Opinion on the welfare of animals killed on-farm

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Farm Animal Welfare Committee,
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FAWC Opinions

FAWC Opinions are short reports to Government[1] on contemporary topics relating to farm animal welfare. They are based on evidence and consultation with interested parties. They highlight particular concerns and indicate issues for further consideration by Governments and others.

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[1] Where we refer to "Government" we are addressing the Department for Environment, Food and Rural Affairs in England, the Scottish and Welsh Governments, the Northern Ireland Assembly and other responsible Government Departments and Agencies.

Contents

Scope

1. The aim of this Opinion is to provide a detailed review of the animal welfare implications of the various circumstances and methods for killing the commonly farmed animals and poultry on-farm (and in hatcheries). The objectives of this review include:

- Reviewing the main methods used for on-farm killing of different farmed species and age groups and legal compliance;
- Assessing the animal welfare issues relating to methods of on-farm killing, competency of those responsible and the decision making process;
- Setting out the conditions for acceptable methods of on-farm killing; and
- Making recommendations to improve the welfare of animals subject to on-farm killing.

2. Exotic species that are farmed, e.g. camelids and ratites, are not covered here[2] and nor are farmed fish, deer and horses. Killing animal populations for notifiable disease control purposes (also called whole farm culling or depopulation) will not be covered in detail in this study and nor will small scale and/or seasonal slaughter on farm. These species and issues have been subjects of a number of previous reviews by FAWC and others[3].

Background

Definitions

3. There are a variety of reasons for killing animals on-farm with their origins reflected in different legislation. Terminology is not always used in a consistent way by different bodies, across different species and in different conditions. In our 2003 report which looked into the welfare of red meat animals being slaughtered or killed[4], we stated that "*Confusion has arisen around the use of common terminology in this area. 'Casualty animal' and 'emergency' slaughter are terms used loosely and outside their strict definitions. Some clarification of what constitutes a moveable or immovable "casualty" and when such an animal need be despatched immediately is required*". That confusion remains. Variations in the use of terminology mask variation in the reasons for killing and complicate accurate assessments of the numbers involved.

4. In seeking to provide clarity and consistency to these terms, this Opinion provides the following definitions and explanations. Most come from the legal framework but these may not be the same as terms used in the field, which is where confusion may arise.

> **Killing**. Council Regulation (EC) 1099/2009 on the protection of animals at the time of killing defines 'killing' as "*any intentionally induced process, which causes the death of an animal*". Farm animals are killed for a number of reasons: when they have reached an appropriate slaughter weight for human food production; when they are suffering with no likely prospect of recovery; when they are mortally injured; or when they are

[2] Advice on killing exotic species can be found at the Humane Slaughter Association website - http://www.hsa.org.uk/downloads/technical-notes/TN25-minority-farmed-species-slaughter.pdf

[3] Farm Animal Welfare Council. Foot and Mouth Disease 2001 and Animal Welfare: lessons for the future, 2002.
Farm Animal Welfare Council. Report on the Welfare of Farmed Animals at Slaughter or Killing: Part One – Red Meat Animals (2003) and Part Two – White Meat Animals (2009).
Farm Animal Welfare Committee. Opinion on the Welfare of Farmed and Park Deer, 2013.
Farm Animal Welfare Committee. Opinion on the Welfare of Farmed Fish at the Time of Killing, 2014.
Report on the Welfare of Farmed Animals at Slaughter or Killing: Part one - Red Meat Animals, Farm Animal Welfare Council, 2013

considered either economically or physically unviable. Killing is a generic term covering different processes and different intentions some of which are described below.

Slaughter. Council Regulation (EC) 1099/2009 defines 'slaughtering' as "*the killing of animals intended for human consumption*".

Emergency killing. Council Regulation (EC) 1099/2009 defines 'emergency killing' as "*the killing of animals which are injured or have a disease associated with severe pain or suffering and where there is no other practical possibility to alleviate this pain and suffering"*. These animals shall be killed as soon as possible.

Emergency slaughter. This term, referred to in Regulation (EC) 853/2004 (Annex III, Section 1, Chapter VI) laying down specific hygiene rules for food of animal origin, applies to the killing of animals for human consumption outside the slaughterhouse in circumstances where an accident has made transporting the animal a welfare issue and where a number of necessary criteria must apply. The term 'casualty slaughter' is in common use in the farming industry, often synonymously with the term 'emergency slaughter', but it might also be used to mean slaughter of injured animals in the slaughterhouse. We shall use the term 'emergency slaughter' and its legal meaning in this Opinion unless otherwise specified.

Culling. Culling refers to the killing of animals removed from the herd or flock for a variety of reasons before they reach either their appropriate slaughter age/weight or their full economic potential. Animals may be culled for livestock management – known as 'management culling' or 'husbandry culling' this will include the removal of 'runts', 'poor do-ers', infertile animals or animals that are unlikely to recover from injury or disease as well as male animals in some farming systems, e.g. egg laying and dairy. Animals may also be culled for inspection or sampling. In some instances the removal of all the animals in a farm or building may be referred to as culling ('whole farm/building culling'), particularly for disease control (see also Depopulation, below).

Depopulation. Legally defined in Council Regulation (EC) 1099/2009 as '*the process of killing animals for public health, animal health, animal welfare or environmental reasons under the supervision of the competent authority*'. The term is generally used when a population of animals or birds is killed for disease control reasons (a process not covered in detail in this Opinion). The term 'depopulation' is also used by the industry for the removal of both animals destined for human consumption, e.g. gathering of poultry for meat production or removal of end of lay hens. In this Opinion, we use the term 'depopulation' in its legally defined context.

Home slaughter. Council Regulation (EC) 1099/2009 allows the slaughter of an animal by its owner (or by a person under the responsibility and supervision of the owner) outside a slaughterhouse for their own personal consumption or that of members of their immediate family (i.e. private domestic consumption).

Private slaughter. The owner of an animal sends it to an approved slaughterhouse to be slaughtered and health-marked and the dressed carcase is returned to the owner.

Euthanasia. The term euthanasia is used to describe the intentional termination of life in a number of situations, which include killing diseased or injured farmed animals with the purpose of ending suffering or the likelihood of suffering in the immediate future and where remedial care is not considered appropriate.

Fallen Stock. Animals that have died on farm, whether they have been killed or have died naturally, and are excluded from human consumption.

5. FAWC has previously stated its commitment to the principle that all farmed animals should have a life worth living and that a growing number should have a 'good life' (FAWC, 2009[4]). It is the responsibility of the animal keeper to be competent in recognising animal welfare issues, to be able to make a decision regarding the killing of an animal in order to relieve suffering and to have the knowledge, skills and equipment required to do so or to procure such with minimal delay. Under certain circumstances, individual farm animals may be considered not to have a life worth living (for example, when an animal is suffering from a severe and untreatable disease or from a severe physical or negative mental state). In such cases the animal should be killed promptly and humanely. FAWC remains committed to the principle that prior to slaughter or killing, whether on-farm or elsewhere, any farmed animal must either be rendered unconscious and insensible to pain instantaneously, or unconsciousness must be induced without pain or distress and that no animal should recover consciousness before death ensues.

6. FAWC considers that when done correctly, purposefully and for the right reasons, on-farm killing may be regarded as a beneficial welfare act. Well-planned management killing may reduce the need for unplanned emergency killing. The timescale of decision making and the act of killing can be an important welfare consideration in reducing the duration and severity of pain and suffering.

7. Public perception of on-farm killing is likely to be complicated. People may not generally recognise farms as possible sites of animal killing and the need to end a farm animal's life to prevent further suffering or to maintain profitability may be poorly understood. Some may find the ethical principal of killing an animal for an economically optimal outcome unacceptable in some circumstances. There is, however, a reality of stunning and killing that is necessary to deal with some animal welfare and farm management issues.

8. Individual animals may have different economic and attachment values for farmers and stockpeople within husbandry systems and this could impact upon readiness and willingness to kill. A relatively low economic value animal may be more readily killed for welfare or management purposes than a high value animal. FAWC holds that the welfare of the individual animal should be the main consideration when assessing any welfare problem. It is necessary to consider the extent of poor welfare, the intensity and duration of suffering, the alternatives available and the opportunities to promote good animal welfare.

9. In this Opinion FAWC has looked into the welfare implications of various aspects of the on-farm killing process, including: species, age, numbers of animals, methods and equipment, decision making, Standard Operating Procedures (SOPs), operator competence, organisation, monitoring and supervision.

Evidence

10. In preparing this opinion, FAWC has reviewed published scientific literature, industry information, published data, retailer and assurance information, European Food Safety Authority (EFSA) Opinions, Humane Slaughter Association publications, expert opinions and

[4] Farm Animal Welfare Council. FAWC Report on Farm Animal Welfare in Great Britain: Past, Present and Future, October 2009

other advice on this issue as well as previous FAWC advice. FAWC has also carried out a written consultation and met with representative and relevant bodies.

Regulations for the welfare of animals during on-farm slaughter or killing

11. The Welfare of Animals at the Time of Killing (England) Regulations 2015 (WATOK) came into force on 5 November 2015[5]. The Welfare of Animals (Slaughter or Killing) Regulations 1995 (WASK) were revoked at the same time (insofar as they applied to England). The Devolved Governments also have equivalent versions of WATOK in place (2013 in Scotland and 2014 in Wales and Northern Ireland).

12. Council Regulation (EC) 1099/2009 on the protection of animals at the time of killing came into direct effect on 1 January 2013. WATOK provides full powers for enforcing the provisions of the EU Regulation as well as maintaining those national rules that provide greater animal welfare protection than the EU Regulation.

13. WATOK contains provisions for slaughter or killing operations other than in slaughterhouses or knackers' yards. Anyone killing a farmed animal or bird on-farm will need a WATOK licence for the relevant species and operation for killing animals outside of a slaughterhouse or a Certificate of Competence[6] - unless the animal is being killed in circumstances exempted from licensing requirements (WATOK (England) 2015, Part 2, Chapter 2 (14)) or under emergency killing procedures.

14. Any slaughter or killing operations carried out on farm must be done without causing the animals any avoidable pain, distress or suffering. The stunning/killing methods that are permitted for non-emergency killing under the legislation (Council Regulation (EC) 1099/2009, Annex 1 and WATOK) are contained in Table 1 (page 19). WATOK requires an appropriate level of competence in those carrying out killing and related operations on-farm in order to do so without causing the animals any avoidable pain, distress or suffering. Anyone carrying out a killing operation must ensure that the animal is restrained appropriately (where possible) and is stunned before killing. Operations requiring a WATOK licence are detailed in WATOK Chapter 2, section 13.

15. Manufacturers of restraining or stunning equipment are required to provide appropriate instructions with their products concerning their use in a manner which ensures optimal conditions for the welfare of animals (Council Regulation (EC) 1099/2009, Article 8).

16. In the case of emergency killing, under Article 19 of Council Regulation (EC) 1099/2009, any effective method of killing that satisfies the General requirements for killing and related operations (Council Regulation (EC) 1099/2009, Article 3(1)&(2) is considered permissible and the keeper of the animals concerned shall take all the necessary measures to kill the animal as soon as possible. WATOK requires that, under emergency killing procedures, an animal unable to walk is killed where it lies if moving it would cause unnecessary pain and suffering. FAWC's view is that this should be irrespective of potential salvage value.

17. EU Regulation (EC) 853/2004 laying down specific hygiene rules for food of animal origin states that, in most cases, meat for human consumption must be from animals slaughtered in an approved slaughterhouse. It is for this reason that meat from an animal that has been home slaughtered on-farm can only be consumed by the owner and their immediate

[5] https://www.gov.uk/government/collections/welfare-of-animals-at-the-time-of-killing
[6] http://www.food.gov.uk/enforcement/sectorrules/meatplantsprems/meatpremlicence

family. Small quantities of poultry (up to 10,000 birds per annum) can be slaughtered on-farm for restricted onward supply (Council Regulations (EC) 1099/2009, Article 11 and (EC) 852/2004 Article 2 (c)).

18. EU Regulation (EC) 853/2004 Chapter VI, Emergency slaughter outside the slaughterhouse, states that food business operators must ensure that meat from domestic ungulates that have undergone emergency slaughter outside the slaughterhouse may be used for human consumption only if it complies with all the stated requirements.

19. Under WATOK, no person may kill an animal for human consumption without prior stunning in accordance with religious rites outside a slaughterhouse.

20. A full list of meat establishments that are approved to slaughter livestock and/or cut meat can be found on the Food Standards Agency (FSA) website[7]. Contact details for those wanting further information about approved meat establishments across the UK are also available.

21. Guidance on the legal requirements for on-farm killing can be found on GOV.UK - https://www.gov.uk/guidance/knackers-yards-and-farms-restraining-stunning-killing-animals.

22. Anyone without relevant experience considering slaughtering a bird or animal on their farm for private domestic consumption is recommended to contact their veterinary surgeon or local APHA Office for advice before the killing takes place. They can advise on the most appropriate ways to ensure the animal's welfare before and during the process, in accordance with the European and domestic regulations.

23. Higher than average rates of on-farm killing within a production system may be indicative of system or husbandry management failures. EU Council Directive 2007/43 for the protection of chickens kept for meat production requires that on-farm broiler mortalities (not all of which necessarily result from intentional culling) be recorded and this data is supplied as part of the Food Chain Information (FCI) to the abattoir. In England, Scotland and Wales, the Food Standards Agency and Food Standards Scotland regularly review this data and any farm reaching a trigger point, such as high mortality, is notified to the Animal and Plant Health Agency (APHA) for action. In Northern Ireland the FSA refer trigger points to the Department for Agriculture, Environment and Rural Affairs (DAERA).

24. Rules relating to on-farm killing would normally be for APHA or local authorities to enforce but it is not clear how much checking is done on-farm, otherwise than in response to complaints. Raising awareness about the rules on on-farm killing for animal keepers and enforcers as well as enforcement responsibilities, processes and contacts should be a priority.

Advice by FAWC, EFSA and others relating to the topic

25. Past FAWC advice relating to on-farm killing include FAWC Reports on the Welfare of Farmed Animals at Slaughter or Killing, Part One, Red Meat Animals (2003) and Part Two, White Meat Animals (2009); Report on Foot and Mouth Disease 2001 and Animal Welfare: Lessons for the Future (2002); Opinion on Contingency Planning for Farm Animal Welfare in Disasters and Emergencies (2012); Opinion on the Welfare of Farmed and Park Deer (2013); and Opinion on the Welfare of Farmed Fish at the Time of Killing (2014).

[7]https://www.food.gov.uk/enforcement/approved-premises-official-controls/meatplantsprems/animalwelfare

26. There are a number of EFSA publications of particular relevance to this topic though none specifically addresses the issue of on-farm killing. These include: the 2004 Scientific Opinion of the AHAW Panel on the welfare aspects of the main systems of stunning and killing the main commercial species of animals[8]; the 2003 EFSA Guidance on the assessment criteria for studies evaluating the effectiveness of stunning interventions regarding animal protection at the time of killing[9] and, more recently, the four Scientific Opinions on monitoring procedures at slaughterhouses for bovines, poultry, sheep and goats and pigs[10].

27. Detailed practical guides for methods for on-farm killing of livestock are produced by the Humane Slaughter Association[11]. Additional advice on on-farm killing and emergency slaughter of farm animals is produced by a number of bodies including Scotland's Rural College [12], the Pig Veterinary Society [13], Red Tractor[15], the British Cattle Veterinary Association[16] and The Sheep Veterinary Society[17].

Main methods used for on-farm killing

28. FAWC strongly believes that anyone intending to kill a farmed animal on-farm for any of the reasons identified in this Opinion should be suitably trained and demonstrably competent in the method adopted. The methods used for killing farmed animals outside of an FSA approved slaughterhouse vary significantly between species and between different size/age categories within species. Different handling skills and different equipment may be required for each.

29. Of the methods we consider in this report, it is worth noting that a non-mechanical percussive blow to the head is not a legal routine stunning method in any species (at any age), except rabbits, (WATOK Schedule 2, Part 5(36)) and could only be used for emergency killing (as long as carried out within legal requirements (Council Regulation (EC) 1099/2009, Article 3(1)&(2), Article 19). This prohibition needs to be more widely understood in the farming industry and amongst enforcement agencies.

30. Owners and keepers of animals have a responsibility for the welfare of their animals at all times under the Animal Welfare Act 1996, as well as under the specific welfare at killing requirements. Any handling of animals immediately prior to slaughter or killing on farm must be done with consideration for the animal's welfare. If a keeper is unable to undertake the necessary killing of an animal under his/her care then they should be able to access a veterinarian or other competent person without delay. They should, however, ensure that adequate biosecurity requirements are in place to reduce risk of disease transmission.

[8] published in July 2004 and available at: http://www.efsa.europa.eu/en/efsajournal/pub/45.htm
[9] published in December 2003 and available at: http://www.efsa.europa.eu/en/efsajournal/doc/3486.pdf
[10] Sheep and Goats - published on the 20th December 2013 and available at http://www.efsa.europa.eu/en/efsajournal/pub/3522, Bovines- published on the 3rd December 2013 and available at http://www.efsa.europa.eu/en/efsajournal/pub/3460, Pigs - published on the 12thDecember 2013 and available at http://www.efsa.europa.eu/en/efsajournal/pub/3523 and Poultry - published on the 20th December 2013 and available at http://www.efsa.europa.eu/en/efsajournal/pub/3521
[11] available at: http://www.hsa.org.uk/publications/publications
[12] Scotland's Rural College Technical Note TN670, Culling small numbers of poultry on farm. http://www.sruc.ac.uk/downloads/120202/technical_notes
[13] Pig Veterinary Society (2013) The Casualty Pig: available on-line at: http://www.pigvetsoc.org.uk/resources/pvs-documents
[15] Red Tractor (undated): available on line at: http://assurance.redtractor.org.uk/standards/search [16] BCVA (2010) Guidance for Veterinary Surgeons on the Emergency Slaughter of Cattle: available at: https://www.food.gov.uk/sites/default/files/multimedia/pdfs/publication/emergency_slaughter_cattle.pdf [17] http://www.sheepvetsoc.org.uk/

Poultry

31. Historically, the most common method for the killing of all farmed species of poultry on-farm has been neck/cervical dislocation. Cervical dislocation kills through a rupturing of the spinal cord and/or damage to major blood vessels in the neck causing the cessation of breathing and loss of oxygenation to the brain. There is significant evidence that manual cervical dislocation does not produce immediate loss of consciousness (Gregory and Wotton, 1990; Erasmus et al., 2010a; Sparrey et al., 2014). Adult and larger birds are killed manually through the sudden stretching of the neck or, in certain cases, via stretching of the neck in an inverted cone[14]. Regulation 1099/2009 refers to stretching and twisting the neck but we are concerned that twisting comes with the danger of asphyxia rather than cervical dislocation. Chicks and smaller birds may be killed by neck dislocation against a hard edge, such as a feeding trough. These methods are heavily reliant on manual skill and may not be as humane, accurate or reliable as other methods, e.g. mechanical percussive device or a gas system.

32. Since Council Regulation (EC) 1099/2009 came into force on 1 January 2013, manual cervical dislocation can only be used for birds under 3kg liveweight and no more than 70 birds can be killed in this manner per handler per day. Mechanical cervical dislocation is permissible in poultry up to 5kg and there is no limit on numbers of birds per person per day. FAWC considers neck crushing or the use of pliers not to be humane, but there is currently no list of approved methods that constitute mechanical cervical dislocation. Other mechanical methods include using a killing cone or a heavy stick placed over the neck on the floor and pulling to dislocate the neck[19].

33. Hand-held electrical and non-penetrative (percussive) captive-bolt stunning equipment applied to the head of each bird is becoming more widely available for killing poultry on-farm. Electrical head only stunning and non-penetrative captive-bolt devices are classed as simple stunning methods (Council Regulation (EC) 1099/2009) and therefore must be followed by a killing method (e.g. neck dislocation or a neck cut immediately following the stun).

34. Non-penetrative captive-bolt devices were developed as a humane method of killing, for use on-farm with poultry (Hewitt, 2000). Initially a non-penetrative captive-bolt device was developed specifically for turkeys and other large poultry. These devices are powered by a blank cartridge and the kinetic energy produced (e.g. 47 Joules; DEFRA MH0150 2016 final report) is far greater than that required to stun and kill smaller poultry, particularly when compared to pneumatically powered devices. Erasmus, et al. (2010b) demonstrated that a non-penetrative captive-bolt device with a lower bolt velocity consistently induced insensibility in turkeys leading to death, whereas all birds showed signs of sensibility after manual and mechanical cervical dislocation. Current research findings suggest that the use of a pneumatic non-penetrative captive–bolt device, either air, CO_2 or butane powered (≥27 Joules), is effective for on-farm killing of all poultry species. Ongoing research in the UK is looking at the development of a spring-powered non-penetrative captive-bolt device for chickens. Key to the development of all these devices is that they be fit for the purpose intended, i.e. species and size of poultry, and their efficacy is verified by scientific research.

35. The Meat Chicken Directive (Reg 2007/43) requires training for any person carrying out emergency killing. Annex IV states that training shall at least cover European Community legislation concerning the protection of chickens and in particular emergency care for chickens, emergency killing and culling. Red Tractor Chicken standards require that "*Birds*

[14] http://www.hsa.org.uk/neck-dislocation/neck-dislocation [19] Scotland's Rural College Technical Note TN670, Culling small numbers of poultry on farm. http://www.sruc.ac.uk/downloads/120202/technical_notes

that do not respond to treatment or require emergency euthanasia must be promptly and humanely euthanased by a trained and competent person."

36. The Welfare of Animals at the Time of Killing (England) Regulations 2015 (WATOK, and similar legislation in Northern Ireland, Scotland and Wales) permits the use of gas stunning methods for on-farm killing of any type of bird under specific legal requirements. When larger numbers of birds are required to be killed on-farm, gas killing, via portable small-scale containerised equipment brought onto the farm for that purpose and using permitted gas mixtures at specific concentrations, is an acceptably humane method.

37. This method might allow end-of-lay birds to be culled on farm reducing the welfare impact of handling and transport. Gas killing of poultry must be carried out by or under the direct supervision of a competent and licensed slaughterman (Certificate of Competence or WATOK licence for the relevant species or operation) or a vet. For depopulation of large numbers of birds for disease control, permitted gas mixtures may be pumped into appropriately sealed sheds and housing units under the direct supervision of the Animal and Plant Health Agency (APHA).

38. In a review article Thornber (2014) discusses the use of new technologies such as firefighting foam for the mass killing of poultry flocks. This method kills the bird by obstructing the airway and causing asphyxiation therefore is not considered humane. Raj et al. (2014) suggested that the dry foam technique using nitrogen-filled foam for killing poultry appears to be better than using direct exposure to high concentration carbon dioxide (CO_2) or firefighting foam in terms of the birds' welfare, and has the potential for use in a variety of housing systems. McKeegan et al. (2013) showed that nitrogen-filled foam delivered a reliable and humane anoxic kill, which was robust even at maximal stocking densities.

39. The research referenced in the previous paragraph has shown that gas-filled foam does not occlude the trachea so birds do not drown or asphyxiate, rather they succumb to the effects of the gas. This method has been designed for the emergency killing of diseased birds, however, there may be situations where it could be used for other purposes where gas alone may not be effective or for on-farm emergencies such as culling animals in buildings where it might not be safe for humans to enter (e.g. killing laying hens in multi-tier cage systems or a collapsing roof due to heavy snow).

40. Gavinelli et al. (2014) suggested the application of humane slaughterhouse practices to large-scale culling and recommended that new buildings should include a system that allows for the quick sealing of the building and the introduction of a lethal gas. Raj et al. (2004) in a review of gaseous methods of killing poultry on-farm, describe the available methods and conclude that mixtures of inert gasses are preferable to direct exposure to high concentration of CO_2 alone as they offer the best welfare advantages. Sandilands et al. (2012) describe the potential of mixing other gases with CO_2 for whole house culling together with concentrations and exposure times (see also McKeegan et al., 2006). A rising or progressive concentration of CO_2 is preferable to direct insertion into a high concentration of CO_2, which is highly aversive. CO_2 appears to act as a sedative in lower concentrations.

41. A number of new stunning/killing methods, such as Low Atmospheric Pressure Stunning (LAPS), microwave and electromagnetic technology, are currently under development. Welfare implications for some of these methods are as yet unproven and will therefore need to be reviewed before these methods are adopted in practice.

42. Cull chicks (birds that are ill or deformed) may be killed in hatcheries by maceration, using specially designed mechanical apparatus. This method should comply with legislation by providing instantaneous crushing of the entire animal (maceration) (in FAWC's view particularly the brain) and immediate death[15]. This method of killing is permitted under Council Regulation (EC) 1009/2009 for chicks of up to 72 hours and for unhatched embryos. The apparatus must be appropriately designed in terms of power and size, to ensure the killing is instantaneous for all animals. Most laying hen hatcheries use inert gas exposure to kill unwanted male chicks; the Lion Egg Code requires this. Sex selection in the egg could reduce the number of male chicks killed after hatching.

43. Humane on-farm killing of small chicks (i.e. less than 7 days old) is challenging. The main methods that are legally permitted for killing chicks are cervical dislocation, instantaneous mechanical destruction (up to 72 hours old) and exposure to gas mixtures. Cervical dislocation is the commonest method used for on-farm killing of small chicks however, legislation requires that it is only used where there is no other method available for killing (WATOK) and limits its use to less than 70 animals per day (Table 1). There can be welfare concerns associated with the challenge of accurate dislocation of the high cervical spine. Also, many methods of cervical dislocation of small chicks involve crushing of the cervical spine. Compliance with legislation may be challenging in occasional circumstances, as culling rates for some flocks of chicks can be highest in the first 7 days. Similar to hatchery methods, killing of chicks on farm could occur by exposure to various gas mixtures (Table 1). This is legally permitted (subject to appropriate licensing), but is not generally applied on-farm. Non-penetrative captive bolt stunning is not appropriate, owing to the soft skull, and also due to health and safety concerns arising from the small size of the chick, its positioning for restraint and proximity of the operator to the captive bolt itself. The use of a manual percussive blow to the head is not legally permitted. Lethal injection of an anaesthetic overdose, which can only be administered by a vet is legally permitted, but is unlikely to be widely used on farm.

44. There is increasing interest in on-farm hatching of eggs (where part incubated eggs are transported to a farm, and the last stage of incubation occurs on the farm, rather than in a hatchery). FAWC is concerned that any lack of appropriate equipment and operator competence may lead to significant welfare issues associated with the killing of increased numbers of sick or deformed chicks on farm, as well as confirmation of the death of the embryo in any un-hatched eggs, prior to disposal of the hatching waste. To meet these situations, it will be essential that there is provision of adequate equipment for humane killing of these chicks on farm as well as appropriate back-up equipment where necessary.

Red meat species

Pigs

45. Pigs can be humanely killed on-farm in a number of ways depending largely upon the age/size of the animal and following specific legal requirements. Recent research has shown that the use of a non-penetrative captive bolt device (percussion) is sufficient to kill neonate piglets (Grist et al., 2017).

46. Killing of larger/older pigs may be done with a penetrative captive-bolt device followed by pithing (the laceration of the central nervous tissue and spinal cord by means of an elongated rod-shaped instrument introduced into the cranial cavity through the bolt hole) or by bleeding via a thoracic cut which would sever the major blood vessels close to the heart[16].

[15] https://www.hsa.org.uk/publications/printed-publications
[16] Pig Veterinary Society. The Casualty Pig, 2013.

Pithing would be the preferred method on farm as a thoracic cut, normally used in slaughterhouses, is a difficult technique and produces copious bleeding. The use of a penetrative captive-bolt device is classed as a simple stunning method (Council Regulation (EC) 1099/2009) and therefore must be followed by a killing method.

47. Firearms with a free projectile (free bullet) of appropriate charge or calibre (shotguns, rifles, pistols) are also commonly used methods for killing larger pigs on-farm [17]. Manufacturers' instructions should be followed with regard to when ammunition (and gas cartridges for pneumatic devices) should be replaced when out-of-date.

48. Recent research in the UK (funded by the Alberta Government) on the use of a non-penetrative captive-bolt (percussive) device (generating 27 Joules of energy), using electroencephalogram (EEG) assessment together with the abolition of Visual Evoked Potentials, demonstrated that controlled blunt force trauma could humanely stun/kill piglets from birth to 10.9 kg (Grist, et al.., 2017). Ongoing research in the UK (DEFRA MH0150 2016 final report) has shown that another non-penetrative captive-bolt device, (47 Joules) produced a humane stun/kill in a field trial on 200 piglets (≤5 kg).

Goats

49. Where the decision has been taken to kill male offspring in dairy goat systems, that are not to be reared for meat and are therefore unwanted, this must be done humanely. Research in New Zealand (Sutherland, et al., 2015) showed that a non-penetrative (percussive) captive bolt device (28 Joules) was 100% effective when the bolt was applied to the back of the head (only permitted in WATOK when the animal has horns) between the ears with the kid's neck bent and with the chin on its chest (n=100, age ≤48 hours old, average weight 3.94kg)). These results have been verified in the UK with a field trial of 200 kids using a non-penetrative captive bolt gun that developed 47 Joules (age approximately 0-7 days, average weight 8.21kg). Adult goats should be stunned/killed by penetrative captive bolt (followed by a killing method) or free bullet.

Sheep and lambs

50. Young lambs (under 9kg) can be killed by non-penetrative captive bolt device with sufficient power causing mechanical blunt force trauma to the head, followed by the severing of the neck vessels as the lambs are simply stunned and not killed (DEFRA MH0150 2016 final report). Larger sheep can be stunned by penetrative captive bolt device followed by pithing or bleeding or by a firearm with a free projectile (shotgun, pistol or rifle) to cause non-recoverable damage to the brain and instantaneous insensibility followed rapidly by death.

Cattle and calves

51. When the decision has been taken to kill unwanted calves this must be done humanely. Legal methods for calves include firearms with a free projectile (shotgun, pistol or rifle) or a penetrative captive bolt device, followed by pithing or bleeding. Manufacturers' instructions should be followed.

52. Adult cattle can be killed on-farm with a free bullet or a penetrative captive bolt device, the latter followed by pithing (if not for human consumption [18*]) or bleeding (for human consumption). FAWC believes that shotguns are a very effective method of killing larger red meat species of farm animals in an emergency, provided they are used from a short distance (5-25cms) from the head (HSA, *Humane killing of livestock using firearms*).

[17] http://www.hsa.org.uk/shop/publications-1/product/humane-killing-of-livestock-using-firearms-2nd-ed
[18] http://www.ecolex.org/details/legislation/restriction-on-pithing-england-regulations-2001-si-no-447-of-2001-lex-faoc024664/

General

53. A veterinarian can administer a lethal injection to kill the animal if the carcass is not destined for human or animal consumption but this will have cost implications for the owner in terms of vet fees and cost of disposal. This method might also require additional restraint and result in a longer time to loss of consciousness than a captive-bolt device or free bullet.

54. Proper disposal is essential to ensure the carcass does not enter the food chain nor endanger domestic or wild animals if eaten. It is required that the carcasses of animals killed on farm be disposed of in a safe and legal manner in line with animal by-products legislation. Killed animals that do not enter the food chain cannot be buried on the farm but must be stored appropriately before being collected from the farm by an approved transporter (or transported by the farmer in a suitable vehicle) and appropriately disposed of as soon as is reasonably practical, e.g. by the National Fallen Stock Scheme, a knacker, a hunt kennel, a maggot farm, a licensed incinerator or a renderer to ensure that blood and other tissue from a diseased animal does not pose a biosecurity risk.

Welfare issues

Welfare issues associated with particular methods of on-farm killing

55. *Cervical dislocation.* As a means of killing poultry and other birds, cervical (neck) dislocation is increasingly seen as problematic in welfare terms. Research[19] has shown that it does not always induce immediate loss of consciousness in birds, can be difficult to achieve with larger birds (e.g. turkeys and mature cockerels), can cause unnecessary suffering as a result of poor handling and restraint of birds and can be inconsistently employed, due to insufficient operator experience or operator fatigue. Accurate confirmation of death (see relevant EFSA documents cited in footnote 12 above) is sometimes confounded by unconscious convulsions or kicking.

56. Cervical dislocation should only be used when other, more humane, methods are unavailable and under the limitations specified under Council Regulation (EC) 1099/2009 (see Table 1, point 5). It was reported to us at consultation that larger poultry units may reach upper limits per stockperson in some circumstances, including young chicks in on-farm hatching systems, implying that, from an industry perspective, they may be too low especially at early stages of production. FAWC would not recommend increases to limits already applied unless stringent review showed this to be justified at certain stages of production of specific species.

57. *Non-mechanical percussive blow to the head*. WATOK 2015 is clear that "No person may stun an animal using a non-mechanical percussive blow to the head" (except for rabbits). A manual (non-mechanical) percussive blow to the head could be permitted for emergency killing if carried out within legal requirements (Council Regulation (EC) 1099/2009, Article

[19] Webster,A.B., Fletcher,D.L., Savage,S.I. 1996. Humane on-farm killing of spent hens. Journal of Applied Poultry Research 5:191-200. Gregory, N.G. and S.B. Wotton, 1990. Comparison *of* neck dislocation and percussion of the head on visual evoked responses in the chicken's brain. Vet. Rec. 126:570-572.
EFSA (2004) Welfare Aspects of Animal Stunning and Killing Methods. Scientific Report of the Scientific Panel for Animal Health and Welfare on a request from the Commission related to welfare aspects of animal stunning and killing methods (Question N° EFSA-Q-2003093). European Food Safety Authority Scientific AHAW/04-027. pp 1-241. http://www.efsa.europa.eu/en/efsajournal/doc/45.pdf.
OIE (2010) Terrestrial Animal Health Code 2010 – Chapter 7.6 Killing of animals for disease control purposes http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_1.7.6.htm.
Sparrey, J. et al. (2014) Current and novel methods for killing poultry individually on-farm. World's Poultry Science Journal, 70, pp. 737-758

3(1)&(2), Article 19). A manual percussive blow to the head might be applied by a hand held object or, as we have been informed at consultation, by manual movement of the animal against a hard surface. The latter we would argue may not deliver the 'accurate blow' described by legislation (Council Regulation (EC) 1099/2009, Annex 1).

58. Delivery of a manual percussive blow to the head requires ability and confidence to be achieved swiftly, consistently, accurately and effectively. This is unlikely to be found on all animal holdings. FAWC considers it should only be used for emergency killing and by competent people.

59. *Electrical stunning*. Hand-held or portable electrical stunners can be used on-farm. Any electrical stun must span the brain. Adapted devices may be uncontrolled in terms of currents and other parameters, may have low currents for health and safety purposes and risk providing an ineffective stun.

60. *Mechanical stunning*. The growing availability of portable penetrative and non-penetrative captive-bolt devices for on-farm use offers the means to achieve a more consistent, effective and accurate stun/kill, notably for smaller farmed animals. Research is ongoing in this area and practices may change in favour of these devices depending on the outcome. Their use demands proficiency and ability, as well as appropriate handling and restraint. The equipment also needs regular cleaning and maintenance and mechanical devices may need to be refurbished or replaced after a high number of shots. Where routine maintenance and equipment cleaning is not carried out regularly, operating failures and misfires may result leading to pain, distress and suffering amongst farm animals. There should be a back-up stunning/killing method available on-farm.

61. Manufacturers of stunning and killing equipment have to supply instructions for the correct use and maintenance of equipment and Standing Operating Procedures should be developed by farmers and be readily available to staff on farms where such equipment is used. Farmers and stockpeople need to be aware of how and in what circumstances such equipment can and should be used and should know what reactions to expect from the animals concerned. Penetrative captive–bolt devices may be inappropriate for the killing of animals with extreme skull thickness or density, such as water buffalo, and may result in considerable suffering.

62. Where the equipment is used to stun, rather than stun/kill, a killing method (e.g. cervical dislocation (poultry), pithing or exsanguination) should immediately follow to avoid any return to consciousness. These are potentially complex and challenging actions and farmers/stockpeople may be reluctant to carry them out. Operators should be able to correctly identify the signs of unconsciousness and death in animals for assurance that the procedure has been successful.

63. *Free bullet*. The correct and accurate use of firearms (including shotguns) is an effective and humane method of killing larger farm animals and those with thicker skulls (cattle, buffalo, larger pigs, sheep) on-farm. The principal welfare concern associated with these methods is the suffering caused by the inappropriate or inaccurate use of the equipment. The calibre and the distance between the firearm and the animal is critical to an effective shot as is accuracy with respect to the shot position and angle of trajectory. Guidelines are available from the Humane Slaughter Association[20] regarding the distance and target points for these methods as well as the ammunition type, calibre or shot.

[20] Humane Slaughter Association (undated) Humane Killing of Livestock using firearms. Available at:

64. *Gas stunning/killing*. The exposure of livestock to high concentrations of CO_2 has been shown to be aversive (Raj and Gregory, 1995; FAWC, 2003; Sandilands, et al., 2011) and should be avoided wherever possible. However, the exposure of poultry to a rising concentration of CO_2 has been shown to be more acceptable, e.g. the use of CO_2 in buildings previously sealed (Turner, et al., 2012).

Competence, confidence, training and supervision

65. The duty of care owed by a keeper of animals includes killing when necessary. They should have the necessary skill to kill an animal or have rapid access to someone who has. They also need to be competent to recognise the need to kill and take the decision, or have sufficient knowledge to know when to engage a professional to make this judgement.

66. No animal should be killed by someone who is not competent. Competency is achieved through training and assessed experience. Where the owner/keeper of an animal is not competent they should have a clear plan for accessing competent people to kill animals on their premises without delay if this becomes necessary to prevent suffering. Procedures for on-farm killing, and contact details of a competent person to kill animals, should be clearly displayed on a notice at the farm premises so that any animal in obvious pain or distress can be killed without delay.

67. Unlike the slaughter of farmed animals and birds for commercial consumption within a licensed abattoir, on-farm killing can be carried out legally in some instances (WATOK Chapter 2, section 14 exceptions and emergency killing) without the need for individuals to hold a specific licence or certificate of competence. This places responsibility on the business operator to ensure that where an uncertified individual is responsible for on-farm killing they are trained and competent and capable of killing an animal without causing it avoidable pain, suffering or distress.

68. Stockpeople charged with the care of farm animals may, understandably, be reluctant to kill them, perceiving such acts as contradictory to their professional role and their own personal commitment to their animals. Stockpeople who may be required to kill animals need adequate training in on-farm killing methods. They should be aware of the welfare implications of killing procedures and the availability and benefits of up-to-date techniques. FAWC notes that some assurance schemes (such as *Red Tractor*) require competent veterinarians or others to train those responsible for on-farm animal care in correct killing techniques and require farmers or stockpeople to compile data records of on-farm killing numbers. The Humane Slaughter Association, along with a number of professional and sector bodies, offer training in on-farm killing methods.

69. An ill or injured animal may suffer unnecessarily if emergency killing is delayed. Calling a vet or other professional will add delay but an inexperienced or unwilling farmer or stockperson may not kill the animal in an optimal manner. It is important to assess all factors and ensure that the best outcome is achieved in terms of animal welfare. If a vet is needed then they should be called as quickly as possible.

70. Animals defined as unfit for travel to slaughter and the proximity, or otherwise, of slaughterhouses willing to take animals that have been inspected ante-mortem by a vet and slaughtered on-farm, may also increase the pressure on on-farm killing. In those cases where

https://www.hsa.org.uk/publications/online-guides

a qualified, certified or licensed person is not available or cannot be brought on-site to undertake emergency/casualty slaughter within a time frame that does not cause additional suffering to the animal, a competent stockperson may have to kill the animal quickly and humanely. Injured or sick animals that would still potentially qualify for the human food chain should not be made to suffer unduly in order to comply with ante-mortem inspection and licensed killing rules. The requirement that a vet conduct the ante-mortem inspection can delay killing and lead to additional suffering (especially for adult bovines). A balance has to be struck between realising the economic value of the animal and minimising the time of suffering.

71. A vet may undertake emergency slaughter under the legislation rather than wait for a slaughterman where there is no other practical possibility to alleviate pain or suffering. The legislation permits a vet to kill an animal for human consumption in the course of their professional duties and does not require specific CPD for this. However, a vet should be suitably experienced and not operate outside their competencies.

72. The effectiveness and humaneness of slaughter and killing techniques rely heavily on the practical experience and technique of the operator. Such skills need to be acquired, monitored and exercised. When on-farm killing is infrequent or irregular (as is more often the case for larger animals), learned and acquired skills may be forgotten. Retraining should be provided on a regular basis.

73. When significant numbers of animals or birds are to be killed, consistency can become an issue as the repetitiveness and/or physicality of the action may tire the operator and lead to avoidable suffering in the animals concerned. Some equipment can become unreliable with repeated use and regular maintenance is essential.

74. Manufacturers' instructions exist for some hand-held stunning devices and other instruments employed to kill animals on-farm. Under the European Regulation this has been extended to all equipment manufactured for on-farm killing. SOPs should be developed by farmers for their use and maintenance of on-farm killing equipment should be documented.

Use of firearms

75. Anyone owning a firearm or shotgun and using it to kill an animal on-farm is required to be in possession of a current firearm or shotgun certificate. Section 3 of the Firearms (Amendment) Act 1997 provides an exemption for handguns specifically for humane dispatch of farmed animals. The language of this section does not restrict the grant of a firearm certificate for a handgun for this purpose to any particular class of person, e.g. professionals such as vets etc.

76. It is permitted under firearms legislation for a person to borrow and use a shotgun (or rifle) from a land occupier (or his servant) specifically licensed for this firearm under supervision, which is usually defined as being within eyesight or earshot, without themselves holding a firearms licence[21]. This rule is largely aimed at sport shooting situations. A captive bolt device can be held without a firearms licence. Captive bolts were taken off the firearms register in 1992.

77. Firearm licences, permitting the use of a free bullet, held by farmers and stockpeople do not always specifically authorise the humane killing of farmed animals either on farm or

[21] Home Office. Guide on Firearms Licensing Law, April 2016

elsewhere. Moreover, we were informed at consultation that different police forces interpret current firearm legislation inconsistently with respect to authorisation for the killing of farmed animals on and off the farm. This would merit further investigation by the relevant authorities.

Deciding if and when to kill an animal

78. In most cases, the decision when to send a healthy animal to slaughter is a commercial one, when the animal has reached an appropriate weight and size, though other factors, such as transport and production cycles may also play a part.

79. The decision when to kill a sick or injured animal on-farm is affected by the potential for treatment and recovery and the duration and likely level of suffering. This may be influenced by:

- the severity of the illness;
- the level of pain and distress the animal is suffering;
- the likelihood that that the illness or disease will spread to other animals;
- whether the animal is fit enough to be safely transported to the slaughterhouse (in compliance with EC Regulation No 1/2005 on the protection of animals during transport) and if so whether the animal is fit for human consumption;
- the possibility of the animal's recovery;
- the likely suffering of the animal if left to recover in a hospital pen;
- the psychological welfare implications of isolating a sick animal from its social group;
- the resources available to care for the sick animal through to recovery;
- the cost of treatment or care through to recovery;
- the likely productivity (and health) of the recovered animal;
- operator availability, expertise, confidence and willingness; □ availability and location of suitable equipment for humane killing;
- the method and cost of carcass disposal.

80. Any person who keeps animals has a duty to be able to kill them humanely when necessary. The decision on the day depends on the likelihood of successful treatment or the likelihood of continual suffering. The elements of the planning process will include:

- The criteria for determining the appropriate method to be used;
- The availability of suitable instruments and equipment;
- The availability of back-up equipment in the event of equipment failure during the killing process;
- The skill, competence and experience of the operator or site-staff/vet;
- The safety of the operator and any other humans or farm animals in the vicinity;
- Up to date SOPs and maintenance records and any other relevant guidance relating to the method selected;
- Compliance with legal requirements;
- Compliance with other rules and requirements (for example, Assurance schemes); and
- Cost of treatment and likely financial return if treatment is successful.

81. The use of hospital pens can create more welfare problems if sick or injured animals are not carefully monitored and treated. Animals failing to demonstrate recovery from illness or injury should be killed without delay to prevent further suffering. This is unlikely to be considered as emergency killing (unless circumstances absolutely dictate), since killing should be a foreseeable outcome when placing an animal in the hospital pen and should be planned for.

82. Animals that pose a significant and unmanageable danger through causing injury to people or other animals, should be humanely killed as soon as possible.

83. The regular and systematic observation and recording of data on farmed animals by stockpeople is essential if instances of unrecoverable animal ill-health and suffering are to be identified and appropriately addressed.

84. 'Decision trees' such as those produced by the British Veterinary Association (BVA) and others (ref. paragraph 27), can be useful guides in the appropriate circumstances to prompt decisions about when to kill or not to kill a farm animal. Checklists of observable animal behaviour (including indicators of acute and chronic pain, stress and suffering) could be helpful in ascertaining an animal's condition in the absence of a veterinarian and inform the decision to kill the animal.

85. Although decision trees imply that decision-making is a rational process, farmers and stockpeople will be influenced by a range of subjective factors. A reluctance to kill might be the result of:

- attachment to an animal;
- a desire to realize the economic value of an animal, especially cattle;
- the unavailability of appropriate equipment for killing or training in its use;
- a lack of confidence, especially with larger animals;
- an unrealistic hope that the animal will recover;
- the cost of veterinary attendance;
- the method and cost of carcass disposal.

86. Ultimately, the decision to kill an animal on-farm or not must be taken with the welfare of the animal to the forefront.

Approved stunning and killing methods

87. Table 1, describes the principal methods for the on-farm killing of different species. The information has been collated from legislation and peer-reviewed publications. For each method, the Table identifies:

- the principal characteristics;
- the conditions for use;
- the key parameters; and
- any specific requirements of the method.

88. The table is set out in the format of Annex 1 of European Council Regulation (EC) 1099/2009 on the protection of animals at the time of killing and is included in this Opinion as a guide to the methods that are currently considered appropriate for on-farm killing.

Table 1. On-farm slaughter methods approved under Council Regulation (EC) 1099/2009 and WATOK.

N	Name	Description	Conditions of use	Key parameters	Specific requirements for certain methods
1	Penetrative captive bolt device	Severe and irreversible damage of the brain provoked by the shock and the penetration of a captive bolt. Simple stunning.	All species	Position and direction of the shot. Appropriate velocity, exit length and diameter of bolt according to animal size and species. Maximum stun to kill interval(s).	Must be followed by a killing method e.g. pithing or bleeding.
2	Non-penetrative captive bolt	Simple stunning[22]	All species	Position and direction of the shot. Appropriate velocity, exit length and diameter of bolt according to animal size and species. Maximum stun to kill interval(s).	Must be followed by a killing method, e.g. neck dislocation with poultry or bleeding. When using this method, business operators shall pay attention to avoid the fracture of the skull and it shall only be used for ruminants of less than 10 kg of live weight.[23]
3	Percussive blow to the head	Firm and accurate blow to the head provoking severe damage to the brain.	Rabbits[24]	Force and location of the blow.	Shall not be used as routine methods but only where there are no other methods available for stunning. No person shall kill by percussive blow to the head more than seventy animals per day.

[22] Research has shown that neonates are killed by non-penetrative captive bolt.

[23] Kinetic energy transfer almost always results in a fracture, with variation between species.

[24] Percussive blow to the head is allowed as a stunning method under Council Regulation 1099/2009 for piglets, lambs, kids, rabbits, hares and poultry up to 5kg live weight but is restricted by stricter national rules in WATOK 2015 to rabbits.

4	Firearm with free projectile	Free-bullet or shotgun producing severe and irreversible damage of the brain provoked by the shock and the penetration of one or more projectiles.	All species	Position of the shot. Power and calibre of the cartridge. Type of projectile.	
5	Cervical dislocation	Manual or mechanical stretching and twist of the neck provoking cerebral ischemia.	Poultry up to 5 kg live weight. Slaughter, depopulation and other situations.	Not applicable.	Shall not be used as routine methods but only where there are no other methods available for stunning. No person shall kill by manual cervical dislocation or percussive blow to the head more than seventy animals per day. Manual cervical dislocation shall not be used on animals of more than three kg live weight.
6	Head-only electrical stunning	Exposure of the brain to a current generating a generalised epileptic form on the Electro-Encephalogram (EEG). Simple stunning.	All species	Minimum current (A or mA). Minimum voltage (V). Maximum frequency (Hz). Minimum time of exposure. Maximum stun-to-kill interval(s). Frequency of calibration of the equipment. Optimisation of the current flow. Position and contact surface area of electrodes.	Must be followed by a killing method e.g. electrically induced ventricular fibrillation. Electrodes shall span the brain of the animal and be adapted to its size. Head-only electrical stunning shall be carried out in accordance with the minimum currents set out in Table 1, Annex I, EC 1099/2009.

7	Head-to Body electrical stunning	Exposure of the body to a current generating at the same time a generalised epileptic form on the EEG and the fibrillation or the stopping of the heart.	All species	Minimum current (A or mA). Minimum voltage (V). Maximum frequency (50 Hz). Minimum time of exposure. Frequency of calibration of the equipment. Optimisation of the current flow. Position and contact surface area of electrodes.	Method promotes the start of death to the point of stun. The minimum currents for head-to-body electrical stunning shall be 1 ampere for sheep and goats and 1,30 amperes for pigs.
8	Carbon dioxide at high concentration	Direct or progressive exposure of conscious animals to a gas mixture containing more than 30 % carbon dioxide. The method may be used in containers or building previously sealed.	Poultry except ducks and geese	Carbon dioxide concentration. Duration of exposure. Quality of the gas. Temperature of the gas.	Exposure time must be sufficient to kill. Under no circumstances shall gases enter into the chamber or the location where animals are to be stunned and killed in a way that it could create burns or excitement by freezing or lack of humidity.
9	Carbon dioxide in two phases	Successive exposure of conscious animals to a gas mixture containing up to 40 % of carbon dioxide, followed when animals have lost consciousness, by a higher concentration of carbon dioxide.	Poultry	Carbon dioxide concentration. Duration of exposure. Quality of the gas. Temperature of the gas.	Exposure time must be sufficient to kill.

10	Carbon dioxide associated with inert gases	Direct or progressive exposure of conscious animals to a gas mixture containing up to 40 % of carbon dioxide associated with inert gases leading to anoxia. The method may be used in containers or in buildings previously sealed.	Pigs[25] and poultry. Pigs in knackers yard only	Carbon dioxide concentration. Duration of exposure. Quality of the gas. Temperature of the gas. Oxygen concentration.	Exposure time must be sufficient to kill. Under no circumstances shall gases enter into the chamber or the location where animals are to be stunned and killed in a way that it could create burns or excitement by freezing or lack of humidity.
11	Inert gases	Direct or progressive exposure of conscious animals to an inert gas mixture such as Argon or Nitrogen leading to anoxia. The method may be used in containers or in buildings previously sealed.	Pigs and poultry[26]. Pigs in knackers yard only Slaughter, depopulation and other situations.	Oxygen concentration. Duration of exposure. Quality of the gas. Temperature of the gas.	Exposure time must be sufficient to kill. Under no circumstances shall gases enter into the chamber or the location where animals are to be stunned and killed in a way that it could create burns or excitement by freezing or lack of humidity.
12	Carbon monoxide associated with other gases	Exposure of conscious animals to a gas mixture containing more than 1 % of carbon monoxide associated with other toxic gases.	Poultry and piglets	Carbon monoxide concentration. Duration of exposure. Temperature of the gas. Filtration of the gas produced from engine.	Carbon monoxide (pure source or associated with other gases). Animals shall be kept under visual supervision at all times. They shall be introduced one by one, and it shall be ensured that before the next animal is introduced the previous one

[25] Pigs cannot be gassed on farm. WATOK does not allow this combination on farm.

[26] As for 10.

					is unconscious or dead. Animals must remain in the chamber until they are dead.
13	Maceration of hatchery waste	Immediate crushing of the entire animal.	Chicks up to 72 hours and egg embryos. All situations other than slaughter	Maximum size of the batch to be introduced. Distance between the blades and speed of rotation Measure to prevent overloading.	This method shall provide instantaneous maceration and immediate death of the animals. The apparatus shall contain rapidly rotating mechanically operated killing blades or expanded polystyrene projections. The capacity of the apparatus shall be sufficient to ensure that all animals are killed instantaneously, even if they are handled in a large number.
14	Lethal injection (Lethal injection can only be administered by a vet.)	Loss of consciousness and sensibility followed by irreversible death induced by the injection of veterinary medicines.	All species. Other situations than slaughter	Type of injection. Using approved medicines.	

Determining when an animal is unconscious or dead

89. A central principle of humane killing is that the death of the animal is achieved quickly and with minimum suffering. Those responsible for killing animals must therefore be able to ascertain the true condition of the animal following the stunning or killing method and determine whether unconsciousness or death has been correctly achieved. All of the methods reviewed above, if not properly undertaken, may result in prolonged periods of suffering for farmed animals if death is not achieved rapidly. Additional or repeated killing methods may need to be applied.

90. In its four Scientific Opinions on monitoring procedures at slaughterhouses (EFSA 2013, footnotes 12), EFSA proposes a series of toolboxes of welfare indicators for determining outcomes of consciousness, unconsciousness and death for each of the major farmed species and for the different stages in each of the approved killing methods. EFSA recommends that at least two of the reliable indicators should be monitored at each relevant stage of the killing process.

91. A lack of movement alone should not necessarily be interpreted as death or unrecoverable loss of consciousness. Inversely, movement should not necessarily be interpreted as sensibility[27]. Reflex movements may well occur after insensibility depending on the method used and to the untrained person may be equated with consciousness. It is generally accepted that confirmation of the onset of death (insensibility or unconsciousness) should take place within 30 seconds following the method used.

Indicators of death

92. Brain death in animals can be indicated by the absence of brain stem reflexes such as rhythmic breathing, pupillary light reflex, corneal reflex and gagging. The heart may continue to beat for some time after brain death but provided brain stem reflexes are absent, this is not a welfare concern.

93. It is important that keepers of farm animals are either familiar with and experienced in using these methods to accurately determine the unconsciousness and death of animals killed on-farm or have access to competent assistance.

Recommendations

94. All those responsible for keeping and caring for farmed animals should:

- have the ability to recognise animal welfare problems;
- have ready access to guidance (in relevant languages) on the decision-making associated with the need and the correct time to kill farm animals;
- receive relevant training in the appropriate on-farm killing methods to be used and in the determination of animal unconsciousness and death;
- hold the relevant certificates and licences where appropriate;
- have ready access to up to date SOPs, guidance and manufacturers' instructions on the killing methods to be used; or
- have access to people with these competencies without delay.

95. Animal keepers should have Standard Operating Procedures (SOPs) for the humane killing of animals on-farm and these documents should be regularly reviewed and rehearsed. Permissible methods should be clearly identified for species and for age/weight groups kept.

[27] Woods, J. et al. (2010) Recommended On-farm Euthanasia practices. In Grandin, T. (Ed) Improving Animal Welfare: A Practical Approach. CABI International, Wallingford, 186-211

96. Herd/Flock Health and Welfare Plans and assurance schemes should include guidelines for dealing with emergency slaughter, emergency killing, culling and management killing and having SOPs in place.

97. It would be good practice to have signage on the farm premises describing on-farm killing procedures and contact details for competent persons to kill farm animals.

98. Government and industry should support the development of coherent and practical assessment criteria to enable farmers to make an informed decision to kill an animal on-farm.

99. FAWC recommends that the Competent Authority should ensure that manufacturers of equipment produced for the stun/killing of animals, produce readily understood instructions for their effective use on-farm.

100. FAWC recommends that all livestock farms should have available ready access to suitable equipment for the humane killing of all farmed animals species, sizes and ages kept on the premises and that all equipment kept on farm for the killing of animals must be maintained in good working order, cleaned after use and stored in suitable facilities as per manufacturers' instructions.

101. FAWC recommends further research and development supported by government and industry into portable mechanical and electrical instruments and other new and novel technologies for the on-farm killing of pigs, sheep, goats and poultry.

102. Government and industry should invest in research and development into practical, humane methods of on-farm killing for small chicks that will alleviate welfare concerns.

103. FAWC holds that mechanical percussive devices should ultimately replace the routine use of cervical dislocation for most poultry. Alternative methods should be developed for younger birds.

104. The current legal maximum numbers for manual cervical dislocation under WATOK should be reviewed by Government in the light of industry experience, including young chicks in on-farm hatching systems.

105. Captive bolt guns should only be used either by licensed slaughtermen or by personnel verifiably trained and competent in their use.

106. FAWC believes that, at the current time, firearms should be the preferred means of killing larger farm animals. However, farmers and stockpeople should be aware of the correct firearm, type of ammunition and shooting position to be employed for the killing of different species, breeds and age/weight groups.

107. In the interests of farm animal welfare we would encourage the Home Office to promote a consistent approach to firearm legislation with respect to authorisation for the killing of farmed animals on and off the farm.

108. Reliable delivery of an effective stun using a non-mechanical percussive blow to the head is challenging and therefore FAWC recommends its routine use for rabbits should be discontinued.

109. Hospital pens should not be used to delay necessary on-farm killing. They should only be used when animals are likely to recover from injury or disease following treatment. Where possible, FAWC recommends that hospital pens should be located such that the animal(s) can see and interact with conspecifics as separation from peer group can, in some cases, affect recovery.

110. We strongly believe that a concerted effort should be made by Government, the research community and industry to arrive at a consistent interpretation of the terminologies and definitions associated with the methods of killing farmed animals, whether on-farm or in the slaughterhouse.

111. FAWC recommends that all on-farm kills are specified as part of farm-held mortality records along with the method applied and whether for eventual human consumption or for emergency, culling or management reasons.

112. Government and industry should as a priority collaborate on awareness raising about the rules on on-farm killing as well as enforcement responsibilities, processes and contacts for farm staff and enforcers.

Literature cited (in addition to footnoted references)[28]

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APPENDIX 1 - Membership of FAWC - 2018

Peter Jinman – Chairman
Martin Barker
Dr Andy Butterworth
Richard Cooper
Dr Jane Downes
Dr Troy Gibson
Dr David Grumett
Dr Carmen Hubbard
Richard Jennison
Richard Kempsey
Dr Dorothy McKeegan
Professor Richard Moody
Debbie Stanton
Mark White

Advisors
Dr Rebeca Garcia – Defra/APHA
Sue Whitehead – Defra
Kelly Verney - Defra
David Coles - Defra
Collin Willson – FSA

FAWC Secretariat
Richard Aram
Louise Mulcahy
Rachael Brunskill

Professor Henry Buller, Steve Wotton and Mike Elliott also assisted in the development of this report as members of the Welfare at Killing Committee before stepping down from FAWC.

APPENDIX 2 - Those who gave evidence or assistance

Agriculture and Horticulture Development Board (AHDB)
Association of Independent Meat Suppliers (AIMS)
British Cattle Veterinary Association (BCVA)
British Veterinary Association (BVA)
Compassion in World Farming (CIWF)
HCC Meat Promotion Wales (HCCMPW)
Humane Slaughter Association (HSA)
National Farmers Union (NFU)
National Farmers Union Scotland (NFUS)
National Farmers Union Wales (NFUW – with NFU)
National Pig Association (NPA – with NFU)
Quality Meat Scotland (QMS)
Royal Society for the Prevention of Cruelty to Animals (RSPCA)
Wales Animal Health and Welfare Framework Group (WAHWFG)

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