

## CHAPTER 4.13.

# DISPOSAL OF DEAD ANIMALS

### Article 4.13.1.

#### Introduction

The mass disposal of dead *animals* associated with an animal disease *outbreak* is often subject to intense public and media scrutiny thereby obligating the *Veterinary Authority* of a Member Country to not only conduct disposal operations within acceptable scientific principles to destroy the pathogenic agent but also to address public and environmental concerns.

The recommendations in this chapter are general in nature. The choice of one or more of the recommended methods should be in compliance with relevant local and national legislation and be attainable with the resources available. The recommendations should also be applied in conjunction with the procedures described for the *killing of animals* in Chapter 7.6.

Strategies for the disposal of dead *animals* (entire *animals* or parts thereof) should be prepared well in advance of any emergency. Major issues related to the disposal of dead *animals* include the number of *animals* involved, *biosecurity* concerns over the movement of infected or exposed *animals*, people and equipment, environmental concerns, and the psychological distress experienced by farmers and *animal handlers*.

### Article 4.13.2.

#### Regulations and jurisdiction

The legislation regulating animal health and the organisation of the *Veterinary Authority* should give the *Veterinary Services* the authority and the legal powers to carry out the activities necessary for the efficient and effective disposal of dead *animals*. Cooperation between the *Veterinary Service* and other relevant government bodies is necessary to developing a coherent set of legal measures for the disposal of dead *animals* in advance of any emergency. In this context the following aspects should be regulated:

- 1) Powers of *Veterinary Services* (inspectors, veterinary officers, etc.) to effect controls and direct persons as well as the right of entry to an *establishment* for the *Veterinary Services* and associated personnel;
- 2) movement controls and the authority to make exemptions under certain *biosecurity* conditions, for example for transport of dead *animals* to another location for disposal;
- 3) the obligation on the involved farmer and *animal handlers* to cooperate with the *Veterinary Services*;
- 4) any need to transfer the ownership of *animals* to the competent authority;
- 5) the determining of the method and location of disposal, and the necessary equipment and facilities, by the *Veterinary Services*, in consultation with other involved authorities including national and local governmental organisations competent for the protection of human health and of the environment.

Should the chosen option for the disposal of dead *animals* be applied near the border of a neighbouring country, the competent authorities of that country should be consulted.

### Article 4.13.3.

#### Preparedness

The mass *killing* and disposal of *animals* in the event of a disease *outbreak* or disposal of *animals* in the event of natural disasters such as floods, usually should proceed with the minimum delay. The success is determined by the structures, policies and infrastructure established in advance:

1. Relationship with industry

A relationship with industry organisations, such as farmer associations, commodity representatives, *animal welfare* organisations, security services, media and consumer representatives is essential to obtain compliance with animal health policies.

2. Standard operating procedures

Standard operating procedures should be developed (including documented decision-making processes, training of staff).

3. Financial preparedness

Financial preparedness means a compensation or insurance mechanism, an access to emergency funding and an access to personnel through agreements with private *veterinarians*.

4. Communication plan

Information sharing with officials involved in the *outbreak*, affected farmers, professional organisations, politicians and the media is essential. A well informed spokesperson should be available at all times to answer enquiries.

5. Resources

The management of resources should address such items as personnel, transport, storage facilities, equipment (such as mobile handling facilities for *animals*, *disinfection* equipment), fuel, protective and disposable material and logistical support.

6. Special equipment

Special equipment such as trucks, tractors, bulldozers, and front-end loaders should be available.

Article 4.13.4.

**Critical elements**

Critical elements which need to be considered in planning and implementation include:

1. Timeliness

Early detection of new *infections*, immediate *killing* of infected *animals* and rapid removal of the dead *animals* with inactivation of the pathogenic agent are important. Spread of the pathogenic agent from the dead *animals* and their surroundings should be blocked as soon and as effectively as possible.

2. Occupational health and safety

Disposal should be organised in such a way that the workers are safeguarded against the risks of handling decomposing dead *animals*. Special attention should be given to zoonotic aspects. Workers should receive appropriate training and be sufficiently protected against *infection* with protective clothing, gloves, face masks, effective respirators, goggles, *vaccination*, and effective anti-viral medicines. Workers should also receive regular health checks.

3. Pathogen inactivation

The disposal procedure should be selected to result in inactivation of the pathogenic agent.

4. Environmental concerns

Different methods of the disposal of dead *animals* have different effects on the environment. For instance, pyre burning will produce smoke and smells; burial might lead to gas and leachate production resulting in potential contamination of air, soil, surface and sub-surface water.

5. Availability of capacity

An assessment of capacities of different methods of disposal should be made prior to any emergency. Temporary storage of dead *animals* in cold stores may relieve a lack of processing capacity.

6. Adequate funding

Adequacy of funding for the options chosen should be ascertained and committed at the earliest possible stage.

7. Staff resources

Availability of sufficient and well trained staff resources in particular for extended and/or large operations should be ensured. This is particularly important for technical and inspection personnel who are usually in short supply.

8. Societal acceptance

Societal acceptance is an important point in choosing a disposal method.

9. Acceptance by farmers

Farmers will be sensitive to the safety measures taken to prevent spread of the disease by disposal method selected and the transport of the dead *animals* to the disposal site. Adequate compensation of owners for the loss of *animals* or for burial or burning sites will improve acceptability.

10. Equipment

Equipment used in the disposal of dead *animals* can transfer *infection* to other premises. The cleaning and *disinfection* of the outside surfaces of equipment such as cranes, *containers* and trucks, and the departure of *vehicles* from the farm should receive special attention. Trucks transporting dead *animals* should be leak proof.

11. Scavengers and vectors

When disposing of dead *animals*, full attention should be given to preventing scavengers and *vectors* gaining access to dead *animals*, which might cause spread of the pathogenic agent.

12. Economic impact (short and long term including recovery)

The method of disposal used has a significant bearing on economic impact.

## Article 4.13.5.

**Practical considerations**1. Selection of disposal site

Sufficient top soil to cover the site; soil type; water drainage; prevailing wind conditions; easy access to transport; availability of meteorological data; separation from sensitive public sites, and the effect on future use.

2. Contractors

Contractors – availability of manpower, materials and equipment including transport *vehicles*; can they supply in all the needs; exclusive use of *vehicles* or would they also be used for other purposes (risk of disease transmission); access to available roads; suitable for the purpose to be used.

3. Logistical preparedness for the appropriate technology

Availability of fuel; sufficient manual labour available; sites and availability of *disinfection* tents for personnel; storage and disposal of protective clothing; housing for personnel to minimise the spread of *infection*; facilities for entry and exit control; availability of electricity for night operations; personal facilities for personnel such as toilets, drinking water; availability of communication – mobile phone reception; protection (e.g. *vaccination*) of personnel; rendering capacity at rendering plants; arms and ammunition, additional cold storage and holding facilities at rendering plants and *slaughterhouses/abattoirs*.

4. Procedures and policies for disposal of other possibly contaminated products

Animal products such as litter, manure, wool, eggs and milk; animal *feed*; non-animal products such as protective clothing.

5. Wildlife

Need to minimise the risks posed by *wildlife*, including by excluding or repelling them from the disposal site.

Article 4.13.6.

**Recommended methods for the disposal of dead animals**

The methods chosen should be based on local conditions and the required capacity and speed of outcome and on the conditions required for the inactivation of the pathogenic agent.

Some of the methods below may require on-farm pre-processing prior to transportation of dead *animals* to central facilities for rendering or incineration. Pre-processing could include the grinding of dead *animals* which can then be transported in sealed *containers*, or be subjected to fermentation, composting or freezing.

1. Rendering

This is a closed system for mechanical and thermal treatment of animal tissues leading to stable, sterilised products, e.g. animal fat and dried animal protein. The technology exists in dedicated facilities. It produces an effective inactivation of all pathogenic agents with the exception of prions where infectivity is reduced. The availability of the capacity should be determined in advance.

2. Incineration in a dedicated facility

In such a facility, whole dead *animals* or parts of *animals* can be completely burned and reduced to ash, often in conjunction with other substances (such as municipal waste, hazardous waste or hospital waste). Effective inactivation of pathogenic agents, including spores, occurs. Fixed facility incineration is wholly contained and has some advantages from the environmental viewpoint as the exhausts may be fitted with afterburner chambers to completely burn hydrocarbon gases and particulate matter from the main combustion chamber.

3. Rendering and incineration

These may be combined for improved security and to provide additional fuel for furnaces in facilities used for other purposes such as in cement kilns and electricity generation plants.

4. Air curtain incineration

This process fan-forces a mass of air through a manifold, thereby creating a turbulent environment in which incineration is accelerated up to six times for example in a burn-pit. The equipment can be mobile and, because it can be used on site, there is no requirement for transportation of the animal material. It also produces effective inactivation of pathogenic agents.

5. Pyre burning

This open system of burning dead *animals* is a well-established procedure that can be conducted on site with no requirement for transportation of animal material. However, it takes an extended period of time and has no way of verifying inactivation of pathogenic agents, and there may be particulate dissemination from incomplete combustion. Further, because the process is open to view, there may be a lack of acceptance by the public.

6. Composting

Composting is a natural biological decomposition process that takes place in the presence of oxygen. In the first phase, the temperature of the compost pile increases, organic materials break down into relatively small compounds, soft tissue decomposes, and bones soften partially. In the second phase, the remaining materials, mainly bones, break down fully to a dark brown or black humus containing primarily non-pathogenic bacteria and plant nutrients. However, some viruses and spore forming bacteria, such as *Bacillus anthracis*, and other pathogenic agents such as *Mycobacterium tuberculosis* may survive.

7. Burial

In this method, whole dead *animals* are buried and covered by soil. Burial is an established procedure which may be conducted on site. It may not inactivate all pathogenic agents. In some circumstances, dead *animals* may be disposed of by mounding whereby they are covered by a layer of soil above ground.

8. Biogas production

This is a closed system of anaerobic fermentation which would require for the disposal of dead *animals* or their parts prior mechanical and thermal treatment of the input material (such as the liquid product of rendering plants). This process may not inactivate all pathogenic agents.

9. Alkaline hydrolysis

This method uses sodium hydroxide or potassium hydroxide to catalyse the hydrolysis of biological material into a sterile aqueous solution consisting of small peptides, amino acids, sugars, and soaps. Heat is applied (150°C) to accelerate the process. The only solid by-products are the mineral constituents of bones and teeth. This residue (2% of the original weight of the animal) is sterile and easily crushed into a powder. The temperature and alkali conditions of the process destroy the protein coats of viruses and the peptide bonds of prions. Both lipids and nucleic acids are degraded. The process is carried out in an insulated steam-jacketed, stainless steel pressure vessel.

10. Bio-refining

Bio-refining is a process of high pressure, high temperature, thermal hydrolysis conducted in a sealed pressurised chamber. The waste material is treated with high-pressure saturated steam at 180°C under a minimum of 10 bar pressure and continuous disruption by mechanical stirring for a period of 40 minutes. The whole procedure, from the loading of the chamber until the discharge from the chamber, occupies approximately 120 minutes. All microbiological agents are inactivated and the infectivity of the infectious agents causing transmissible spongiform encephalopathies is destroyed.

11. Dead animal disposal at sea

International Conventions define the conditions to be met for the disposal of dead *animals* at sea.

## Article 4.13.7.

**Recommendations for decision-making for the disposal of dead animals**

The disposal of large numbers of dead *animals* will be expensive. As well, fixed and variable costs will vary with the choice of the disposal method. Each method used will result in indirect costs on the environment, local economies, producers, and the livestock industry. In addition to *biosecurity* considerations, decision makers need to understand the economic, social, environmental protection and aesthetic impact of various disposal technologies.

A disposal option hierarchy may be incapable of fully capturing and systematizing the relevant dimensions at stake, and decision makers may be forced to consider the least preferred means. It therefore requires a comprehensive understanding of any array of dead animal disposal technologies and should reflect a balance between the scientific, economic, and social issues at stake. Timely *slaughter*, maintenance of security and prevention of further spread of disease, are the essential considerations in terms of disease control.

The following is an example of a possible process for aiding decision-making by comparing the suitability of various disposal options against factors that are considered important for the specific disposal event in question:

- 1) Step 1 – Define the factors to be considered. Include all relevant factors and allow enough flexibility to permit modifications for different situations and locations. Examples of possible factors include operator safety, community concerns, international acceptance, transport availability, industry standards, cost effectiveness and speed of resolution. These factors can be modified or changed, as is shown in the following example, to best fit the situation of event involved.
- 2) Step 2 – Assess the relative importance of the factors by weighting each on their considered importance to addressing the event in question. The sum of all the weightings, regardless of the number of factors, should total 100.
- 3) Step 3 – Identify and list all disposal options under consideration. Rate each disposal option against each factor and assign a Utility Rating of between 1 to 10 to each comparison. The Utility Rating (U) is a number between 1 and 10 which is allocated in accordance with how well the option achieves the ideal with respect to each factor (e.g. 1 = the worst possible fit, and 10 = the best fit).
- 4) Step 4 – For each factor and each disposal option, multiply the Factor Weight (F) x Utility Rating (U) to yield a numeric Balanced Value (V), (e.g.  $V = F \times U$ ).
- 5) Step 5 – By adding the Balanced Values to a sum for each disposal option, it is possible to compare the suitability of disposal options by numerically ranking the sums of the Balanced Values for each disposal option. The largest sum would suggest that disposal option is the best balanced choice.

An example of the use of this process follows in Table 1. In this example, rendering achieved the highest sum and would be considered as the best balanced choice and the most suitable disposal option for the factors considered.

Table 1. Decision Making Process

Method		Rendering		Fixed Incineration		Pyre Burning		Composting		Mass Burial		On-Farm Burial		Commercial Landfill	
	Weight	Utility	Value	Utility	Value	Utility	Value	Utility	Value	Utility	Value	Utility	Value	Utility	Value
Factors															
Operator Safety	20	7	140	4	80	8	160	3	60	7	140	8			
Speed of Resolution	20	8	160	8	160	2	40	5	100	5	100	6			
Pathogen Inactivation	15	10	150	10	150	8	120	5	75	4	60	4			
Impact on Environment	10	10	100	8	80	3	30	10	100	3	30	3			
Reaction of the Public	10	10	100	7	70	1	10	9	90	3	30	4			
Transport Availability	5	1	5	1	5	8	40	5	25	3	15	8			
Acceptable to Industry	5	7	35	7	35	7	35	7	35	6	30	7			
Cost	5	4	20	1	5	6	30	9	45	8	40	9			
Risk to Wildlife	5	10	50	10	50	5	25	4	20	5	25	5			
Capacity to Meet Requirements	5	5	25	3	15	9	45	9	45	9	45	9			
Total Weight to Equal 100 Units	100	sum	785	sum	650	sum	535	sum	595	sum	515	sum		sum	

---

NB: FIRST ADOPTED IN 2006; MOST RECENT UPDATE ADOPTED IN 2010.