



HOME OFFICE
ANIMALS (SCIENTIFIC PROCEDURES) ACT 1986

Code of Practice FOR THE HOUSING AND CARE OF ANIMALS USED IN SCIENTIFIC PROCEDURES

London
Her Majesty's Stationery Office

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(Animals (Scientific Procedures) Act 1986)

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**CODE OF PRACTICE FOR THE HOUSING
AND CARE OF ANIMALS USED IN
SCIENTIFIC PROCEDURES
(issued under section 21)**

Part 1

1 Introduction

1.1. The Animals (Scientific Procedures) Act 1986 regulates “any experimental or other scientific procedure applied to an animal which may have the effect of causing that animal pain, suffering, distress or lasting harm”.

1.2. The Act came into effect on 1 January 1987 and its provisions are being progressively brought into force.

Inspectors

1.3. Section 18 of the Act empowers the Home Secretary to appoint Inspectors; sets out their duties to visit establishments and advise and report to the Secretary of State; and empowers Inspectors to order the killing of an animal if it is considered to be undergoing excessive suffering.

Animal Procedures Committee

1.4. Section 19 of the Act establishes the Animal Procedures Committee and sets out its constitution. Section 20 of the Act lays down that it is the duty of the Committee to advise the Home Secretary, having “regard both to the legitimate requirements of science and industry and to the protection of animals against avoidable suffering and unnecessary use in scientific procedures”.

Codes of Practice

1.5. Under section 21 of the Act, the Home Secretary is required to “issue codes of practice as to the care of protected animals and their use for regulated procedures and may approve such codes issued by other persons” and to consult the Animal Procedures Committee before publishing such a code.

1.6. This Code of Practice is issued under section 21. Section 21(4) says that a “failure on the part of any person to comply with any provision of a code . . . shall not of itself render that person liable to criminal or civil proceedings but . . . any such code shall be admissible in evidence in any such proceedings . . . and if any of its provisions appears to the court . . . to be relevant . . . it shall be taken into account” in determining the outcome of the case.

The RS/UFAW Guidelines

1.7. As a response to the Act, the Royal Society and the Universities Federation for Animal Welfare (UFAW) jointly issued detailed guidelines for the housing and care of animals in scientific procedures (46).

1.8. In preparing these guidelines, the two bodies undertook wide consultations within the scientific community and organisations concerned with the welfare of animals. It was always understood that the Royal Society/UFAW guidelines might form the basis of a code of practice issued under section 21 of the Act.

1.9. The conclusion of the RS/UFAW guidelines reads as follows:

“It is an underlying principle of the 1986 Act that animals bred, supplied and used for scientific purposes should be cared for in accordance with the best standards of modern animal husbandry. It is hoped that these guidelines on housing and care will help to establish such standards.

Although sizes of cages and pens are recommended, from the animal’s point of view cage shape and furniture may be more important than size and the social relationship of its fellows more important than stocking densities. The care given by staff may be the most important factor of all.

Knowledge of the needs of animals is always growing and it is necessary that it continues to be shared. Breeders are willing to provide details of the high quality animals they supply; licensees, technicians, animal house curators and veterinary surgeons responsible for the care of the animals should share their experiences and knowledge and, if needs be, seek advice from the Home Office Inspectorate. It is up to all concerned to keep themselves fully aware of developments that might improve the standards of husbandry of the laboratory animals in their care.”

1.10. The Government shares this view. It is the Government’s policy, enshrined in the Act, that scientific procedures on living animals can be permitted only if stringent safeguards are followed to prevent unnecessary suffering to the animals.

This Code of Practice

1.11. This Code is closely based on these guidelines and it is a tribute to the excellent and thorough work done by the Royal Society and UFAW that little amendment has been needed to convert their guidelines into a Code of Practice which should command widespread support.

1.12. It is issued following further and extensive consultation with a number of interested organisations. It has been endorsed by the Animal Procedures Committee. Like the guidelines on which it is based, this Code represents “a consensus of views obtained from scientists and consultants working in academic and industrial spheres as well as from societies and associations that have a direct interest” (46).

1.13. It is not appropriate for a code of practice to set mandatory requirements for housing which must be followed in all circumstances. This Code incorporates the best practice of animal scientists of the highest standing. To ensure good husbandry and to safeguard animal welfare, a high standard of facilities must be provided for animals wherever they are held and used and this Code contains specific recommendations. Where facilities are not satisfactory, a realistic (but not too extended) programme for improvement will be set. Any proposed alterations to housing systems or facilities are a matter for discussion with the Inspector.

1.14. Animal science is a developing discipline. For example, research has begun to show innovative ways of group housing which further study may show to be superior to standard methods of housing particularly for non-human primates but also for cats, dogs, ferrets and rabbits.

Application of the Code of Practice

1.15. This Code applies throughout the United Kingdom. In Great Britain it is administered by the Home Office. In Northern Ireland, it is administered by the Department of Health and Social Services on behalf of the Secretary of State for Northern Ireland. Where the Code speaks of “the Secretary of State” or “the Home Office” it means, in Northern Ireland, the Department of Health and Social Services.

1.16. This Code does not apply to places designated solely under section 7 of the Act, where animals are bred or supplied for use in procedures. Many of the requirements which will need to be met in breeding establishments are however similar. The Code may be extended to include recommendations relevant to the needs of breeding establishments.

1.17. As understanding of how best to care for animals evolves, the recommendations contained in this Code of Practice may need to be updated. The Secretary of State will keep this Code of Practice under review and will issue amendments as necessary.

2 Housing and Environment

2.1. The purpose of this Code of Practice is to establish standards for the care of laboratory animals and for designing and constructing animal facilities.

2.2. In scientific work involving living animals, the most reliable results are likely to be obtained by using healthy animals that are well adapted to their housing conditions and, in quantitative assays or comparisons, precision is increased if those animals are uniform.

2.3. The 1986 European Convention (20) provides that:

“Any animal used or intended for use in a procedure shall be provided with accommodation, and environment, at least a minimum of freedom of movement, food, water and care, appropriate to its health and well-being. Any restriction on the extent to which an animal can satisfy its physiological and ethological needs shall be limited as far as practicable. In the implementation of this provision, regard should be paid to the guidelines for accommodation and care of animals set out in Appendix A to this Convention.”

2.4. These principles have been borne in mind throughout the preparation of this Code.

2.5. All animals, except when undergoing regulated procedures licensed under the Act, are subject to other controls. For example, the Protection of Animals Act 1911 (1912 Scotland; in Northern Ireland, the Welfare of Animals Act (NI) 1972) prohibits causing or permitting any unnecessary suffering. The Animal Health Act 1981 and Diseases of Animals (NI) Order 1981 apply in respect of notifiable diseases and the Wildlife and Countryside Act 1981, and Wildlife (NI) Order 1985, relate to the taking of wild animals.

2.6. The Agriculture (Miscellaneous Provisions) Act 1968 relates to farm animals and attention is drawn to the various Codes of Recommendations for the Welfare of Livestock issued under that Act by the Ministry of Agriculture, Fisheries and Food (MAFF Codes; 38). In Northern Ireland, similar codes may be issued by the Department of Agriculture under the Welfare of Animals Act (NI) 1972.

2.7. Where animal facilities do not conform to the standards of this Code, it is expected that modifications necessary for the well-being of the animals will be made without delay. New facilities must meet the standards, but nothing in this Code is intended to imply that absolute uniformity is in itself desirable, or to make a case for change to achieve uniformity for its own sake. Inspectors will consider, as part of their enquiries, whether the facilities, or any proposed changes, are acceptable before making a recommendation to the Secretary of State on applications for licences and certificates of designation.

2.8. Those responsible for laboratory animals should be thoroughly trained in their care and familiar with the basic requirements of their animals under normal and experimental conditions. They need to be fully aware of the legal and moral responsibilities of using animals in scientific procedures. They must appreciate also the importance of, and be competent in, correct animal handling and restraint, and in the procedures which they will be carrying out (51).

2.9. Under the Health and Safety at Work Act 1974, the person in charge of a unit is required to ensure that it is a safe and healthy place in which to work. Staff should be aware of the action to be taken in case of accident, fire or other emergencies, and of the potential existence of zoonotic organisms. Occupational asthma caused by exposure to laboratory animals is a prescribed disease. For further information, see 2, 4, 34, 50, 52.

THE ANIMAL HOUSE

2.10. An animal house should be designed, sited and constructed to provide a suitable environment, including any special requirement for exercise or social contact for the species to be housed, and should incorporate facilities sufficient for the activities carried out within it. When substantial alterations to the premises are proposed, the Inspector should be consulted at an early stage.

2.11. When siting an animal house, consideration should be given to the activities in the adjacent buildings and any effect these may have on the welfare of the animals. An animal facility forming part of a larger complex should be designed to be self-contained. Wild, stray or pet animals should not be able to gain entry to any part of the animal house, including stores and personnel areas. Special care should be taken where drains and other services pierce the walls or floors to ensure that they have been properly proofed against rodents and insects (45).

Security

2.12. The animal house and its facilities should be designed to prevent animals escaping. It is also proving necessary to protect animal facilities against illegal entry by unauthorised persons. Advice should be taken about security from Crime Prevention Officers from the local police or other experts during the design of new facilities or modifications of existing premises.

Animal Rooms

2.13. For the purpose of this Code, an animal room means the room normally used to house stock, breeding or experimental animals or one which is used for the performance of minor non-surgical procedures.

2.14. Animal rooms should be constructed of impervious materials, with easily cleanable surfaces which are resistant to attack from the chemicals used to clean or fumigate the rooms. Consideration should be given to using materials which are least likely to crack and craze. Floor finishes should be non-slip whether wet or dry. All joints between door frames and wall etc. should be sealed. Floor to wall, wall to ceiling and wall to wall junctions should be coved for easy cleaning.

2.15. Animal rooms should be protected against ingress by pests, such as wild rodents and insects; special care should be taken where drains are present (45). Services should be installed in such a way that they are either buried within the fabric of the building, boxed in or clear of the wall surface for easy cleaning. When the fabric of the building is penetrated, the holes created should be sealed.

2.16. Design should take into account the fact that building maintenance may disturb animals and disrupt experiments. Services should be installed to be accessible from outside and with fittings that can be removed by the staff for

maintenance or repair elsewhere. If possible, provision should be made for the addition of new services during the lifespan of the building, for instance by the insertion of spare ducting in the walls.

2.17. Farm animals in pens generally require more robust wall and floor finishes and there should be no projections which may present a hazard to animals or staff. Farm animals which are kept in animal houses should be given at least as much room as recommended in the Code issued by MAFF (38). For some procedures the standards of environment and housing required may be much higher than where animals are kept under farm conditions. Exercise areas should be provided for larger farm animals but, in some cases, such facilities may be impracticable from an experimental, environmental, disease control or security point of view.

2.18. Maximum stocking levels are limited primarily by the adequacy of the ventilation system. The stocking density for each room for each species likely to be housed should be calculated and be readily available (see para 2.52). Any smell of ammonia probably reflects overstocking, too little ventilation, inadequate cleaning, or a combination of these factors; the causes should be investigated and rectified.

2.19. Species that are incompatible, for example predator and prey, or animals requiring different environmental conditions or of different health status, should not be housed in the same room nor, in some cases, within smell or earshot.

2.20. Precautions should be taken in animal rooms to minimise the exposure of personnel to hazards which may arise from the incorrect handling of animals, for example bites and scratches, allergens and infections (65) and to prevent exposure to hazardous treatments intended for, or applied to, the animals.

2.21. Animals inoculated with infective agents which are transmissible to man or to other animals held on the premises should be contained within an area reserved for this purpose.

2.22. There should be special provision to house animals that are ill or injured, including facilities for isolation, if necessary.

2.23. Breeding animals should normally be held separately from animals in procedures. According to the microbiological and genetic quality of animal desired, different levels of separation and physical barrier will be required between breeding and other areas.

2.24. Adequate arrangements should be provided for the receipt of incoming animals. Animals brought into an animal house should not put at risk animals which are already there. Space should be provided for acclimatisation and quarantine, where appropriate.

Procedure rooms

2.25. General and specialist procedure rooms should be provided as appropriate. Major surgery and euthanasia should not be performed in rooms where animals are normally housed or where other conscious animals are undergoing procedures.

2.26. Where surgery is to be performed, suitable operating facilities should be provided, including separate preparation areas for the animals, equipment and staff. There should be a post-operative recovery area.

2.27. Surgery from which animals are to recover will normally be carried out under appropriate clean or aseptic conditions in a designated operating room.

Minor procedures may be carried out in a designated area within the animal room or in a separate room designed for this purpose.

2.28. All establishments should have access to facilities for diagnostic investigation, post-mortem examinations and the collection of samples for examination elsewhere. These rooms may not necessarily be in the animal house.

Service areas and support facilities

2.29. The design and construction of service and circulation areas should normally be of the same standard as the experimentation areas. The building should be planned to prevent cross-contamination between clean and dirty equipment. Corridors should be wide enough for easy movement of personnel and equipment.

2.30. Service areas are subject to rough treatment and wall surfaces should be resistant to impact damage, with guard rails to protect walls and corners. Surfaces and corners should be easy to clean. Adequate floor drainage should be provided in wash areas, with sufficient ventilation to remove excess heat and humidity.

2.31. There should be adequate storage space; corridors should not be used for storage. Separate stores should be provided for food, bedding, cages, cleaning materials and other items. Special facilities may be required for handling and storing chemicals.

2.32. Food and bedding stores should be clean, dry, vermin and insect proof. In addition, food stores should be cool and sunless and provided with ventilation. Perishable foods should be stored in cold rooms, refrigerators or freezers.

2.33. A vermin-free collection area should be provided for waste, prior to its disposal. Special arrangements should be made for handling carcasses and radioactive or other hazardous material.

Facilities for staff

2.34. Personnel facilities should include staff and record rooms, sufficient changing rooms, decontamination areas, first aid and toilet facilities and space for storing protective and outdoor clothing etc.

2.35. Animal care personnel may be present at times when normal catering facilities may not be available; special arrangements or facilities for meals may therefore be needed. Smoking, eating and drinking should be prohibited in all areas other than those staff areas specifically reserved for such activities.

Staffing

2.36. Sufficient suitably-qualified staff must be available at all times to care for the animals, including during weekends, holiday periods and when the normal staff are absent e.g. due to sickness. Only competent staff should be given responsibility for the care and husbandry of animals.

Training

2.37. The person named in the certificate of designation of the premises as responsible for the day-to-day care of animals should ensure that adequate

training is provided for all personnel. The degree of training required will depend on the activities being carried out.

2.38. Information on training and courses in laboratory animal science and technology are available from the Business and Technician Education Council, the Institute of Animal Technology, the Institute of Biology, the Royal College of Surgeons, the Royal College of Veterinary Surgeons and the Royal Veterinary College, University of London. Several pharmaceutical companies arrange courses for their own staff (51).

The named veterinary surgeon

2.39. Under section 6(5)(b) of the Act, it is a requirement for certification as a designated establishment that there is a named veterinary surgeon (or in exceptional circumstances, another suitably qualified person) to provide advice on the health and welfare of the animals. It is important that he or she has knowledge of the needs of laboratory animals and of all the procedures in use.

THE ENVIRONMENT

2.40. Experimental results may be influenced by environmental conditions (13) and animals should be kept under conditions that favour a consistency of response to scientific procedures. Unstable environmental conditions are likely to introduce avoidable variability into biological responses. To demonstrate any experimental response against such a variable background generates a requirement for greater animal usage if the result is to be statistically valid. Good control of variables such as ventilation, humidity, temperature, lighting and noise can therefore contribute both to good science and to the minimisation of animal use. Conditions should not override the welfare of the animals concerned unless necessary to achieve the scientific objective. For breeding, a controlled daily fluctuation in temperature may be positively beneficial.

Temperature

2.41. Animal room temperatures should be carefully controlled and continuously monitored by instruments which are checked at least once daily. The limits within which room temperatures should generally be maintained are set out in para 5.1. The equipment, insulation and design of the building should be such as to ensure that these temperatures can be maintained in both winter and summer.

2.42. The target should be to maintain the room temperature in a band width of 4°C, the whole of the band lying within the optimal range indicated. If an animal's thermoregulatory ability has been affected by anaesthesia or other scientific procedures, a higher room temperature or more bedding material should be provided.

2.43. It should be noted that temperatures within the cages will often be higher than room temperatures. Even in rat cages with grid floors in a room with adequate ventilation, the temperature can be 3-6° above room temperature, according to the position of the cage in the room (14). If bedding material is present, the animal can manipulate its own immediate environment and provide a warm nest for its young.

2.44. Temperature regulation should ensure that there are no undue fluctuations within or between rooms and so avoid causing unnecessary stress. In the majority of establishments it is desirable to provide a cooling system for rooms

containing rodents and rabbits to comply with the upper limitations for room temperatures. If this is not available *ad hoc* methods, such as reduction of stocking densities, may be necessary to avoid heat stress.

2.45. Animals kept outdoors or under farm conditions indoors will be maintained at ambient temperature. For some species, shade or shelter will be required in the summer; in winter, there may be a need for access to shelter as well as additional heat and food.

2.46. Requirements for birds vary according to species (38, 65).

2.47. Reptiles and amphibians are unable to control their body temperature except by behaviour. Each species has a temperature range within which it will feed and behave normally. The aim in the laboratory should be to provide this (65). Where amphibians are maintained at low temperatures, they and their environment should still be checked daily.

2.48. Fish should be kept as close to their natural environmental temperature as practicable (31).

Relative Humidity

2.49. Extreme variations in relative humidity can have adverse effects on the well-being of animals (14) and, by affecting the rate of heat loss, can influence activity and food intake (59).

2.50. The relative humidity in animal rooms should normally be maintained at $55\% \pm 10\%$. Prolonged periods below 40% or above 70% should be avoided. In most cases, some form of humidification will be required. Chickens are more tolerant than mammals and a range 30-70% is acceptable (44).

2.51. For most amphibians and some reptiles, 70% is desirable but 'dry' reptiles should be kept at 40-60%. Some other amphibians and reptiles may require humidity outside those ranges (5, 21, 55).

Ventilation

2.52. The functions of the ventilation system are:

- (i) to regulate within prescribed limits temperature and humidity;
- (ii) to reduce the levels and spread of odours, noxious gases, dust and infectious agents;
- (iii) to provide sufficient air of an appropriate quality.

2.53. The ventilation rate of the room should be related to its stocking density and to the heat generated by animals and equipment in the room (thermal load). In fully-stocked rooms for rodents and lagomorphs, 15-20 changes of fresh or conditioned air per hour distributed throughout the room are normally adequate. For cats, dogs and primates, 10-12 changes per hour may be adequate. Fewer air changes may be acceptable where stocking densities are low.

2.54. The air distribution system should deliver as even a proportion of air to each cage or animal as possible whilst avoiding draughts (15). Careful attention should be given to air inlet and outlet positions to ensure good air circulation and avoid draughts and noise disturbance. In general, environmental conditions for both staff and animals will be improved by higher rates of air changes and properly directed air flow.

2.55. The ventilation system can be used to create differential air pressures within the building as part of a 'barrier' system. 'Clean' areas are generally maintained at higher pressure and 'hazardous' areas at lower pressure than those adjacent to them to minimise the leakage of 'dirty' air into 'cleaner' areas and the escape of airborne hazards into the air outside the premises. This is effective only if the supply air is itself clean or is suitably filtered to be free from contaminants.

2.56. For further information on farm animal housing, see 8, 10, 11, 38. For further information on laboratory animals, see 14, 15, 37.

Lighting

2.57. Most laboratory mammals are either crepuscular or nocturnal. Their eyes are adapted, therefore, to dim light conditions. Light-induced retinal damage occurs principally in albino animals and most severely when periods of darkness are too short to allow recovery (7, 27, 61, 68, 70). The important aspects of light are its intensity, wavelength and photoperiod.

- (i) Intensity—350-400 lux at bench level is adequate for routine experimental and laboratory activities. Care may be required to avoid undesirably high levels inside cages (14, 42), especially for albino animals.
- (ii) Wavelength—few laboratory animals other than primates (and perhaps cats) have colour vision although there is some evidence that wavelength can nevertheless have an effect (48, 53, 54). There is no evidence to indicate that either fluorescent or incandescent lights have adverse effects.
- (iii) Photoperiod—the importance of light to dark (L:D) cycles in regulating circadian rhythms and stimulating and synchronising breeding cycles is well documented (13). For the majority of laboratory animals a daily cycle of 12:12 hours is suitable. The circadian 'clock' of some species may be affected as much by light pulses of less than one second during the dark phase as by a long photoperiod; thus it may be important not to turn on lights during the dark period (13, 22). On the other hand, intervals of darkness during the light period are not known to be disruptive. Where animals are maintained on reverse photoperiod, daily inspections of the animals must still be undertaken.
- (iv) Dawn and dusk—for some species of primates, birds and fish a simulated dawn and dusk may be required. This can be provided by the use of either automated dimmer switches or low wattage bulbs that remain on into, or during, the period of darkness (60).

Windows

2.58. Windows allow fluctuations in light intensity during daylight and in photoperiod throughout the year and natural lighting may have a beneficial effect on staff. However, they can interfere with temperature control, particularly if they admit direct sunlight, and be a weak point in the security of the building.

Noise

2.59. The control of noise is important in the care of laboratory animals (13, 25). Loud, unexpected and unfamiliar sounds are probably more disruptive than constant sounds. There is no indication that constant background noise, such as that generated by air-conditioning and similar equipment, is harmful to animals providing it is not too loud. The ability of such sounds to mask other noise is, however, unproven (24, 41).

2.60. Because different species have the ability to hear sounds of different pitch/frequency (13, 47) and loudness (13, 40), and because of the variations in sounds that can occur in animal houses, it is not possible to give firm recommendations for noise levels.

2.61. However, it has been found empirically that if the general background sound level in an empty animal room can be kept below about 50dB (A); below a noise rating curve of 45; and free from distinct tonal content, then it is unlikely that there will be damage to animals or personnel when the room is in use (11).

2.62. Excessive noise and vibration most commonly arise from imperfectly balanced rotating or reciprocating machinery which is usually sited in a plant room. Vibration is most often noticeable during machine start-up (i.e. low-frequency movement) when some machines have to pass through a critical (resonant) speed before reaching their normal operating condition. Such disturbances may not be important if the machine operates for long periods. Machines which switch in and out, however (perhaps due to a thermostatic or other operational controller), may require special precautions. Vibrations transmitted by machines through their base to the building structure may be felt at considerable distances from the plant, in extreme cases even in neighbouring buildings (11).

Special environments

2.63. There have been several developments aimed at increasing the separation between animals and personnel to provide, amongst other things, protection from dangerous pathogens (2) and to contain other hazardous substances, such as potential carcinogens and allergens. Devices used include filter caps and bonnets, environmental chambers, filter-racks, safety cabinets and isolator systems (15). All can be effective if used properly and each has its advantages and disadvantages. As their use can lead to a false sense of security, expert advice should be sought before selection, particularly with the more sophisticated and hence generally more expensive equipment.

Emergency alarms and stand-by systems

2.64. A technologically-dependent animal facility is a vulnerable entity. It is strongly recommended that such facilities are appropriately protected to detect hazards such as fires and the breakdown of essential equipment such as ventilation fans, air heaters, coolers etc., and the intrusion of unauthorised persons. Care should be taken to ensure that where possible the operation of the alarm system causes the minimum of disturbance to the animals; an example of this is the use of the so-called 'silent' fire alarm which is inaudible to small rodents (16).

2.65. Animal facilities which rely heavily on electrical or mechanical plant for environmental control and protection will need stand-by equipment in order to maintain essential services and emergency lighting systems (it should be borne in mind that certain species will not eat in the absence of light) as well as to ensure that alarm systems themselves do not fail to operate.

2.66. The heating and ventilation system should be equipped with monitoring devices to enable the staff to be assured at all times that it is working satisfactorily and maintaining the correct environmental conditions.

3 Animal Care and Health

3.1. Animals living within an animal house are totally dependent on humans for their health and well-being. Their physical and psychological state will be influenced by their surroundings, food, water and the care and attention provided by the animal house staff.

3.2. The aim is to maintain animals in good health and physical condition; behaving in a manner normal for the species and strain and with a reasonably full expression of their behavioural repertoire; amenable to handling; and suitable for the scientific procedures for which they are kept.

3.3. **The general well-being of all animals must be checked at least once daily.** More detailed examinations should be carried out with sufficient frequency to ensure that the health and well-being of the animals is maintained. Animals which are undergoing scientific procedures must be inspected at a frequency commensurate with the severity of the procedure.

Responsibility for animals

3.4. Responsibility for the care of laboratory animals which are involved in or held for scientific procedures falls to:

- (i) the **personal licence holder** who is responsible for all animals submitted to procedures under the terms of his or her licence;
- (ii) the **animal technician**;
- (iii) the **person named as responsible for the day to day care** of the animals;
- (iv) the **named veterinary surgeon** (or, in exceptional circumstances, another suitably qualified person) who monitors and advises on the health and welfare of the animals;
- (v) the **project licence holder**;
- (vi) the **holder of the certificate of designation**.

Sources of animals

3.5. Under section 10(3) of the Act, unless an exemption has been issued by the Secretary of State, the following species named in Schedule 2—mouse, rat, guinea-pig, hamster, rabbit and primate — must be obtained from designated breeding or supplying establishments: dogs and cats must be bred at and obtained from designated breeding establishments.

3.6. The importation of animals from overseas is controlled by the Animal Health Act 1981 and, for some species, by the Endangered Species (Import and Export) Act 1976. Details about licences, health certificates, rabies and other quarantine requirements should be obtained from the Animal Health Division, MAFF, or the Department of Agriculture for Scotland (DAFS) and from the Wildlife and Conservation Licensing Section, Department of the Environment (DoE), Bristol. In Northern Ireland, importation is controlled by the Department of Agriculture.

3.7. Many wild animals, including birds, reptiles and amphibians, are protected by the Wildlife and Countryside Act 1981 (in Northern Ireland by the Wildlife (NI) Order 1985). There is additional statutory protection for badgers, seals, deer and fish. The Dangerous Wild Animals Act 1976 (which does not apply in Northern Ireland) controls the keeping of some animals, including some primates: further information may be obtained from DoE, Bristol.

3.8. Trapping methods (49, 63) must be humane and should be undertaken only by competent people. Any animal that is injured should be given first aid and, if necessary, examined as soon as possible by a veterinary surgeon. If pharmacological restraint is necessary, it should be done under the supervision of a veterinary surgeon or other authorised person. The permission of MAFF may be required.

3.9. If it is necessary to use an anaesthetic or immobilising agent in the capture of large animals, this should be administered by a veterinary surgeon or other authorised person.

3.10. Tranquillising weapons, including blowpipes, are classed as prohibited weapons under the Firearms Act 1968 and may be acquired only on the authority of the Home Office and with a permit from the local Chief Constable. The tranquillising agent may itself be subject to additional control under the Misuse of Drugs Act 1971 (32, 43).

TRANSPORT

3.11. Stress during transport should be minimised by making animals as comfortable as possible in their containers and, if confinement is to be prolonged, by providing food and water. Time in transit should be kept to a minimum (17, 67). Animals that are incompatible should not be transported together.

3.12. The sender should ensure that the animals to be transported are in good health and that their containers are adequately labelled. Sick or injured animals should be transported only for purposes of treatment, diagnosis, or emergency slaughter.

3.13. Pregnant animals need special care. Farm animals should not normally be transported during the last week of pregnancy and small animals in the last fifth of pregnancy.

3.14. Where animals are subject to control under the Act, it is necessary to consult the Inspector about authority to transfer them to other designated premises. Where laboratory animals are to be exported or imported advice should be sought from the Home Office and the local Divisional Veterinary Office of MAFF.

3.15. The advice of the DoE should be sought about the transport of wild animals. Special considerations apply to the transport of fish (31). Farm animal transport is regulated by various orders under the Animal Health Act 1981 and details should be obtained from MAFF.

Reception

3.16. Animals should be removed from their transport containers with the least possible delay. After inspection, the animals should be transferred to clean cages or pens and be supplied with food and water as appropriate. Animals that are sick, injured or otherwise out of condition must be kept under close observation, housed separately and examined by a veterinary surgeon (or other competent person) as soon as possible.

3.17. A record should be made of animals received, their source and date of arrival as required by section 10(6)(b). Animals should be identified by cage labelling in the case of rodents and other small laboratory animals. In the case of dogs, cats, equidae, primates, farm animals and adult birds, each animal accommodated in the establishment must be readily identifiable. In the case of dogs, cats and primates each animal will need to be identifiable by a method of permanent marking approved by the Secretary of State. If permanent marking is not practicable, e.g. in marmosets, the animal should be fitted with a collar or necklace bearing its number or other identifier.

Acclimatisation and quarantine

3.18. Acclimatisation is necessary for an animal to overcome the stress imposed by transport and subsequent exposure to a new environment with different diet, microflora and a change of human contacts, before subjecting it to scientific procedures. The period of time required will vary according to circumstances and should be determined by the user in consultation with the senior animal technician (28, 35, 56, 58) or named veterinary surgeon.

3.19. Imported animals are subject to statutory control by licences issued by MAFF. A period of quarantine may be given as a condition of the licence and details of the requirements can be obtained from local veterinary officers. The Rabies (Importation of Dogs, Cats and Other Mammals) Order 1974, as amended, specifies a period of quarantine for some animals. Wild-caught animals should be housed separately from laboratory-bred ones to prevent transmission of infection. An acclimatisation period of up to 3 months may be necessary if animals are to be used for breeding.

CARE OF ANIMALS

Animal accommodation

3.20. Building and environmental control have been dealt with in Section 2. This section deals with the space required for each animal. Laboratories should always consult their Inspector before committing themselves to a programme of work to comply with the recommendations contained in this Code as it may be that simple innovations produced in their workshops will prove preferable to new caging in terms of both animal welfare and cost.

3.21. Size, shape and fittings of pens and cages should be designed to meet the physiological and behavioural needs of the animals. The shape of the cage and the furniture provided may be as important to the animal as the overall size of the cage. Social relationships are as important as stocking densities and room must be allowed for growth of the animals. Some animals continue to grow into old age although they may become less active.

3.22. Cage and pen dimensions based on those recommended in the RS/UFAW guidelines (46) are given in Part 2. The height and area recommended are internal, not overall, dimensions. The sizes suggested are broadly in line with the recommendations of the European Convention (20). Where they differ, this is to take account of current British practice.

3.23. The sizes are intended to be used with discretion and indicate standards that users should seek to achieve and cages below the tabled heights and floor areas may be accepted temporarily at the discretion of the Home Office provided that the welfare of animals is not impaired. However, all new purpose-built housing should at least comply with the stated dimensions from the outset.

3.24. The pens or cages should be made of material that is not detrimental to the health of the animals and which is resistant to cleaning agents and techniques. They should be designed to minimise risk of injury with comfortable floors that permit easy removal of excreta. Floors, walls and doors should have surfaces which are resistant to wear and tear caused by the animals or by cleaning procedures.

3.25. Animals should be housed so that they can be easily inspected: animals should not be held in cages which are stacked so high that they cannot be inspected without removing them from the rack.

3.26. Pens for larger animals should have stable, non-slip floors. If slatted floors are used, design and finish must allow the animals to lie comfortably without injury to legs, feet or udders. Cows housed on slatted floors should have a separate solid floored area with straw or bedding material (38). Farm animals may be kept for scientific procedures in paddocks, yards, etc., which have been designated for the purpose.

3.27. Post-operative recovery pens and cages may be smaller than the sizes suggested. Some procedures may require a more restrictive system of housing to cater for special requirements imposed by experimental procedures, for example, the need to collect excreta or expired air, or the use of radioactive isotopes. Such housing should be used for the minimum time only.

Bedding and nesting material

3.28. Bedding and nesting material should be provided, unless it is clearly inappropriate. It should be comfortable for the particular species, dry, absorbent, dust free, non-toxic and free from infectious agents, vermin and other forms of contamination. Sawdust or shavings should not be derived from hardwoods or wood that has been treated chemically. Nesting materials should provide insulation but cause no hazard to the young or adult animals (65). Where large animals are housed on concrete, cattle mats should be used to protect pressure points.

Food

3.29. Diet should be formulated to satisfy the nutritional requirements of the animals (12). In the selection, production and preparation of food, precautions should be taken to avoid chemical, physical and microbiological contamination. Food should, when appropriate, be packed in sealed bags that are stamped with the production date and, when applicable, the expiry date. Packing, transport and storage should be such as to avoid contamination, deterioration or destruction of food. Perishable foods should be stored in cold rooms, refrigerators or freezers.

3.30. Diets for disease-free animals should be treated to destroy vegetative organisms, parasites, pests and spores. Diets for germ-free or gnotobiotic animals must be sterilised by autoclaving or irradiation (18). Where special diets containing chemicals for testing have been used, the nutritional consequences of the preparation and storage of the diet should be considered. Special considerations apply to the feeding of fish (28).

3.31. All food hoppers and utensils should be cleaned regularly and their sterilisation considered. If moist food is used or if the food is easily contaminated, daily cleaning is essential.

3.32. Where animals are held in groups, care should be taken to ensure that subordinate animals have adequate access to food and water. Consideration should be given to the avoidance of obesity by controlling food intake (23, 62).

Where 'withholding of food' is necessary for experimental or safety reasons, such as prior to anaesthesia, care should be taken that 'deprived' animals are not stressed by exclusion from food whilst other animals around them are fed. This may necessitate removal to another cage or room.

Water

3.33. Clean drinking water must normally be available to all animals at all times. It is usually provided in water bottles or other containers or by an automatic system. During transport, it is acceptable in some cases to provide water in the form of a moist diet (39).

3.34. Water is a vehicle for micro-organisms and the method of supply should minimise this hazard, for example by acidification or chlorification. When bottles are used, they should be sterilisable and sufficiently transparent to enable their contents to be observed. They should be wide-mouthed for easy cleaning. If plastic material is used, it should be resistant to leaching and suitable for sterilisation. Caps, stoppers and pipes should also be sterilisable and easy to clean. All bottles and accessories should be dismantled, cleaned and sterilised at intervals. Bottles should be replaced by clean, full ones rather than being topped up in the animal rooms. Water containers should not tip or spill easily.

3.35. The operation of automatic systems should be checked daily. They should be properly serviced and cleaned regularly to avoid malfunction and the risk of spread of infection. The water should be monitored for quality and purity to avoid bacterial contamination. If solid-bottomed cages are used, precautions should be taken to avoid flooding. Emergency supplies should be available in case pipes freeze or supplies otherwise fail.

Water for aquaria

3.36. The successful keeping of fish in the laboratory depends upon maintaining water quality within the range that will allow survival and growth. Uneaten food debris and excretory products must be removed from the tanks. The dissolved oxygen concentration for fish native to Britain should be maintained at least at 5mg/l. When preparing water for salt water aquaria, the specifications are critical (1, 3, 31, 57).

3.37. The tolerance of fish, amphibians and reptiles to changes in pH, chlorine and other chemicals differs widely from species to species. Water quality in aquaria and tanks must take account of these differing needs and tolerance limits.

Exercise

3.38. All animals must be allowed to exercise. For the smaller species, this should usually be achieved by providing adequately sized cages or pens and sometimes play objects. Indoor exercise may be acceptable provided adequate space and time are made available and it does not disturb other animals. For larger species, special arrangements will usually be required for social contact as well as exercise.

Handling

3.39. The behaviour of an animal during a procedure depends on the confidence it has in its handler. This confidence is developed through regular human contact and, once established, should be preserved. Where appropriate, time should be

set aside for handling and grooming. All staff, both scientific and technical, should be sympathetic, gentle and firm when dealing with the animals.

Cleaning

3.40. Regular cleaning and maintenance and a high standard of hygiene are essential for good husbandry. Routines should be established for cleaning, washing, decontaminating or sterilising cages and accessories.

SPECIAL CONSIDERATIONS

Wild animals

3.41. It is important that licence holders are aware of general advice on the care and use of wild animals (9, 49). Animals caught in the wild or being prepared for release back into the wild should be kept in conditions which conform as nearly as possible to their natural habitat in such respects as light intensities, food etc. Treatment for ectoparasites is usually necessary but care should be taken to choose an insecticide and method of application that does not harm the animal or interfere with experimental results.

3.42. The progeny of wild-caught animals may be kept under normal laboratory conditions and fed pelleted diets.

Non-human primates

3.43. The Order *Primates* includes both the 60g mouse lemur and the 200kg gorilla and encompasses a wide range of lifestyles. In considering the provision of a suitable laboratory environment for such a widely diverse group, it is best to work from a thorough understanding of the biological, psychological and behavioural needs of the individual species. Primates have high intelligence, most have arboreal habits and all need complex, stimulating environments.

3.44. The Home Secretary has set out a number of aspects of current policy towards primates in his response to the FRAME/CRAE report, "The Use of Non-Human Primates as Laboratory Animals" (29).

3.45. Housing should be secure and present the minimum hazard to the handlers and to the animals. Within this constraint, it should provide adequate space, complexity (e.g. varied diets, cage furniture) and opportunities for social interaction. Food items such as nuts, grain etc. may with benefit be added to bedding to encourage foraging behaviour and reduce boredom.

3.46. The use of space by primates means that cage volume is important. Virtually all show a vertical flight reaction. Cage height should allow for this and should permit the animals to stand erect, jump and climb, and to sit on a perch without head or tail touching the cage. Perches and swings may be chewed and will need periodic replacement. No monkey should be housed in a cage which has any dimension shorter than twice its crown/rump length. Cages should have adequate floor space for the more terrestrial species.

3.47. Most species are highly sociable and benefit from being housed with companions and should be so housed that they have opportunity for social interaction. This can be achieved by careful design of single housing, paired or gang-caging systems with access to exercise or play areas whenever possible.

3.48. Single housing should be avoided wherever possible but care should be taken to ensure that animals which are housed together are compatible. Harmonious social groups can often be established even with animals which have been single-housed for many years. In some cases, same-sex strangers or adult/infant pairs are compatible, while in others only opposite-sex strangers can be housed together although this may not be acceptable where breeding is not desired.

3.49. Wherever possible, caging systems should have the flexibility of removable walls to give access to adjacent units. If animals cannot be kept together, cages should be so placed that the animals can see each other for at least some of the time. Intermittent social contact is better than none at all.

3.50. The least distressing method of handling is to train the animal to co-operate in routine procedures. Advantage should be taken of the animal's ability to learn. Young captive-bred well-socialised animals which are familiar with their handlers are the most satisfactory.

3.51. The RS/UFAW guidelines (46) gave examples of cage sizes for the monkeys most commonly kept in laboratories and these are the basis for para 5.5. The dimensions specified may however need to be adapted to individual requirements. In addition, UFAW, with the support of the Association of British Pharmaceutical Industries, has published a study of the housing and welfare of cynomolgus macaques and baboons (30). Other considerations for the common types are set out below.

3.52. **Arboreal monogamous monkeys** (e.g. common marmoset). A breeding pair will produce twins or triplets every five months and the group should be permitted to increase to 6 to 8 in number. Eldest twins or triplets should be kept together to 15-18 months of age before being paired with unfamiliar partners. New pairs should not be housed in proximity to members of the same family group as this may inhibit breeding. Isolation of more than a few days should be avoided for non-breeding animals, preferably by keeping them in same-sex sibling groups.

3.53. Unfamiliar same-sex animals (even juveniles) should not be put in the same cage as they may fight.

3.54. Cages should include wooden perches, a swing, a wooden nest box, a shelf for feeding and sufficient wood shavings to allow foraging. The animals should have space to jump horizontally from one perch to another.

3.55. **Arboreal polygamous monkeys** (e.g. squirrel-monkeys). A breeding group may consist of two compatible males and 6-8 females. The cage should have two compartments so that the sexes can be kept apart and females giving birth should be able to withdraw from the rest of the group. Sub-adult young can be removed and kept in gang cages in same-sex groups.

3.56. Non-breeding animals can be kept in same-sex groups. Cage inclusions should be the same as for marmosets.

3.57. **Semi-terrestrial polygamous/promiscuous cercopithecoids** (e.g. macaque and baboon). A recommended breeding group is one male and 1-12 females. Females should have adequate space or means of escape should the male harass them. There should be several entrances to sleeping quarters. Groups should be monitored to check whether any individuals are being intimidated. Several food and water dispensers should be available.

3.58. Non-breeding females can be kept together. Males are highly aggressive and competitive and compatibility should be assured before housing them together.

3.59 Any animal housed individually should be assessed periodically to re-evaluate its social and environmental needs, including whether it has enough space for its size. Special arrangements should be agreed with the Inspector for animals over 9kg.

Rats and mice

3.60. Rats and mice should be group-housed (36) unless a particular experiment requires otherwise (69).

Hamsters and guinea-pigs

3.61. Guinea-pigs do well in floor pens provided care is taken to avoid draughts and plenty of bedding material is supplied. The climbing behaviour of hamsters should be taken into consideration when designing cages.

Rabbits

3.62. Where rabbits are to be held in floor pens, attention should be given to the avoidance of draughts. Floors should be so constructed as to minimise damage to feet and hocks. The entry in para 5.6 is based upon dwarf breeds (under 2kg), Dutch and New Zealand White (up to 6kg) and Flemish Giant (over 6kg). The area recommended is based on cages of up to 50cm deep to allow the animal to lie at full stretch crosswise. Wherever practicable rabbits should be group-housed.

Ferrets

3.63. Ferrets do well when group-housed in escape-proof floor pens provided care is taken to avoid draughts. A small inner compartment to provide animals with darkness and security may be appropriate.

Cats

3.64. Wherever practicable, cats should be housed in social groups. Where they must be housed singly, they should be let out for exercise at least once a day where this does not interfere with the procedure. Cat pens should be equipped with dirt trays, which should be changed at regular intervals. There should also be ample shelf room for resting as well as objects suitable for climbing and claw trimming.

Dogs

3.65. Dogs with permanent access to outside runs should have a sheltered place to find protection against unfavourable weather conditions. Grid floors should not be used unless a procedure requires it. Partitions between pens should be such as to minimise the risk of dogs injuring themselves or each other. All pens should have adequate drainage.

3.66. The minimum floor area for a dog pen should be 4.5 sq m. Two or more dogs may be housed in this area depending on weight. Where one dog is confined in part of this area, it should not be confined for longer than the normal overnight period.

3.67. Compatible dogs may be kept in pairs. Where they cannot be kept in pairs,

their pens should be placed so that they can see one another, but there may be a requirement to be able to prevent this for procedural reasons.

3.68. There is always the need for dogs to have regular human contact. Dogs should have access to adequate exercise areas and be able to exercise with other dogs. Staff time should be allocated to encouraging activity during such periods.

Farm animals and equidae

3.69. Where practicable, these animals should be housed within sight of each other. Where horned cattle are housed in groups, more space will be required. Horned and dehorned cattle should not be mixed in the same pen. Pens should be rectangular rather than square. The width of the pen should be not less than the length of the animal from nose to root of tail.

Birds

3.70. Mesh size in grid floors should not be greater than 10×10 mm for young chicks, and 25×25 mm for growers and adults. The wire thickness should be at least 2 mm. The sloping gradient should not exceed 14% (8°). Water troughs should be of the same length as the feed troughs. If nipples or cups are provided, each bird should have access to two. Cages should be fitted with perches and allow birds in single cages to see each other. Pigeons and finches should be housed in large aviaries wherever possible.

3.71. Special care should be taken when housing chickens and quail in groups to prevent feather pecking. Where large mature birds are housed, the cages should be high enough so that the birds do not touch the top of the cage with their heads.

ANIMAL HEALTH

3.72. Healthy animals are an essential prerequisite for good science. Intercurrent infection in the animal population may call in question the validity of information obtained from scientific procedures and make interpretation of results impossible.

3.73. It is essential that, in consultation with the named veterinary surgeon or other suitably qualified person, plans should be prepared to prevent or deal with possible disease outbreaks. An effective health and disease recording system should be maintained and available for inspection. It should include details of arrivals, departures, treatments and deaths.

3.74. Most laboratory species are purpose-bred and healthy animals of known microbiological status can be acquired for experimental procedures. Animals from less controlled sources, such as from the wild, may harbour pathogens transmissible to man and other species. Where there is a danger of spreading disease, separation by barrier or quarantine management procedures should be adopted to help reduce risks.

3.75. Animals that are deliberately infected with pathogens should be held at the appropriate containment level in accordance with the recommendations described by the Advisory Committee on Dangerous Pathogens (2). Further information may be obtained from the Health and Safety Executive in Bootle.

Conventional animals

3.76. The term 'conventional' is used to describe animals that are reared with a minimum barrier system and that may carry organisms pathogenic for their own or other species. Disease control in populations of such animals may be achieved by the use of appropriate vaccines or chemotherapy. Individual animals showing signs of disease should be isolated and treated or killed.

3.77. Animals that may harbour zoonotic agents should be caged, managed and handled in such a way as to minimise any risk of infection being transmitted.

Pathogen-free animals

3.78. Animals free from specified pathogenic organisms require to be maintained in buildings in which filtered air and treated food and water are supplied and where all caging and utensils, etc. are adequately disinfected. Personnel in such units are required to adopt standards of hygiene and wear clothing which prevent them carrying infection to the animals in their care. Access of personnel to such units should be restricted in order to minimise the possibility of introducing infection. Within such barrier-maintained units, physical isolation of separate experimental populations is recommended in order to reduce further the risk of introducing disease. Regular microbiological surveillance is necessary to ensure that the status is being maintained.

3.79. Gnotobiotic animals need complete physical separation from environmental contaminants and isolation techniques are essential (19).

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4 Humane Killing of Animals

4.1. Standard methods of killing laboratory animals humanely are listed in Schedule 1 to the Act. Killing a protected animal for scientific purposes at a designated establishment does not require a licence if a method listed in Schedule 1, appropriate to the animal, is used. However, if some other method is used, killing becomes a regulated procedure and requires the authority of personal and project licences.

4.2. Under section 15 of the Act, if the animal is no longer under experiment but is suffering or is likely to suffer adverse effects, the person who applied the regulated procedures to the animals, or the last of them, must cause the animal to be killed immediately by an appropriate method under Schedule 1 or as authorised by their personal licence.

4.3. Where an animal has not been, or is no longer, under experiment and is not suffering or likely to suffer adverse effects, but nonetheless it is desired to kill the animal, the method must be either one appropriate to the animal in Schedule 1 or a method that is otherwise approved by the Secretary of State under section 10(5) of the Act.

4.4. Wherever practicable, animals to be killed should be removed from the immediate presence of others and handled carefully to ensure that they are not frightened or antagonised. With methods that are not instantaneous, unconsciousness should be induced as quickly as possible with minimum stress and should be fully maintained until death. Death must be confirmed by physical checks or ensured by exsanguination, severance of the major blood vessels or ventricles of the heart, before disposal of the body. Personnel allowed to kill animals must be suitably trained. The American Veterinary Medical Association has prepared general information on euthanasia (6).

4.5. Schedule 1 to the Act must be consulted to check whether the methods given below can be performed without specific authority.

Inhalation of carbon dioxide

4.6. This is suitable for small rodents and birds. Animals should be exposed to an atmosphere of 30% CO₂ to ensure loss of consciousness. The concentration is then increased to 70% to kill the animals. This may be achieved by placing the animal in an air-filled container and then allowing the gas to flow into it so that the concentration rises to at least 70% and is maintained there for at least three minutes. Animals may be left in the container until *rigor mortis* is observed, or they may be removed and death ensured by exsanguination or dislocation of the neck. Death must be confirmed. Young animals require longer exposure to CO₂ than adult animals. Rodents under 10 days and birds under one week should not be killed by this method.

Inhalation of volatile anaesthetic

4.7. Prolonged exposure to an anaesthetic overdose is suitable for small rodents. However, there should be no contact between the animal and the anaesthetic

agent in its liquid form. The procedure should always be carried out in a fume cupboard or a well ventilated area so that the operator is not subjected to prolonged exposure to the vapour.

Injection of anaesthetic agents

4.8. This is suitable for all species and is often the method of choice for larger animals. The dose should be administered intravenously or intraperitoneally and be sufficient to ensure rapid unconsciousness and a certain death.

Exsanguination and perfusion-fixation

4.9. Exsanguination or perfusion with tissue fixatives under deep anaesthesia may be allowed but it is not a Schedule 1 method and will, therefore, require authority to be included in project and personal licences.

Dislocation of the neck

4.10. This is suitable for small rodents, small rabbits and large birds (66). Schedule 1 to the Act gives maximum permitted weights.

Concussion by striking the back of the animal's head

4.11. This method is restricted to animals which are handled easily and which have relatively thin skulls i.e. small rodents, small birds and fish.

Decapitation

4.12. This may be used for rodents where other methods would be unsuitable e.g. where enzyme levels are to be determined. This method must always be carried out using a specially designed and properly maintained guillotine. Amphibians, new-born mice, rats, hamsters and gerbils (up to 4 days old) may be decapitated with large sharp scissors. This not a Schedule 1 method, except when used for cold-blooded vertebrates.

SPECIAL CONSIDERATIONS FOR PARTICULAR SPECIES

Farm animals and equidae

4.13. When appropriate, and with the prior permission of the Inspector, arrangements may be made to send farm animals to a licensed slaughterhouse, provided that they are fit to travel. If animals are to be killed on site the following methods may be used as an alternative to injection of an anaesthetic agent. They are not Schedule 1 methods and therefore require authorisation on a licence or certificate. Those who carry out the following methods must be fully trained.

- (i) **Pigs**—up to 70kg liveweight, they should be stunned electrically or by captive bolt followed by either destruction of the brain and spinal cord or exsanguination. For heavier pigs, captive bolt and low voltage electrical stunning are not suitable.

- (ii) **Sheep and goats**—exsanguination after captive bolt or electrical stunning.
- (iii) **Cattle**—captive bolt stunning followed by exsanguination or destruction of the brain and spinal cord.
- (iv) **Horses**—humane killer using a free bullet. If used correctly, the horse drops dead immediately and no further action is required. If breathing persists, a second shot may be necessary.

Fish

4.14. Under Schedule 1 to the Act, fish may be killed by a sharp blow to the head followed by destruction of the brain. Separate destruction of the brain may not be necessary provided the initial blow is of sufficient force to achieve this. Although not a requirement under Schedule 1, electronarcosis or galvanonarcosis may be used to immobilise the fish which can then be killed.

4.15. Alternatively, an overdose of anaesthetic may be added to the water, followed by destruction of the brain (64).

Amphibians and reptiles

4.16. Where possible, an overdose of an anaesthetic agent should be used. When cold-blooded vertebrates are killed by decapitation the brain must be destroyed immediately.

DISPOSAL OF DEAD ANIMALS

Laboratory animals

4.17. It is essential to ensure that animals are dead before disposal. Animals must be kept and observed for sufficient time to be certain that all signs of life have ceased. Alternatively, the animal's neck should be dislocated or the animal may be exsanguinated. Animals should be disposed of on site by incineration. If this is not possible, care should be taken to prevent exposure of the carcasses to the general public. Infected, toxic or radioactive carcasses must not be disposed of in such a manner as to present a hazard.

Farm animals

4.18. Carcasses may be disposed of, whenever practicable, to a licensed animal by-products processor. However, infected, toxic or radioactive carcasses must be disposed of so as not to present a hazard.

Part 2

5 Tables Based upon the RS/UFAW Guidelines

5.1. Room Temperature

Adults	Optimal range in °C
Non-human New World primates	20-28
Non-human Old World primates	15-24
Mouse	19-23
Rat	19-23
Hamster	19-23
Gerbil	19-23
Guinea-pig	16-23
Rabbit	16-20
Small birds	19-23
Quail	16-23
Pigeon	15-24
Domestic fowl and duck	12-24
Cat	15-24
Dog	15-24
Ferret	15-24
Pig	15-24
Goat	10-24
Sheep	10-24*
Cattle	10-24
Horse	10-24

* depending on fleece length

CAGE AND PEN DIMENSIONS FOR THE HOUSING OF ANIMALS

5.2. Cage areas and heights are the internal cage dimensions and not the overall size of the cages. They include all floor area available for use by the animal(s). "Area" means the product of cage length and cage width measured internally and horizontally, *not* the product of the floor length and floor width which may be sloping.

5.3. The cage floor area for animals housed in groups must be not less than that specified for an animal housed singly. Where large, mature animals are to be housed, the minimum cage floor area required may be larger than those specified.

5.4. For the purpose of calculating the minimum floor area, the shelf area may be included, where there is adequate height for the animal above the shelf.

5.5 Non-human Primates

Weight of animal	Minimum floor area sq cm per animal		Minimum height cm
	When housed in groups	When housed singly	
up to 700g	1350	2500	80
700 to 1400g	2500	5000	100
1400 to 4000g	2000*	—	150
4000 to 6000g	6000	6000	100
6000 to 9000g	8000	8000	110
	14000	14000	150

* for arboreal monkeys in groups when they are held in taller cages.

5.6. Small mammals

Weight of animal	Minimum floor area sq cm per animal		Minimum height cm
	When housed in groups	When housed singly	
Mice			
up to 30g	60	200	12
over 30g	100	200	12
Rats and gerbils			
up to 50g	100	500	18
50 to 150g	150	500	18
150 to 250g	200	500	18
250 to 350g	250	700	20
350 to 450g	300	700	20
450 to 550g	350	700	20
over 550g	400	800	20
Hamsters			
up to 60g	80	300	15
60 to 90g	100	300	15
90 to 120g	120	300	15
over 120g	165	300	15
Guinea-pigs			
up to 150g	200	700	20
150 to 250g	300	700	20
250 to 350g	400	900	20
350 to 450g	500	900	23
450 to 550g	600	900	23
550 to 650g	700	1000	23
over 650g	750	1250	23
Rabbits			
up to 2000g	1300	2000	40
2000 to 4000g	2600	4000	45
4000 to 6000g	3300	5400	45
over 6000g	4000	6000	45
Ferrets and mink			
up to 800g	1500	2250	50
over 800g	3000	4500	50
Cats			
up to 3kg	3300	5000	50
over 3kg	5000	7500	80
Dogs			
up to 5kg	10000	45000	150
5 to 10kg	19000	45000	150
10 to 25kg	22500	45000	200
25 to 35kg	32500	65000	200
over 35kg	40000	80000	200

5.7. Farm animals and equidae

Species and weights	Minimum floor area sq m per animal		Minimum length of feed rack or trough per head m
	When housed in groups	When housed singly	
Pigs			
up to 30kg	1.0	2.0	0.20
30 to 50kg	1.3	2.0	0.25
50 to 100kg	2.0	3.0	0.30
100 to 150kg	2.7	4.0	0.35
over 150kg	3.75	5.0	0.40
Adult boar	—	7.5	0.50
Sheep and goats			
up to 35kg	1.3	2.0	0.35
over 35kg	1.9	2.8	0.35
Cattle			
up to 60kg	1.5	2.2	0.30
60 to 100kg	1.6	2.4	0.30
100 to 150kg	1.9	2.8	0.35
150 to 200kg	2.4	3.6	0.40
200 to 400kg	3.8	5.7	0.55
over 400kg	5.3	8.0	0.65
Adult bull	—	16.0	0.65
Horses, donkeys and crossbreds			
Height at withers			
up to 147cm	—	12	—
148 to 160cm	—	17	—
Over 160cm	—	20	—

5.8. Birds

Species and weights	Minimum floor area sq cm per bird		Minimum height cm	Minimum length of feed trough per bird cm
	When housed in groups	When housed singly		
Chickens and ducks				
up to 300g	250	350	30	3
300 to 600g	470	700	40	7
600 to 1200g	830	1250	50	10
1200 to 1800g	950	1450	50	12
1800 to 2400g	1200	1700	55	12
over 2400g	1900	2800	75	15
Quail				
up to 150g	250	350	20	4
150 to 250g	250	400	25	4
Pigeons				
	800	1225	35	5

6 References

1. Adema, D M M (1980) The Determination of the Possible Effects of Chemicals and Wastes on the Aquatic Environment. Degradability, Ecotoxicity and Bioaccumulation: (Chapter 5). The Hague: Government Publishing Office.
2. Advisory Committee on Dangerous Pathogens (1984) Categorisation of Pathogens according to Hazard and Categories of Containment. London: HMSO.
3. APHA-AWWA-WPCF (1975) Standard Methods for the Examination of Water and Waste-water. 14th ed. New York: American Public Health Association. American Water Works Association, Water Pollution Control Federation.
4. Association of the British Pharmaceutical Industry (1987) Advisory note on Laboratory Animal Allergy. London: Association of the British Pharmaceutical Industry.
5. Avery, R A (1979) Lizards — A Study in Thermoregulation. Institute of Biology's Studies in Biology: No. 109. London: Edward Arnold.
6. AVMA Panel (1986) The 1986 Report of AVMA Panel on Euthanasia. J. Am. Vet. Assoc. 188: 252-268.
7. Bellhorn, R W (1980) Lighting in the Animal Environment. Lab. Anim. Sci. 30: 440-450.
8. British Veterinary Association (1984) Farm Animal Housing: A Compilation of Articles from the Veterinary Record. London: British Veterinary Association.
9. Canadian Council on Animal Care (1984) Guide to the Care and Use of Experimental Animals: 2. Ottawa: Canadian Council on Animal Care.
10. Carpenter, G A (1972) The Design of Permeable Ducts and their Application to the Ventilation of Livestock Buildings. J. Agric. Engng Res. 17: 219-230.
11. Chartered Institution of Building Services Engineers (CIBSE) (1986-87) Guide (3 vols.) London: Chartered Institution of Building Services Engineers.
12. Clarke, H E, Coates, M E, Eva, J K, Ford, D J, Milner, C K, O'Donogue, P N, Scott, P P and Ward, R J (1977) Dietary Standards for Laboratory Animals: Report of the LAC Diets Advisory Committee. Lab. Anim. 11: 1-28.
13. Clough, G (1982) Environmental Effects on Animals used in Biomedical Research. Biol. Rev. 57: 487-523.
14. Clough, G (1984) Environmental factors in relation to the Comfort and Well-being of Laboratory Rats and Mice. In Standards in Laboratory Animal Management. pp 7-24 Proceedings of a LASA/UFAW Symposium. Potters Bar: UFAW.
15. Clough, G (1987) The Animal House; Design, Equipment and Environment Control. In the UFAW Handbook on the Care and Management of Laboratory Animals: 6th ed, Ch. 8. pp 108-143, Harlow: Longman Group UK Ltd.

16. Clough, G and Fasham, J A L (1975) A "silent" Fire Alarm. *Lab. Anim.* 9: 193-196.
17. Clough, G and Townsend, G H (1987) Transport. In the UFAW Handbook on the Care and Management of Laboratory Animals: 6th ed. Ch. 10. pp 159-169. Harlow: Longman Group UK Ltd.
18. Coates, M E (1984) Sterilization of Diet. *The Germfree Animal in Biomedical Research* (eds: M E Coates and B E Gustafsson). London: Laboratory Animals Ltd.
19. Coates M E and Gustafsson, B E (eds.) (1984) *The Germfree Animal in Biomedical Research*. London: Laboratory Animals Ltd.
20. Council of Europe (1986) *European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes*. Strasbourg: Council of Europe. (Obtainable London: HMSO).
21. Davies, P M C (1981) *Anatomy and Physiology. Diseases of the Reptilia* (eds: J E Cooper and O J Jackson). London and New York: Academic Press.
22. Ellis, D H and Follett, B K (1983) Gonadotrophin Secretion and Testicular Function in Golden Hamsters exposed to Skeleton Photoperiods with Ultrashort Light Pulses. *Biol. Reprod.* 29: 805-818.
23. Eva, J (1984) Problems in Maintenance Nutrition of Rabbits. *Standards in Laboratory Animal Management. Proceedings of a LASA/UFAW Symposium.* pp 168-179. Potters Bar: UFAW.
24. Fletcher, J L (1976) Influence of Noise on Animals. *Control of the Animal House Environment*, (ed. T McSheehy). *Laboratory Animal Handbooks No. 7.* pp 51-62. London: Laboratory Animals Ltd.
25. Gamble, M R (1982) Sound and its Significance for Laboratory Animals. *Biol. Rev.* 57: 395-421.
26. Grant, L, Hopkinson, P, Jennings, G and Jenner, F A (1971) Period of Adjustment of Rats used for Experimental Studies. *Nature* 232: 135.
27. Greenman, D L, Bryant, P, Kodell, R L and Sheldon, W (1982) Influence of Cage Shelf Level on Retinal Atrophy in Mice. *Lab. Anim. Sci.* 32: 440-450.
28. Halver, J E (ed.) (1972) *Fish Nutrition*. New York: Academic Press.
29. Hansard 16 November 1987. Written Answer to Mr Greg Knight MP. Reproduced as Appendix VI to the Report of the Animal Procedures Committee for 1987: HC36. London: HMSO.
30. Harris, D H R (1988) *Welfare and Housing of Laboratory Primates*. UFAW Animal Welfare Research Report No 1. Potters Bar: UFAW.
31. Hawkins, A D (ed.) (1981) *Aquarium Systems*. London: Academic Press.
32. Home Office (1979) *The Use and Safekeeping of Tranquillising Weapons*. London: Home Office.
33. Industrial Injuries Advisory Council (1986) *Occupational Asthma*. Cmnd 9717. London: HMSO.
34. Institute of Biology (1985) *Safety in Biological Laboratories* (ed. C H Collins) Chichester: John Wiley and Sons Ltd.

35. Landi, M S, Kreider, J W, Lang, M and Bullock, L P (1982) Effects of Shipping on the Immune Function of Mice. *Am. J. Vet. Res.* 43: 1654-1657.
36. Lawlor, M (1984) Behavioural Approaches to Rodent Management. In *Standards in Laboratory Animal Management. Proceedings of a LASA/UFAW Symposium.* pp 40-49. Potters Bar: UFAW.
37. McSheehy, T (ed.) (1976) *Control of the Animal House Environment.* London: Laboratory Animals Ltd.
38. MAFF Codes of Recommendations for the Welfare of Livestock: Cattle (1983), Pigs (1983), Domestic Fowls (1971), Sheep (1977). Ministry of Agriculture, Fisheries and Food; Department of Agriculture and Fisheries for Scotland; Welsh Office Agriculture Department.
39. Peters, A G and Bywater, P M (1985) Observations on a Method of Providing Moisture for Rats. *Anim. Technol.* 36(1): 69-75.
40. Pfaff, J (1974) Noise as an Environmental Problem in the Animal House. *Lab. Anim.* 8: 347-354.
41. Pfaff, J and Stecker, M (1976) Loudness Levels and Frequency Content of Noise in the Animal House. *Lab. Anim.* 10: 111-117.
42. Porter, G, Lane-Petter, W and Horne, M (1969) Effects of Strong Light on Breeding Mice. *J. Anim. Tech. Ass.* 14: 117-119.
43. Porter, A R W (1982) Drugs for Use in Dart Guns. Publication of the Veterinary Deer Society, 1(2) 2-4. Also in RCVS 1984, *Guide to Professional Conduct*, pp 49-51.
44. Prince, R P, Whitaker, J H, Matterson, L D and Luginbuhl, R E (1965) Responses of Chickens to Temperature and Relative Humidity Environments. *Poultry Sci.* 44: 73-77.
45. Rentokil. *Keeping Pests out of Business Premises.* East Grinstead: Rentokil.
46. Royal Society/UFAW Guidelines on the Care of Laboratory Animals and their Use for Scientific Purposes: I—Housing and Care (1987) London: The Royal Society and the Universities Federation for Animal Welfare.
47. Sales, G and Pye, J D (1974) *Ultrasonic Communication by Animals.* London: Chapman & Hall.
48. Salterelli, C G and Coppola, R P (1979) Influence of Visible Light on Organ Weights of Mice. *Lab. Anim. Sci.* 29: 319-322.
49. Schemnitz, S D (ed.) (1980) *Wildlife Management Techniques Manual.* 4th ed. Washington DC: The Wildlife Society.
50. Seamer, J H and Wood, M (eds) (1981) *Safety in the Animal House.* 2nd ed. Laboratory Animal Handbooks No. 5. London: Laboratory Animal Ltd.
51. Smith, M W (ed.) (1984) Report of the Working Party on Courses for Animals Licensees. *Lab. Anim.* 18: 209-220.
52. Smith, M W (1987) Safety. In *The UFAW Handbook on the Care and Management of Laboratory Animals.* 6th ed. ch. 11. pp 170-186. Harlow Longman Group UK Ltd.

53. Spalding, J F, Archuleta, R F and Holland, L M (1969) Influence of the Visible Colour Spectrum on Activity in Mice. *Laboratory Animal Care* 19: 50-54.
54. Spalding, J F, Holland, L M and Tietjen, G L (1969) Influence of the Visible Colour Spectrum on Activity in Mice II. Influence of Sex, Colour and Age on Activity. *Laboratory Animal Care* 19: 209-213.
55. Spellerberg, I F (1982) *Biology of the Reptiles*. Glasgow and London: Blackie.
56. Steinberg, H and Watson, R H J (1960) Failure of Growth in Disturbed Laboratory Rats. *Nature* 185: 615-616.
57. Stephan, C E (ed.) (1975) In *Methods for Acute Toxicity Tests with Fish, Macroinvertebrates and Amphibians*. Environmental Protection Agency 660/3-75-009. Oregon: Natural Environmental Research Centre.
58. Steyn, D G (1975) The Effects of Captivity Stress on the Blood Chemical Values of the Chacma Baboon (*Papio ursinus*). *Lab. Anim.* 9: 111-120.
59. Stille, G, Brenzowsky, H and Weihe, W H (1968) The Influence of the Weather on the Locomotor Activity of Mice. *Arzneimittel-Forschung* 18: 892-893.
60. Stoskopf, M A (1983) The Physiological Effects of Psychological Stress. *Zoo Biol.* 2: 179-190.
61. Stotzer, H, Weisse, I, Knappen, F and Seitz, R (1970) Die Retina-Degeneration der Ratte. *Arzneimittel-Forschung* 20: 811-817.
62. Tucker, M (1984) Nutrition—an Important Factor. In *Standards in Laboratory Animal Management. Proceedings of a LASA/UFAW Symposium*. Potters Bar: UFAW.
63. Twigg, G I (1975) Catching Mammals. *Mammal Review* 5: 83-100.
64. Tytler, P and Hawkins, A D (1981) In *Aquarium Systems* (ed. A D Hawkins) London: Academic Press.
65. UFAW (1987) *The UFAW Handbook on the Care and Management of Laboratory Animals*. (ed. T B Poole) 6th ed. Harlow: Longman Group UK Ltd.
66. UFAW (1989) *Humane Killing of Animals*. 4th ed. Potters Bar: UFAW.
67. Wallace, M E (1984) The Mouse in Residence and in Transit. In *Standards in Laboratory Animal Management. Proceedings of a LASA/UFAW Symposium*, pp 25-39. Potters Bar: UFAW.
68. Weihe, W H (1976) The Effect of Light on Animals. In *Control of the Animal House Environment*. (ed. T McSheehy) *Laboratory Animal Handbooks*; No. 7, ch. 5. pp 63-76. London: Laboratory Animals Ltd.
69. Weiss, J and Taylor, G T (1984) A New Cage Type for Individually Housed Laboratory Rats. In *Standards in Laboratory Animal Management. Proceedings of a LASA/UFAW Symposium*. pp 85-89. Potters Bar: UFAW.
70. Weisse, I, Stotzer, H and Seitz, R (1974) Age and Light — dependent Changes in the Rat Eye. *Virchows Archiv. fur Pathologische Anatomie und Physiologie und fur Klinische Medizin* 362: 811-817.

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