https://animalhealthaustralia.com.au//wp-content/uploads/dlm_uploads/Persistence_of_Disease_Agents_Report_Web_20170413-1.pdf

When intervention is required because the potential for pathogen spread without intervention is considered too high, the volume, EAD agent, impurities (eg organic matter), environmental conditions (including weather, climate, soil type/lining of dam etc) and logistical requirements (eg chemical suitability, chemical availability, cost and needs of application) must be identified.

Tables 9.1–9.4 provide advice on appropriate decontaminants and processes for the range of EADRA-listed EADs.

8.6 Other considerations

8.6.1 Managing people on suspect premises

If there is no legal requirement forcing a person to remain on a suspect premises, an authorised officer/ inspector can direct them to undertake decontamination, if appropriate, before leaving.

If a person has to leave a suspect premises and decontamination is considered necessary, showering and dressing in clean clothes and clean footwear will reduce the likelihood of pathogen spread.

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

- the name, address and occupation of the person concerned
- the degree of contact between the person and the suspected disease agent
- the reason for their need to leave, and location they are travelling to
- the need to shower or change clothes and footwear if possible
- advice on the most appropriate cleaning and disinfection procedures, including chemical use.

8.6.2 Access by emergency services to contaminated premises

During an EAD incident it may be necessary for emergency services such as fire, police, ambulance and state emergency services to enter a quarantined/biosecurity-controlled area to respond to a reported incident (for example, a 000 call). It is essential that these agencies can perform their normal emergency response roles while on a quarantined/biosecurity-controlled premises. Performance of emergency response duties should always prioritise the preservation of human life and, especially in the case of potential zoonotic diseases (eg Hendra virus, high pathogenicity avian influenza), a risk assessment should be made, and actions planned to eliminate or minimise the exposure of emergency personnel. In some urgent circumstances, normal biosecurity protocols may need to be abandoned. A risk assessment should determine the subsequent disinfection procedures required. In such cases, it may be necessary to decontaminate at a site remote from the quarantined premises (eg at a hospital).

Wherever possible, emergency services should try to minimise the likelihood of spreading pathogens from a quarantined/biosecurity-controlled site by following appropriate decontamination procedures.

Wherever possible and practicable, the control agency should notify emergency services of the location of quarantined properties and areas and the nature of the disease agent present. This notification should include details of any human risks associated with the disease agent, recommended PPE, appropriate decontamination procedures, and suitable decontamination chemicals. Agencies may choose to modify their normal response procedures to reflect the risk.

Wherever possible, minimise the number of personnel, items and vehicles allowed to enter a quarantined/biosecurity-controlled premises. Upon leaving a quarantined/biosecurity-controlled premises, emergency services may need to decontaminate uniforms/clothing, PPE, vehicles and equipment. Response staff may be onsite to assist in this process or alternatively advice should be sought on how this may be best achieved. Even after only superficial decontamination, all emergency services personnel entering a quarantined/biosecurity-controlled premises should shower, wash hair, change clothes and footwear and observe an appropriate self-quarantine period before any contact with susceptible animals to avoid the risk of spreading the pathogen. Advice should be sought from the response agency as to what this time may be for different diseases.

8.7 Demonstrating decontamination process is complete

This manual covers only decontamination in field situations and includes no procedures for 'proof of decontamination'. The relevant **AUSVETPLAN response strategy** should be referred to for such procedures, including conditions for restocking or alternative farm uses. The disease response strategy will also address procedures for recognition of Australia's animal health status following an EAD incident.

It is rare that 100% decontamination can be attained or proven in field situations, and infectivity testing for EAD agents is undertaken in the field using sentinels. Laboratory infectivity testing is not routinely undertaken.

In many cases, gross contamination can be removed effectively, but the final phase will involve time and the natural elements of heat (ambient temperature), desiccation and solar radiation to achieve the desired goal. The conservative decontamination procedures recommended here are likely to be matched by the conservative approaches of relevant authorities when considering restocking.

8.7.1 Environmental sampling for biological material

In some circumstances, it may be practical to verify the decontamination effectiveness by environmental surface sampling of animal housing and other surfaces (eg floors, walls, drinkers, feeders and other equipment). Swabs can be used to collect samples for microbial analysis, microbial load or virus isolation. Depending on the disease situation, various sampling methods and laboratory tests can be performed.

Consideration should be given to the use of onsite adenosine triphosphate (ATP) testing. ATP testing is a rapid testing method used to quickly assess the cleanliness of surfaces by detecting the presence of biological materials. It has the advantage of providing rapid feedback on the standard of decontamination and can highlight areas that may require additional attention.

Care must be taken when interpreting the results given that variability in sampling locations, frequency, type, calibration of equipment and tests, and proficiency of the user may introduce errors into this process.

9 Decontamination strategies for specific EAD agents

9.1 Chemical handling

Cleaning and disinfection are labour-intensive and potentially dangerous activities depending on the chemicals being used. All chemicals must be handled with care, especially 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 whenever possible. They have the required equipment, trained (and in some cases licensed) 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.

9.2 Chemical choice

When choosing a chemical disinfectant, the following should be considered:

- availability
- spectrum of activity (ie effective against the disease agent)
- product brochure (information), Australian Pesticides and Veterinary Medicines Authority (APVMA) permit or registration
- speed of action (eg fast acting; short contact time)
- the required concentration
- application method
- ease of use
- activity in the presence of organic matter
- toxicity to the user, animals or plants
- surface compatibility — it should not corrode metallic surfaces and should not cause the deterioration of cloth, rubber, plastics, and other materials
- stability in concentrate, on dilution and in storage
- residual effect on treated surfaces
- compatibility with other chemicals
- cost effectiveness
- environmental impacts.

The chemicals identified in this manual have been chosen because:

- they are effective against the range of emergency animal disease (EAD) agents of concern to Australia
- 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 peroxymonosulfate compounds
- 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 infected premises (IP) or dangerous contact premises, followed by appropriate dilution

- most are effective as technical grade chemicals but all require an APVMA permit for use against EADs.

To determine what chemicals can be used against EADs during a disease outbreak in Australia, search the APVMA permit database for the disease agent.[39] Safety data sheets are available through Safe Work Australia[40], ChemCERT[41] and the chemical manufacturer.

Special approval will be required (eg APVMA emergency use permit approval, chief veterinary officer approval) to use chemicals against disease agents when the chemicals do not have current APVMA permits or registration approval for the proposed use. It is prudent to check the APVMA website for new or additional products and label applications and permits.

9.2.1 Selecting the appropriate chemical decontaminant

Tables 9.1–9.4 are used to select a chemical to decontaminate a range of commonly contaminated items for each disease or group of diseases. All chemicals listed in these tables are available in Australia.

Table 9.1 is an alphabetical list of all the Emergency Animal Disease Response Agreement (EADRA)-listed diseases and indicates where further information is found — in Table 9.3 or 9.4. Diseases shown in bold have an **AUSVETPLAN disease-specific response strategy**.

Table 9.2 is a key to the chemical classes and groups mentioned in Tables 9.3 and 9.4.

Table 9.3 shows decontamination approaches for key EADRA-listed EADs. Some diseases/agents are grouped if they require the same or a very similar disinsection/decontamination strategy. For each item to be decontaminated, refer also to Sections 8.3–8.5.

Table 9.4 shows available information for the remaining EADRA-listed EADs.

Table 9.1 EADRA-listed emergency animal diseases and location of further information

Disease	Table	Row
African horse sickness	9.3	1
African swine fever	9.3	2
Anthrax	9.3	3
Aujeszky's disease	9.3	4
Australian bat lyssavirus	See Lyssaviruses	
Avian influenza	9.3	5
Bluetongue	9.3	6
Borna disease	9.4	1
Bovine spongiform encephalopathy	9.3	7
Bovine tuberculosis (due to *Mycobacterium bovis*)	9.4	19

[39] https://portal.apvma.gov.au/permits
[40] https://www.safeworkaustralia.gov.au/safety-topic/hazards/chemicals/safety-data-sheets
[41] https://www.chemcert.com.au

Disease	Table	Row
Brucellosis (due to *Brucella abortus*)	9.4	20
Brucellosis (due to *Brucella melitensis*)	9.4	21
Classical scrapie	9.3	8
Classical swine fever	9.3	2
Contagious bovine pleuropneumonia	9.4	26
Contagious equine metritis	9.4	22
Dourine	9.4	29
East Coast fever (theileriosis)	9.4	30
Encephalitides (tickborne)	9.4	2
Epizootic lymphangitis	9.4	23
Equine babesiosis (equine piroplasmosis)	9.4	31
Equine encephalomyelitis (western, eastern and Venezuelan)	9.4	3
Equine encephalosis	9.4	4
Equine influenza	9.3	9
Foot-and-mouth disease	9.3	10
Getah virus	9.4	5
Glanders	9.4	24
Haemorrhagic septicaemia	9.4	25
Heartwater	9.4	27
Hendra virus	9.4	6
Infectious bursal disease (hypervirulent form)	9.4	7
Influenza A viruses in swine	9.4	8
Japanese encephalitis	9.4	9
Jembrana disease	9.4	10
Lumpy skin disease	9.3	12
Lyssaviruses	9.3	14
Maedi–visna	9.4	11
Menangle virus (porcine paramyxovirus)	9.4	12
Nairobi sheep disease	9.4	13
Newcastle disease	9.3	11
Nipah virus	9.4	14
Peste des petits ruminants	9.3	13

Disease	Table	Row
Porcine epidemic diarrhoea	9.3	15
Porcine respiratory and reproductive syndrome	9.4	15
Potomac fever	9.4	28
Pulmonary adenomatosis (ovine)	9.4	16
Rabies	See Lyssavirus	
Rift Valley fever	9.3	16
Rinderpest	9.3	13
Screw-worm fly	9.3	17
Sheep pox and goat pox	9.3	12
Sheep scab	9.4	34
Surra	9.4	32
Swine vesicular disease	9.3	18
Teschen disease (enterovirus encephalomyelitis)	9.4	17
Transmissible gastroenteritis	9.3	19
Trichinosis (trichinellosis)	9.4	33
Vesicular exanthema	9.3	18
Vesicular stomatitis	9.3	20
Wesselsbron disease	9.4	18

Note: Diseases shown in bold have an AUSVETPLAN disease-specific response strategy.

Table 9.2 Chemical decontaminant

Chemical decontaminant
Soaps and detergents
Oxidising agents: a. Sodium hypochlorite b. Calcium hypochlorite c. Peroxymonosulfate compounds (eg potassium peroxymonosulfate mixed with sodium dodecylbenzenesulfonate, sodium chloride and inorganic buffers)
Alkalis: a. Sodium hydroxide (caustic soda) (NaOH) b. Sodium carbonate: anhydrous (Na_2CO_3), washing soda ($Na_2CO_3.10H_20$)
Acids: a. Hydrochloric acid b. Citric acid

Chemical decontaminant
Aldehydes: a. Glutaraldehyde b. Didecyldimethylammonium chloride, alkyldimethylbenzylammonium chloride and glutaraldehyde c. Formalin d. Formaldehyde gas
Insecticides: a. Organophosphates b. Synthetic pyrethroids c. Ivermectin d. Aluminium phosphide
Alkaline hydrolysis
Peroxygen compounds a. Hydrogen peroxide b. Peracetic acid
Other chemical agents a. Quicklime / chloride of lime b. Sodium dichlorisocyanurate c. Activated chloramine d. Biguanides e. Iodophors f. Quaternary ammonium compounds g. Phenolics

Table 9.3 Chemicals and procedures for key EADs[42]

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
1	African horse sickness (Category C virus)	General	Inactivated by formalin (0.1%) for 48 hours, β-propiolactone (0.4%), binary ethyleneimine or radiation Resistant to lipid solvents such as ether Inactivated by acetic acid (2%), potassium peroxymonosulfate/sodium chloride (1%) and sodium hypochlorite (3%)[43]
		Carcasses	Disposal
		Animal housing / equipment	Oxidising agents, acids (only necessary if contaminated with blood) and organophosphates or synthetic pyrethroids for insect control
		Environment	Oxidising agents, acids (only necessary if contaminated with blood) and organophosphates or synthetic pyrethroids for insect control
		Personnel	Soaps and detergents, citric acid, peroxymonosulfate compounds (not approved for use on skin; beware of WHS issues for skin contact)
		Water (tanks, dams)	Decrease insect vector habitat
		Animal feed	Dispose of if contaminated with blood
		Effluent, manure	Insect control: organophosphates or synthetic pyrethroids
		Human housing, machinery, vehicles	Oxidising agents, acids if necessary (only necessary if contaminated with blood)
		Clothing	Oxidising agents, acids

[42] Always read the manufacturer's label before use.
[43] https://www.woah.org/app/uploads/2021/09/african-horse-sickness-1.pdf

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
2	African swine fever (ASF) [44,45] Classical swine fever (CSF) (Category A virus)	General	ASF: • Susceptible to ether and chloroform • Inactivated by 8/1000 sodium hydroxide (30 minutes), hypochlorites — between 0.03% and 0.5% chlorine (30 minutes), 3/1000 formalin (30 minutes), 3% ortho-phenylphenol (30 minutes) and iodine compounds • Disinfectant activity may vary depending on the pH, time of storage and organic content[46] CSF: • Susceptible to ether, chloroform, β-propiolactone (0.4%) • Inactivated by sodium hypochlorite, phenolic compounds, QACs and aldehydes, chlorine-based disinfectants, cresol (5%), sodium hydroxide (2%), formalin (1%), sodium carbonate (4% anhydrous or 10% crystalline, with 0.1% detergent), ionic and nonionic detergents, and strong iodophors (1%) in phosphoric acid[47]
		Carcasses	Disposal
		Animal housing / equipment	Soaps and detergents, then oxidising agents, alkalis, citric acid, glutaraldehyde/QAC or peroxymonosulfate compounds (APHIS 2023, Shirai et al 2000)
		Environment	ASF: Consider organophosphates or synthetic pyrethroids for tick eradication, otherwise not applicable
		Personnel	Soaps and detergents, peroxymonosulfate compounds (not approved for use on skin; beware of WHS issues for skin contact)
		Water (tanks, dams)	Drain tanks Not applicable to dams
		Animal feed	Disposal

[44] APVMA PER88135 details a variety of disinfectants for the treatment of equipment, fabric and surfaces in case of an outbreak of ASF or CSF.
[45] Juszkiewicz et al (2020); Beato et al (2022)
[46] https://www.woah.org/app/uploads/2021/03/a-african-swine-fever-v2-0.pdf
[47] https://www.woah.org/fileadmin/Home/eng/Animal_Health_in_the_World/docs/pdf/Disease_cards/CLASSICAL_SWINE_FEVER.pdf

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Effluent, manure	Disposal, alkalis, citric acid
		Human housing, machinery, vehicles, clothing	Soaps and detergents then oxidising agents, alkalis or citric acid
3	Anthrax[48] (gram-positive bacteria — spore forming)	Carcasses	Dispose of, including contaminated soils/bedding etc. Require special disposal conditions (eg burning) and ensure use of PPE to prevent human infection
		Milk	Vegetative bacilli die in milk over 24 hours
		Animal housing / equipment	Oxidising agents, aldehydes, or hydrogen peroxide, followed by soaps and detergents, followed by aldehydes, hydrogen peroxide or peracetic acid
		Environment	Control tabanid flies; remove dead animals promptly; aldehydes, sodium hydroxide, calcium hypochlorite, chloramine.
		Personnel	Very thorough personal decontamination through washing with soap and water Wear PPE that can be disposed of. For contaminated skin, use calcium hypochlorite Use PPE to protect against skin and mucous membrane exposure during postmortems. Use respiratory PPE when in environments where dust contamination may be significant
		Water (tanks, dams)	Filter tank water (may not be practicable for dams)
		Animal feed	Aldehydes, sodium hydroxide, calcium hypochlorite
		Effluent, manure	Disposal or aldehydes, sodium hydroxide, calcium hypochlorite
		Human housing	Sodium hypochlorite or calcium hypochlorite
		Machinery	Activated chloramine
		Vehicles	Sodium hypochlorite, calcium hypochlorite, glutaraldehyde or formaldehyde

[48] APVMA PER10594 and PER87995 detail a variety of anthrax disinfectants.

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Clothing	Disposal or aldehydes
4	Aujeszky's disease (Category A virus)	Carcasses	Disposal
		Animal housing / equipment	Soaps and detergents then oxidising agents or alkalis
		Environment	Soaps and detergents then oxidising agents or alkalis
		Personnel	Soaps and detergents then sodium carbonate (anhydrous (Na_2CO_3), washing soda ($Na_2CO_3.10H_20$)) (not concentrated), peroxymonosulfate compounds (not approved for use on skin; beware of WHS issues for skin contact)
		Water (tanks, dams)	Oxidising agents, alkalis
		Animal feed	Dispose of if contaminated
		Effluent	Quarantine >3 days
		Manure	Disposal
		Human housing, machinery, vehicles, clothing	Soaps and detergents, oxidising agents or alkalis
5	Avian influenza (AI)[49,50]	Carcasses	Disposal
		Eggs (intact shells)	Virus can penetrate intact shells, but eggs may be treated with sodium hypochlorite
		Animal housing / equipment	Soaps and detergents, sodium hypochlorite, calcium hypochlorite, peroxymonosulfate compounds, alkalis, glutaraldehyde, citric acid

[49] APVMA PER89609 details a variety of disinfectants for the treatment of equipment, fabric and surfaces in case of an outbreak of avian influenza.
[50] https://www.epa.gov/pesticide-registration/epas-registered-antimicrobial-products-effective-against-avian-influenza

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Environment	Not applicable
		Personnel	Soaps and detergents, peroxymonosulfate compounds (not approved for use on skin; beware of WHS issues for skin contact)
		Water (tanks, dams)	Drain tanks to pasture where possible Drain dams to pasture if practicable, otherwise not applicable
		Animal feed	Disposal
		Effluent, manure	Disposal, acids, alkalis
		Human housing	Soaps and detergents, sodium hypochlorite, calcium hypochlorite, peroxymonosulfate compounds
		Machinery, vehicles	Soaps and detergents, alkalis, glutaraldehyde/QAC
		Clothing	Soaps and detergents, sodium hypochlorite, calcium hypochlorite, peroxymonosulfate compounds, alkalis, citric acid, glutaraldehyde/QAC
6	Bluetongue (Category C virus)	General	Inactivated by β-propiolactone; iodophors and phenolic compounds.[51]
		Carcasses	Disposal
		Animal housing / equipment	Organophosphates; synthetic pyrethroids if insect knockdown warranted
		Environment	Decrease insect vector habitat
		Personnel	Soaps and detergents
		Water (tanks, dams)	Decrease insect vector habitat
		Animal feed	Not applicable

[51] https://www.woah.org/app/uploads/2021/03/bluetongue-2.pdf

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Effluent, manure	Disposal or organophosphates or synthetic pyrethroids to prevent insects breeding
		Human housing, machinery, vehicles	Not applicable Organophosphates or synthetic pyrethroids for aircraft disinsection if necessary; spray with insecticides to eliminate vector
		Clothing	Soaps and detergents
7	Bovine spongiform encephalopathy (prion)	Carcasses	Disposal (with care for environment) or incineration
		Environment	Dispose of or incinerate animal bedding, topsoil, halters etc that are suspected of contamination
		Animal housing / equipment	Soaps and detergents then oxidising agents with steam sterilisation
		Personnel	See the **AUSVETPLAN response strategy *Bovine spongiform encephalopathy***
		Water (tanks, dams)	Not applicable
		Animal feed	Disposal or incineration only if contaminated with carcasses
		Effluent, manure	Disposal
		Human housing	Soaps and detergents then oxidising agents
		Machinery, vehicles	Oxidising agents, steam sterilisation
		Clothing	Incinerate if heavily contaminated
8	Classical scrapie (prion)	Carcasses	Disposal (with care for environment) or incineration Incinerate or dispose of all contaminated birth materials
		Environment	Disposal or incineration of animal bedding, topsoil, halters, etc that are suspected of contamination

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Animal housing / equipment	Soaps and detergents then oxidising agents with steam sterilisation
		Personnel	See the **AUSVETPLAN response strategy *Classical scrapie***
		Water (tanks, dams)	Not applicable
		Animal feed	Disposal, if contaminated with birth material, manure or carcasses
		Effluent, manure	Disposal
		Human housing	Soaps and detergents then oxidising agents
		Machinery, vehicles	Oxidising agents
		Clothing	Incinerate if heavily contaminated
9	Equine influenza[52] (Category A virus)	Carcasses	Disposal
		Animal housing / equipment	Soaps and detergents, oxidising agents, alkalis and organophosphates or synthetic pyrethroids for insect control if abundant; rodent control if abundant
		Environment	Soaps and detergents, oxidising agents, alkalis and organophosphates or synthetic pyrethroids for insect control if abundant; rodent control if abundant
		Personnel	Soaps and detergents, oxidising agents, sodium carbonate (anhydrous (Na_2CO_3), washing soda ($Na_2CO_3.10H_20$)), peroxymonosulfate compounds (not approved for use on skin; beware of WHS issues for skin contact)
		Water (tanks, dams)	Not applicable
		Animal feed	Dispose of if heavily contaminated
		Effluent, manure	Disposal

[52] APVMA PER89609 details a variety of disinfectants for the treatment of equipment, fabric and surfaces in case of an outbreak of equine influenza.

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Human housing	Unnecessary
		Machinery, vehicles	Soaps and detergents, oxidising agents, alkalis
		Clothing	Soaps and detergents, oxidising agents
10	Foot-and-mouth disease[53] (Category B viruses)	General	Inactivated by sodium hydroxide (2%), sodium carbonate (4%), citric acid (0.2%), acetic acid (2%), sodium hypochlorite (3%), potassium peroxymonosulfate/sodium chloride (1%), and chlorine dioxide Resistant to iodophors, QACs and phenol, especially in the presence of organic matter[54]
		Carcasses	Disposal, alkalis, acids
		Wool	For FMD: storage, scouring, fumigation (formaldehyde), slaked lime or sodium sulfide
		Milk	Heat treatment in accordance with WOAH *Terrestrial animal health code* Articles 8.8.35 and 8.8.36[55] for use of milk for human or animal consumption respectively Citric acid, sulfamic acid, ortho-phosphoric acid, sodium hydroxide, sodium carbonate, calcium hypochlorite or sodium hypochlorite
		Animal housing / equipment	Soaps and detergents then peroxymonosulfate compounds, oxidising agents, alkalis or acids, glutaraldehydes/QAC (APHIS 2023)
		Environment	Alkalis, acids
		Personnel	Soaps and detergents then citric acid
		Dairy equipment	Alkalis, acids, hydrogen peroxide
		Water (tanks, dams)	Alkalis, citric acid

[53] APVMA PER83649 details a range of disinfectants for the treatment of equipment, fabric and surfaces in case of an outbreak of FMD. APVMA PER92652 details the use of citric acid as an aid in the reduction of transmission of FMD virus.
[54] https://www.woah.org/app/uploads/2021/09/foot-and-mouth-disease-1.pdf
[55] https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_fmd.htm

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
			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 Citric acid or hydrochloric acid could be used to lower pH, but not if concrete tanks are involved
		Animal feed	Disposal
		Effluent, manure	Disposal or alkalis or acids
		Human housing	Soaps and detergents (if practical), followed by peroxymonosulfate compounds, alkalis, citric acid
		Machinery, vehicles	Soaps and detergents then peroxymonosulfate compounds, alkalis, acids, glutaraldehyde/QAC
		Clothing	Oxidising agents, peroxymonosulfate compounds, alkalis, citric acid
11	Newcastle disease (ND)[56] (Category A virus)	General	Sodium hypochlorite, phenols, glutaraldehyde, chlorhexidine, and oxidising agents QACs must be used in conjunction with sodium carbonate ethers and formalin deactivate the virus[57]
		Carcasses	Disposal
		Eggs (intact shells)	Sodium hypochlorite
		Animal housing / equipment	Soaps and detergents, sodium hypochlorite, calcium hypochlorite, peroxymonosulfate compounds, sodium hydroxide, sodium carbonate, glutaraldehyde/QAC (APHIS 2023)
		Environment	Not applicable; sunlight inactivates virus in 30 minutes
		Personnel	Soaps and detergents, citric acid, peroxymonosulfate compounds (not approved for use on skin; beware of WHS issues for skin contact)
		Water (tanks, dams)	Drain tanks to pasture where possible Drain dams to pasture if practicable, otherwise not applicable

[56] APVMA PER88157 details a variety of disinfectants for the treatment of equipment, fabric and surfaces in case of an outbreak of Newcastle disease.
[57] https://www.woah.org/app/uploads/2022/02/newcastle-disease-virus-wild-birdsinfection-with.pdf

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Animal feed	Disposal or fumigate with methyl bromide
		Effluent, manure	Disposal, alkalis, acids, citric acid
		Human housing	Soaps and detergents, sodium hypochlorite, calcium hypochlorite, peroxymonosulfate compounds
		Machinery, vehicles	Soaps and detergents, alkalis, glutaraldehyde/QAC
		Clothing	Soaps and detergents, sodium hypochlorite, calcium hypochlorite, peroxymonosulfate compounds, alkalis, citric acid, glutaraldehyde/QAC
12	Lumpy skin disease (LSD)[58] Sheep pox and goat pox(Category A viruses)	General	LSD virus: [59] • Susceptible to ether (20%), chloroform, formalin (1%), and some detergents — eg sodium dodecyl sulfate • Susceptible to phenol (2% for 15 minutes), sodium hypochlorite (2–3%), iodine compounds (1:33 dilution), peroxymonosulfate compounds (2%), QACs (0.5%) Sheep and goat pox virus: [60] • Susceptible to highly alkaline or acid pH (hydrochloric or sulphuric acid at 2% for 15 minutes) • Inactivated by phenol (2% for 15 minutes) • Sensitive to detergents — eg sodium dodecyl sulphate • Sensitive to ether (20%), chloroform, formalin (1%), and sodium hypochlorite (2-3%), iodine compounds (1:33 dilution), peroxymonosulfate compounds (2%), QACs (0.5%) • Susceptible to sunlight, but remains viable in wool/hair and dry scabs on skin for up to 3 months. Persists in unclean shaded pens for as long as 6 months. Remains viable through freeze–thaw cycles, but infectivity may be reduced
		Carcasses	Disposal

[58] APVMA PER88717 details a variety of disinfectants for the treatment of equipment, fabric and surfaces in case of an outbreak of lumpy skin disease, sheep pox or goat pox virus.
[59] https://www.woah.org/app/uploads/2022/06/lumpy-skin-disease-final-v1-1forpublication.pdf
[60] https://www.woah.org/fileadmin/Home/eng/Animal_Health_in_the_World/docs/pdf/Disease_cards/SHEEP_GOAT_POX.pdf

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Animal housing / equipment	Soaps and detergents (to clean) then sodium and calcium hypochlorite, sodium hydroxide, sodium carbonate, citric acid or glutaraldehyde/QAC or peroxymonosulfate compounds
		Environment	Oxidising agents or alkalis or citric acid; virus susceptible to UV light
		Personnel	Soaps and detergents, oxidising agents, sodium carbonate, citric acid.
		Dairy equipment	Soaps and detergents (to clean), oxidising agents, sodium carbonate, citric acid. or glutaraldehyde/QAC or peroxymonosulfate compounds
		Water (tanks, dams)	Decrease insect vector habitat
		Animal feed	Disposal
		Effluent, manure	Disposal and organophosphates or synthetic pyrethroids for insect control
		Human housing, machinery, vehicles	Soaps and detergents then sodium and calcium hypochlorite, sodium hydroxide, sodium carbonate, citric acid
		Clothing	Destroy if not valuable, or sodium and calcium hypochlorite, sodium hydroxide, sodium carbonate, glutaraldehyde/QAC, citric acid
13	Peste des petits ruminants[61] Rinderpest (eradicated) (Category A viruses)	Carcasses	Disposal
		Wool	Storage, scouring, fumigation, slaked lime or sodium sulfide
		Animal housing / equipment	Soaps and detergents then oxidising agents, alkalis if necessary

[61] APVMA PER88157 details a range of disinfectants for the treatment of equipment, fabric and surfaces in case of an outbreak of peste des petits ruminants.

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Environment	Oxidising agents or alkalis (necessary for ensuring freedom from infection)
		Personnel	Soaps and detergents, citric acid, peroxymonosulfate compounds (not approved for use on skin; beware of WHS issues for skin contact)
		Water (tanks, dams)	Drain to pasture if possible
		Animal feed	Dispose of contaminated animal feed
		Effluent, manure	Oxidising agents, alkalis, acids then dispose of
		Human housing	Soaps and detergents then oxidising agents or alkalis if necessary; fomites unlikely to play a significant role in disease transmission
		Machinery, vehicles, clothing	Soaps and detergents then oxidising agents, alkalis if necessary; fomites unlikely to play a significant role in disease transmission
14	Lyssaviruses (rabies and Australian bat lyssavirus) (Category A viruses)	Carcasses	Submit head to high security laboratory (ACDP) in an appropriate infectious goods container for confirmation of infection; dispose of the remainder of the carcass
		Animal products	Disposal
		Animal housing / equipment	Soaps and detergents then oxidising agents
		Environment	Not applicable
		Personnel	All people handling bats should: • be vaccinated against rabies with regular serological testing to determine antibody titres are acceptable (Australian Veterinary Association 2017)[62]

[62] https://immunisationhandbook.health.gov.au/contents/vaccine-preventable-diseases/rabies-and-other-lyssaviruses#vaccine-and-immunoglobulin-information

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
			• use appropriate PPE If bitten or contaminated in any way: • thoroughly wash bites with soaps and detergents, then clean with a disinfectant suitable for human wounds (see the **AUSVETPLAN response strategy *Lyssaviruses***) • treat mucous membrane contamination by thoroughly flushing with water • wash the rest of the body that may have had contact with saliva from an infected animal with soaps and detergents. Oxidising agents or peroxymonosulfate compounds may be used for equipment • obtain immediate medical attention • euthanase offending animal and send head to ACDP 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 (NHIG)
		Machinery	Not applicable
		Human housing, vehicles, clothing,	Soaps and detergents (to clean) then oxidising agents
15	Porcine epidemic diarrhoea	Carcasses	Disposal
		Animal housing / equipment	Soaps and detergents then 4% anhydrous sodium carbonate, iodophors in phosphoric acid (1%) and sodium hydroxide (2%)[63]
		Environment	Oxidising agents, or QAC/glutaraldehyde combination (Bowman et al 2015)
		Personnel	Soaps and detergents
		Water (tanks, dams)	Oxidising agents

[63] https://www.woah.org/app/uploads/2021/03/a-factsheet-pedv.pdf

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Animal feed	Dispose of if heavily contaminated and disease risk outweighs replacement cost; otherwise, quarantine, heat to over 130 °C for 30 minutes or electron-beam irradiate with a dose of 50 kGy (Scott Williams Consulting 2017)
		Effluent/manure	Dispose of or hold for natural decontamination
		Human housing, clothing, machinery, vehicles	Soaps and detergents then oxidising agents Seek specialist advice for machinery, vehicles and aircraft
16	Rift Valley fever (Category A virus)	Carcasses	Disposal
		Animal housing / equipment	Soaps and detergents (to clean) then oxidising agents or acids or
		Environment	Oxidising agents or acids and insect control (organophosphates or synthetic pyrethroids)
		Personnel	Soaps and detergents, citric acid, peroxymonosulfate compounds (not approved for use on skin; beware of WHS issues for skin contact)
		Water (tanks, dams)	Decrease insect vector habitat
		Animal feed	Dispose of animal feed contaminated by blood, aerosols, fomites
		Effluent/manure	Drain to pit/dispose of Use organophosphates or synthetic pyrethroids for insect control
		Human housing, clothing, machinery, vehicles	Soaps and detergents (to clean) then oxidising agents or acids
17	Screw-worm fly (insect)[64]	Carcasses	Treat animals with organophosphates, synthetic pyrethroids (APHIS 2023) or ivermectin

[64] APVMA PER90398 details a variety of products for the control of old world screw-worm fly in sheep and cattle during a screw-worm fly incursion.

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
			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 carcasses (see above) Use disinsection and decontamination procedures 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)
		Animal housing / equipment	Clean every 3 days and dispose of sweepings
		Environment	Not applicable
		Personnel	Refer wounds to medical practitioner; otherwise not applicable
		Water (tanks, dams), animal feed, effluent, manure	Not applicable
		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 **AUSVETPLAN response strategy *screw-worm fly*)**
		Clothing	Wash with soaps and detergents
18	Swine vesicular disease (SVD)[65] Vesicular exanthema (VE)[66] (Category B viruses)	Carcasses	Disposal, alkalis, acids

[65] APVMA PER88053 details a variety of disinfectants for the treatment of equipment, fabric and surfaces in case of an outbreak of swine vesicular disease.
[66] APVMA PER88053 details a variety of disinfectants for the treatment of equipment, fabric and surfaces in case of an outbreak of vesicular exanthema.

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Animal housing / equipment	Soaps and detergents then peroxymonosulfate compounds (APHIS 2023), oxidising agents, alkalis or acids, glutaraldehyde/QAC (SVD only)
		Environment	Alkalis, acids
		Personnel	Soaps and detergents then citric acid
		Dairy equipment	Alkalis, acids, hydrogen peroxide
		Water (tanks, dams)	Alkalis, citric acid (VE only) 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
		Animal feed	Disposal f
		Effluent, manure	Disposal or alkalis or acids
		Human housing	Soaps and detergents (if practical), followed by peroxymonosulfate compounds, alkalis, citric acid
		Machinery, vehicles	Soaps and detergents then peroxymonosulfate compounds, alkalis, acids, glutaraldehyde/QAC (SVD only)
		Clothing	Oxidising agents, peroxymonosulfate compounds, alkalis, citric acid
19	Transmissible gastroenteritis (Category A virus)	Carcasses	Rendering or processing
		Animal housing / equipment	Soaps and detergents then oxidising agents, alkalis or aldehydes
		Environment	Oxidising agents, alkalis or aldehydes plus vertebrate (bird) and invertebrate pest controls Decrease vector/insect habitat UV light will inactivate virus

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Personnel	Soaps and detergents then oxidising agents, alkalis or aldehydes, peroxymonosulfate compounds (not approved for use on skin; beware of WHS issues for skin contact)
		Water (tanks, dams)	Decrease insect vector habitat
		Animal feed	Dispose of if heavily contaminated and disease risk outweighs replacement cost; otherwise, quarantine
		Effluent/manure	Disposal
		Human housing, clothing, machinery, vehicles	Soaps and detergents then oxidising agents, alkalis or aldehydes
20	Vesicular stomatitis (Category A virus)	Carcasses	Disposal
		Animal housing / equipment	Organophosphates, synthetic pyrethroids (to kill insects) Soaps and detergents (to remove virus); peroxymonosulfate compounds, oxidising agents, alkalis, acids also effective (APHIS 2023)
		Environment	Organophosphates; decrease insect vector habitat; virus sensitive to UV light
		Personnel, clothing	Soaps and detergents
		Water (tanks, dams)	Drain to pasture where possible if contaminated with saliva and vesicular fluid; decrease vector insect habitat
		Animal feed	Aluminium phosphide
		Effluent, manure	Disposal or organophosphates
		Human housing	Organophosphates, synthetic pyrethroids (to kill insects) Soaps and detergents (to remove virus)

Row	Disease (agent)	Item to be decontaminated	Chemical/procedure
		Machinery, vehicles	Synthetic pyrethroids (to kill insects) Soaps and detergents (to remove virus)

ACDP = Australian Centre for Disease Preparedness; FMD = Foot-and-mouth disease; WHS = work health and safety; PPE = personal protective equipment; UV = ultraviolet; WOAH = World Organisation for Animal Health

Table 9.4 Chemicals and procedures for other EADs

Row	Disease (agent)	Human decontamination	Fomite decontamination	Vector control	Comments
Viral diseases					
1	Borna disease (Category A)	Thorough personal hygiene with soap and water, PPE, 1% soda ash and detergent	Alkali, phenolics	Not applicable	Little information available on decontamination
2	Encephalitides (tick-borne) (Category A)	Not applicable; use basic personal hygiene	Not applicable	Appropriate acaricides	Vector transmission
3	Eastern, western and Venezuelan equine viral encephalo-myelitis (Category A)	Not applicable; use basic personal hygiene	Not applicable	Appropriate mosquito insecticides	
4	Equine encephalosis (Category C)	Not applicable; use basic personal hygiene	Not applicable	Control *Culicoides* insects	
5	Getah virus (Category A)	Not applicable; use basic personal hygiene	Not applicable	Control mosquito vectors	Alphaviruses are unstable in the environment

Row	Disease (agent)	Human decontamination	Fomite decontamination	Vector control	Comments
6	Hendra virus infection (Category A)	Soaps and detergents, PPE	2% glutaraldehyde, 10% formalin, hypochlorites, iodine compounds, biguanides, QACs, peroxymonosulfate compounds[67]	Not applicable	Use PPE and avoid respiratory aerosols when undertaking postmortem examinations
7	Infectious bursal disease (hyper-virulent form) (Category C)	Soap and water, personal hygiene, 1% soda ash and detergent	Peroxymonosulfate compounds, hypochlorites, alkali	Not applicable	Very resistant to many disinfectants
8	Influenza A viruses in swine[68] (Category A)	Detergents, 1% soda ash and detergent	Detergents, hypochlorites, alkali, peroxymonosulfate compounds	Not applicable	
9	Japanese encephalitis	Not applicable	Not applicable	Decrease insect vector habitat	
10	Jembrana disease (Category A)	Soap and water for physical removal, 1% soda ash and detergent	Hypochlorites, peroxymonosulfate compounds, alkalis	Control vectors (biting insects)	
11	Maedi–visna virus (Category A)	Thorough cleaning with detergents	Clean instruments and equipment with detergents; peroxymonosulfate compounds	Not applicable	
12	Menangle virus (porcine paramyxo-virus) (Category A)	Soaps and detergents, PPE.	Sodium hypochlorite to supply 10,000 ppm chlorine, peroxymonosulfate compounds	Not applicable	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

[67] https://www.woah.org/app/uploads/2022/02/henipaviruses-hendra-viruses-infection-with.pdf

[68] APVMA PER89609 details a variety of disinfectants for the treatment of equipment, fabric and surfaces in case of an outbreak of influenza A in pigs.

Row	Disease (agent)	Human decontamination	Fomite decontamination	Vector control	Comments
					flushing with water. Obtain immediate medical attention
13	Nairobi sheep disease (Category A)	Not applicable; use basic personal hygiene	Not applicable	Control ticks, especially *Rhipicephalus*	
14	Nipah virus (Category A)[69]	Soaps and detergents, PPE	Sodium hypochlorite to supply 10,000 ppm chlorine, peroxymonosulfate compounds	Not applicable	Use PPE and avoid respiratory aerosols when undertaking postmortem examinations
15	Porcine respiratory and reproductive syndrome[70] (Category A)	Detergents, citric acid (pH <5)	Peroxymonosulfate compounds, hypochlorite, alkali (pH >7)	Not applicable	
16	Pulmonary adenomatosis (ovine) (Category A)	Thorough cleaning with detergents	Clean instruments and equipment with detergents	Not applicable	
17	Teschen disease (Category B)	1% soda ash and detergent	Hypochlorites, alkali, peroxymonosulfate compounds	Not applicable	
18	Wesselsbron disease (Category A)	1% soda ash and detergent	Alkali, phenolics	Not applicable	PPE to prevent skin, respiratory and mucous membrane exposure while doing postmortems
Bacterial diseases including mycoplasma and rickettsia					
19	Bovine tuberculosis (*Mycobacterium bovis*)	Use basic personal hygiene (thorough washing), PPE	Land and buildings: clean, dry and spell for > 2 months	Not applicable	Use PPE and avoid respiratory aerosols when undertaking postmortem examinations

[69] https://www.woah.org/app/uploads/2022/02/henipaviruses-nipah-viruses-infection-with.pdf

[70] APVMA PER88157 details a variety of disinfectants for the treatment of equipment, fabric and surfaces in case of an outbreak of porcine respiratory and reproductive syndrome .

Row	Disease (agent)	Human decontamination	Fomite decontamination	Vector control	Comments
			Other equipment: clean and disinfect with peroxymonosulfate compounds; 5% phenol, iodine solutions with a high concentration of available iodine; glutaraldehyde, formaldehyde; 1% hypochlorite if low organic matter contamination[71]		
20	Brucellosis (due to *Brucella abortus*)	Standard disinfectants like chlorhexidine, thorough washing with soap and water	Peroxymonosulfate compounds Susceptible to many disinfectants: 1% sodium hypochlorite, 70% ethanol, iodine/alcohol solutions, glutaraldehyde, formaldehyde	Not applicable	Use PPE to avoid skin contact and reproductive secretions and aerosols
21	Brucellosis (due to *Brucella melitensis*)	Standard disinfectants like chlorhexidine, thorough washing with soap and water	Peroxymonosulfate compounds Susceptible to many disinfectants: 1% sodium hypochlorite, 70% ethanol, iodine/alcohol solutions, glutaraldehyde, formaldehyde	Not applicable	Use PPE to avoid skin contact and reproductive secretions and aerosols
22	Contagious equine metritis	Chlorhexidine, detergents	Sodium hypochlorite (40 mL household bleach per 5 L), chlorhexidine and ionic and nonionic detergents	Not applicable	
23	Epizootic lymphangitis	Liberal washing with soap and water	1% sodium hypochlorite, glutaraldehyde, formaldehyde, phenolics	Control flies (physical vector)	Usually controlled by destruction of infected animals and hygiene
24	Glanders	Common disinfectants such as chlorhexidine	Sensitive to most disinfectants. Use peroxymonosulfate compounds, hypochlorites, alkali	Not applicable	PPE to include skin and respiratory protection

[71] https://www.cfsph.iastate.edu/Factsheets/pdfs/bovine_tuberculosis.pdf

Row	Disease (agent)	Human decontamination	Fomite decontamination	Vector control	Comments
25	Haemorrhagic septicaemia	Good personal hygiene and use of personal disinfectants such as chlorhexidine	Most hospital disinfectants, hypochlorites, phenolics	Not applicable	Caution is essential, although no evidence of human infection
26	Contagious bovine pleuropneumonia	Citric acid, 1% soda ash and detergent	Inactivated by many of the routinely used disinfectants Susceptible to 1% sodium hypochlorite, 70% ethanol, iodophors, glutaraldehyde and peracetic acid Inactivated by mercuric chloride (0.01% for 1 minute), phenol (1% for 3 minutes), and formaldehyde solution (0.5% for 30 seconds)[72]	Not applicable	Sensitive to disinfectants and desiccation
27	Heartwater[73]	Not applicable; use basic personal hygiene	Not applicable	Control *Amblyomma* ticks	
28	Potomac fever	Not applicable; use basic personal hygiene	Not applicable	Control potential arthropod vectors, especially ticks	
Parasitic diseases (protozoa, helminths, mites)					
29	Dourine[74]	Not applicable; use basic personal hygiene	Not applicable	Not applicable	Control by testing and management and/or destruction of breeding stock

[72] https://www.woah.org/app/uploads/2021/03/cbpp.pdf
[73] https://www.woah.org/app/uploads/2021/03/heartwater-1.pdf
[74] https://www.woah.org/app/uploads/2021/03/dourine-1.pdf

Row	Disease (agent)	Human decontamination	Fomite decontamination	Vector control	Comments
30	East Coast fever (theileriosis)[75]	Not applicable; use basic personal hygiene	Not applicable	Appropriate tick control agents	
31	Equine babesiosis (equine piroplasmosis)[76]	Not applicable; use basic personal hygiene	Not applicable	Control ticks	Use disposable syringes or disinfect between animals
32	Surra	Not applicable; use basic personal hygiene	Not applicable	Control arthropod vectors[77]	
33	Trichinosis (trichinellosis)	Through personal hygiene after handling meat and carcases	Mechanical removal of pig faeces	Not applicable	Prevent ingestion of muscle tissue or pig faeces by animals
34	Sheep scab	Shower and change clothes between properties	Treat with miticide or thoroughly clean before movement	Use appropriate miticide on stock and equipment	

WHS =work health and safety; PPE = personal protective equipment; QAC = quaternary ammonium compound

[75] https://www.woah.org/app/uploads/2022/02/theileria-spp-new-or-unusual-occurrences-infection-with.pdf
[76] https://www.woah.org/app/uploads/2021/03/equine-piroplasmosis-1.pdf
[77] https://www.woah.org/app/uploads/2021/03/trypano-evansi.pdf

Appendix 1 Decontamination equipment

Appendix 1.1 Personal decontamination equipment (individual)

The following equipment[78] may be used by personnel entering and exiting a contaminated or potentially contaminated premises. Equipment used and taken on and off a premises should be specific to the investigation or need required. Quantities are indicative only and are per person.

Considerations include:

- number of people entering and exiting the premises
- type of disease investigation or work required (eg initial investigation or surveillance)
- disease and mechanisms of transmission (eg vectorborne; fomite)
- zoonotic impacts and infection pathway (eg respiratory)
- mechanisms of animal-to-animal transmission (eg fomite compared with vectorborne)
- weather (eg wet, cold, hot).

Equipment taken on or used should be minimised to avoid waste and the need to decontaminate accidentally contaminated items. Chemicals used should be accompanied by manufacturer's instructions for use and the associated safety data sheet (SDS).

- Respiratory protective device (per person)

Item	Quantity
Powered air purifying respirator (PAPR)	1
PAPR replacement filters	1
PAPR replacement batteries and/or charger	≥1
Reusable face negative-pressure respirator (half or full face)	1
Reusable face respirator replacement filters	1
Disposable P2 particulate respirators	≥2

- Personal protective equipment (per person)

Item	Quantity
Disposable overalls — impervious / resistant to penetration of fluids	≥2
Waterproof protective clothing	As needed
Rubber boots — in good repair with easy clean treads	1 pair
Gloves — disposable nitrile examination gloves (per site or task)	≥10 pairs
Gloves — heavy-duty nitri-solve	Optional
Gloves — cut-proof Kevlar / stainless steel chain mesh (for postmortem)	Optional
Hat — washable / disinfectable	Optional
Protective eyewear — antifog goggles (for use with P2 / half-face respirators) or face shield	1
Disposable ear plugs	1 pair

- Decontamination kit

[78] Based on Biosecurity Queensland (2018ab).

Item	Quantity
Water — fresh, clean, in jerry can or similar	≥40 L
Plastic drop sheet — may be small tarpaulin, disposable plastic or several biohazard bags	1–2 m^2
Large biohazard bags	≥5
Sturdy garbage bags	≥5
Cable ties	≥20
Clip seal / Ziploc® bags — A4 size	≥10
Peroxymonosulfate compounds (eg Virkon S® powder / sachets — 10 × 50-gram sachets or small bulk supply (100 g per 10 L water)	≥ 500 g
Chlorhexidine disinfectant	≥50 ml
Citric acid — 500 grams powder	1
Isopropyl swabs/wipes (pack)	1
Alcohol-based hand cleaner	1
Detergent (bottle) — commercial preparation or quality dishwashing liquid	1
Foot bath tubs — sturdy, 40 L volume	2
Large buckets — sturdy, 20 L volume containing water	2
Buckets — 9 L volume	4
Spray packs, pump or hand spray — 500 ml	2
Sponge — for disinfecting (wiping) document bags, bagged phones, tablets, etc	1
Hoof pick, screwdriver or 150-mm nail for cleaning boot treads	1
Scrubbing brushes — include long-handle brush to scrub boots	3
Nail brush	1
Hand soap	1
Paper towel — for drying hands	≥2 rolls
Waterproof duct / gaffer tape — for sealing gloves to overall sleeves	1
Scissors — for cutting tape	1
Suitable container to carry equipment onto the site — large enough to carry all animal restraint, diagnostic and sampling equipment	1
Spare ice box and ice bricks — used for packaging samples once they are decontaminated off the premises	Optional

- Equipment for animal restraint; diagnostic and sampling equipment

Item	Quantity
Mouth gags	Various sizes
Nose pliers	1
Sedatives/tranquiliser	Optional
Rectal thermometer	1
Syringes, needles, blood tubes, specimen containers (including fixative)	As required

Other personal equipment for consideration includes:

- industrial hard hat
- waterproof jacket and trousers
- cotton overalls
- neck cloth (eg hand towel)
- spare underclothes and clothes

- spare shoes
- sunglasses
- sunscreen
- first aid kit
- torch and batteries.

Appendix 1.2 Personal decontamination equipment (temporary site)

Premises requiring the entry and exit of multiple personnel may be scaled according to the size of the operation. Contaminated premises requiring decontamination over a period of days may benefit from the establishment of a temporary personal decontamination site. It may include the following equipment in addition to that identified in Appendix 1.1:

- emergency response trailer with decontamination equipment supplies
- waterproof shelter such as a caravan, purpose-built trailer or similar
- sun shelter
- signage (entry, exit, clean zone, transition and dirty zone)
- modular shower units
- temporary fencing, including hessian sacking and star pickets
- plastic moulded grating or ground protection matting for foot traffic
- witches hats
- portable shower units
- boot trays and foot baths
- water supply (eg town water)
- water tanks (if required)
- hoses, pipes and fittings
- drainage tanks
- chemical supplies
- electrical generator with fuel and other consumables
- seating.

Appendix 1.3 Premises decontamination equipment

The premises to be decontaminated may require bespoke equipment or procedures. In addition to items identified in Appendix 1.2, the following should be considered and scaled up as required:

- portable pumps; eg firefighting pumps
- high-pressure industrial pumps and lances
- fuel and other consumables for pumps and engines
- electrical leads and connectors
- hand tools, such as
  - shovels
  - brooms
  - forks
  - scrapers
  - brushes (including wire brushes)

    - crowbars
    - wheelbarrows
- heavy equipment, such as
    - excavators
    - bulldozers
    - tractors with trailers
    - other trailers
    - front-end loaders
    - vehicle-mounted boom spray.

Appendix 1.4 Vehicle decontamination equipment

The following equipment will vary with specific circumstances and is indicative only:

- work area with hard surface and good drainage at wash-down site
    - for premises, near or at exit for final decontamination / disinfection
    - for roadways, in a safe location, with traffic management support
- wash-down area with liquid-waste capturing and holding tanks or similar
- water supply for pumps, high-pressure cleaner and washing by hand
- equipment to maintain water supply
- high-pressure cleaner — complete, with long hose and lance
- volume pump, hose, and nozzle for spraying disinfectant
- supply of suitable chemicals for cleaning and disinfection
- tank to mix chemicals, and any specific mixing equipment
- shovels, scrapers, brooms, hand brushes for gross decontamination
- sponges
- buckets
- if required, support such as scaffolding or cherry picker for working at heights
- personal protective equipment (eg gloves, disposable overalls, waterproofs, gumboots, ear and eye protection, face shield)
- appropriate safety data sheets for chemicals being used.

Appendix 2 Decontamination with formaldehyde gas

Warning: Formaldehyde is hazardous according to 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 specific environments and in the hands of experienced operators.

The use of gaseous formaldehyde is applicable to:

- enclosed spaces that can be made airtight (for example, grain bins[79], 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
- poultry incubator rooms and egg rooms.

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 can 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 infectious agent 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. Gaseous formaldehyde should only be used when there is not alternative. Warning notices should be fixed to the entrance of the area being fumigated. There should be 2 people involved in the operation — both equipped with *full-face respirators* effective against formaldehyde gas. Only certified persons are allowed to use gaseous formaldehyde, and they must use it in a manner that has previously been approved.

The safety of the operator is of greatest importance, and the method of use of formaldehyde is based on the primacy of safety (see Section 7). 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.

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

[79] https://www.grdc.com.au/__data/assets/pdf_file/0025/142567/grdc-gsfs-14_grainfumigationguide_lr-pdf.pdf.pdf

are likely to decontaminate naturally for most pathogens (but not for 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. If gaseous decontamination of equipment or machinery is considered essential, specialist advice should be sought and approved operators used, and the contaminated equipment kept in quarantine until that time.

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 15 to 24 hours.

Several points must be considered before attempting formaldehyde decontamination:

- Ensure that all surfaces are clean.
- An even dispersal of the gas within the enclosed space is essential for uniform decontamination. Electric fans are recommended to assist circulation.
- 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.
- 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 air. It is difficult to establish the required relative humidity outside a controlled laboratory situation.
- 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.
- Formaldehyde will react with free chlorine or chlorides (eg hypochlorites or hydrochloric acid) to produce carcinogenic compounds, which are a potential danger.
- Environmental release of formaldehyde is prohibited by most regulatory health agencies.
- Mixtures of formaldehyde with air are explosive, so risks of fire and explosion are substantial.

Notwithstanding the problems associated with formaldehyde decontaminations, there are 2 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. Use of several smaller vessels is preferable. Each 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, beginning with the vessel furthest from the exit door.

Alternatively, paraformaldehyde powder may be sublimed by heating to 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

Document-specific terms

Term	Definition
Biofilm	An assemblage of surface-associated microbial cells that is enclosed in a matrix of primarily polysaccharide material (Donlan 2002).
Cleaning	The process of removing unwanted substances, such as organic and inorganic material, infectious agents, and other impurities, from an object or environment.
Gross cleaning	The removal all manure, dirt and debris and contaminated articles that cannot be disinfected.
Natural decontamination	The use of natural means, including solar radiation (sunlight), heat (ambient temperature) and desiccation to achieve decontamination.
Sanitiser	A chemical substance or preparation for removing or inactivating surface bacteria.
Sanitising	The killing of surface bacteria to help ensure that there are very low levels of disease-causing bacteria left on surfaces. It does not make claims about fungi or viruses.
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.
Thermal decontamination	Thermal decontamination or disinfection is the inactivation of disease agents using heat, either through active application of a heating system or through passive ambient heat.

Standard AUSVETPLAN terms

Term	Definition
Animal	
- captive wildlife	A wild animal that has been tamed and lives under human supervision and control to serve a purpose.
- domestic animal	An animal that lives under human supervision and control to serve a purpose – especially a member of those species that have, through selective breeding, become notably different from their wild ancestors.
- feral animal	A previously domesticated animal that now does not live under human supervision or control.
- wildlife/wild animal	An animal that does not live under human supervision or control, and has not been selectively bred or its phenotype selected by humans.

Term	Definition
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, hooves, bones, fertiliser).
Animal Health Committee	A committee whose members are the chief veterinary officers of the Commonwealth, states and territories, along with representatives from the CSIRO Australian Centre for Disease Preparedness (CSIRO-ACDP) and the Australian Government Department of Agriculture, Fisheries and Forestry. There are also observers from Animal Health Australia, Wildlife Health Australia, and the New Zealand Ministry for Primary Industries. The committee provides advice to the National Biosecurity Committee on animal health matters, focusing on technical issues and regulatory policy. *See also* National Biosecurity Committee
Animal products	Meat, meat products and other products of animal origin (eg eggs, milk) for human consumption or for use in animal feed.
Approved disposal site (ADS)	A premises that has zero susceptible animals and has been approved as a disposal site for animal carcasses, or potentially contaminated animal products, wastes or things.
Approved processing facility (APF)	An abattoir, knackery, milk or egg processing plant or other such facility that maintains increased biosecurity standards. Such a facility could have animals or animal products introduced from lower-risk premises under a permit for processing to an approved standard.
Assessed negative (AN)	A qualifier that may be applied to at-risk premises, premises of relevance and premises previously defined as suspect premises, trace premises, dangerous contact premises or dangerous contact processing facilities that have undergone an epidemiological and/or laboratory assessment and have been cleared of suspicion at the time of classification, and can progress to another status.
At-risk premises (ARP)	A premises in a restricted area that contains one or more live susceptible animals but is not considered at the time of classification to be an infected premises, dangerous contact premises, dangerous contact processing facility, suspect premises or trace premises.
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	Australian Veterinary 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 and link policy, strategies, implementation, coordination and emergency-management plans.
Carcase	The body of an animal slaughtered for food.
Carcass	The body of an animal that died in the field.

Term	Definition
Case fatality rate	The proportion of infected animals that die of the disease among all animals diagnosed with the disease at the time.
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
Compartmentalisation	The process of defining, implementing and maintaining one or more disease-free establishments under a common biosecurity management system in accordance with World Organisation for Animal Health (WOAH) guidelines, based on applied biosecurity measures and surveillance, to facilitate disease control and/or trade.
Compensation	The sum of money paid by government to an owner for livestock or property that are destroyed for the purpose of eradication or prevention of the spread of an emergency animal disease, and livestock that have died of the emergency animal disease. *See also* Cost-sharing arrangements, Emergency Animal Disease Response Agreement
Consultative Committee on Emergency Animal Diseases (CCEAD)	The key technical coordinating body for animal health emergencies. Members are state and territory chief veterinary officers, representatives of CSIRO-ACDP and the relevant industries, and the Australian Chief Veterinary Officer as chair.
Control area (CA)	A legally declared area that acts as a disease-free buffer[80] between the restricted area and the outside area (the limits of a control area and the conditions applying to it can be varied during an incident according to need) where the disease controls and movement controls applied are of lesser intensity than those in a restricted area.
Cost-sharing arrangements	Arrangements agreed between governments (national, states and 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 (DCP)	A premises, apart from an abattoir, knackery or milk or egg processing plant (or other such facility) that, after investigation and based on a risk assessment, is considered to contain one or more susceptible animals not showing clinical signs, but is considered highly likely to contain one or more infected animals and/or contaminated animal products, wastes or things, and that requires action to address the risk.
Dangerous contact processing facility (DCPF)	An abattoir, knackery, milk or egg processing plant or other such facility that, based on a risk assessment, appears highly likely to

[80] The use of the term 'disease free' implies that disease is not known to occur within the geographic area described by the CA.

Term	Definition
	have received infected animals, or contaminated animal products, wastes or things, and that requires action to address the risk.
Declared area	A defined tract of land that is subjected to disease control restrictions under emergency animal disease legislation. There are two types of declared areas: restricted area and control area.
Decontamination	Includes all stages of cleaning and disinfection.
Depopulation	The removal of a host population from a specified area to control or prevent the spread of disease.
Destroy (animals)	To kill animals humanely.
Disease agent	A general term for a transmissible organism or other factor that causes an infectious disease.
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.
Disinsection	The destruction of insect pests, usually with a chemical agent.
Disposal	Sanitary removal of animal carcasses, 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 Hotline	24-hour freecall service for reporting suspected incidences of exotic diseases — 1800 675 888.
Emergency Animal Disease Response Agreement	Agreement between the Australian, state and territory governments and livestock industries on the management of emergency animal disease responses. Provisions include participatory decision making, risk management, cost sharing, 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
Enzyme-linked immunosorbent assay (ELISA)	A serological test designed to detect and measure the presence of antibody or antigen in a sample. The test uses an enzyme reaction with a substrate to produce a colour change when antigen–antibody binding occurs.

Term	Definition
Epidemiological investigation	An investigation to identify and qualify the risk factors associated with the disease. *See also* Veterinary investigation
Epidemiological unit	In the context of infectious disease, an epidemiological unit is a unit which shares the same likelihood of exposure to a pathogen.[81] For the purposes of AUSVETPLAN premises classifications, an epidemiological unit can be defined as a discrete area encompassing all, or part, of a premises, within which control measures can be applied to achieve disease control outcomes.
Epidemiology	The study of disease in populations and of factors that determine its occurrence.
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
Feeding prohibited pig feed	Also known as 'swill feeding', it includes: • feeding, or allowing or directing another person to feed, prohibited pig feed to a pig • allowing a pig to have access to prohibited pig feed • the collection and storage or possession of prohibited pig feed on a premises where one or more pigs are kept • supplying to another person prohibited pig feed that the supplier knows is for feeding to any pig. This definition was endorsed by the Agriculture Ministers' Council through AGMIN OOS 04/2014.
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.
General permit	A legal document that describes the requirements for movement of an animal (or group of animals), commodity or thing, for which permission may be granted without the need for direct interaction between the person moving the animal(s), commodity or thing and a government veterinarian or inspector. The permit may be completed via a webpage or in an approved place (such as a government office or commercial premises). A printed version of the permit must accompany the movement. The permit may impose preconditions and/or restrictions on movements. *See also* Special permit
In-contact animals	Animals that have had close contact with infected animals, such as noninfected 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.

[81] www.woah.org/fileadmin/Home/eng/Health_standards/tahc/2018/en_glossaire.htm#terme_unite_epidemiologique

Term	Definition
Index case	
– for the outbreak	The first case of the disease to be diagnosed in a disease outbreak. *See also* Index property
– for a herd, flock or other defined group	The first diagnosed case of an outbreak in a herd, flock or other defined group.
Index property	The property on which the index case is found. *See also* Index case
Infected area (IA)	An area on which wild/feral animals meeting the case definition are or were present, or the causative agent of the emergency animal disease is present, or there is a reasonable suspicion that either is present, and that the relevant chief veterinary officer or their delegate has determined to be an infected area. The area may be subject to wild/feral animal disease controls, including, as necessary, destruction, disposal and decontamination activities, vaccination, intense surveillance and movement controls.
Infected premises (IP)	A premises on which animals meeting the case definition are or the causative agent of the emergency animal disease is present, or there is a reasonable suspicion that either is present, and that the relevant chief veterinary officer or their delegate has declared to be an infected premises.
Local control centre (LCC)	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 or the level of contamination of a site for remediation purposes. *See also* Surveillance
Movement control	Restrictions placed on the movement of animals, people and other things to prevent the spread of disease.
National Biosecurity Committee (NBC)	A committee that was formally established under the Intergovernmental Agreement on Biosecurity (IGAB). The IGAB was signed on 13 January 2012, and signatories include all states and territories except Tasmania. The committee provides advice to the Agriculture Senior Officials Committee and the Agriculture Ministers' Forum on national biosecurity issues, and on the IGAB.
National management group (NMG)	A group established to approve (or not approve) the invoking of cost sharing under the Emergency Animal Disease Response Agreement. NMG members are the Secretary of the Australian Government Department of Agriculture, Fisheries and Forestry as chair, the chief executive officers of the state and territory government parties, and the president (or analogous officer) of each of the relevant industry parties.
Native wildlife	*See* Wild animals
Operational procedures	Detailed instructions for carrying out specific disease control activities, such as disposal, destruction, decontamination and valuation.

Term	Definition
Outside area (OA)	The area of Australia outside the restricted and control areas.
Owner	Person responsible for a premises (includes an agent of the owner, such as a manager or other controlling officer).
Polymerase chain reaction (PCR)	A method of amplifying and analysing DNA sequences that can be used to detect the presence of viral DNA.
Premises	A geographically defined tract of land including its buildings. A premises may be represented geospatially (eg on maps) as a polygon for whole or parts of a property, or as a centroid to identify the entire property. A premises may be part of, or an entire property. Premises with a case number are assigned a premises classification for disease control management and monitoring purposes. As such, a premises is an 'epidemiological unit' for disease control purposes. A premises can also be a separate epidemiological unit internal of a land parcel in some circumstances. On an exceptional basis and subject to a risk assessment, a property may be divided into multiple, discrete biosecure epidemiological units. These units may then be reclassified as separate premises for disease control purposes. An epidemiological unit may define the extent of the premises.
Premises of relevance (POR)	A premises in a control area that contains one or more live susceptible animals but is not considered at the time of classification to be an infected premises, dangerous contact premises, dangerous contact processing facility, suspect premises or trace premises.
Premises with susceptible species (PSS)	A premises in the outside area that contains one or more live susceptible animals or other units of interest, but is not considered at the time of classification to be an infected premises, dangerous contact premises, dangerous contact processing facility, suspect premises or trace premises.
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 case	The individual that introduces disease into a herd, flock or other group under study. Not necessarily the first case diagnosed case in that herd, flock or other group under study.
Prohibited pig feed	Also referred to as 'swill'. Material of mammalian origin, or any substance that has come in contact with this material, but does not include: (i) milk, milk products or milk byproducts either of Australian provenance or legally imported for stockfeed use into Australia (ii) material containing flesh, bones, blood, offal or mammal carcases which is treated by an approved process[1]

Term	Definition
	(iii) a carcass or part of a domestic pig, born and raised on the property on which the pig or pigs that are administered the part are held, that is administered for therapeutic purposes in accordance with the written instructions of a veterinary practitioner (iv) material used under an individual and defined-period permit issued by a jurisdiction for the purposes of research or baiting. [1] In terms of (ii), approved processes are: 1. rendering in accordance with the Australian Standard for the Hygienic Rendering of Animal Products 2. under jurisdictional permit, cooking processes subject to compliance verification that ensure that a core temperature of at least 100 °C for a minimum of 30 minutes, or equivalent, has been reached 3. treatment of cooking oil, which has been used for cooking in Australia, in accordance with the National Standard for Recycling of Used Cooking Fats and Oils intended for Animal Feeds 4. under jurisdictional permit, any other nationally agreed process approved by the Animal Health Committee for which an acceptable risk assessment has been undertaken and that is subject to compliance verification. The national definition is a minimum standard. Some jurisdictions have additional conditions for feeding of prohibited pig feed that pig producers in those jurisdictions must comply with, over and above the requirements of the national definition.
Qualifiers	
— assessed negative	Assessed negative (AN) is a qualifier that may be applied to premises previously defined as SPs, TPs, DCPs or DCPFs. The qualifier may be applied following surveillance, epidemiological investigation, and/or laboratory assessment/diagnostic testing, and indicates that the premises is assessed as negative at the time of classification.
— sentinels on site	Sentinels on site (SN) is a qualifier that may be applied to IPs and DCPs to indicate that sentinel animals are present on the premises as part of response activities (ie before it can be assessed as a resolved premises).
— vaccinated	The vaccinated (VN) qualifier can be applied in a number of different ways. At its most basic level, it can be used to identify premises that contain susceptible animals that have been vaccinated against the EAD in question. However, depending on the legislation, objectives and processes within a jurisdiction, the VN qualifier may be used to track a range of criteria and parameters.
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.
Resolved premises (RP)	An infected premises, dangerous contact premises or dangerous contact processing facility that has completed the required control measures and is subject to the procedures and restrictions appropriate to the area in which it is located.

Term	Definition
Restricted area (RA)	A relatively small legally declared area around infected premises and dangerous contact premises that is subject to strict disease controls and intense surveillance. The limits of a restricted area and the conditions applying to it can be varied during an incident according to need.
Risk enterprise	A defined livestock or related enterprise that 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, artificial insemination centres, veterinary laboratories and hospitals, road and rail freight depots, showgrounds, field days, weighbridges and garbage depots.
Sensitivity	The proportion of truly positive units that are correctly identified as positive by a test. *See also* Specificity
Sentinel animal	Animal of known health status that is monitored to detect the presence of a specific disease agent.
Sentinels on site (SN)	A qualifier that may be applied to infected premises to indicate that sentinel animals are present on the premises as part of response activities.
Seroconversion	The appearance in the blood serum of antibodies (as determined by a serology test) following vaccination or natural exposure to a disease agent.
Serosurveillance	Surveillance of an animal population by testing serum samples for the presence of antibodies to disease agents.
Serotype	A subgroup of microorganisms identified by the antigens carried (as determined by a serology test).
Serum neutralisation test	A serological test to detect and measure the presence of antibody in a sample. Antibody in serum is serially diluted to detect the highest dilution that neutralises a standard amount of antigen. The neutralising antibody titre is given as the reciprocal of this dilution.
Slaughter	The humane killing of an animal for meat for human consumption.
Special permit	A legal document that describes the requirements for movement of an animal (or group of animals), commodity or thing, for which the person moving the animal(s), commodity or thing must obtain prior written permission from the relevant government veterinarian or inspector. A printed version of the permit must accompany the movement. The permit may impose preconditions and/or restrictions on movements. *See also* General permit
Specificity	The proportion of truly negative units that are correctly identified as negative by a test. *See also* Sensitivity
Stamping out	The strategy of eliminating infection from premises through the destruction of animals in accordance with the particular

Term	Definition
	AUSVETPLAN manual, and in a manner that permits appropriate disposal of carcasses and decontamination of the site.
State coordination centre (SCC)	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 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.
Surveillance area	A geographically defined area in which animals are subject to intensive surveillance for the purposes of early detection of, or proof of freedom from, EADs, It may or may not be legally declared, and may be used for disease control purposes in some jurisdictions.
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 (SP)	Temporary classification of a premises that contains one or more susceptible animals showing clinical signs similar to the case definition, and that therefore requires investigation.
Swill	*See* Prohibited pig feed
Swill feeding	*See* Feeding prohibited pig feed
Trace premises (TP)	Interim classification of a premises that tracing indicates may have susceptible animals that have been exposed to the disease agent, or contains potentially contaminated animal products, wastes or things, and that requires investigation.
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.
Transmission area	An area, not usually legally declared, that is used for vectorborne diseases for epidemiological purposes, recognising that vectors are not confined by property boundaries.
Unclassified processing facility (UPF)	An abattoir, knackery, milk or egg processing plant or other such facility where the current presence of susceptible animals and/or risk products, wastes or things is unknown.
Units of interest	Units of interest may require classification commensurate with the needs of a response and may include: • transporters, and transport depots where trucks carrying potentially infected stock and animal products are stored, or through which livestock may transiently move

Term	Definition
	• milk tankers • veterinarians, and other personnel of specific interest that move between properties.
Unknown status premises (UP)	A premises where the current presence of susceptible animals and/or risk products, wastes or things is unknown.
Vaccination	Inoculation of individuals with a vaccine to provide active immunity.
Vaccine	A substance used to stimulate immunity against one or several disease-causing agents to provide protection or to reduce the effects of the disease. A vaccine is prepared from the causative agent of a disease, its products or a synthetic substitute, which is treated to act as an antigen without inducing the disease.
— adjuvanted	A vaccine in which one or several disease-causing agents are combined with an adjuvant (a substance that increases the immune response).
— attenuated	A vaccine prepared from infective or 'live' microbes that are less pathogenic but retain their ability to induce protective immunity.
— gene deleted	An attenuated or inactivated vaccine in which genes for non-essential surface glycoproteins have been removed by genetic engineering. This provides a useful immunological marker for the vaccine virus compared with the wild virus.
— inactivated	A vaccine prepared from a virus that has been inactivated ('killed') by chemical or physical treatment.
— recombinant	A vaccine produced from a virus that has been genetically engineered to contain only selected genes, including those causing the immunogenic effect.
Vaccinated (VN)	A qualifier that may be used to identify premises that contain susceptible animals that have been vaccinated against the emergency animal disease in question.
Vaccination area	A geographically defined area in which emergency vaccination is applied for the purpose of EAD control. It may or may not be legally declared, and may be used for disease control purposes in some jurisdictions.
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.
Veterinary investigation	An investigation of the diagnosis, pathology and epidemiology of the disease. *See also* Epidemiological investigation
Viraemia	The presence of viruses in the blood.

Term	Definition
Wild animals	
— native wildlife	Animals that are indigenous to Australia and may be susceptible to emergency animal diseases (eg bats, dingoes, marsupials).
— feral animals	Animals of domestic species that are not confined or under control (eg cats, horses, pigs).
— exotic fauna	Nondomestic animal species that are not indigenous to Australia (eg foxes).
Wild animal management area	A geographically defined area in which wild animal management or control activities are conducted for the purpose of EAD control. It may or may not be legally declared, and may be used for disease control purposes in some jurisdictions.
WOAH Terrestrial Code	Describes standards for safe international trade in animals and animal products. Revised annually and published on the internet at: www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access.
WOAH Terrestrial Manual	WOAH Manual of 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: www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-manual-online-access.
Wool	Sheep wool.
Zero susceptible species premises (ZP)	A premises that does not contain any susceptible animals.
Zoning	The process of defining, implementing and maintaining a disease-free or infected area in accordance with World Organisation for Animal Health (WOAH) guidelines, based on geopolitical and/or physical boundaries and surveillance, to facilitate disease control and/or trade.
Zoonosis	A disease of animals that can be transmitted to humans.

Abbreviations/acronyms

Document-specific abbreviations/acronyms

Abbreviation/acronym	Full title
APVMA	Australian Pesticides and Veterinary Medicines Authority
AS/NZS	Australian New Zealand Standard
PAPR	powered air purifying respirator
PPE	personal protective equipment
QAC	quaternary ammonium compounds
RPD	respiratory protective device
SDS	safety data sheet
SES	State Emergency Service
SMS	spunbond-meltblown-spunbond

Standard AUSVETPLAN abbreviations/acronyms

Abbreviation/acronym	Full title
ACDP	Australian Centre for Disease Preparedness
ADS	approved disposal site
AN	assessed negative
APF	approved processing facility
ARP	at-risk premises
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
DCP	dangerous contact premises
DCPF	dangerous contact processing facility
EAD	emergency animal disease
EADRA	Emergency Animal Disease Response Agreement
EADRP	Emergency Animal Disease Response Plan

Abbreviation/acronym	Full title
EDTA	ethylenediaminetetraacetic acid (anticoagulant for whole blood)
ELISA	enzyme-linked immunosorbent assay
GP	general permit
IETS	International Embryo Transfer Society
IP	infected premises
LCC	local control centre
NASOP	nationally agreed standard operating procedure
NMG	National Management Group
OA	outside area
PCR	polymerase chain reaction
POR	premises of relevance
PSS	premises of susceptible species
RA	restricted area
RP	resolved premises
SCC	state coordination centre
SP	suspect premises
SpP	special permit
TA	transmission area
TP	trace premises
UP	unknown status premises
UPF	unclassified processing facility
VN	vaccinated
WOAH	World Organisation for Animal Health
ZP	zero susceptible species premises

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