**Article 7.X.1.**

**Definitions**

‘Pig production systems’ are defined as all commercial ‘Commercial pig production systems’, means those systems in which the purpose of the operation includes some or all of the breeding, rearing and management of pigs (*Sus scrofa* intended for the production of commercially traded pigs or pig meat).

For the purposes of this chapter, ‘management’ is defined at the farm management level and at the animal handler level. At the level of farm management, human resources management practices, including selection and training of handlers, and animal management practices, such as best practice in housing and husbandry and implementation of welfare protocols and audits, all have an impact on animal welfare. At the animal handler level this requires a range of well-developed husbandry skills and knowledge of how to care for animals.

For the purposes of this chapter, ‘environmental enrichment’ means increasing the complexity (e.g. foraging opportunities, social housing) of the animal’s environment to foster the expression of normal behavior, provide cognitive stimulation and reduce the expression of abnormal behavior and provide cognitive stimulation. The endpoint aim of providing enrichment should be to improve the biological functioning physical and psychological state of the animal (Newberry, 1995, Mellor, 2015 and 2016).

For the purposes of this chapter ‘stereotypy’ is a repetitive behaviour induced by frustration, repeated attempts to cope or central nervous system dysfunction. It is expressed as a sequence of abnormal and unvarying behaviours which have no obvious purpose or function, caused by known factors such as frustration, coping attempts. Permanent or dysfunction of the central nervous system in response to stressful conditions may mean that developed stereotypies may not resolve despite later changes to the environment or other treatment. Since stereotypies may not always indicate negative welfare of the individual or reflect the pig’s current welfare status, caution should be used when using them as a welfare measure. Some stereotypies commonly observed in pigs include sham chewing, stone chewing, tongue rolling, teeth grinding, bar biting and floor licking (NFACC, 2014; Tuyttens, 2007; Mason and Latham, 2004).

**Rationale:** Addition of “and unvarying” is done for clarification. Stereotypic behavior is uniquely defined by the performance of the behavior in a consistent and persistent manner.

Most stereotypic behaviors do have a purpose because they are considered to be coping mechanisms. While, to human observers, the behavior may appear to have no obvious gain or purpose, these behaviors do indeed serve a purpose to the animal and its potential welfare. Utilizing a stereotypic behavior as a coping strategy may reduce the aversiveness of a condition or alter sensory stimulation to compensate for a lack or abundance of environmental stimuli (Dantzer and Mormede, 1983; Jones et al., 1989; Cooper and Nicol, 1993; Mason and Latham, 2004; Tuyttens, 2007). Therefore, stereotypic behaviors are not consistently an indicator of negative welfare of the individual. The idea of stereotypic behaviors serving as a successful coping mechanism is further supported by studies that focus on individual differences in stereotypic behavior within a single treatment or population which found that animals that perform the most stereotypic behavior are likely to be the least welfare-compromised individuals of the group (Mason and Latham, 2004). Furthermore, some stereotypies have been shown to increase in response to changes that
are considered positive for animal welfare. For example, increasing dietary bulk through increased fiber can increase sham-chewing (Broom and Potter, 1984).

A stereotypic behavior may become uncoupled from the original eliciting situation over time due to the behavior shifting to a form of automatic processing (Mason and Turner, 1993; Toates, 2001) or due to central nervous system alteration or dysfunction (Cooper and Odberg, 1991). These uncoupled behaviors may be performed in a more diverse set of situations (Lawrence and Terlouw, 1993; Dailey and McGlone, 1997; Haskell et al., 2000) and harder to interrupt or modulate even with changes in the environment (Cooper et al., 1996; Cosyns and Odberg, 2000). Such stereotypic behaviors may be viewed as indicators of past experiences rather than current welfare states.

For these reasons, the degree to which stereotypic behavior is performed does not necessarily correspond to the degree its well-being is impaired or even reflect the animal's current state of welfare (Broom and Potter, 1984; Mason and Latham, 2004; Tuyttens, 2007). Further, identifying stereotypic behavior in practice is somewhat arbitrary and difficult to implement and verify during on-farm welfare assessments (Mason, 1993; Tuyttens, 2007).


For the purposes of this chapter ‘apathy’ means that the animal ceases to respond to stimuli that would normally elicit a response (Wood-Gush and Vestergaard, 1989). Furthermore, apathetic behaviour has been described as an abnormal or maladaptive behaviour, indicated by reduced activity, lack of interest or concern (i.e. indifference) and lack of feeling or emotion (impassiveness).

For the purposes of this chapter ‘agonistic behaviour’ is a continuum of behaviours expressed in conflict situations, and includes offence, defence and submissive or escape components. The behaviours involved may include contact, such as biting and pushing, or non-contact, such as threats in the form of body postures and gestures. Aggressive behaviour (i.e., fighting) is a component of agonistic behaviour (Petherick and Blackshaw, 1987).

**Rationale:** While “aggression” and “agnostic” have precise ethological meanings, in psychology and lay parlance “aggression” is frequently considered to include all acts intended to harm in the broadest sense and is not limited to physical harm; that is, including acts of or generally expressing anger even when the victim is not physically present. As such, clarifying that the scope here is only “physical aggression” or “fighting” is recommended for clarity given the broad audience referencing this chapter (Reference: Warburton, W. A., & Anderson, C. A. [2015]. Social psychology of aggression. In J. Wright & J. Berry [Eds.], International Encyclopedia of Social and Behavioral Sciences, 2nd Edition, Volume 1 [pp. 373-380]).

Article 7.X.2.

**Scope**

This chapter addresses the welfare aspects of commercial domestic pig production systems. However, Captive wild pigs are not considered.

Article 7.X.3.

**Commercial pig production systems**

Commercial pig production systems include:

1. **Indoors systems**

   These are systems in which pigs are kept indoors, and are fully dependent on humans to provide for basic animal needs such as feed and water. The type of housing depends on the environment, climatic conditions and management system. The animals may be kept in groups or individually.

2. **Outdoors systems**

   These are systems in which pigs live outdoors with shelter or shade, have some autonomy over access to shelter or shade, and may be fully dependent on humans to provide for basic animal needs such as feed and water. They are typically confined in paddocks or pastures according to their production stage. The animals may be kept in groups or individually.

3. **Combination systems**

   These are systems in which pigs are managed in any combination of indoor and outdoor production systems, depending on weather or production stage.

Article 7.X.4.
Criteria (or measurables) for the welfare of pigs

The following outcome-based criteria (or measurables), specifically animal-based criteria, can be useful indicators of animal welfare. The use of these indicators and their appropriate thresholds reference values should be adapted to the different situations in which pigs are managed. Consideration should also be given to the design of the systems. These criteria can be considered as a tool to monitor the efficiency of design and management, given that both of these can affect animal welfare.

Rationale: Clarification. As the term is used in animal welfare science, “threshold” data tend to be closely related to welfare states and thus do not have acceptable variance between sites and systems. For example, welfare-relevant “thresholds” that are often referenced include clinical infection and mortality rates, and “thresholds” are used in inspection systems to make between-farm comparisons, rather than being permitted to have a systematic or excusable variance (see following references). Consequently, the use of the term “threshold” should be avoided as a method for describing any reference value that is expected to have acceptable site-to-site or system-to-system variability. (References: Main, D. C. J., Mullan, S., Atkinson, C., Cooper, M., Wrathall, J. H. M., & Blokhuis, H. J. [2014]. Best practice framework for animal welfare certification schemes. Trends in food science & technology, 37, 127-136; Lundmark, F., Berg, C., Wahlberg, B., & Röcklinsberg, H. [2015]. ‘One animal is no animal’—consequences of measuring animal welfare at herd level. In D. E. Dumitras, I. M. Jitea and S. Aerts [Eds.], Know your food: Food ethics and innovation [pp. 254-271])

1. Behaviour

Certain behaviours could indicate an animal welfare and health problem. These include changes of in feed and water intake, altered locomotory behaviour and posture, altered lying time, postures and patterns, altered respiratory rate and panting, coughing, shivering and huddling, certain vocalisations, and increased agonistic behaviours (including aggression), and stereotypic, apathetic or other abnormal behaviours (e.g. tail biting).

Rationale: Most stereotypic behaviors do have a purpose as they are considered to be coping mechanisms and therefore, are not a consistent indicator of negative welfare of the individual. In many cases when individual differences are evaluated, animals that perform the most stereotypic behavior are likely to be the least welfare-compromised individuals of the group (Mason and Latham, 2004). Furthermore, some stereotypies have been shown to increase in response to changes that are considered positive for animal welfare (Broom and Potter, 1984). A stereotypic behavior may become uncoupled from the original eliciting situation over time (Mason and Turner, 1993; Cooper and Odberg, 1991; Toates, 2001) which can result in the behaviors being performed in a more diverse set of situations (Lawrence and Terlouw, 1993; Dailey and McGlone, 1997; Haskell et al., 2000) and harder to interrupt or modulate even with changes in the environment (Cooper et al., 1996; Cosyns and Odberg, 2000). Such stereotypic behaviors may be viewed as indicators of past experiences rather than current welfare states. For these reasons, the degree to which stereotypic behavior is performed does not necessarily correspond to the degree its well-being is impaired or even reflect the animal’s current state of welfare (Broom and Potter, 1984; Mason and Latham, 2004; Tuyttens, 2007). Further, identifying stereotypic behavior in practice is somewhat arbitrary and difficult to implement and verify during on-farm welfare assessments (Mason, 1993; Tuyttens, 2007).

Certain behaviours are indicators of good animal welfare. These may include positive social and play behaviour.

Stereotypy is defined as a sequence of invariant motor acts, which provide no obvious gain or purpose for the animal. Some stereotypies commonly observed in pigs include sham chewing, tongue rolling, teeth grinding, barbiting and floor licking.

2. Morbidity rates

Rates of infectious and metabolic diseases, lameness, peripartum peripartum and post-procedural complications, injury and other forms of morbidity, above recognised thresholds, may be direct or indirect indicators of the animal welfare status of the whole at the herd level. Understanding the aetiology of the disease or syndrome is important for detecting potential animal welfare problems. Mastitis and metritis, leg and hoof problems, shoulder ulcers in sows, skin lesions, respiratory and digestive diseases, and reproductive diseases are also particularly important animal health problems for pigs. Scoring systems, such as for body condition, lameness and injuries, and information gathered at the slaughterhouse/abattoir, can provide additional information.

Both clinical and post mortem pathologic examination and pathology should be utilised as indicators of disease, injuries and other problems that may compromise animal welfare.

3. Mortality and culling rates

Mortality and culling rates affect the length of productive life and, like morbidity rates, may be direct or indirect indicators of the animal welfare at the herd level status. Depending on the production system, estimates of mortality and culling rates can be obtained by analysing the causes of death and culling and their temporal and
spatial patterns of occurrence. Mortality and culling rates, and their causes, when known, should be recorded regularly, e.g. daily, and used for monitoring e.g. monthly, annually.

Necropsy is useful in establishing the cause of death.

4. **Changes in body weight and body condition**

In growing animals, body weight changes outside the expected growth rate, especially excessive sudden weight loss, are indicators of poor animal welfare and health.

In mature animals, body condition outside an acceptable range or large variation amongst individual animals in the group may be an indicator of compromised animal welfare and health, and reproductive efficiency in mature animals.

5. **Reproductive efficiency**

Reproductive efficiency can be an indicator of animal welfare and health status. Future performance of sows or gilts can be affected by under- or over-nutrition at different stages of rearing. Poor reproductive efficiency, compared with the targets expected for a particular breed or hybrid, can indicate animal welfare problems (Hemsworth et al. 1981, 1986, 1989, 1994, Munsterjelm et al., 2006).

Examples may include:
- low conception rates,
- high abortion rates,
- metritis and mastitis,
- low small litter size (total born),
- low numbers born alive,
- high numbers of stillborns or mummies.

6. **Physical appearance**

Physical appearance may be an indicator of animal welfare and health. Attributes of physical appearance that may indicate compromised animal welfare include:
- body condition outside an acceptable range,
- presence of ectoparasites,
- abnormal texture or hair loss,
- excessive soiling with faeces in indoor systems,
- reddish-skin discoloration,
- swellings, injuries or lesions,
- discharges (e.g. from nose or eyes, including tear staining) (Telkänranta et al., 2016),
- feet and leg abnormalities,
- abnormal posture (e.g. rounded back, head low),
- emaciation or dehydration (in piglets).

7. **Handling response**

Improper handling or lack of human contact can result in fear and distress in pigs. Fear of humans may be an indicator of poor animal welfare and health. Indicators may include:
evidence of poor human-animal relationship, such as marked avoidance of handlers and abnormal or excessive vocalisation disturbed behaviour when being moved or when animal handlers interact with pigs enter a pen,

- animals slipping or falling during handling,

- injuries sustained during handling, such as bruising, lacerations and fractured legs,

- animals vocalising abnormally or excessively during restraint and handling.

8. Lameness

Pigs are susceptible to a variety of infectious and non-infectious musculoskeletal disorders. These disorders may lead to cause lameness and to gait abnormalities. Pigs that are lame or have gait abnormalities may have difficulty reaching food and water and may experience pain and distress. Musculoskeletal problems have many causes, including genetic, nutrition, sanitation, floor quality, and other environmental and management factors. There are several gait scoring systems available.

9. Complications from common procedures

Some painful or potentially painful procedures such as surgical castration, tail docking, teeth clipping or grinding, tusk trimming, identification, nose ringing and hoof care are commonly performed in pigs to facilitate management, to meet market or environmental requirements and improve human safety and improve human safety or and safeguard animal welfare.

However, if these procedures are not performed properly, animal welfare and health can be unnecessarily compromised.

Indicators of such problems associated with these procedures could include:

- post-procedure infection and swelling,

- post-procedure lameness,

- behaviour indicating pain, fear, distress or suffering (Mellor and Patterson-Kane, 2009) and distress,

- increased morbidity, mortality and culling rates,

- reduced feed and water intake,

- post procedure body condition and weight loss.

Article 7.X.5.

Recommendations

Ensuring good welfare of pigs is contingent on several management factors, including system design, environmental management, 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.X.6. to 7.X.27 provide recommendations for measures applied to pigs.

Each recommendation in Article 7.X.6. to 7.X.24. includes a list of relevant animal outcome-based criteria (or measurables) derived from Article 7.X.4.

This does not exclude other criteria being used where or when appropriate.
Article 7.X.6.

**Housing**

When new facilities are planned or existing facilities are modified, professional advice on design in regards to welfare and health of animals should be sought.

Housing systems and their components should be designed, constructed and regularly inspected and maintained in a manner that reduces the risk of injury, disease or stress for pigs. Facilities should to allow for the safe, efficient and humane management and movement of pigs.

There should be a separate area where sick and injured animals can be treated and monitored. When a separated space is provided, this should accommodate all the needs of the animal e.g. recumbent or lame animals or animals with severe wounds may require additional bedding or an alternative floor surface.

Pigs should not be tethered as part of their normal housing systems.

Good outcomes in the welfare and health of animals can be achieved in a range of housing systems. The design and management of the system are critical for achieving that.

Pigs are social animals and prefer living in groups, therefore housing systems where pregnant sows and gilts can be kept in groups are recommended.

Outcome-based criteria (or measurables): physical appearance (injuries), behaviour, changes in body weight and body condition, handling response, reproductive efficiency, lameness and morbidity, mortality and culling rates.

Article 7.X.6.7.

**Training of Personnel training**

Pigs should be cared for by a sufficient number of personnel, who collectively possess the ability, knowledge and competence necessary to maintain the welfare and health of the animals.

All people responsible for pigs should be competent through formal training or practical experience in accordance with their responsibilities. This includes understanding of and skill in animal handling, nutrition, reproductive management techniques, behaviour, biosecurity, signs of disease, and indicators of poor animal welfare such as stress, pain and discomfort, and their alleviation.

Outcome Animal-based criteria (or measurables): handling response, physical appearance, behaviour, changes in body weight, body condition, reproductive efficiency, lameness and morbidity, mortality and culling rates and complications from common procedures.

Article 7.X.7.8.

**Handling and inspection**

Pigs should be inspected at least once a day when fully dependent on humans to provide for basic needs such as feed and water and to identify welfare and health problems.

Some animals should be inspected more frequently, for example, farrowing sows, new born piglets, newly weaned pigs, newly-mixed gilts and sows, sick or injured pigs and those showing abnormal behaviours such as tail nibbling and tail biting.

Pigs identified as sick or injured should be given appropriate treatment at the first available opportunity by competent animal handlers. If animal handlers are unable to provide appropriate treatment, the services of a veterinarian should be sought.
Recommends on the handling of pigs are also found in Chapter 7.3. In particular handling aids that may cause pain and distress (e.g. electric goads) should be used only when other methods fail in extreme circumstances and provided that the animal can move freely and is able to move away from the handling aid. The use of electric prods goads should be avoided (see also point 3 of Article 7.3.8.), and in any case should not be repeated used on the same animal, and not be used in sensitive areas including the udder, face, eyes, nose, ears or ano-genital region.

Exposure of pigs to sudden movement, loud noises or changes in visual contrasts should be minimised where possible to prevent stress and fear reactions. Pigs should not be improperly or aggressively handled aggressively (e.g. kicked, thrown, dropped, walked on top of, held or pulled by one front leg, ears or tail). Pigs that become distressed during handling should be attended to immediately.

Pigs should be restrained only for as long as necessary and only appropriate, well-maintained restraint devices should be used.

Well designed and maintained handling facilities assists proper handling.

Outcome Animal-based criteria (or measurables): physical appearance, behaviour, changes in body weight and body condition, handling response, reproductive efficiency, lameness and morbidity, mortality and culling rates.

Article 7.X.89.

Painful procedures

Some procedures such as surgical castration, tail docking, teeth clipping or grinding, tusk trimming, identification, and nose ringing are may be commonly performed in pigs. These procedures should only be performed when necessary to facilitate management, to meet market or environmental requirements and improve human safety, improve human safety or and safeguard animal welfare.

These procedures are painful or have the potential to cause pain. They and thus should be performed only when necessary and-in such a way as to minimise any pain and, distress or suffering to the animal, e.g. using anaesthesia, or analgesia or both under the recommendation or supervision of a veterinarian.

Options for enhancing animal welfare in relation to these procedures include the internationally recognised ‘three Rs’ which involves: replacement (e.g. using entire males or immunocastrated males vs. rather than castrated males), reduction (e.g. tail docking and teeth clipping only when necessary) and refinement (e.g. providing analgesia or anaesthesia under the recommendation or supervision of a veterinarian) (Bonastre et al., 2016 and Hansson et al., 2011).

Ovariectomy should not be performed without anaesthesia and prolonged analgesia. An immunological product that reversibly and effectively suppresses ovarian function in pigs is available. Immunological prevention of oestrus should be encouraged to avoid ovariectomy (Dalmau et al., 2015).

Outcome Animal-based criteria (or measurables): complications from common procedures, morbidity rates, mortality and culling rates, abnormal behaviour, physical appearance and changes in weight and body condition.

Article 7.X.910.

Feeding and provision of watering of animals

The amount of feed and nutrients pigs require in any management system is affected by factors such as climate, the nutritional composition and quality of the diet, the age, gender, genetics, size and physiological state of the pigs (e.g. pregnancy, lactation, growth), and their state of health, growth rate, previous feeding levels and level of activity and exercise.

All pigs should receive adequate quantities quantity and quality of feed and nutrients each day to enable each pig to:

- maintain good health;
meet its physiological and behavioural requirements; and,

meet its requirements for foraging (Bergeron et al., 2008, Brouns et al., 1994, Ramonet et al., 1999, Robert et al., 1993 and 1997).

**Rationale:** This new addition overlaps with content in the Environmental Enrichment section (Article 7.X.10) where it states animals should be provided with an environment that provides complexity, manipulability and cognitive stimulation (e.g. foraging opportunities) to foster normal behaviour (e.g. rooting and foraging). We believe the existing language in the environmental enrichment section adequately addresses the foraging requirement and allows flexibility beyond just diet for how the animals’ foraging requirements can be met.

avoid metabolic and nutritional disorders.

Feed and water should be provided in such a way as to prevent undue excessive or injurious competition and injury.

Pigs should be fed a diet with sufficient fibrous feedstuffs in order to reduce as much as possible the intention to prevent the occurrence of gastric ulcers (Herskin et al., 2016).

**Rationale:** We agree that steps should be taken to prevent the occurrence of gastric ulcers. However, we disagree with the specificity of the statement that this can only be accomplished with the inclusion of fibrous feedstuffs. While inclusion rates of fibrous feedstuffs have been shown to impact development of gastric ulcers (Herskin et al., 2016), feed particle size (Cabrera et al., 1994; Wondra et al., 1995a; Wondra et al., 1995b; Wondra et al., 1995c; Wondra et al., 1995d; Eisemann et al., 1999; Hancock et al., 2001), prolonged interruptions in feed intake (Chamberlain et al., 1967; Pocock et al., 1968; Lawrie et al., 1998; Deen, 1993; Brumm et al., 2005), restricted feeding vs. ad libitum feeding (Robert et al., 1991), feed pelleting (Chamberlain et al., 1967; Pocock et al., 1969; Wondra et al., 1995a; Nielsen and Ingvartsen, 2000), and inclusion of heat-treated corn (Mahan et al., 1966; Pocock et al., 1968; Picket et al., 1969) have all been shown to influence the incidence and severity of gastric ulcer development.

Inclusion of fibrous feedstuffs is not appropriate for all ages of pigs. The large intestine continues to develop after birth and does not reach full maturation and functionality until the pig reaches approximately 150 kg (Nielsen, 1962; Nabuurs, 1998). Therefore, pigs less than 36 kg are unable to digest fibrous feedstuffs (Forbes and Hamilton, 1952; Cunningham et al., 1961; Jiminez, 1972; DeGoey and Ewan, 1975). Weaned pigs fed high fiber diets had increased crypt depth in the large intestine (Jin et al., 1994) which resulted in increased water secretion into the intestinal lumen. This increased water secretion is one of the primary mechanisms *E. coli* or *Salmonella* use to initiate hypersecretory diarrhea (Montagne et al., 2003). Young pigs are incapable of absorbing enough fluid to prevent clinical diarrhea and dehydration (Nabuurs, 1998).


All pigs should have access to an adequate supply of palatable drinkable water at a temperature that does not inhibit drinking and that meets their physiological requirements and is free from contaminants hazardous to pig health (Patience, 2013).

**Outcome - Animal-based criteria (or measurables):** changes in body weight and body condition, physical appearance (emaciation, dehydration in piglets), behaviour (agonistic behaviour at feeding and watering places and abnormal behaviour such as tail biting), mortality and culling rates, and morbidity rates (gastric ulcers).

**Environmental enrichment**

Animals should be provided with an environment that provides complexity, manipulability and cognitive stimulation (e.g. foraging opportunities, social housing) to foster normal behaviour (e.g. rooting, and biting/foraging or chewing materials other than feedstuffs), reduce abnormal behaviour (e.g. tail, ear, leg and flank biting and apathetic behaviour) and improve their well-being physical and psychological state, biological function (Dudnik et al., 2006; Elmore et al., 2011; Newberry, 1995; Van de Weerd et al., 2006; Wittaker et al., 1999).

Pigs should be provided with multiple forms of enrichment that aim to improve their welfare of the animals through the enhancement of their physical and social environments, such as:

**Rationale:** Editorial clarification. There are five categories of enrichment: social, occupational, physical, sensory and nutritional (Bloomsmith et al., 1991). Examples of enrichment that address these categories are adequately covered in the following bullet points. However, it is important to note that these categories are not mutually exclusive and that one specific form of enrichment may satisfy multiple categories. For example, straw could meet occupational, nutritional and physical enrichment for pigs (Mench et al., 2010). Indeed, a farmer may sufficiently enrich the pigs' environment by providing one form of enrichment that addresses multiple categories.


sufficient quantity of suitable materials to enable pigs to fulfil their innate needs to explore and look for feed (edible materials), bite (chewable materials), root (investigable materials) and manipulate (manipulable materials) (Bracke et al., 2006); novelty is another aspect that is important in maintaining interest in the provided material(s) (Trickett et al., 2009; Abou-Ismaila and Mendl, 2016; Tarou and Bradshaw 2007);

social enrichment which involves either keeping pigs in groups or individually with visual, olfactory and auditory contact with other pigs;

positive human contact (such as regular direct physical contact associated with positive events, which may include feed, pats, rubs, scratching and talking when the opportunity arises) (Hemsworth and Coleman, 2011; Hemsworth and Coleman, 1994).

Outcome - Animal-based criteria (or measurables): physical appearance (injuries), behaviour (stereotypies, tail biting), changes in body weight and body condition, handling response, reproductive efficiency, lameness and morbidity, mortality and culling rates.

Prevention of abnormal behaviour

In pig production there are a number of abnormal behaviours that can be prevented or minimised with appropriate management procedures.

Many of these problems are multifactorial and minimising their occurrence requires an examination of the whole environment and of several management factors. However, some recommendations to Management procedures that may reduce their occurrence include:

1) Oral stereotypies (e.g. bar biting, sham chewing, excessive drinking) in adult pigs can be minimised by providing environmental enrichment and increasing feeding time and satiety by increasing fibre content in the diet or foraging roughage (Robert et al., 1997; Bergeron et al., 2000).

2) Tail biting may be reduced by providing an adequate enrichment material and an adequate diet (avoiding deficiencies of sodium minerals (Fraser, 1987) or essential amino acids, and avoiding high stocking densities and competition for feed and water (Walker and Bilkei, 2005). Other factors to consider include animal characteristics (breed, genetics, gender) and social environment (herd size, mixing animals) (Schroder-Petersen and Simonsen, 2001; EFSA, 2007; Taylor et al., 2010), general health, thermal comfort and air quality.

3) Belly nosing and ear sucking may be reduced by increasing the weaning age, and providing feed to piglets prior to weaning to avoid the abrupt change of feed (Marchant-Forde, 2009; Sybesma, 1981; Worobec, 1999).

4) Vulva biting may be reduced by minimising competition for resources, including feed and water in accessing the feeding area (Bench et al., 2013; Leeb et al., 2001; Rizvi et al., 1998).

Outcome - Animal-based criteria (or measurables): physical appearance (injuries), behaviour (abnormal behaviour), morbidity rates, mortality and culling rates, reproductive efficiency and changes in body weight and body condition.

Housing (including outdoor production systems)

When new facilities to accommodate pigs are planned or existing facilities are modified, professional advice on design in regards to welfare and health of animals should be sought.

Housing systems and their components should be designed, constructed and regularly inspected and maintained in a manner that reduces the risk of injury, disease or stress for pigs. Facilities should allow for the safe, efficient and humane management and movement of pigs. In systems where pigs could be exposed to adverse weather conditions they should have access to shelter to avoid thermal stress and sunburn.

There should be a separate pen or area where sick and injured animals or animals that exhibit abnormal behaviour can be isolated, treated and monitored. Certain animals may need to be kept individually. When a separated space is provided, this should accommodate all the needs of the animal e.g. recumbent or lame animals or animals with severe
wounds may require additional bedding or an alternative floor surface, and water and food feed must should be within reach.

Pigs should not be tethered as part of their normal housing systems.

Good outcomes in the welfare and health of animals can be achieved in a range of housing systems. The design and management of the system are critical for achieving these outcomes.

Pigs Sows and gilts, like other pigs, are social animals and prefer living in groups (Stolba and Wood-Gush, 1989; Newberry and Wood-Gush, 1988; Gonyou, 2001). Therefore housing systems where pregnant sows and gilts should preferably be housed can be kept in groups are recommended (Ani et al., 2005; Barnett et al., 2001; Boyle et al., 2002; Broom et al., 1995; Karlen et al., 2007; Marchant and Broom, 1996; McGlone et al., 2004; AVMA, 2015). Sows and gilts can be successfully mixed early after breeding, without any reproduction consequences (Spoolder et al., 2009).

**Rationale:** The stated preference of the ad hoc group towards one housing type is counter to the previous paragraph stating that good outcomes in the welfare and health of animals can be achieved with a range of housing systems and that the design and management of the system are critical for achieving these outcomes. It is well documented in the scientific literature that individual and group housing systems have advantages and disadvantages to their design and management but both can result in good animal welfare outcomes for pregnant sows and gilts (EFSA, 1997; Barnett et al., 2001; McGlone et al., 2004; Rhodes et al., 2005; Karlen et al., 2007; Stalder et al., 2007a; Stalder et al., 2007b; Salak-Johnson et al., 2007; Pajor, 2010; Salak-Johnson et al., 2012; McGlone, 2013; AASV, 2015; AVMA, 2015).


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Outcome—Animal-based criteria (or measurables): physical appearance (injuries), behaviour, changes in body weight and body condition, handling response, reproductive efficiency, lameness and morbidity, mortality and culling rates.

Article 7.X.13.

Space allowance

Space allowance should be managed taking into account different areas for lying, standing, and feeding and elimination. Crowding Stocking density should not adversely affect normal behaviour of pigs and durations of time spent lying.

Insufficient and inadequate space allowance may increase stress, the occurrence of injuries and have an adverse effect on growth rate, feed efficiency, reproduction and behaviour such as locomotion, resting, feeding and drinking, agonistic and abnormal behaviour (Gonyou et al., 2006; Ekkel, 2003; Turner, 2000).

1. Group housing

   Floor space may interact with a number of factors such as temperature, humidity, floor type and feeding systems to affect pig welfare (Marchant–Forde, 2009; Verdon, 2015). All pigs should be able to lie down rest simultaneously, and each animal lie down, to stand up and move freely. Sufficient space should be provided to enable animals to have access to feed, water, to separate lying and elimination areas and to avoid aggressive animals.

   Group housing systems should provide sufficient space and opportunities to avoid or escape from potential aggressors.

   If abnormally aggressive behaviour is seen, corrective measures should be taken, such as increasing space allowance and providing barriers where possible or individually housing the aggressive pig.

   In outdoor systems where pigs have some autonomy over diet selection, stocking density should be matched to the available feed supply.

   Outcome—Animal-based criteria (or measurables): reduction or variation in body weight and body condition, increasing agonistic and abnormal behaviour such as tail biting, injuries, morbidity, mortality and culling rates, and physical appearance (e.g. excessive presence of faeces on the skin).

2. Individual pens

   Pigs should only be housed in individual pens if necessary. In individual pens, pigs must be provided with sufficient space so that they can stand up, turn around and lie comfortably in a natural position, and that provides separate areas for separation of dunging-elimination, lying and eating areas.

   Outcome—Animal-based criteria (or measurables): increasing abnormal behaviour (stereotypies), morbidity, mortality and culling rates, and physical appearance (e.g. excessive presence of faeces on the skin, injuries).

3. Stalls and (crates)

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Feeding, insemination and gestation and insemination stalls and farrowing crates. Stalls should be sized appropriately to allow pigs to:

- be able to stand up in their natural stance without contact with either side of the stall or crate,
- stand up without touching the top bars,
- stand in a stall without simultaneously touching both ends of the stall or crate,
- lie comfortably on their sides without disturbing neighbouring pigs or being injured by another pig.

**Outcome** Animal-based criteria (or measurables): physical appearance (e.g. injuries), increasing abnormal behaviour (stereotypies), reproductive efficiency, lameness and morbidity, mortality and culling rates (e.g. piglets).

**Article 7.X.14.**

**Flooring, bedding, resting surfaces**

In all production systems pigs need a well-drained, dry and comfortable place to rest.

Floor management in indoor production systems can have a significant impact on pig welfare (Temple et al., 2012; Newton et al., 1980). Flooring, bedding, resting surfaces and outdoor yards should be cleaned as conditions warrant, to ensure good hygiene, comfort and minimise risk of diseases and injuries. Areas with excessive faecal accumulation are not suitable for resting.

Floors should be designed to minimise slipping and falling, promote foot health, and reduce the risk of claw injuries.

If a housing system includes areas of slatted floor, the slat and gap widths should be appropriate to the claw size of the pigs to prevent injuries.

Slopes of the floor pens should allow water to drain and not pool in the pens.

In outdoor systems, pigs should be rotated between paddocks or pastures to ensure good hygiene and minimise risk of diseases.

If bedding or rubber matting is provided it should be suitable (e.g. hygienic, non-toxic) and maintained to provide pigs with a clean, dry and comfortable place on which to lie.

**Outcome** Animal-based criteria (or measurables): physical appearance (e.g. injuries, presence of faeces on the skin, bursitis), lameness and morbidity rates (e.g. respiratory disorders, reproductive tract infections).

**Article 7.X.15.**

**Air quality**

Good air quality and ventilation are important for the welfare and health of pigs and reduce the risk of respiratory discomfort, and abnormal behaviour. Dust, toxins, microorganisms, and noxious gases, including ammonia, hydrogen sulphide, and methane caused by decomposing animal waste, can be problematic in indoor systems due to decomposing animal waste (Drummond et al., 1980).

Air quality is influenced strongly by management and building design in housed systems. Air composition is influenced by stocking density, the size of the pigs, flooring, bedding, waste management, building design and ventilation system (Ni et al., 1999).

Proper ventilation is important for effective heat dissipation in pigs and to prevent the build-up of effluent gases (e.g. ammonia and hydrogen sulphide), including those from manure and dust in the housing unit. The ammonia level concentration in enclosed housing should not exceed 25 ppm. A useful indicator is that if air quality at the level of the pigs is unpleasant for humans it is also most likely to be a problem for pigs.
Outcome Animal-based criteria (or measurables): morbidity, mortality and culling rates, physical appearance (excessive soiling and tear staining), behaviour (especially respiratory rate, or coughing and tail biting), change in body weight and body condition.

Article 7.X.16.

Thermal environment

Although pigs can adapt to different a range of thermal environments, particularly if appropriate breeds and housing are used for the anticipated conditions, sudden fluctuations in temperature can cause heat or cold stress.

1. Heat stress

Heat stress is a serious problem in pig production. It can cause significant discomfort, as well as reductions in weight gain and fertility, or sudden death (Werremann and Bazer, 1985).

The risk of heat stress for pigs is influenced by environmental factors including air temperature, relative humidity, wind speed, ventilation rates, stocking density, shade and wallow availability in outdoor systems, and animal factors including breed, age and body condition (Heitman and Hughes, 1949; Quiniou and Noblet, 1999).

Animal handlers should be aware of the risk that heat stress poses to pigs and of the thresholds in relation to heat and humidity that may require action. If the risk of heat stress reaches too high levels the animal handlers should institute an emergency action plan that gives priority to access to additional water and could include provision of shade and wallows in outdoor systems, fans, reduction of stocking density, water-based cooling systems (dripping or misting), and provision of cooling systems as appropriate for the local conditions.

Outcome Animal-based criteria (or measurables): behaviour (feed and water intake, respiratory rate, panting, lying postures and patterns, agonistic behaviour), physical appearance (presence of faeces on the skin, sunburn), morbidity, mortality and culling rates, and reproductive efficiency.

2. Cold stress

Protection from cold should be provided when these conditions are likely to compromise the welfare of pigs, particularly in neonates and young pigs and others that are physiologically compromised (e.g. ill animals). This protection can be provided by insulation, extra bedding, heat mats or lamps and natural or man-made shelters in outdoor systems (Blecha and Kelley, 1981).

Outcome Animal-based criteria (or measurables): morbidity, mortality and culling rates, physical appearance (long hair, piloerection), behaviour (especially abnormal postures, shivering and huddling) and changes in body weight and body condition.

Article 7.X.17.

Noise

Pigs are able to cope with a range of adaptable to different levels and types of noise. However, exposure of pigs to sudden or loud noises should be minimised or avoided where possible to prevent stress and fear reactions. Ventilation fans, feeding machinery or other indoor or outdoor equipment should be constructed, placed, operated and maintained in such a way that they cause the least possible amount of noise (Algers and Jensen, 1991).

Outcome Animal-based criteria (or measurables): behaviour (e.g. fleeing and abnormal or excessive vocalisation), physical appearance (e.g. injuries), reproductive efficiency, changes in body weight and body condition.

Article 7.X.18.
Lighting

Indoor systems should have light levels sufficient to allow all pigs to see one another, to investigate their surroundings visually and to show other normal behaviour patterns and to be seen clearly by staff to allow adequate inspection of the pigs. The lighting regime shall be such as to prevent health and behavioural problems. It should follow a 24-hour rhythm and include sufficient uninterrupted dark and light periods, preferably no less than 6 hours for both.

A minimum of 40 lux of lighting is recommended for a minimum of 6 hours per day (Martelli et al., 2006; Taylor et al., 2006).

Artificial light sources should be located so as not to cause discomfort to the pigs.

Outcome Animal-based criteria (or measurable): behaviour (locomotive behaviour), morbidity rates, reproductive efficiency, physical appearance (injuries) and changes in body weight and body condition.

Article 7.X.19.

Farrowing and lactation

Sows and gilts need time to adjust to their farrowing accommodation before farrowing. Nesting material should be available to sows and gilts where possible for at least one day prior to some days before farrowing (Yun et al., 2014, Lawrence et al., 1994 and Jarvis et al., 1998). Sows and gilts should be observed frequently around their expected farrowing times. As some sows and gilts need assistance during farrowing, there should be sufficient space and competent staff.

When new buildings are planned, loose housing systems for farrowing sows and gilts should be considered. (Baxter et al., 2012; Cronin et al., 2014; KilBride et al., 2012; Morrison et al., 2013; Weber, 2007).

Outcome Animal-based criteria (or measurable): mortality and culling rates (piglets and sows), morbidity rates (metritis and mastitis), behaviour (stereotypies—restlessness and savaging), reproductive efficiency, physical appearance (injuries).

Article 7.X.20.

Weaning

Weaning can be a stressful time for sows and piglets and good management is required. Problems associated with weaning are generally related to the piglets’ size and physiological maturity. Early weaning systems require good management and nutrition of the piglets.

Weaned piglets should be moved into clean and disinfected housing separate from where sows are kept, in order to minimise the transmission of diseases to the piglets.

An average Piglets should be weaneding age of at three weeks or older, unless otherwise recommended by a veterinarian for disease control purposes, is recommended (Hameister et al., 2010; Smith et al., 2010; Gonyou et al., 1998; Worobec et al., 1999). Early weaning systems require good management and nutrition of the piglets.

Delaying weaning to the age of four weeks or more may produce benefits such as improved gut immunity, less diarrhoea and less use of antimicrobial agents (EFSA, 2007; Hameister et al., 2010; McLamb et al., 2013; Smith et al., 2010; Gonyou et al., 1998, Bailey et al., 2001).

Regardless of age, low weight piglets require additional care and can benefit from being kept in small groups until they are able to be moved to the common nursery area.

Newly weaned pigs are susceptible to disease challenges, so adherence to high-level hygiene protocols and appropriate diet is important. The area that piglets are weaned into should be clean, dry and warm.
All newly weaned pigs should be monitored during the first two weeks after weaning for any signs of ill-health or abnormal stress.

Outcome Animal-based criteria (or measurables): mortality and culling rates (piglets), morbidity rates (respiratory disease, diarrhoea), behaviour (belly nosing and ear sucking), physical appearance (injuries) and changes in body weight and body condition.

Article 7.X.21.

Mixing

Mixing of unfamiliar pigs can result in fighting to establish a dominance hierarchy, and therefore mixing should be minimised as much as possible (Moore et al., 1994; Fabrega et al., 2013). When mixing, strategies to reduce aggression and injuries should be implemented and animals should be observed after mixing and interventions applied if the aggression is intense or prolonged, and pigs become injured supervised.

Measures to prevent excessive fighting and injuries can include (Arey and Edwards, 1998, Verdon et al., 2015):
- providing additional space and a non-slippery floor,
- feeding before mixing,
- feeding on the floor in the mixing area,
- provision of straw or other suitable enrichment materials in the mixing area,
- providing opportunities to escape and to hide from other pigs, such as visual barriers,
- mixing previously familiarised animals whenever possible,
- mixing young animals should be mixed as soon after weaning as possible,
- avoiding the addition of one or small number of animals to a large established group.

Outcome Animal-based criteria (or measurables): mortality, morbidity and culling rates, behaviour (agonistic), physical appearance (injuries), changes in body weight and body condition and reproductive efficiency.

Article 7.X.22.

Genetic selection

Welfare and health considerations should balance any decisions on productivity and growth rate when choosing a breed or hybrid for a particular location or production system.

Selective breeding can improve the welfare of pigs for example by selection to improve maternal behaviour, piglet viability, temperament and resistance to stress and disease and to reduce tail biting and aggressive behaviour (Turner et al., 2006). Including social effects into breeding programmes may also reduce negative social interactions and increase positive ones and may have major positive effects on group-housed animals. (Rodenburg et al., 2010)

Outcome Animal-based criteria (or measurables): physical appearance, behaviour (e.g., maternal and agonistic behaviour), changes in body weight and body condition, handling response, reproductive efficiency, lameness, and morbidity, mortality and culling rates.

Article 7.X.23.

Protection from predators and pests

In outdoor and combination systems pigs should be protected from predators.
Where practicable, pigs should also be protected from pests such as excessive numbers of flies and mosquitoes.

Outcome: Animal-based criteria (or measurables): morbidity, mortality and culling rates, behaviour, and physical appearance (injuries).

Article 7.X.24.

Biosecurity and animal health

1. Biosecurity and disease prevention

Biosecurity plans should be designed, implemented and maintained, commensurate with the best possible herd health status, available resources and infrastructure, and current disease risk and, for listed diseases in accordance with relevant recommendations in the Terrestrial Code.

These biosecurity plans should address the control of the major sources and pathways for spread of pathogenic agents including:

- pigs, including introductions to the herd, especially from different sources,
- young semen coming from different sources,
- other domestic animals, wildlife, and pests,
- people, including sanitation practices,
- equipment, including vehicles, tools and facilities,
- vehicles,
- air,
- air, water supply, semen, feed and bedding,
- waste, including manure, waste garbage and disposal of dead animals,
- semen.

Outcome-based criteria (or measurables): morbidity, mortality and culling rates, reproductive efficiency, changes in weight and body condition, physical appearance (signs of disease).

a) Animal health management

Animal health management should optimise the physical and behavioural welfare and health of the pigs in the herd. It includes the prevention, treatment and control of diseases and conditions affecting the herd (in particular respiratory, reproductive and enteric diseases).

There should be an effective programme for the prevention and treatment of diseases and conditions, formulated in consultation with a veterinarian, when appropriate. This programme should include biosecurity and quarantine protocols, the acclimatisation of replacements, vaccinations, and good colostrum management, the recording of production data (e.g. number of sows, piglets per sow per year, feed conversion, and body weight at weaning), morbidity, mortality and culling rate and medical treatments. It should be kept up to date by the animal handler. Regular monitoring of records aids management and quickly reveals problem areas for intervention.

For parasitic burdens (e.g. endoparasites, ectoparasites and protozoa) and fly insect control, a programme should be implemented to monitor, control and treat, as appropriate.
Lameness can be a problem in pigs. *Animal handlers* should monitor the state of feet and legs and take measures to prevent lameness and maintain foot and leg health.

Those responsible for the care of pigs should be aware of early specific signs of *disease, pain, distress or suffering or distress*, such as coughing, abortion, diarrhoea, changes in locomotory behaviour or apathetic behaviour, and non-specific signs such as reduced feed and water intake, changes in weight and body condition, changes in behaviour or abnormal physical appearance.

Pigs at higher risk will require more frequent inspection by *animal handlers*. If *animal handlers* suspect the presence of a *disease* or are not able to correct the causes of *disease, pain, distress or suffering or distress*, they should seek advice from those having training and experience, such as *veterinarians* or other qualified advisers, as appropriate.

Non-ambulatory Nonambulatory pigs should not be transported or moved unless absolutely necessary for treatment, recovery, or diagnosis. Such movements should be done carefully using methods that avoid dragging the animal or lifting it in a way that might cause further pain, suffering or exacerbate injuries.

*Animal handlers* should also be competent in assessing fitness to transport, as described in Chapter 7.3.

In case of *disease* or injury, when treatment has failed, *is not feasible* or recovery is unlikely (e.g. pigs that are unable to stand up, unaided or refuse to eat or drink), or severe pain that cannot be alleviated, the animal should be humanely killed as soon as possible in accordance with Chapter 7.6.

**Rationale:** For consistency with Article 7.X.27.

**Outcome - Animal-based criteria (or measurables):** morbidity, mortality and culling rates, reproductive efficiency, behaviour (apathetic behaviour), lameness, physical appearance (injuries) and changes in body weight and body condition.

*b) Emergency plans for disease outbreaks*

Emergency plans should cover the management of the farm in the event of an *emergency* disease outbreak, consistent with national programmes and recommendations of *Veterinary Services* as appropriate.

Article 7.X.25.

**Emergency Contingency plans**

Where the failure of power, water and or feed supply systems could compromise *animal welfare*, pig producers should have contingency plans in place to cover the failure of these systems. These plans may include the provision of fail-safe alarms to detect malfunctions, back-up generators, contact information for key service providers, ability to store water on farm, access to water cartage services, adequate on-farm storage of feed and an alternative feed supply.

Preventive measures for emergencies should be input-based rather than outcome-based. Contingency plans should be documented and communicated to all responsible parties. Alarms and back-up systems should be checked regularly.

Article 7.X.26.

**Disaster management**

Plans should be in place to minimise and mitigate the effect of disasters (e.g. earthquake, fire, flooding, blizzard and hurricane). Such plans may include evacuation procedures, identifying high ground, maintaining emergency feed and water stores, destocking and humane *killing* when necessary.

**Procedures for humane killing procedures for of sick or injured pigs** should be part of the *disaster management plan* and should follow the recommendations of Chapter 7.6 of the *Terrestrial Code* should be part of the *disaster management plan*.
Reference to emergency contingency plans can also be found in Article 7.X.25.

Article 7.X.27.

Euthanasia (Humane killing)

Allowing a sick or injured animal to linger unnecessarily is unacceptable. Therefore, for sick and injured pigs a prompt diagnosis should be made to determine whether the animal should be treated or humanely killed.

The decision to kill an animal humanely and the procedure itself should be undertaken by a competent person.

For a description of acceptable methods for humane killing of pigs see Chapter 7.6.

The establishment should have documented procedures and the necessary equipment for on-farm humane killing. Staff should be trained in humane killing procedures appropriate for each class of pig.

Reasons for humane killing may include:

- severe emaciation, weak pigs that are non-ambulatory or at risk of becoming non-ambulatory,
- severely injured or non-ambulatory pigs that will not stand up, refuse to eat or drink, or have not responded to treatment,
- rapid deterioration of a medical condition for which therapies have been unsuccessful,
- severe, debilitating pain that cannot be alleviated,
- compound fracture,
- spinal injury,
- central nervous system disease,
- multiple joint infections with chronic weight loss,
- piglets that are premature and unlikely to survive, or have a debilitating congenital defect, and
- as part of disaster management response.

For a description of acceptable methods for humane killing of pigs see Chapter 7.6.

Scientific references


Mellor DJ. Updating Animal Welfare Thinking: Moving beyond the “Five Freedoms” towards “A Life Worth Living”. Animals (Basel), 2016 Mar 14;6(3).


