

CHAPTER 7.Z.

ANIMAL WELFARE AND LAYING HEN
PRODUCTION SYSTEMS

Article 7.Z.1.

Definitions

For the purposes of this chapter:

Laying hens (hens): means sexually mature female birds of the species *Gallus gallus domesticus* kept for the commercial production of eggs for human consumption. Laying hens kept in village or backyard flocks are excluded. Breeding hens are excluded.

End-of-lay hens: means laying hens at the end of their productive lives.

Layer pullets (pullets): means female birds of the species *Gallus gallus domesticus* raised for commercial layer production purposes from hatch until the onset of sexual maturity.

Article 7.Z.2.

Scope

This chapter addresses the welfare aspects of commercial laying hen production systems. This chapter covers the production period from the arrival of day-old birds on the pullet-rearing farm to the removal of end-of-lay hens from the laying production facilities. Laying hens kept in village or backyard flocks and used for personal consumption are excluded.

Commercial production systems involve the confinement of pullets and hens birds, the application of *biosecurity* and trade in ~~the~~ eggs or pullets. These recommendations cover pullets or laying hens kept in cage or non-cage systems, whether indoors or outdoors.

Commercial pullet or hen production systems include:

1. Indoor systems

Pullets or hens are completely confined in a poultry house, with or without mechanical environmental control and with no designated outdoor area.

2. Outdoor systems

Pullets or hens are kept in premises with or without mechanical environmental control but have access to that include a designated outdoor area.

This chapter should be read in conjunction with Chapters 6.5., 7.1., 7.2., 7.3., 7.4., 7.5. and 7.6.

Article 7.Z.3.

Criteria (or measurables) for the welfare of pullets and ~~or~~ hens

The welfare of pullets and ~~or~~ hens should be assessed using outcome-based measurables, specifically animal-based measurables. ~~Consideration should also be given to the resources provided and the design of the system. Outcome-based measurables, specifically animal-based measurables, can be useful indicators of animal welfare.~~ The use of these measurables indicators and the appropriate thresholds should be adapted to the different situations where hens are managed, also taking into account the genetics used strain of bird concerned.

Annex 16 (contd)

Consideration should also be given to the resources provided as well as the design and management of the system. Animal-based criteria can be considered as tools to monitor and refine these factors.

Criteria that can be measured in the farm setting include behaviour, body and plumage condition, egg shell condition, mortality and morbidity rates, bone and foot problems, etc. together with other factors such as genetics and environment. The age at which abnormalities of these criteria are observed can help to determine the origin causation of potential problems. ~~Other conditions such as bone and foot problems, disease, infection or infestation can also be assessed at depopulation or during routine sampling. It is recommended that values for welfare measurables be determined with reference to appropriate national, sectorial or regional standards for pullets or hens.~~

Conditions such as bone and foot problems, disease, infection or infestation can be assessed during routine or targeted sampling and at depopulation. It is recommended that target values or thresholds for welfare measurables be determined with reference to current scientific knowledge and appropriate national, sectorial or regional standards for pullets or hens.

The following outcome-based criteria and measurables are can be useful indicators of pullet or hen welfare:

1. Behaviour

The presence or absence of certain chicken behaviours could indicate either good animal welfare or an animal welfare problem, such as including fear, pain or sickness. ~~In addition, chickens have evolved behaviours that they are highly motivated to perform and a good understanding of normal chicken behaviour [Nicol, 2015], including their social interactions [Estevez *et al.*, 2007; Rodríguez-Aurrekoetxea, A. and Estevez, I., 2014], is required. Some behaviours may not be uniquely indicative of one type of problem; they may be exhibited for a variety of reasons. The domestic fowl have evolved behaviours that they are highly motivated to perform and a good understanding of their normal behaviour [Nicol, 2015], including their social interactions [Estevez *et al.*, 2007; Rodríguez-Aurrekoetxea A. and Estevez I., 2014], is required for appropriate management decision making. Opportunities to display these behaviours are influenced by the physical and social environment [Widowski *et al.*, 2016; Lay *et al.*, 2011; O'Connor *et al.*, 2011].~~

a) Dust bathing

Dust bathing is an intricate body maintenance behaviour. During dust bathing, pullets and hens work loose material, such as litter, through their feathers. This behaviour helps remove stale lipids dirt [Van Liere and Bokma, 1987] and parasites [Martin and Mullen, 2012], which contributes to maintaining plumage condition, which in turn helps to maintain body temperature and to protect against skin injury. Reduced dust bathing behaviour in the flock may indicate problems with litter or range quality, such as the litter or ground being wet or not friable [Olson and Keeling, 2005; Van Liere and Bokma, 1987]. The presence of complete sequences of dust bathing may indicate good welfare [Widowski and Duncan, 2000].

b) Fear behaviour

Fearful pullets and hens show high reactivity to various stimuli [Jones R. B., 1987; Zeltner and Hirt, 2008]. Fearfulness can lead to traumatic injuries, and suffocation when the pullets and hens pile on top of, ~~and sometimes suffocate,~~ one another. Fearful pullets and hens may be less productive [Barnett J. *et al.*, 1992] and more prone to injurious feather pecking behaviour [Hass *et al.*, 2014]. Methods have been developed for evaluating fearfulness, for example when while animal handlers walk through the poultry house or pullets and hens area [Jones, 1996; Forkman *et al.*, 2007].

c) Feeding and drinking behaviour

~~Reduced~~ Changes in feeding or drinking behaviour can indicate management problems, including inadequate spaces for, or inappropriate placement of, feeders or drinkers, dietary imbalances, poor feed or water quality, or feed contamination [Garner *et al.*, 2012; Thogerson *et al.*, 2009a; Thogerson *et al.*, 2009b]. Feeding and drinking are often depressed when birds are ill, and intake may also be reduced change during periods of heat [Lara L. J. & Rostagno M. H., 2013; Lin H. *et al.*, 2006.] ~~stress and increased or~~ during cold stress [Alves *et al.*, 2012] [Garner *et al.*, 2012; Thogerson *et al.*, 2009a; Thogerson *et al.*, 2009b].

d) Foraging activity

Foraging is the act of searching for food, typically by walking and pecking or scratching the ~~litter~~ substrate. Reduced foraging activity could suggest problems with ~~litter~~ substrate quality or the presence of conditions that decrease pullets and hens' movement [Appleby *et al.*, 2004; Lay *et al.*, 2011; Weeks and Nicol, 2006]. When in the presence of an adequate substrate, laying hens spend a large amount of time foraging even when food is readily accessible [Weeks and Nicol, 2006]. Frequent foraging bouts may indicate good welfare [Dawkins, 1989; Duncan and Hughes, 1972] and reduce the incidence of injurious feather pecking [Blokhuys, 1989].

e) Injurious feather pecking and cannibalism

Injurious feather pecking can result in significant feather loss and may lead to cannibalism. Cannibalism is the tearing of the flesh of another bird, and can result in severe injury or death. These behaviours can have multifactorial causes [Hartcher, 2016; Estevez, 2015; Nicol *et al.*, 2013; Rodenburg, 2013; Lambton, 2013; Newberry, 2004].

f) ~~Locomotory~~ and comfort behaviours

~~Locomotory~~ and comfort behaviours are important for the health of the pullets and hens, allowing for skeletal, body and plumage development and their maintenance. These behaviours and may include walking, running, leaping, turning, stretching legs and wings, wing flapping, feather ruffling and tail wagging and preening [Dawkins and Hardie, 2007; Shipov *et al.*, 2010; Norgaard, 1990].

Opportunities to display these behaviours are influenced by housing system and space [Widowski *et al.*, 2016; Lay *et al.*, 2011].

g) Nesting

Nesting is a natural and highly motivated behaviour that includes nest site selection, nest formation and egg laying [Cooper and Albetosa, 2003; Weeks and Nicol, 2006; Cronin *et al.*, 2012; Yue and Duncan, 2003]. Uneven nest box utilisation and egg laying outside the nests may be indicative of problems with environmental or social behavioural factors [Cronin *et al.*, 2012; Cooper and Appleby, 1996; Gunnarsson *et al.*, 1999].

h) Perching

Perching is a natural and highly motivated behaviour. Birds Pullets and hens seek elevation during the day; the motivation to seek elevation is particularly strong at night when pullets and hens select a site for resting or sleeping [EFSA, 2015]. Reduced perching behaviour in the *flock* may indicate problems with environmental factors, injuries and pullet rearing experience [Janczak and Riber, 2015; Gunnarsson *et al.*, 1999].

i) Resting and sleeping

Sleeping is a natural behaviour in pullets and hens, including slow-wave and fast-wave sleep states [Blokhuys, 1983]. Sleep is an adaptive state that allows animals to recover from daily stress, conserve energy and consolidate memory [Siegel, 2009]. Pullets and hens display highly synchronized resting and sleeping behaviours, which can be disrupted by light intensity, photoperiod, environmental or social factors [Malleau *et al.*, 2007; Alvino *et al.*, 2009].

ii) Social behaviour

Pullets and hens ~~Chickens~~ are a highly social species, engaging in synchronised behaviour [Olsson *et al.*, 2002; Olsson and Keeling, 2005]. Benefits include social learning, protection from predators [Newberry *et al.*, 2001], aiding help in thermoregulation and plumage maintenance. Social behaviour may differ according to the characteristics of the social environment (Estevez *et al.*, 2002; 2007). Problems in social behaviour can be assessed using scoring systems for measuring the degree of aggression damage and competition for resources [Estevez *et al.*, 2002].

Annex 16 (contd)j/k) Spatial distribution

Uneven spatial distribution of the birds may indicate thermal discomfort or uneven availability or use of resources, such as light, food or water, shelter, nesting area and comfortable resting locations. [Rodríguez-Aurrekoetxea and Estevez, 2016; ~~Cornetto and Estevez, 2004~~; Bright and Johnson, 2011].

k/l) Thermoregulatory behaviour

Prolonged or excessive panting and wing spreading are observed during heat stress [Mack, 2013; Lara and Rostagno, 2013]. Indicators of cold stress include feather ruffling, rigid posture, trembling, huddling and ~~piling on top of each other and~~ distress vocalisations.

m) Vocalisation

Vocalisation can indicate emotional states, both positive and negative. A good understanding of *flock* vocalisations is useful for good animal care [Zimmerman *et al.*, 2000; Bright, 2008; Koshiba *et al.*, 2013].

2. Body condition

Poor body condition is reflective of ~~poor animal welfare outcomes problems~~ for individual birds. At *flock* level, uneven body condition may be an indicator of ~~potential poor animal welfare problems~~. Body condition can be evaluated using on-farm sampling methods for body weight or body condition scores [Gregory and Robins, 1998; Craig and Muir, 1996; Elson and Croxall, 2006; Keeling *et al.*, 2003]. The choice of sampling methods should take into account feather cover that can mask actual body condition.

3. Eye conditions

Conjunctivitis can indicate disease or the presence of irritants such as dust and ammonia. High ammonia levels can also cause corneal burns and eventual blindness. Abnormal eye development ~~can~~ may be associated with low light intensity [Jenkins *et al.*, 1979; Lewis and Gous, 2009; Prescott *et al.*, 2003].

4. Foot problems

Hyperkeratosis, ~~and~~ bumblefoot, excessive claw growth, broken claws and toe injuries are painful conditions associated with inappropriate flooring, poorly designed perches or poorly maintained litter [EFSA, 2005; Lay *et al.*, 2001; Abrahamsson and Tauson, 1995; Abrahamsson and Tauson, 1997].

~~Excessive claw growth, broken claws and toe injuries affect locomotion and may be associated with pain [EFSA, 2005].~~

Contact dermatitis affects skin surfaces that have prolonged contact with wet litter, manure or other wet flooring surfaces [Tauson and Abrahamson, 1996].

Foot problems are usually manifested as blackened skin progressing to erosion and fibrosis on the lower surface of the footpads and at the back of the hocks. If severe, the foot and hock lesions may contribute to locomotion problems and lead to secondary *infections*. Scoring systems for foot problems have been developed [Blatchford *et al.*, 2016].

5. Incidence of diseases, infections, metabolic disorders and infestations

Ill-health, regardless of the cause, is a welfare concern, and may be exacerbated by poor environmental or husbandry management.

6. Injury rate and severity

Injuries are associated with pain and risk of infection. The rate and severity of injuries ~~can~~ indicate health and welfare problems, in the flock during production. They can be a consequence of the actions of ~~injuries include those caused by~~ other birds (e.g. scratches, feather loss or wounding), management (e.g. nutrition), by environmental conditions, (e.g. fractures and keel bone deformation), ~~and or by~~ human intervention (e.g. during handling and catching).

7. Mortality, culling and morbidity rates

Daily, weekly and cumulative mortality, culling and morbidity rates should be within expected ranges. Any unforeseen increase in these rates could reflect an *animal welfare* problem.

8. Performance

Daily, weekly and cumulative performance should be within expected ranges. Any unforeseen reduction decreases in these rates could may be reflective of the welfare status of the individual birds or the *flocks*.

- a) Pullet growth rate measures average daily mass gain per average pullet and *flock* uniformity.
- b) Pullet feed conversion measures ~~the~~ quantity of feed consumed by a *flock* relative to the total live mass produced, expressed as the mass of feed consumed per unit of body mass.
- c) Hen feed conversion measures ~~the~~ mass of feed consumed by a *flock* relative to the unit of egg production.
- d) Egg production, ~~such as when~~ measured by e.g. the number of eggs per hen housed.
- e) Egg quality and downgrades, ~~such as when~~ measured by e.g. grade percentage, shell strength ~~and~~ Haugh units, abnormalities and mis-laid or floor eggs.

9. Plumage condition

Evaluation of ~~the~~ plumage condition of ~~pullets and hens~~ provides useful information about aspects of welfare. Feather loss and damage can result from injurious feather pecking behaviour, nutritional problems, external parasites and abrasions ~~resulting from faults in the equipment housing system~~ [Rodriguez-Aurrekoetxea and Estevez, 2016; Drake *et al.*, 2010]. Plumage dirtiness may be associated with illness, ~~the~~ environmental conditions ~~and or~~ production system. Plumage scoring systems have been developed for these purposes [Blokhuis, 2007].

10. Water and feed consumption

Monitoring daily water and feed consumption is a useful tool ~~to~~ which may indicate thermal stress, disease, *infection* or *infestation* and other welfare conditions, taking into consideration ambient temperature, relative humidity and other related factors. ~~Problems with the water or feed quality and supply can result in~~ Changes in intake, crowding at feeders and drinkers and wet litter and diarrhoea, dermatitis, dehydration, changes in egg quality or quantity, production and body condition may be associated with problems with the water or feed quality and supply.

Article 7.Z.4.

Recommendations

Ensuring good welfare of pullets and hens is contingent on several management factors, including system design, environmental and animal management practices which include responsible husbandry and provision of appropriate care. Serious problems can arise in any system if one or more of these elements are lacking.

Articles 7.Z.5. to 7.Z.29. provide recommendations for measures applied to pullets and hens.

Each recommendation in Article 7.Z.5. to 7.Z.29. includes a list of relevant animal-based criteria and measurables derived from Article 7.Z.3. This does not exclude other criteria and measurables being used where or when appropriate. The suitability of some of these criteria and measurables will be determined by the system in which the pullets and hens are housed.

~~Each recommendation includes a list of relevant outcome-based measurables derived from Article 7.Z.3. This does not exclude other measures being used when appropriate.~~

Annex 16 (contd)

Article 7.2.5.

Location, design, construction and equipment of establishments

The location of pullets and hen *establishments* should be chosen to be safe from the effects of fires and floods and other natural disasters to the extent practicable. In addition, *establishments* should be located or designed to avoid or minimise disease risks, exposure of pullets and hens to chemical and physical contaminants, noise and adverse climatic conditions.

Pullet and layer houses, outdoor areas and accessible equipment should be designed, after consideration of bird ~~the~~ opportunities for pullets and hens to perform highly motivated behaviours (e.g. perching and nesting), to promote good animal welfare and be maintained to avoid injury or discomfort ~~to the birds~~.

Pullet and layer houses should be constructed with materials and electrical and fuel installations that minimise the risk of fire and other hazards.

Producers should have a maintenance programme in place for all equipment and contingency plans in place to deal with, ~~the~~ failures of which could jeopardise bird pullet and hen welfare.

~~Outcome~~Animal-based measurables include: culling and morbidity rates, fear behaviour, feeding, and drinking behaviour, and foraging activity, foot problems, incidence of diseases, *infections* and *infestations*, injury rates and severity, locomotion and comfort behaviours, mortality rates, performance, plumage condition, resting and sleeping, social behaviour and spatial distribution, thermoregulatory behaviour, vocalisations.

Article 7.2.6.

Matching the birds and the housing and production system

Welfare and health considerations should balance any decisions on performance when choosing a layer strain for a particular location, housing and production system. The pullet rearing system should pre-adapt ~~prepare~~ the bird for the intended layer production system [Aerni et al., 2005].

~~Animal~~Outcome-based measurables include: dust bathing, feeding, and drinking behaviours, foraging activity, incidence of diseases, injurious feather pecking and cannibalism, injury rate and severity, locomotory ~~ion~~ and comfort behaviours, mortality rate, nesting, *infestations*, perching, performance, plumage condition, resting and sleeping, social behaviour, spatial distribution.

Article 7.2.7.

~~Stocking density~~ Space allowance

Pullets and hens should be housed with at a space allowance ~~stocking density~~ that allows them to have adequate access to resources and to express locomotory ~~ion~~ and comfort behaviours. The following factors should be taken into account:

- management capabilities,
- ambient conditions,
- housing design system
- usable space,
- production system,
- litter quality,
- ventilation,
- *biosecurity* strategy,
- genetics strain,
- age and bird mass.

Annex 16 (contd)

~~Animal Outcome~~-based measurables include: dust bathing, feeding and drinking and foraging behaviour, foraging activity, feeding, incidence of diseases, *infections* and *infestations*, injury rate and severity, locomotory~~ion~~ and comfort behaviours, mortality rate, nesting, perching, performance, plumage condition, resting and sleeping, social behaviour, spatial distribution.

Article 7.Z.8.

Nutrition

Pullets and hens should always be fed a diet appropriate to their age, production stage and genetics strain, which contains adequate nutrients to meet their requirements for good health and welfare.

The form and quality of feed and water should be acceptable to the birds and free from contaminants, debris and microorganisms hazardous to bird health.

The feeding and watering systems should be inspected regularly and cleaned as needed regularly to prevent the growth of hazardous microorganisms.

~~Birds~~ Pullets and hens should be provided with adequate access to feed on a daily basis. Water should be continuously available except under veterinary advice. Special provision should be made to enable newly hatched pullets ~~chicks~~ to access appropriate feed and water.

~~Animal Outcome~~-based measurables include: aggression, body condition, performance (egg quality), water and feed consumption, foraging activity ~~behaviour~~, incidence of disease, *infections* and *infestations*, injurious feather pecking, injury rate and severity, metabolic disorders, mortality rate, performance, plumage condition, vocalisations.

Article 7.Z.9.

Flooring

~~The flooring for the birds should be easy to clean and disinfect and not cause harm or damage to them.~~

The slope, ~~and design~~ and construction of the floor should allow birds pullets and hens to express normal locomotory~~ion~~ and comfort behaviours. The floors should provide adequate support ~~the birds adequately~~, prevent injuries, entrapments and ensure good health and that manure does not contaminate other birds pullets and hens. Changes of flooring types from pullet to layer housing should be avoided. The flooring should be easy to clean and disinfect and should not cause harm.

~~The provision of loose and dry litter material is desirable to encourage dust bathing and foraging by pullets and hens. When litter is provided it should be managed to minimise any detrimental effects on welfare and health. Litter should be managed to remain dry and friable, replaced or adequately treated or replaced when required to prevent diseases and minimise any detrimental effects on welfare, infections and infestations.~~

~~Animal Outcome~~-based measurables include: comfort behaviour, dust bathing, foot problems, foraging, incidence of diseases, *infections* and *infestations*, injury rates and severity, locomotory~~ion~~, performance, plumage condition, resting and sleeping.

Article 7.Z.10.

Dust bathing areas

~~The provision of friable, dry litter material is desirable to encourage dust bathing by pullets and hens.~~

~~When d~~Dust bathing areas ~~are offered, they should be provide suitable friable materials~~, designed and positioned to encourage dust bathing, allow synchronised behaviour, prevent undue competition and not cause damage or injuries. Dust bathing areas should be easy to inspect and maintain clean [Lentfer *et al.*, 2011] [Weeks and Nicol, 2006].

~~Animal Outcome~~-based measurables include: dust bathing, injury rate and severity, plumage condition, spatial distribution.

Annex 16 (contd)

Article 7.2.11.

Foraging areas

The provision of friable, dry litter material is desirable to encourage foraging activity by pullets and hens.

~~When f~~Foraging areas ~~are offered, they~~ should provide suitable materials, and be designed and positioned to encourage foraging activity, allow synchronised behaviour, prevent undue competition and not cause damage or injuries. Foraging areas should be easy to inspect and maintain clean.

Animal Outcome-based measurables include: foraging activity, injurious feather pecking and cannibalism, injury rate and severity, spatial distribution.

Article 7.2.12.

Nesting areas

~~When n~~Nesting areas should be provided ~~are offered, they~~ and should be built of suitable materials, designed and positioned to encourage nesting, prevent undue competition and not cause damage or injuries. Nesting areas should be easy to inspect, clean and maintain/disinfect.

Animal Outcome-based measurables include: injurious feather pecking and cannibalism, injury rate and severity, nesting, performance, ~~(mis-laid or floor eggs)~~, spatial distribution.

Article 7.2.13.

Perches

~~When p~~Perches should be provided ~~are offered, they~~ and should be built of suitable materials, designed, elevated and positioned to encourage perching for all pullets and hens, to prevent keel bone deformation ~~or~~ foot problems or other harms, and to maintain stability ~~of the birds~~ during perching. In the absence of designated perches, platforms, grids and slats that are perceived by the pullets and hens ~~birds~~ as elevated and that do not cause damage or injuries, may be a suitable alternative. Perches or their alternatives should be easy to clean and maintain, disinfect and positioned to minimise faecal fouling [Hester, 2014; EFSA, 2015].

~~Perch elevation should be carefully considered to minimise injurious feather pecking, cannibalism, keel deformities and fractures.~~

Animal Outcome-based measurables include: foot problems, injurious feather pecking and cannibalism, injury rate and severity, perching, plumage condition, resting and sleeping, spatial distribution.

Article 7.2.14.

Outdoor areas

Pullets and hens can be given access to outdoor areas ~~as soon as~~ when they have sufficient feather cover and ~~are old enough to can~~ range safely. There should be sufficient appropriately designed exit areas openings to allow them to leave and re-enter the poultry house freely.

Management of outdoor areas is important. Land and pasture management measures should be taken to reduce the risk of birds becoming infected by pathogenic agents, infested by parasites or being injured. This might include limiting the stocking density or using several pieces of land consecutively in rotation.

Outdoor areas should be located on well-drained ground and managed to minimise ~~swampy conditions~~ standing water and mud. The outdoor area should be able to contain the Pullets and hens ~~birds~~ and prevent them escaping. Outdoor areas should allow pullets and hens to feel safe outdoors and be encouraged to optimise utilisation of the range, while mitigating predation and disease risks [Gilani *et al.*, 2014; Hegelund *et al.*, 2005; Nagle and Glatz, 2012]. Hens should be habituated early to the outdoor area [Rodriguez–Aurrekoetxea and Estevez, 2016]. Outdoor areas should provide shelter for the birds and be free from ~~poisonous~~ harmful plants and contaminants.

Annex 16 (contd)

~~Animal Outcome~~-based measurables include: fear behaviour, foot problems, foraging activity, incidence of diseases, injury rate and severity, locomotory ~~ion~~ and comfort behaviours, morbidity rate, mortality rate, *infestations*, performance, plumage condition, social behaviour, spatial distribution, thermoregulatory behaviour, vocalisation.

Article 7.Z.15.

Thermal environment

Thermal conditions for pullets and hens should be maintained within a range that is appropriate for their stage of life, and extremes of heat, humidity and cold should be avoided. A heat index can assist in identifying the thermal comfort zones for the pullets and hens at varying temperature, air velocity and relative humidity levels, ~~and can be found in management guidelines provided by primary laying hen genetics companies~~ [Xin and Harmon, 1998].

When environmental conditions move outside of these zones, strategies should be used to mitigate the adverse effects on the pullets and hens ~~birds~~. These may include adjusting air speed, provision of heat or evaporative cooling [Yahav, 2009].

Control of the thermal environment should be monitored frequently enough so that failure of the system will be ~~noticed~~ detected and corrected before it causes a welfare problem.

~~Animal Outcome~~-based measurables include: morbidity rate, mortality rate, performance, spatial distribution, thermoregulatory behaviours, water and feed consumption.

Article 7.Z.16.

Air quality

Ventilation, housing, and manure management can affect air quality. Actions are required to maintain air quality at all times, including the removal or mitigation of noxious ~~of waste~~ gases such as carbon dioxide and ammonia, dust and excess moisture ~~content from in~~ the environment.

~~The a~~Ammonia concentration should not routinely exceed 25 ppm at bird level [David *et al.*, 2015; Milles *et al.*, 2006; Olanrewaiu, 2007].

Dust levels should be kept to a minimum [David, 2015]. ~~Where the health and welfare of birds depend on an artificial ventilation system, provision should be made for an appropriate back-up power and alarm system.~~

~~Animal Outcome~~-based measurables include: eye conditions, incidence of respiratory diseases, plumage condition, performance.

Article 7.Z.17.

Lighting

There should be an adequate period of continuous light.

The light intensity during the light period should be sufficient and homogeneously distributed to promote ~~for~~ normal development ~~of the birds~~, for finding feed and water, to stimulate activity, to stimulate onset of lay, minimise likelihood of feather pecking and cannibalism and to allow adequate inspection [Prescott *et al.*, 2003; Prescott and Wathes, 1999; Green *et al.*, 2000].

There should also be an adequate period of ~~light and~~ darkness during each 24-hour cycle to allow pullets and hens ~~the birds~~ to rest, to reduce stress and to promote circadian rhythms [Malleau *et al.*, 2007].

When changes in lighting are needed, they should be performed in a step-wise fashion, except during induced moulting (~~if practised~~) when rapid adjustments to lighting should be considered ~~are desired~~.

~~Animal Outcome~~-based measurables include: eye conditions, injurious feather pecking and cannibalism, injury rate and severity, locomotory ~~ion~~ behaviours, nesting, perching, performance, plumage condition, resting and sleeping, spatial distribution.

Annex 16 (contd)

Article 7.Z.18.

Noise

Pullets and hens are adaptable to different levels and types of noise. ~~However, Exposure of birds pullets and hens to unfamiliar noises, particularly those that are sudden or loud, should be minimised wherever possible to prevent stress and fear reactions, such as piling up [Bright and Johnson, 2001].~~ Ventilation fans, machinery or other indoor or outdoor equipment should be constructed, placed, operated and maintained in such a way ~~that it~~ causes the least possible amount of noise [Chloupek *et al.*, 2009].

Location of establishments should, where possible, take into account existing local sources of noise. Strategies should be implemented to habituate the birds to the conditions [Candland *et al.*, 1963; Morris, 2009].

~~Animal Outcome~~-based measurables include: fear behaviours, injury rate and severity, mortality rate, performance, resting and sleeping, vocalisation.

Article 7.Z.19.

Prevention and control of injurious feather pecking and cannibalism

Injurious feather pecking and cannibalism are challenges in pullet and hen production.

Management methods that may reduce the risk of occurrence include:

- managing light in rearing and lay [Nicol *et al.*, 2013; van Niekerk *et al.*, 2013],
- choosing genetics ~~strain~~ with a low propensity to injurious feather pecking [Craig and Muir, 1996; Kjaer and Hocking, 2004],
- influencing age of onset of lay [Green *et al.*, 2010],
- providing foraging or other manipulable materials in rearing and lay [Huber-Eicher and Wechsler, 1998; de Jong *et al.*, 2010; Daigle *et al.*, 2014],
- adapting diet and form of feed in rearing and lay [Lambton *et al.*, 2010],
- ~~reducing stocking density [Zimmerman *et al.*, 2006];~~
- reducing group size in rearing and lay [Bilcik and Keeling, 1999],
- providing elevated perches in rearing and lay [Green *et al.*, 2010],
- treating beaks in chicks [Gentle and Hughes, 1997], especially by using new non-invasive beak treatments that are being developed.

Comment: treating beaks in chicks [Gentle and Hughes, 1997], especially by using new non-invasive beak treatments. that are being developed.

African Union seeks clarification on whether the new non-invasive beak treatments are available. if they are not yet available or are still under development, African Union proposes deletion of the phrase “that are being developed”

- minimising fear-related stimuli [Uitdehaag K. A. *et al.*, 2009].
- ~~introducing males [Bestman and Wagenaar, 2003].~~

Management methods to control the occurrence include the above list, where applicable, and prompt removal of affected pullets and hens to a hospital area or euthanasia.

If these management strategies fail, therapeutic beak treatment trimming is the last resort. may be considered as a final course of action.

~~Animal Outcome~~-based measurables include: injurious feather pecking and cannibalism, injury rate and severity, mortality and culling rate, plumage condition, vocalisation.

Article 7.Z.20.

Moulting

Induced moulting can lead to *animal welfare* problems if not well managed. When induced moulting is practised, techniques that do not involve withdrawal of feed ~~should be used~~ and are consistent with Article 7.Z.8. should be used. Hens should have light and have access to water at all times. Only hens in good body condition and health should be moulted. During the moulting period, body mass loss should not compromise hen welfare, including welfare during the subsequent laying period. Total mortality and culling rate during the moult period should not exceed normal variations in *flock* mortality and culling rate.

~~Animal Outcome~~-based measurables include: body condition, feeding and drinking, foraging activity [Biggs *et al.*, 2004; Saiozkan *et al.*, 2016; Petek and Alpay, 2008], injurious feather pecking and cannibalism, injury rate and severity, morbidity rate, mortality and culling rate, performance, plumage condition, social behaviour.

Article 7.Z.21.

Painful interventions

Painful interventions, such as beak ~~treatment~~trimming, should not be practised unless ~~absolutely~~ necessary and pain mitigation interventions should be used. Beak trimming at a mature age can cause chronic pain. Other mutilations (e.g. dubbing and toe trimming) should not be performed in pullets and hens. Pain-free alternatives should be favoured are preferred. If preventive beak ~~treatment~~trimming is required, it should be carried out by ~~trained and skilled personnel~~ at the earliest age possible and care should be taken to remove the minimum amount of beak necessary using a method, which minimises pain and controls bleeding. ~~Current methods include infrared treatment or hot blade cutting. Beak trimming at a mature age can cause chronic pain.~~ If management strategies to control injurious feather pecking and cannibalism fail, therapeutic beak treatment may be considered as a final course of action [Gentle *et al.*, 1991; Marchand-Forde *et al.*, 2008; Marchand-Forde *et al.*, 2010; McKeegan and Philbey, 2012; Freire *et al.*, 2011; Glatz *et al.*, 1998]. Other mutilations (e.g. dubbing and toe trimming) should not be performed in pullets and hens.

~~Beak trimming at a mature age can cause chronic pain.~~ If therapeutic beak trimming is required, at whatever age, it should be carried out by trained and skilled personnel and care should be taken to remove the minimum amount of beak necessary using a method which minimises pain and controls bleeding.

~~Animal Outcome~~-based measurables include: feeding and drinking behaviour and foraging activity, ~~feeding~~, injurious feather pecking and cannibalism, locomotory and comfort behaviours, mortality rate, morbidity rate, performance, plumage condition, vocalisations.

Article 7.Z.22.

Animal health management, preventive medicine and veterinary treatment

Animal handlers responsible for the care of pullets and hens should have ~~be~~ knowledge aware of normal pullet and hen behaviour, ~~the and be able to detect~~ signs of ill-health or distress, such as a change in feed and water intake, reduced production, changes in behaviour, abnormal plumage condition ~~appearance of feathers~~, faeces, or other physical features.

If they are ~~not~~ unable to identify the causes of disease, ill-health or distress, or unable to correct these, or if they suspect the presence of a *notifiable disease*, they should seek advice from *veterinarians* or other qualified advisers. Veterinary treatments should be prescribed by a *veterinarian*.

There should be an effective programme for the prevention and treatment of diseases consistent with the programmes established by *Veterinary Services* as appropriate.

Vaccinations and treatments should be administered by personnel skilled in the procedures and with consideration for the welfare of the pullets and hens.

Sick or injured pullets and hens should be placed in a hospital area for observation and treatment or humanely killed in accordance with Chapter 7.6. as soon as possible.

~~Animal Outcome~~-based measurables include: body condition, incidence of diseases, injury rate and severity, metabolic disorders and *infestations*, morbidity rate, mortality rate, performance.

Article 7.Z.23.

Biosecurity

Biosecurity plans should be designed and implemented, commensurate with the best possible pullets and hens ~~birds~~ health status and current disease *risk* (endemic and exotic or transboundary) that is specific to each epidemiological group of pullets and hens and in accordance with relevant recommendations in the *Terrestrial Code*.

Annex 16 (contd)

These programmes should address the control of the major routes for *infection and infestation* such as:

- direct transmission from other *poultry*, *domestic animals* and *wildlife* and humans,
- fomites, such as equipment, facilities and vehicles,
- *vectors* (e.g. arthropods and rodents),
- aerosols,
- water supply,
- feed,
- the practice of partially restocking the house (back filling), due to catastrophe or incomplete *flock* placement, which should only be performed with due consideration to *biosecurity* and in a manner that prevents commingling of *flocks*.

Animal Outcome-based measurables include: incidence of diseases, ~~*infestations*~~, ~~morbidity rate~~ mortality rate, culling and morbidity rates, ~~mortality rate~~, performance.

Article 7.Z.24.

Humane killing of individual birds or flocks

Individual sick or injured pullets or hens requiring euthanasia should be humanely killed as soon as possible. When an individual or groups of pullets or hens birds are killed for euthanasia, diagnostic purposes, depopulation of end-of-lay *flocks* or for purposes of disease control, the techniques used should be performed in a humane manner in accordance with Chapter 7.6.

Article 7.Z.25.

Depopulation of pullet and ~~layer~~ hen facilities

This article refers to removal of pullets and laying hens from facilities for whatever reason and should be read in conjunction with Article 7.Z.24.

Pullets and hens should not be subjected to an excessive period of feed withdrawal prior to ~~the expected depopulation time~~ [Webster, 2003].

Water should be available up to the time of depopulation.

~~Birds~~ Pullets and hens that are not fit for *loading* or transport ~~because they are sick or injured~~ should be humanely killed.

Catching should be carried out by competent *animal handlers* in accordance with the condition of Article 7.Z.28. and every attempt should be made to minimise stress, fear reactions and ~~injuries~~. If a pullet or hen bird is injured during catching, it should be humanely killed.

~~Birds~~ Pullets and hens should be handled and placed into the transport *container* according to Chapter 7.3. Article 7.Z.14.

Catching should preferably be carried out under dim or blue light to calm the birds pullets and hens.

Catching should be scheduled to minimise the transport time as well as climatic stress during catching, transport and holding.

Stocking density in transport *containers* should comply with Chapters 7.2., 7.3. and 7.4.

Animal Outcome-based measurables include: fear behaviour, injury rate and severity, mortality ~~at depopulation and on arrival at the destination~~, spatial distribution, vocalisation.

Article 7.Z.26.

Emergency Contingency plans

Pullet and hen producers should have ~~emergency contingency~~ plans to minimise and mitigate the consequences of natural disasters, disease *outbreaks* and the failure of mechanical equipment. Planning should include a fire safety plan and where relevant, may include the provision, maintenance and testing of fail-safe alarm devices to detect malfunctions, backup generators, access to maintenance providers, alternative heating or cooling arrangements, ability to store water on farm, access to water cartage services, adequate on-farm storage of feed and alternative feed supply, a fire safety plan and a plan for managing ventilation emergencies.

The ~~emergency contingency~~ plans should be consistent with national programmes established or recommended by *Veterinary Services*. Humane emergency *killing* procedures should be a part of the plan according to the methods recommended in Chapter 7.6.

~~Animal Outcome~~-based measurables include: culling, morbidity and mortality rates.

Article 7.Z.27.

Personnel competency

All *animal handlers* responsible for the pullets and hens should have received appropriate training or be able to demonstrate that they are competent to carry out their responsibilities and should have sufficient knowledge of pullet and hen behaviour, handling techniques, emergency killing procedures, *biosecurity*, general signs of diseases, and indicators of poor *animal welfare* and procedures for their alleviation.

~~Animal Outcome~~-based measurables include: fear behaviour, incidence of diseases, locomotory ~~ion~~ and comfort behaviours, performance, ~~morbidity rate~~, mortality, culling and morbidity rate, spatial distribution, vocalisation.

Article 7.Z.28.

Inspection and handling

Pullets and hens and facilities and equipment within their premises should be inspected at least daily. Inspection should have the following three main objectives: to identify sick or injured birds to treat or cull them, to detect and correct any welfare or health problem in the flock and to pick up dead birds.

- = to identify sick or injured pullets and hens and to treat or cull them;
- = to pick up dead pullets and hens;
- = to detect and correct any welfare or health problem in the flock; and
- = to detect and correct malfunctioning equipment and other facility problems.

Inspection should be done in such a way that ~~birds-pullets and hens~~ are not unnecessarily disturbed, for example *animal handlers* should move quietly and slowly through the *flock*.

When pullets and hens are handled, particularly when ~~birds are~~ placed into or removed from the house, they should not be injured, and should be held in postures that minimise fear and stress unnecessarily frightened or stressed (e.g. should be restrained in an upright posture) [Gregory & Wilkins, 1989; Gross & Siegel, 2007; Kannan & Mench, 1996]. The distances pullets and hens are carried should be minimised. Laying hens are prone to bone fractures when not handled properly.

~~Animal Outcome~~-based measurables include: fear behaviour, injury rate and severity, ~~morbidity rate~~, mortality, culling and morbidity rates, performance, spatial distribution, vocalisation.

Annex 16 (contd)

Article 7.2.29.

Protection from predators

Pullets and hens should be protected from predators in indoor and outdoor areas. All production systems should be designed and maintained to prevent access by predators and wild birds.

Animal Outcome-based measurables include: fear behaviour, ~~mortality~~, injury rate and severity, locomotion and comfort behaviours, mortality, culling and morbidity rates, performance, spatial distribution, vocalisation.

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