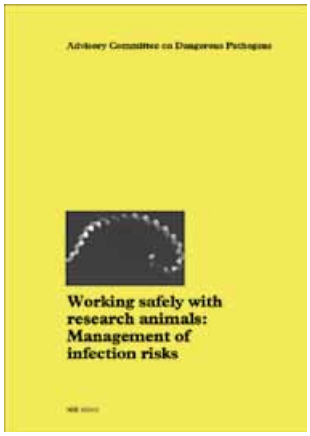
Working safely with research animals: Management of infection risks



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The main focus of this guidance is working safely with experimentally infected animals in the laboratory setting. Although the guidance is aimed primarily at protecting human health, full account is taken of animal welfare issues.

Since the ACDP first published guidance on animal containment, COSHH regulations have been amended. This has resulted in many of the basic containment measures for animal rooms being translated from guidance into law. This new guidance amplifies the principles expressed in COSHH and enlarges on the recommendations.

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This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

Photograph on cover shows a scanning electron micrograph of *Leptospira interrogans*. Bar = 0.5 μm.

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Preface

Since the Advisory Committee on Dangerous Pathogens (ACDP) first published guidance on animal containment in the Categorisation of pathogens according to hazard and categories of containment in 1984,[1] the Control of Substances Hazardous to Health Regulations (COSHH) have been amended. As a result, many of the basic containment measures for animal rooms have been translated from guidance into law.

This new guidance amplifies the principles in COSHH and also expands on the recommendations in the new edition of categorisation of biological agents. The main focus of the guidance is work with experimentally infected animals in the laboratory setting. However, it contains useful information for those working with animals in other situations, for example, where there is contact with wild animals during fieldwork.

While the recommendations in this guidance are aimed primarily at protecting human health and safety, full account is taken of animal welfare issues.

Also included in this guidance is a brief section on the management of simians based on guidance published by the Medical Research Council (MRC). A new separate publication on infection hazards from working with simians is being prepared.

Background

Introduction

1 The study of disease processes and the testing of drugs and vaccines may require the use of experimental animals. Animals may also be required for other experimental purposes, for example, in teaching laboratories at universities, or in ecological field work.

2 The protection of animals used in experimental work is the subject of specific legislation, the Animals (Scientific Procedures) Act 1986, under which Home Office Inspectors visit designated establishments to monitor compliance. The recommendations in this guidance are aimed primarily at human health and safety and take full account of the need to observe the requirements and welfare of animals.

3 Guidance on animal containment was first published by the Advisory Committee on Dangerous Pathogens (ACDP) in the *Categorisation of pathogens according to hazard and categories of containment* in 1984 and revised in 1990.[1] More recently, a European Directive on the control of biological agents at work has been implemented in the new Control of Substances Hazardous to Health Regulations (COSHH)[2] and, as a consequence, many of the basic containment measures for both laboratories and animal rooms have been translated from guidance into law.

4 This new guidance amplifies the principles expressed in COSHH and also enlarges on the recommendations in the new edition of the categorisation of pathogens (now a categorisation of biological agents).[3] The principal control measures for managing infection risks are set out in Part II of Schedule 9 of COSHH. These are statutory requirements and are indicated in this guidance by the use of the word 'must'. Additional control measures which are not statutory requirements are indicated by the word 'should' or similar. The guidance focuses primarily on work with experimentally infected animals in the laboratory setting and it is also applicable, to some extent, to any situation where animals are being used for other experimental procedures or for example, where there is contact with wild animals in the course of fieldwork.

5 An important inclusion in this publication is a brief section on the management of simians based on guidance first published by the Medical Research Council (MRC) in 1985 and later revised in 1990. Following outbreaks of Ebola virus infection in monkey colonies in the USA and Italy, this guidance has been revised again in collaboration with the MRC Simian Virus Committee and with their agreement, will in future be issued under the auspices of the ACDP. A new separate publication on infection hazards from working with simians is in preparation.[4]

6 This guidance is divided into three parts:

- the first part contains background information about the hazards and risks of working with animals;
- the second part sets out appropriate measures to be taken when working at different containment levels and provides guidance on certain operating procedures;
- the third part provides guidance on the decontamination and disposal of waste associated with animals.

Hazards and risks

7 The first question to be answered is whether it is essential to use animals for the procedure. You should only use animals if there is no appropriate alternative. This section explains the nature of potential infection hazards, both deliberately introduced and pre-existing, and examines factors that should be considered when selecting animals for a procedure. It is advisable to consult the named veterinary surgeon (see Appendix 1) and the person named as responsible for day-to-day care of the animals at the earliest possible stage of planning a procedure. They will be able to give more specific advice.

8 Identification of all the hazards, including physical and chemical,[5] and identification of the route of exposure, together with an evaluation of the likelihood of exposure occurring, will form part of the overall assessment. The assessment will assist selection of the appropriate containment, and experimental procedures necessary for work with infected animals.

9 The type of animals involved and the nature of the procedure will affect the risk of exposure to infectious hazards. For example, an experiment with *Salmonella* will generate much larger quantities of infectious bedding using a calf compared with using a rat. The nature of each procedure will also present different risks. Animal husbandry, bleeding procedures and post mortem examinations all present opportunities for exposure but in different ways and so may require different methods of control. It is impossible to generalise, and an appropriate risk assessment should be made for each procedure.

10 Work with animals can present unique infection hazards. These may result from:

(a) direct physical contact - where a sudden movement by the animal causes an accident, for example, a scratch or a bite;
(b) behaviour - newly acquired animals may not be used to being handled and so the likelihood of being bitten or scratched may increase.

11 On other occasions the hazards may be more complex, for example, animals used for studies on an organism of a low hazard grouping may be naturally infected with a more hazardous organism.

Selection of animals

12 Most laboratory species are purpose bred and healthy animals of known microbiological status are supplied for experimental procedures. Home Office guidance[6] states that unless authorised in a project licence, none of the following animals shall be used in procedures unless they have been bred and obtained from a designated establishment: mouse, rat, hamster, guinea pig, rabbit, primate and the common quail (*Coturnix coturnix*). Furthermore, unless otherwise authorised in a project licence, no cat or dog shall be used unless it has been bred at and obtained from a designated establishment.

13 Cats, dogs, primates or equidae should be used only if no other species is suitable for the purposes of the programme of work or if it is not practicable to obtain animals of any other species that are suitable for the experimental work.

14 The following issues should be addressed when selecting animals.

Characteristics of animals

15 The species, strain, age or sex of an animal may affect the level of risk presented during the procedure. For example, a pregnant or nursing animal may be more aggressive towards handlers than one without young. Alternatively, a

different species or strain of animal may be more likely to injure the handler, for example dairy bulls such as Holstein Friesians are generally more unpredictable than beef breeds such as Herefords.

Persistent or latent zoonotic infection

16 Two factors should be considered:

(a) could the species be a vector for zoonotic organisms? Some animals selected for procedures may have pre-existing infection with zoonotic micro-organisms which could potentially be transmitted to workers or other stock. The risk of such infections is likely to be greater in animals obtained from the wild than in specially bred laboratory animals. If this is the case then;
(b) what is known about the health status of the individual animals to be used?

Zoonoses

17 Table 1 is a summary of some infections that may be present in those animals most commonly used in research. As stated previously, the majority of laboratory animal species are of known microbiological status. However, the table might help decide whether or not the species to be selected for a procedure could pose a hazard of a zoonotic infection if the **microbiological status is not known**, for example on the rare occasions when wild caught animals are used or when ecological studies require the handling of wild animals. Permission to use wild caught animals in regulated procedures must be sought from the Home Office.

Table 1: Zoonoses in natural populations of animal species most commonly used for experimental procedures. (The table is not all-inclusive and consideration should always be given to any special factors which may affect assessment of risk.)

Host species	*Zoonosis*	*Prevalence in host*	*Hazard Group of caustive agent*
Mice/rats	Salmonellosis	Low-moderate	2*
	Leptospirosis	Low	2
	Lymphocytic choriomeningitis (LCM)	Low	3
	Campylobacteriosis	Moderate	2
	Hantavirus disease (pulmonary and renal syndrome)	Moderate	2/3
	Rat bite fever (*Streptobacillus moniliformis and Spirillum minus*)	Moderate	2
Voles/shrews	Leptospirosis	Low-moderate	2
Hamsters	Hantavirus disease	Low	2/3
	Campylobacteriosis	Moderate	2
	Salmonellosis	Moderate	2*
	Lymphocytic choriomeningitis (LCM)	Low	3
Rabbits	Salmonellosis	Moderate	2*
	Pasteurellosis	Moderate	2
Guinea pigs	Salmonellosis	Moderate	2*
Ferrets	Salmonellosis	Low-moderate	2*
	Tuberculosis	Low	2/3
Cats	Salmonellosis	Moderate	2*
	Toxoplasmosis	Moderate-high	2
	Cat scratch fever (*Bartonella henselae*)	Low	2
	Cowpox infection	Low	2
	Tuberculosis	Low	3
	Chlamydiosis	Low	2

Host species	*Zoonosis*	*Prevalence in host*	*Hazard Group of caustive agent*
Dogs	Campylobacteriosis	Moderate-high	2
	Leptospirosis	Low	2
	Salmonellosis	Low	2*
	Toxocariasis	Moderate	2
	Pasteurellosis	Moderate	2
Sheep/goats	Cryptosporidiosis	Moderate	2
	Q fever	Moderate	3
	Orf virus infection	Moderate	2
	Salmonellosis	Low-moderate	2*
	Louping ill	Low	3
	Toxoplasmosis	Moderate	2
	Ovine chlamydiosis (*enzootic abortion*)	Moderate	2
	Erysipelas	Low	
	E. coli O157 infection	Low-moderate	2
Pigs	*Streptococcus suis* infection	Moderate	2
	Salmonellosis	Moderate	2*
	Campylobacteriosis	Moderate	2
	Erysipelas	Moderate	2
Host species	Zoonosis	Prevalence in host	Hazard Group
Cattle	Cryptosporidiosis	Moderate	2
	Leptospirosis	Moderate-high	2
	Q fever	Moderate	3
	Ringworm (*eg Trichophyton* spp)	Moderate	2
	Salmonellosis	Moderate	2*
	Tuberculosis	Low	3
	E. coli O157 infection	Moderate	2
Birds	Campylobacteriosis	Moderate-high	2
	Chlamydiosis	Moderate	3
	Salmonellosis	Low	2*
	Newcastle disease	Low	2
	Mycobacterium avium infection	Moderate	3
Non-human primates	Marburg	Rare	4
	Ebola	Rare	4
	Herpesvirus simiae (Simian herpes B virus)	Moderate-high	3
	Tuberculosis	Low	3
	Salmonellosis	Moderate	2*
	Shigellosis	Moderate	2/3
	Campylobacteriosis	Moderate	2
	Helminth infection	Low	2
	Other herpes viral infections	Moderate	2
Reptiles (eg lizards)	Salmonellosis	Moderate-high	2*
Aquatic vertebrates (eg terrapins)	Salmonellosis	Moderate-high	2*
	Mycobacterial infection	Low	2/3

Host species	*Zoonosis*	*Prevalence in host*	*Hazard Group of caustive agent*
Invertebrates	Ehrlichiosis	Low	3
(eg ticks)	Lyme disease		
	Louping ill	Moderate	3
Aquatic invertebrates (eg shellfish)	Various viral gastrointestinal diseases - organisms which filter feed concentrate viruses, eg Norwalk, hepatitis A	Moderate	2

* *Salmonella typhi and S. paratyphi* are in Hazard Group 3

18 Having established whether or not the species in question could pose an infection risk, an assessment of the risk of transmission of infection should be made. In the case of commonly carried micro-organisms like hantavirus, it might be presumed that all wild caught animals are infected unless proved otherwise. In other cases, the assessment might be based on tests which establish health status, or on guarantees from the suppliers of the animals.

19 Animals that fall within the scope of the 1986 Act must be obtained from Home Office designated suppliers and so will have their own screening procedures. The Act does not extend to farm animals and poultry and it is recommended that such animals should be obtained from competent animal suppliers who have suitable screening procedures in place. In circumstances, for example where farm animals are obtained directly from farms, the onus will be on the recipient to screen animals accordingly. It is not possible, however, to screen all animals for all infections because in some cases diagnostic tests are not readily available and there remains the potential for new diseases to emerge, for example hantavirus pulmonary syndrome.

20 It is therefore recommended that certain minimum precautions are taken, including:

(a) wearing appropriate protective clothing at all times;
(b) reducing aerosol and dust generation;
(c) minimising the use of sharp instruments and ensuring their correct use and disposal;
(d) being aware of likely hazards and the early symptoms of the more common persistent infections.

Acceptance of animals

21 A decision should be made whether or not to accept the animals or to seek further guarantees of health status. There may be instances where it is feasible to accept animals which carry a zoonotic organism in circumstances where appropriate containment can be instituted. For example, calves from a farm environment may carry Salmonella spp but this need not automatically exclude them from a procedure provided that appropriate control measures can be put in place and providing that the presence of the micro-organism does not adversely affect the outcome of the experiment.

Infection hazards during the procedure

Behaviour of the micro-organism in the animal

22 The behaviour of a micro-organism in an animal, in particular the extent to which it replicates, may affect the overall risk. For example, a micro-organism may mutate and the risk from such an agent would then be unpredictable, although it would have to be assumed to be high.

Potential routes for transmission of infection.
Table 2 sets out potential sources of infection and potential routes of transmission. In some cases, where the animal is an end-stage host or not the natural host for an infection, the live animal may not pose an infection hazard during the experiment, other than when it undergoes certain procedures, for example blood sampling.

Table 2: Sources of infection. (The table is not all-inclusive and consideration should always be given to any special factors which may arise.)

Source of infection	*Examples of organisms involved*	Routes of transmission
Oral discharges	Rabies virus, Actinobacilli, some spirochaetes, B virus	Bites from infected animals, salivary contamination of eyes or broken skin
Blood	Simian immunodefiency virus, Simian T-cell lymphotropic virus, Ebola, Marburg	Direct contact with mucous membranes or eyes via splashing. Needlestick or other sharps injuries, bites
Faeces	*Salmonella* spp and other enterobacteria, some protozoa, *Echinococcus* spp	Poor hygiene following contact with faeces or bedding, especially where the animal may be suffering from diarrhoea or when faeces has dried and become dusty
Urine	*Leptospira* spp	Poor hygiene following contact with urine or bedding, especially where the handler has broken skin, exposure to aerosols of urine
Reproductive tract discharges or contents	Q fever, *Chlamydia, Salmonella*, B virus	Contact with reproductive tract discharges or contents, obstetric manipulations
Milk	*Brucella* spp, *Mycobacterium*, *Tuberculosis*, *Leptospira* spp	Milking procedures (in case of Leptospira, exposure to aerosols of urine during milking) and consumption of unpasteurised milk
Skin/ hair	Mycoses, parasite infections (eg sarcoptic mange), pox virus infections	Direct handling of infected animals, scratches from animals
Respiratory tract	*Chlamydia* spp, mycobacteria	Inhalation of infected aerosols/droplets discharges/aerosols
Vectors	*Borrelia* spp, louping ill, some parasitic infections	Ectoparasites, or other insects and arthropods may be vectors for some diseases from infected animals by bite

24 Specimens of any of the material in the table above should be handled at the level of containment corresponding to the hazard group of the biological agent concerned.

Allergy to animals

25 This guidance focuses on assessing the infection hazards posed by laboratory animals, however, allergy to animals is a well known hazard which should be taken into account when conducting the risk assessment. Guidance on prevention and control of exposure to animal allergens has been published elsewhere.[6,7] Most of the measures advocated in this guidance for the control of infection should also serve to control exposure to allergens.

26 In animal units, the most common allergens are proteins from body tissue, excretions and secretions. The most common symptoms in individuals that are allergic include rhinitis, conjunctivitis, urticaria and asthma.

Field work

27 Although this guidance is aimed primarily at those working in laboratories with animals that are deliberately infected, some of the information and basic precautions will also be of use to those who work with animals in the field, for example, for those involved with ecological or behavioural studies. Of particular interest will be the information in Tables 1 and 2 and also paragraph 20 which sets out certain basic precautions. In addition, paragraph 6 of Schedule 9 of COSHH contains measures for the control of exposure to biological agents, some of which may be appropriate for use in the field.

Working with simians

28 This section provides a brief summary of the essential points to be considered in avoiding infection when working with simians. More detailed information is to be found in a new publication entitled *The management of simians in relation to infection hazards to staff* which is a revision of earlier guidance issued by the MRC.[8]

29 Some naturally occurring virus infections of simians are known to be especially pathogenic to man. B virus (*Herpesvirus simiae*), for example, has been responsible for a number of deaths in laboratory and animal workers. Other viruses of concern are rabies and the filoviruses which cause viral haemorrhagic fevers. However, other agents are prudently assumed to be potentially harmful to humans, for example, the many herpes viruses found in vervets and baboons whose full range of pathogenicity is uncertain. Haemorrhagic fever viruses and a number of different retroviruses have also been isolated from simians. Simian T-cell lymphotropic virus (STLV) and simian immunodeficiency virus (SIV), for example, bear a strong relationship to their human counterparts and laboratory workers have become infected, so far without evidence of disease occurring. More familiar human pathogens may also be carried by simians eg, mycobacteria (TB or TB-like infections), *Shigella* spp, *Salmonella* spp, protozoa and helminths; some of which can be contracted by monkeys from human sources.

Selection of stock

30 All mammals imported from abroad are subject to control under animal health legislation (Rabies [Importation of Dogs, Cats and other Mammals] Order 1974). Imported monkeys are required to complete a 6 month period of rabies quarantine in accommodation approved by Agriculture Departments (MAFF, WOAD and SOAEFD). Animals under this restriction may nevertheless be used in experiments.

Precautionary isolation of stock

31 All simians should be isolated for at least 6 weeks, even though they may already have completed rabies quarantine elsewhere. They should be handled as little as possible and preferably be kept in pairs for welfare reasons, with the same cage partner throughout. Different consignments and different species should be isolated separately.

Clothing and personal protective equipment (PPE)

32 Staff should always wear adequate protective clothing when in contact with simians and used cages etc. Where assessment shows it to be necessary, specific items of personal protective equipment (gloves, face-shields, respiratory protective equipment [RPE] etc) should also be supplied. Local codes of practice should encourage the consistent use of these items.

Handling

33 Safe working methods (including, for example, the use of sedation and adequate restraining methods) should be specified for all procedures. Staff must be trained in their use and be provided with suitable information and instruction on the hazards and risks of the work.

Control measures - containment and operating procedures

Introduction to containment

34 In illustrating the control measures to be adopted when working with animals infected with biological agents, a clear distinction has to be made between 'must' and 'should'. 'Must', or other imperative wording, indicates an essential requirement defined in legislation while 'should' indicates the ACDP's strong recommendation. The principal control measures for animal rooms that appear in Part II of Schedule 9 of COSHH appear in **bold**. These have been paraphrased for ease of reading. Other requirements of COSHH, also in **bold**, are addressed at each level of containment where the use of 'must' indicates a statutory duty. All other guidance appears in normal type face.

35 The levels of containment are intended to address the risks encountered when knowingly working with biological agents in the various hazard groups, including work in which animals are deliberately infected with biological agents. Except where formal derogation applies (see the Certificate of Exemption in Appendix 23 of the ACDP publication *Categorisation of biological agents according to hazard and categories of containment*)[3] COSHH requires that the containment level selected must match the hazard group of the agent in question.

Ministry of Agriculture, Fisheries and Food (MAFF) containment requirements

36 Some of the agents in Hazard Groups 1-4 may also be pathogens of animals. For these MAFF sets out its own containment requirements. These are based on those of the ACDP (see below) but differ in points of detail. The requirements state that, in all cases, the ACDP recommendations must be complied with as a minimum, but in many cases the MAFF requirements may impose higher containment conditions which must be complied with before a licence can be issued. This is because MAFF's primary concern is with the prevention of the spread of exotic pathogens from the laboratory.

Definition of terms

37 *Animal room* - this is the room in which the animals are housed.

Animal suite - this comprises of one or more animal rooms with an anteroom and other ancillary rooms separated from general corridors and service areas.

Animal unit - this is a building or separate area within a building, containing animal rooms and other facilities such as changing rooms, showers, autoclaves, store rooms, etc.

38 In some instances, a small suite of rooms rather than a single room may be in use for work with infected animals. The guidance below should be read accordingly.

39 Where the word 'insect' is used in the following text, it is taken to include other invertebrates. For additional guidance on the containment of invertebrates, see Appendix 5.

Animal containment levels

40 The following four levels of animal containment are suitable for work with vertebrates that are deliberately inoculated with biological agents in Hazard Groups 1-4, or with material suspected of containing those agents The containment levels are based on those in the fourth edition of *Categorisation of biological agents according to hazard and categories of containment* .[3] However, in this publication each level has been supplemented, to some extent, by additional practical guidance. Rather than reiterate all the requirements and recommendations at each containment level, only those which are in addition to the preceding level are listed, for example, the requirement 'mouth pipetting should be forbidden' while only listed at Containment Level 1 clearly applies to all other containment levels.

41 The accommodation used for the safe containment of experimental animals should also comply with the relevant legislation and guidance concerning animal welfare - the Animals (Scientific) Procedures Act 1986 and Codes of Practice. Sensitisation and latent infection are also hazards which need to be prevented, or adequately controlled, by observing the relevant provisions of the COSHH Regulations.

42 The requirements for the maintenance of animals may differ in scale because of the size and nature of the animal species in use and the numbers involved but the basic principles for ensuring safe containment given below are applicable for all. Local codes of practice should be prepared based on these principles.

43 Each containment level is suitable for work with animals that are deliberately inoculated with biological agents in the corresponding hazard group or viable material suspected of containing these agents. Personnel must receive suitable and sufficient information, instruction and training in the handling of infected animals and an appropriate standard of supervision of the work should be maintained. Those having contact with the animals and waste materials arising from the work must be made familiar with the local code of practice and be aware of any other precautions or procedures that may be required, for example, to protect them against latent or persistent infections in the species in use. The person responsible for the animal experiment must ensure that all those who need to know are made aware of the particular hazards concerned.

44 Although subject to an assessment that indicates a significant risk to the health of staff (see COSHH Schedule 9, paragraphs 2 and 11), a list should be kept of the names of those employees who may be exposed to biological agents in Hazard Groups 3 and 4 through contact with infected animals or waste materials. The record must indicate the type of work and, where known, the agent(s) to which employees are exposed. This must include, as appropriate, a record of exposures (for example, resulting from accidents and incidents). The list must be retained for at least 10 years but paragraph 11 of Schedule 9 in COSHH shows that for some agents, an extended period of up to 40 years may be necessary.

Animal containment Level 1

Security and access

45 Access to the room should be limited to authorised persons.

Disinfection and disposal procedures

46 (a) The animal room should be easy to clean.
(b) Effective disinfectants should be available for immediate use.
(c) Material for autoclaving and used animal cages should be transported without spillage and an autoclave for the sterilisation of contaminated waste materials should be accessible on site.
(d) Used animal cages should be decontaminated after use.
(e) All waste materials should be disposed of safely.

Air handling

47 The room should be adequately ventilated.

Protective equipment and procedures

48 (a) All procedures should be performed so as to minimise the production of aerosols.
(b) Suitable protective clothing and footwear should be worn in the animal room and cleansed, or removed, when leaving the animal room.
(c) **PPE including protective clothing, must be:**

(i) **stored in a well-defined place;**
(ii) **checked and cleaned at suitable intervals;**
(iii) **when discovered to be defective, repaired or replaced before further use.**

(d) **PPE which may be contaminated by biological agents must be:**

(i) **removed on leaving the working area;**
(ii) **kept apart from uncontaminated clothing and equipment;**
(iii) **decontaminated and cleaned or, if necessary, destroyed.**

(e) Eating, chewing, drinking, smoking, taking medication, storing food for human consumption and applying cosmetics should be forbidden.
(f) Mouth pipetting should be forbidden.
(g) There should be a basin or sink that can be used for handwashing and hands should be decontaminated immediately when contamination is suspected and before leaving the animal room.
(h) All accidents and incidents, including animal bites and scratches, should be reported to and recorded by the person responsible for the work or other delegated person.

Animal containment Level 2

49 In addition to the requirements/recommendations set out for Containment Level 1, the following apply to Containment Level 2.

Security and access

50 (a) **Access to the room must be limited to authorised persons.**

(b) **Efficient vector control measures (for example for rodents and insects) must be taken**.

(c) **There must be facilities for the safe storage of biological agents.**

(d) The door to the animal room should be closed when infected animals are present and should be labelled with a sign indicating the level of the work.

(e) Escape of animals from cages or the animal unit should be reported to the person responsible for the work. Once recaptured, such animals should be placed in a separate cage (although the provision of a number of spare cages may make this impractical for primates) and the appropriate licence holder informed (see Appendix 1). There should be a written procedure in place for action to be taken in the event of an escape.

(f) It is recommended that the animal room or building should be fitted with an intruder alarm.

(g) Maintenance and engineering staff, service engineers and other external staff should be appropriately supervised and trained if entry to the animal unit or room is necessary for the purposes of their task(s) and, subject to risk assessment and local circumstances, should receive appropriate vaccination.

Disinfection and disposal procedures

51 (a) **The animal room must be easy to clean. Bench surfaces must be impervious to water and resistant to acids, alkalis, solvents and disinfectants.** To minimise the spread of hazardous material by the airborne route, cleaning of animal rooms should be carried out after damping down with an appropriate disinfectant. To prevent cross contamination, rooms should be disinfected between experiments or a series of experiments.

(b) **There must be specified disinfection procedures.**

(c) **An incinerator for the disposal of animal carcasses must be accessible.** Access may be taken to mean an incinerator at another site but whether local or distant, carcasses and any other material for incineration must be transported in secure containers.

(d) Used animal cages should be rendered non-infective by disinfection, fumigation or heat treatment (steaming or autoclaving).

(e) All waste material, including animal bedding, should be rendered non infective before disposal.

(f) Work surfaces should be disinfected after use.

(g) If floor drains are installed, the traps should always contain water. Drain traps should regularly be disinfected and cleaned.

Air handling

52 **If the animal room is mechanically ventilated, it must be maintained at an air pressure negative to the atmosphere.** In effect, this means maintaining a flow of air into the room. The animal room should be adequately ventilated and where mechanical ventilation is used, the air from the room should be extracted to atmosphere which, in this context, may be taken to mean the external air and/or other parts of the animal building.

Protective equipment and procedures

53 (a) **For procedures which involve the handling of infected material, including any infected animal, where an aerosol may be created a safety cabinet, isolator or other suitable containment must be used** and all manipulations should be performed so as to minimise the production of aerosols.

(b) Suitable protective clothing and footwear should be worn in the animal room and be cleansed, or removed, when leaving. A face shield or visor should be worn when inoculating animals. It is considered good practice to wear suitable gloves whenever animals are handled.

(c) Facilities should be provided for hand washing, preferably in the animal room and hands should be decontaminated immediately when contamination is suspected and before leaving the animal room.

Animal containment Level 3

54 In addition to the requirements/recommendations set out for Containment Level 2, the following apply to Containment Level 3.

Security and access

55 (a) **The animal room must be separated from other activities in the same building.** It should be separated from any general thoroughfare by an anteroom with two doors or be sited within an animal suite or animal unit. The anteroom should have facilities for the storage of protective clothing. Showering facilities should be provided in the anteroom or within the animal suite or unit.

(b) **There must be an observation window or an alternative so that occupants can be seen.** It is recommended this be installed so that all occupants can be seen wherever they are working in the room; this may require one or more windows. Such windows should not be positioned on exterior walls such that those outside the facility may see into the animal suite, for example use one way glass.

(c) **The room is to contain its own equipment, so as far as is reasonably practicable.**

(d) A specific biohazard sign indicating the level of the work should be posted at the entry to the room and the room or suite should be locked when staff are absent.

(e) A suitable system should be instituted which signals occupancy of the room or suite by an employee. This is particularly important for weekend or out-of-hours work. Arrangements for lone working in animal facilities should be considered in the local rules. For some out-of-hours work, for example feeding of small animals, there may be minimal risk. However, for work with larger animals, for example primates, or for more complex tasks, it is recommended that accompanied working should be undertaken.

Disinfection and disposal procedures

56 (a) **In addition to bench surfaces, the walls and the floor must be impervious to water and resistant to acids, alkalis, solvents and disinfectants.**

(b) **The animal room must be sealable to permit disinfection.** While the definition of ‘disinfection’ may be widely interpreted, in practice it may be necessary to decontaminate by fumigating the accommodation when, for example, a spillage has occurred at the end of the experiment or when maintenance work is to be carried out.

(c) There should be means for the safe collection, storage and disposal of contaminated waste.

(d) The autoclave should be sited in the same building as the animal room or animal suite.

(e) Safety cabinets and isolators should be fumigated after use.

(f) The room should be disinfected or fumigated at the end of each experiment.

(g) Where floor drains are installed, the drain traps should be kept filled. The drain traps should be disinfected and cleaned regularly and at the end of each experiment.

(h) Infective materials taken into the animal room, or removed from it, should be transported in sealed containers.

Air handling

57 **The room must be maintained at an air pressure negative to atmosphere. Extracted air must be filtered using a HEPA (high efficiency particulate absorption) filter (or equivalent).** 'Atmosphere' in this context may be taken to mean the external air and/or other parts of the animal suite or unit. In effect, this means arranging engineering controls such that a continuous inward airflow into the room is to be maintained. Provision should be made for comfort factors for both animals and staff, ie supply of fresh air and temperature control. Air should be extracted through a HEPA filter via ducting or by extracting air with a fan and HEPA filter sited in a wall or window. The ventilation system should incorporate a means of preventing reverse airflows. The supply and extract systems should be interlocked to prevent positive pressurisation of the room in the event of failure of the extract fans. Further guidance on alternative means by which the inward flow of air may be achieved is given under Laboratory Containment Level 3 in the *Categorisation of biological agents according to hazard and categories of containment*.[3]

Protective equipment and procedures

58 (a) Animals infected with Hazard Group 3 agents should be housed in some form of primary containment, for example isolators or safety cabinets that are provided with HEPA-filtered exhaust ventilation or equivalent. However, where it is not reasonably practicable to use primary containment for animals, personnel should wear a complete change of clothing and use high performance RPE at all times.

(b) When undertaking procedures with infected materials that are likely to give rise to aerosols (inoculation procedures, post mortem examinations and harvesting infected tissues and fluids), a Class I or Class III microbiological safety cabinet (BS 5726: 1992 or a unit offering an equivalent level of protection), an isolator or other suitable means of containment is to be used. The containment unit used must exhaust to the outside air or to the room air extract system via a HEPA filter (or equivalent). If exhausting to the open air causes major problems, recirculation of exhaust air through two HEPA filters in series may, in exceptional circumstances, be considered as an alternative. In this case , the maintenance of a continuous airflow into the animal room during work with infectious material will be of particular importance and such an option should not be considered without prior consultation with HSE.

(c) Protective clothing, including footwear and gloves, supplemented where necessary by heavy duty or waterproof clothing, should be worn in the animal room and be removed when leaving the room. The clothing should be disinfected or autoclaved after use. Gloves should be worn for all work with infective materials and hands should be washed before leaving the animal room. Gloves should be washed or preferably removed before touching items that will be touched by others not similarly protected, for example telephone handsets, paperwork, etc. Where practicable, equipment controls should be protected by a removable flexible cover that can be disinfected.

(d) There should be a wash-basin fitted with taps that can be operated without being touched by hand.

Animal containment Level 4

59 Written instructions must be prepared for work at this level, and a safety officer should be appointed and be accountable to the person identified as being responsible for the work. Personnel should be over the age of 18 years and must have had specific training in the handling of the animals infected with Hazard Group 4 biological agents and in the use of the safety equipment and controls of the animal room. The work should be closely supervised. The person responsible for the animal experiment must ensure that all those having contact with the animals and waste materials are made aware of the nature of the agent in question and of any specific precautions and procedures that may be required.

60 In addition to the requirements or recommendations set out for Containment Level 2 and 3, the following apply to Containment Level 4.

Security and access

61 (a) **A key procedure must be established so that the entry is restricted at all times. Entry must be through an airlock.** The clean side of the airlock should be separated from the restricted side by changing and showering facilities and preferably by interlocking doors. The outer door should be labelled with a 'work in progress' sign.

(b) At all times during work in the animal unit there should be a second competent person available to assist in the case of emergency.

(c) High performance RPE (two or more units) should be available in the clean side of the animal unit for use in an emergency.

(d) There should be a telephone or other means of outside communication inside the animal unit.

Disinfection and disposal procedures

62 (a) **In addition to surfaces mentioned at Containment Levels 2 and 3, the ceiling must also be impervious to water and resistant to acids, alkalis, solvents and disinfectants.**

(b) **An incinerator for the disposal of animal carcasses must be available on site.**

(c) A double ended autoclave with interlocking doors with entry in the animal room and exit in a clean area should be provided. An additional ventilated airlock that can be fumigated may be required for passage of equipment that cannot enter the animal room through the personnel airlock or double-ended autoclave.

(d) All waste material should be rendered non-infective before being removed from the animal room and should be autoclaved. Animal bedding and carcasses should be incinerated immediately on removal. A double-ended dunk tank filled with an effective disinfectant may be required for the removal of materials that cannot be autoclaved. Removal of materials in this manner should be undertaken only with the authorisation of the safety officer and under conditions defined in the local code of practice. The dunk tank should be sealed during fumigation if the disinfectant is incompatible with the fumigant. All effluent, including that from the shower, should be rendered safe before discharge.

(e) Where floor drains are installed, the drain traps should be kept filled and sealed until required. The effluent from traps must be rendered non-infective before discharge to a sewerage system. The drain traps should be disinfected and cleaned regularly and at the end of each experiment.

Air handling

63 (a) **Input air must be HEPA-filtered and extract air is to be double HEPA-filtered (or equivalent)** before it is ducted to the outside air or to the room air extract system.

(b) The supply and extract airflow should be interlocked to prevent positive pressurisation of the room in the event of a failure of the extract fan and an emergency electricity supply should be provided to cut in automatically in the event of a power failure. The ventilation system should incorporate a means of preventing reverse airflows. Emergency power should provide for adequate lighting (not simply standard dim emergency lights) because if a power failure occurs whilst a procedure is being carried out, the animal may become more difficult to handle, increasing the risk of injury or escape.

(c) A negative pressure of at least 70 Pascals (7 mm of water) should be maintained in the animal room and a negative pressure of about 30 Pascals (3 mm of water) in the airlock. An alarm system should be fitted to detect any unacceptable change in air pressure and manometers should be displayed which can be read from both inside and outside the laboratory.

Protective equipment and procedures

64 (a) **Infected material, including any animal, is to be handled in a Class III safety cabinet or cabinet line (see paragraph 27 of Laboratory Containment Level 4 in the *Categorisation of biological agents according to hazard and categories of containment*),[3] in an isolator or in other suitable containment in which exhaust air is double HEPA-filtered or equivalent.** In general, the principle of primary containment of hazards implicit in COSHH should always be applied to controlling the risks from infected animals. However, in some circumstances, the nature of the species (size and disposition) and the operations to be performed are such that this form of close containment may not be practical. It may be appropriate, for example, for small mammals such as mice but not for larger animals. Where this is the case, and the risks involved have been adequately assessed, 'other suitable containment' may be taken to include use of alternative engineering controls or, as a last resort, the use of RPE of proven efficacy.

(b) A complete change of clothing should be worn, ie staff should change into protective clothing before entering the animal suite. After work, the clothing should be removed in the dirty side of the changing area and placed in a container for autoclaving. A shower should be taken before leaving the laboratory unit.

(c) There should be a programme of regular validation of the continuing safe operation of control systems (for example, checks on airflows, filter integrity, sensors and indicators) coupled with routine servicing and maintenance of all safety equipment and plant. COSHH Regulation 9, in referring to maintenance, examination and test of control measures and specifically to 'local exhaust ventilation', must be observed. This means, for example, that HEPA filters and their fittings and seals must be thoroughly examined and tested at intervals not exceeding 14 months. In practice, depending on the frequency of use, these tests are commonly carried out at shorter intervals, for example, six monthly.

(d) Infective material should be stored in the animal room, but where this is impractical such material taken into the room (or removed from it to another Containment Level 4 room on site) should be transported under the supervision of the safety officer, in sealed containers that have been externally disinfected.

Design features

65 There are certain features of animal rooms and suites that should be considered which may facilitate the management of health and safety, including the way in which such facilities are decontaminated. These design features should be considered when planning new facilities or upgrading existing rooms/suites. Examples of good design for health and safety include:

(a) suites and rooms should be designed so that they can be serviced from the outside thus minimising (or preventing) the need for untrained personnel to enter the animal room;
(b) structural components and mechanical, electrical and other fittings within the animal facility should be designed to reduce the likelihood of contamination and be readily accessible for decontamination by exposure to liquid or gaseous disinfectants;
(c) internal surfaces including floors, walls, working surfaces, furniture, fittings and other contents of animal rooms should be designed and constructed to facilitate decontamination whilst taking into account the requirements imposed at the various containment levels. For example, the internal surfaces of the animal rooms should be constructed of smooth, impervious materials with an easily cleanable surface such as epoxy or polyester coated plaster, or equivalent surfaces which are resistant to the normally used disinfectants, detergents, acids, alkalis, solvents or other chemical preparations. Junctions of the walls with the ceiling and floor should be coved for easy decontamination;
(d) consideration should be given to the use of materials and the siting of equipment which will minimise noise and vibration levels in the animal room;
(e) drains and other piped services that enter the animal room should be designed to prevent access and egress by rodents and insects (such measures are mandatory at Containment Level 2-4). Doors should be self closing and close fitting with the joints between the door frame and wall sealed with a flexible, waterproof sealant but designed to allow an inward flow of air if required. If external windows are fitted these should be fixed shut and sealed, for example by secondary glazing and should allow a one way view, ie to the outside only;
(f) light fittings (preferably recessed) and electrical socket outlets should be waterproof/resistant or protected by barriers or covers against ingress by liquids and particulates;
(g) non-essential furniture, fittings and items of equipment should be excluded from the animal room. Where furniture and fittings are provided for essential purposes they should be capable of being decontaminated *in situ* or be removable;
(h) initiation of fumigation of the room should be controlled from outside the room or be activated by a delayed time switch;
(i) in animal rooms which are mechanically ventilated, the extract duct system should be protected against contamination by the use of a coarse particulate filter and HEPA (or equivalent) filter in series at all exhaust air grilles at Containment Levels 3 and 4. The filtered exhaust air should be discharged safely to the atmosphere and not re-circulated within the building. Air exhausted from flexible film isolators or ventilated cage racks should be passed through coarse particulate and HEPA filters before being vented to the atmosphere.

Equipment for containment and protection

66 There is a variety of equipment available that may be used to contain animals inoculated with biological agents. The choice of such equipment will depend

on a number of factors, but primarily its effectiveness and ease of use. Other considerations will include maintenance requirements and cost.

67 The hazards of working with animals deliberately infected with biological agents should always be identified by carrying out suitable and sufficient risk assessments so that procedures and equipment may be selected to prevent potential exposure. It may be useful to consider a hierarchy of control measures, where primary containment is preferred, supplemented by secondary measures such as PPE. Users of containment equipment should always assess the appropriateness of such equipment **under 'in use' conditions** and should seek evidence of the efficacy of protection before purchase. As a minimum, and in the absence of other standards, devices should provide a level of protection equivalent to that specified for microbiological safety cabinets in BS 5726.

68 Equipment available includes: flexible film isolators (FFIs), flexible and rigid isolators with half-suits, microbiological safety cabinets, animal husbandry units, downdraft post mortem tables, RPE and combinations of these options.

Flexible film isolators

69 FFIs are mainly used under positive pressure to protect animals, for example gnotobiotic animals and immunodeficient mice, from exposure to animal pathogens. They may also be used under negative pressure to contain animals infected with biological agents.[9] Animal inoculations, collection of blood samples and post mortem examinations can all take place within isolators. Sealed carriers that attach to ports on isolators can be used to remove samples, animals and animal waste from isolators. These systems are suitable for mice, rats and small numbers of guinea pigs. Rabbits and young farm animals have also been maintained in such systems. Training in the use of FFIs is essential with additional consideration given to such operator factors as fatigue, dexterity and limited mobility.

Flexible and rigid isolators with half-suits

70 These can be used for work with infected animals and may provide more space than the flexible film isolators described above. In addition to some of the factors considered when using FFIs, attention should also be focused on practical aspects and comfort factors such as entering and exiting the half-suits, the variation in body size in relation to suit size and the provision of adequate ventilation to the operator.

Safety cabinets

71 These provide very effective containment but they are not recommended for animal husbandry. They may be appropriate for manipulations on small numbers of mice, rats and guinea pigs and for post mortem examinations, although these procedures may be difficult and tiring in some cabinets, for example Class III. Open fronted safety cabinets will not contain flying or crawling arthropods.

Animal husbandry units

72 These units may operate under negative pressure to reduce the exposure of animal technicians to allergens whilst others are designed to provide a germ-free or otherwise 'clean' environment for immunosuppressed animals by operating at positive pressure, air being supplied by a built-in fan through HEPA-type filters. These units have the potential to house all species except farm animals, however, certain specialised facilities do exist which can operate under negative pressure to maintain 'clean' large animals, for example cattle, sheep, pigs, deer and horses. Users should be aware that since containment is broken when removing animals from such units, they do not provide total protection and RPE may be required.

Downdraft tables
73 Post mortem examinations and other procedures can be performed on these tables and they are appropriate for most species except farm animals. The aim for such devices is to provide a level of protection, under 'in-use' conditions, equivalent to that afforded by an open fronted safety cabinet. However, the additional use of RPE may also be required although the challenge to this personal protection will be reduced substantially.

Respiratory protective equipment
74 RPE allows greater freedom of mobility or dexterity than, for example, working in a Class III cabinet, however visibility may be impaired and it can often cause fatigue to operators. Standard operating procedures for their use will apply to all species and infectious agents. Respirators can operate under either positive or negative pressure (either one or the other, not both on one model); the former are less fatiguing but are harder to decontaminate. RPE should only be contemplated when primary containment is not considered a practical alternative. RPE may provide useful protection for those suffering from allergies.

Combinations
75 Combinations of ventilated husbandry units, downdraft tables and safety cabinets, used in conjunction with RPE, may offer satisfactory protection against aerosol infection and may be considered an alternative to single systems particularly when greater mobility and dexterity is needed.

Operating procedures

Handling experimental animals
76 An essential part of safe working practice with experimental animals is the ability to move and restrain the animal in such a way as to avoid injury or distress to the animal and injury or the possibility of infection to the handler. Infection may arise from bites, scratches, abrasions and contact with fluids from infected animals. It may also be caused by needle injury or aerosols following sudden movement by the animal or by involuntary movement of the handler as a result of bites, scratches, kicks, struggling or other action by an improperly restrained animal.

77 Techniques for the handling and restraint of large and small animals must be acquired by training and reinforced by practice and must not be undertaken other than by fully trained staff. Animal handling is an essential component of the training of animal technicians and is mandatory for applicants for a Personal Licence under the Animals (Scientific Procedures) Act (1986) who are required to complete an approved training course.

78 It is not possible here to describe techniques for the safe handling and restraint of all the numerous species of animals used in experiments. Advice for different species should be sought from experienced colleagues and manuals produced by organisations involved in the training of animal technicians and veterinary surgeons.[10-13]

Handling and restraint of small animals
79 For the purposes of this section, the term 'small animal' includes most species used in experiments including rodents, rabbits, small carnivores, cats, dogs, and birds, but does not include primates and farm animals such as cattle, sheep, goats, pigs and horses.

80 Handling and restraint techniques for small animals will depend upon:

(a) the species, size, age, weight and temperament of the animal;
(b) the technique to be carried out, particularly if this may induce pain or distress or involves the use of biological agents;
(c) the condition of the animal - whether it is pregnant;
(d) the housing or caging of the animal;
(e) the possible necessity to handle the animal in an isolator or safety cabinet.

81 When approaching, handling and restraining small animals the following recommendations should be considered:

(a) many procedures can be carried out by a single handler, but with animals larger than mice it may be safer if one or more handlers restrain an animal while techniques are being carried out;
(b) the appropriate protective clothing including gloves should always be worn. Consideration should be given to the use of appropriate gloves which may protect against needle injury or animal bites, although thicker gloves may lead to a loss of sensitivity when handling animals and some tasks may be harder to carry out;
(c) animals should be approached in a quiet and confident manner. Most small animals will not bite or scratch if handled correctly. Care should be taken with animals that are sleeping; they should be allowed to wake fully before being handled;
(d) restraint of animals should be firm but gentle and should not cause pain or interfere with blood flow. An animal properly restrained is less inclined to bite or scratch and such actions are prevented by the method of restraint. Animals should be placed on non-slip surfaces;
(e) animals should be correctly restrained before needle covers are removed and needles and syringes should be safely discarded, without resheathing unless there is a safe means of doing so, before the animal is released;
(f) particular care should be taken when handling animals such as mice and rats which may urinate when restrained because some organisms, for example leptospires, are excreted in the urine;
(g) animals may enjoy being handled if contact is frequent and may even be trained for complicated techniques prior to the procedure;
(h) consideration should be given to the use of sedatives or anaesthetics. Advice should be obtained from a veterinary surgeon and/or persons proficient with the species in question;
(i) if an animal handler has any doubt about their ability to restrain an animal, or if presented with a species of animal they have not handled before they should take advice from an experienced colleague.

Handling and restraint of large animals

82 This section applies to large (farm) animals including cattle, sheep, goats, pigs, horses and primates. Under normal circumstances, most large animals are placid and relatively easy to handle, but can cause serious injury if handled improperly. The greatest care should always be exercised when approaching and handling any animal to avoid being crushed, trodden on, kicked or bitten. Particular care should be exercised when large animals are housed in groups. Before attempting to carry out any procedure on an animal, ensure that it is suitably restrained. Assistance should be obtained from one or more competent animal handlers depending upon the species and size of the animal. Animals are likely to be more disturbed by incorrect restraint than by experimental procedures.

83 Species and strains of animals differ in temperament and some are more aggressive than others. This should be considered when selecting animals for experiment. Otherwise placid animals can become aggressive when rearing young,

ill, or in pain. Rough handling, loud noises or sudden changes in environment should be avoided where possible.

84 When approaching, handling and restraining large animals, the following recommendations should be considered:

(a) the presence of one or more qualified assistants may be required before an animal is approached;
(b) safety footwear and appropriate protective clothing, for example drab colours and materials which do not rustle, should be worn;
(c) the animal should be observed quietly before being approached to determine whether it is likely to become violent or frightened. The animal should not be taken by surprise, but allowed to become aware of the handler's presence before moving towards it. The animal should be approached slowly and with caution. Both the environment of the animal and objects which may impede movement or escape should be noted;
(d) animals should never be handled in groups, they should be segregated and manipulations carried out on one animal at a time;
(e) whenever possible, animals should be restrained by the use of a crush or similar device or separated from human handlers by rails or gates, although young or small animals should be handled manually;
(f) consideration should be given to the use of sedatives or anaesthetics. Advice should be obtained from a veterinary surgeon;
(g) animals such as cattle, sheep, pigs or horses can be dangerous because of their weight. They should not be approached in restricted spaces where it is possible for the handler to be trodden on or crushed between the animal and a solid object such as a wall. Cattle can kick backwards and sideways whereas horses can kick forwards and backwards with either fore or hind limbs and may cause damage by swinging their heads. Never stand behind an animal unless the ability to kick has been prevented. By keeping close to the side of an animal and near a leg, the force of any kick will be reduced. Care should be taken when stepping away from an animal once a procedure is finished.

Safe working with sharps

85 When carrying out experiments with animals, two of the most common sources of human laboratory infection are accidental inoculation with a contaminated needle or injury by a sharp instrument contaminated with infective material. In many situations the operator will be involved in procedures that require the needle or instrument to be relatively close to the hands holding the animal. A sudden movement of the animal or failure to observe relatively simple precautions may lead to accidental infection of either the operator or the assistant. Aerosols generated by inappropriate use of the needle and syringe may also provide a potential source of accidental infection. Care should be taken to avoid the generation of aerosols when air bubbles are being removed from the syringe prior to inoculation of the infectious material, for example by wrapping cotton wool soaked in alcohol or disinfectant around the end of the needle.

86 Needles and other sharp instruments should not be unsheathed until immediately before use. If possible, in use they should be directed away from the hands being used to restrain the animal. It is important to wear gloves to prevent contamination of hands by infectious material during inoculation but the type of glove chosen must be suitable for the animal being used. Following completion of the procedure, at the earliest opportunity the needle or sharp instrument should be carefully discarded into a suitable container without replacing its cover, unless there is a safe means of doing so. As a general rule, the operator should rehearse all procedures either on their own, if unassisted, or with their assistants before commencing the work.

Post mortem examinations

87 Before a post mortem examination is performed on an infected animal, a risk assessment must be carried out to determine the appropriate level of containment and controls necessary for the procedure. The guidance given here is applicable for work with large and small animals in most cases, unless otherwise indicated. It should serve as a general guide to draw up local codes of practice. Specific guidance on conducting post mortem examinations on animals infected with transmissible spongiform encephalopathies can be found in the latest edition of the ACDP publication *Precautions for work with human and animal transmissible spongiform encephalopathies*.[14]

88 Only essential persons should be present in the post mortem room when infected animals are being handled. However, it is generally recommended that at least two persons should attend, although this may depend on specific assessment of the procedure. For example, the size of animal being examined, such as a mouse, may only require one person to be present. For work with animals which are infected with Hazard Group 3 or 4 agents, it is recommended that three people should be present: the pathologist, an assistant and a circulator. The circulator should remain uncontaminated and act as an observer and co-ordinator.

89 For non-infected animals, for example controls, examinations should take place at different times. If separation from infected animals cannot be maintained, then an area of the room should be set aside for examination to allow appropriate standards of disinfection to be maintained and to minimise the possibility of cross contamination.

90 Post mortem examination of animals should take place in a different room within the animal unit from where live animals are kept. Where animals are housed in isolators, an assessment should be made to compare the risk of carrying out the examination in isolators, cabinets or on downdraft tables.

91 Protective clothing, including footwear and gloves, should be worn. This should be supplemented where necessary, for example when examining large animals, with heavy duty or waterproof clothing. A full face visor may be required if the procedure is likely to cause splashing, etc. The wearing of armoured gloves should also be considered. If large animals are examined in the vertical position, the use of head protection for the operator is advised.

92 A dedicated set of instruments should be available for the procedure. All cutting tools should be sharp, clean and ready for use. Oscillating saws or band saws should not be used without local exhaust ventilation (LEV).

93 All items of reusable clothing should be disinfected or autoclaved after use. Non disposable equipment should be autoclaved or treated with a suitable disinfectant if the equipment is not heat stable. All disposable clothing and equipment should be rendered non infective before disposal or made safe to handle if incineration is to be employed.

94 Where it is not practical to use primary containment at Containment Levels 3 and 4, personnel should wear a complete change of clothing and use high performance RPE at all times during the procedure.

95 Carcasses should be bagged or placed in a disposable burn bin and incinerated. Small carcasses can be autoclaved prior to incineration. If possible, large animal carcasses should be incinerated whole or if facilities are not available they should be dismembered (taking care to avoid injury) and placed in bins with other material awaiting incineration. When possible, at Containment Level 3, large animal carcasses should be autoclaved prior to incineration. If it is not possible to

incinerate or transport to the incinerator on the same day, then carcasses should be placed in cold storage.

96 At the end of each examination or set of examinations, benches and floors should be washed with water and detergent before disinfecting according to local rules.

97 Consideration should be given to the means by which information is recorded and removed from the procedure room, for example phones, voice activated dictating machines or dedicated computers or faxes could be used to send the information out without the need for decontaminating paper, etc.

Decontamination and disposal of waste

Introduction

98 Establishments where experimental animals are held must have written decontamination and waste management policies, and establish effective plans and procedures, for example for the collection, segregation, storage, treatment and disposal of infected waste. These procedures should be included in local codes of practice or standard operating procedures (see Appendix 1).

99 The selection of procedures for the decontamination, treatment and disposal of waste should be based on a careful assessment of the risks taking account of:

(a) the Hazard Group of any experimental agent, including its likely survivability in the waste stream;
(b) the likelihood of infection, including latent infections;
(c) composition and quantity of waste, especially when dealing with large animals where certain decontamination or treatment options may not be reasonably practicable and alternatives have to be considered;
(d) the hazards and risks arising from the chemical agents, plant and equipment used in the decontamination or treatment processes;
(e) any environmental risks, for example from the transportation of infective waste and the discharge of waste effluent.

100 There may also be specific requirements that need to be taken into account for waste arising from certain activities, including work with agents under the control of MAFF, work involving genetically modified organisms (GMO) and work involving radioactive substances.

Definition of terms

101 *Disinfection* - is the process which destroys or irreversibly inactivates pathogenic agents or reduces their number to a non-hazardous level.

Sterilisation - is the process which results in the total destruction of all viable biological agents and spores.

Decontamination - may involve disinfection or sterilisation. Cleaning of contaminated surfaces using detergent solutions applied by wet scrubbing or spraying may be used in addition to but not as a substitute for decontamination.

Decontamination

102 Waste at Containment Levels 2-4 should be rendered non-infective before disposal. Decontaminated waste is not classified as clinical waste or as an infectious substance according to the Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Vessels Regulations 1996 (see Appendix 1). Where waste is not treated within the laboratory or suite but is removed for treatment or disposal off-site, it should be packaged to provide adequate containment and labelled accordingly.

103 Liquid waste effluents whether treated or not should be discharged only with the consent of the appropriate water company.

Small animal housing

104 Cages and isolators should be constructed of materials that are easily cleanable, resistant to the disinfectants in use and where applicable to fumigants, or are able to be sterilised by heat or steam. If, for welfare reasons, animals such as rabbits, guinea pigs, ferrets or cats are kept in floor pens, then the rooms should be designed and constructed so that all internal surfaces can be readily cleaned and decontaminated.

105 At Containment Levels 1 and 2 contaminated cages should be cleaned in a designated area within the animal unit. The soiled cages should be sprayed with water or a mild detergent solution before being removed to the cleaning area in a closed trolley or covered, for example with a plastic box which can be disinfected. This will reduce the spread of contamination. The dampened, contaminated bedding should be removed from the cage using appropriate control measures, for example under LEV. The bedding should be scraped directly into sealable, impermeable plastic bags or bins for disposal. Bedding from Containment Level 2 facilities should be rendered non-infective by autoclaving or disinfection before disposal. Where practicable, at Containment Level 2, dirty cages should be autoclaved before bedding is removed.

106 At Containment Level 3, if there is an autoclave available within the suite, the entire cage and bedding should be autoclaved before bedding is removed for disposal. Alternatively, the soiled bedding should be scraped into suitable secure containers while the cage is still in the containment device and then removed to the autoclave. The cage is then disinfected in the containment area and subsequently removed for autoclaving. Bedding from Containment Level 3 facilities should be removed in sealed, impermeable bags for incineration.

107 At Containment Level 4, the soiled cage and bedding should be placed intact in a double ended autoclave within the containment area prior to the removal of the bedding for disposal. Bedding from Containment Level 4 facilities should be incinerated on site.

108 After removal of the soiled or treated bedding, cages should be decontaminated by autoclaving (Hazard Group 4 or lower agents), total immersion in a suitable chemical disinfectant (Hazard Group 3 or lower agents) or by cleaning in a cage washer operating at the highest temperature cycle (Hazard Group 2 or lower agents). Disposable cages should be autoclaved and incinerated.

109 Ventilated cage racks, FFIs, microbiological safety cabinets and equivalent equipment used to house cages should be suitably decontaminated, for example the internal surfaces and contaminated outer surfaces should be wiped with disinfectant at the appropriate use-dilution or the equipment exposed in situ to a gaseous disinfectant using recommended procedures.

Large animal housing

110 Rooms housing large animals inoculated with Hazard Group 3 or 4 agents must be sealable for disinfection. For work at Containment Level 4, if floor drains are fitted these should lead directly to a holding or treatment tank.

111 Slurry (a mixture of animal excreta, urine and water) which may also contain bedding, uneaten food and other materials, should be removed regularly from the animal accommodation and always before decontamination of the room is begun. Slurry can, in the case of Hazard Group 1 or 2 agents and subject to assessment, be removed for composting (this would not be the case for agents not indigenous

to the UK). Slurry contaminated by such agents may be discharged with consent as trade effluent or removed for treatment by traditional methods.

112 Slurry from animals inoculated with Hazard Group 3 or 4 agents should be rendered non-infective before being discharged or removed from the premises. Liquid slurry should be discharged by gravity or pumped to a treatment tank and heated to a sufficiently high temperature and period of time to render the contaminating agent non-infective; steam injection or electric heating coils with gentle mechanical agitation are suitable methods. After cooling, the non-infective waste can be discharged, with consent, to the public sewer. Alternatively, the slurry may be treated with acid or alkali separately to attain a pH which inactivates the agent or by sequential treatment with acid or alkali to achieve a pH switch. pH should be adjusted, if necessary, prior to discharge with consent as trade effluent. Solid waste contaminated with Hazard Group 3 agents should first be dampened down with disinfectant and then placed in impervious containers and be steam sterilised immediately. Solid waste contaminated with Hazard Group 4 agents should be incinerated.

Disposal of waste

113 Waste which has been rendered non-infective is no longer classified as clinical or infectious for disposal purposes and it may therefore be consigned as non-hazardous waste. However, such solid non-infectious waste remains 'controlled waste' and so is subject to 'duty of care'. Treated liquid waste discharged to the sewers remains 'trade effluent' and is subject to discharge consent. Wastes, though rendered non-infectious and waste contaminated by Hazard Group 1 agents, may be aesthetically offensive, for example animal tissues or remains, and should therefore be disposed of by incineration.

114 The principal options for final treatment and disposal are:

(a) incineration in a plant suitable for the complete destruction of animal or clinical waste. Incineration is the preferred disposal route for animal carcasses, tissues and other remains including that which has been rendered non-infective by chemical (tissues) and thermal (carcasses) treatment. Animal incinerators should comply with current guidance from the Secretary of State for the Environment unless they are exempt because they have an operating capacity of less than 50 kg per hour;
(b) burial in a licensed landfill site, for example for non-infectious treated solid wastes, such as animal bedding;
(c) discharge to the sewer system, for example for non-infectious treated waste, low-hazard liquids and semi-liquid waste from Containment Levels 1 or 2.

115 Solid waste, whether treated or not, which is consigned for transportation to an off-site disposal facility should be secured in sealed, impermeable containers and carried only by a registered waste disposal carrier or in the waste producer's own vehicle. Certain solid wastes may be discharged to the sewer system after maceration together with liquid or semi-solid liquid waste which has been autoclaved or disinfected with consent from the local water authority.

116 Waste from experiments involving Hazard Group 3 agents should be rendered non-infectious on site by sterilisation or disinfection before being discharged or removed for disposal. Where autoclaving is not practicable or effective, for example for sterilising animal carcasses, large tissues or organs and some types of cage bedding or litter, the waste should be removed directly for incineration in labelled, sealed, impermeable containers. Non-rigid containers such as plastic bags or sacks should when sealed be placed in a rigid outer container,

intermediate bulk carriers or a locked covered skip for transportation to the incinerator. Consideration should also be given to the use of disposable burn bins which reduce manual handling of the waste, although these would need to be of a type suitable for the transport of infectious waste.

117 Wastes from Hazard Group 4 agent experiments must be rendered non-infectious and all viable organisms killed by a validated method before being removed from the designated containment area. Steam sterilisation using a double-ended autoclave is the preferred treatment method. Waste that cannot be autoclaved within the containment area should be placed in a double-ended dunk tank containing an effective disinfectant and subsequently removed in sealed double containers for on-site incineration.

118 All liquid waste and waste effluent from Containment Level 4 accommodation including animal slurry, used disinfectants and detergent solutions, washings and effluent from showers, hand basins, water hoses and sprinkler systems should be discharged via a sealed and leak-proof drainage system into an impermeable holding or treatment enclosed tank within the designated containment area. The tank should be of sufficient size to contain the anticipated volume of waste that may be generated, with a safety factor to handle unintentional spills of liquid effluent, or a secondary over-flow tank fitted in parallel or series with the first. The tank should be designed so that waste has to be actively pumped out following disinfection. The tanks and their joints, seals and valves should be of sufficient mechanical strength to withstand the hydraulic pressure generated by their contents and be constructed of materials resistant to the disinfectants and other chemical agents that may be discharged into them. Tanks should be vented safely to the atmosphere through a stack fitted with a pressure-relief valve or bursting disc and with two HEPA filters in series on the clean side of the disc or valve.

Testing and validation of treatment and disposal methods

119 Decontamination and waste management procedures should be periodically and systematically monitored to check their continuing effectiveness and to identify any improvements that need to be made. Checks and inspections should identify adherence to and deviations from local procedures and codes of practice and the effectiveness of the operational and control devices of plant and equipment (for example autoclaves and cage washers). The results and conclusions of the inspection and monitoring programme should be seen by the employer or their representative and an action plan agreed for the implementation of any recommended improvements.

120 Methods for the treatment and disposal of animal and related waste should be able to be tested or validated to verify that the conditions necessary for the biological agent to be destroyed or reduced to a level acceptable have been achieved prior to discharge of the waste effluent. Validation should be a documented procedure for obtaining, recording and interpreting the required results to show that the treatment process consistently yields the desired outcome according to predetermined specifications.

121 Where the treatment or disposal is one for which a British or European Standard specification exists then validation will depend on strict adherence to that specification including operational sampling, monitoring and performance testing. Validation may involve the periodic or continuous sampling of the effluent from the treatment plant or process to monitor compliance with any emission standard or discharge consent.

122 Devices and equipment used to monitor or measure the performance of any treatment method or to assay any waste effluent should be calibrated at least annually by a method which employs an independent reference test device or probe, for example for temperature or pressure, or by a method specified in a British or European standard.

Appendix 1 Legislation and local rules

Health and safety law

The Health and Safety at Work etc Act 1974 (HSWA)

1 All work except domestic service is subject to regulation under the Health and Safety at Work etc Act 1974. **Employers** have general duties to ensure, so far as is reasonably practicable, the health, safety and welfare at work of employees, and to conduct their undertakings in such a way as to ensure, so far as is reasonably practicable, that other persons who may be affected by the work are not exposed to risks to their health and safety. **Self-employed** people have general duties to conduct their undertakings in such a way as to ensure, so far as is reasonably practicable, that they and other persons are not exposed to risks to their health and safety from the work. **Employees** have a general duty to take reasonable care for the health and safety of themselves and of other persons who may be affected by their work, and to co-operate with their employer or any other person to enable them to comply with any health and safety duties.

The Control of Substances Hazardous to Health Regulations 1994 (COSHH)

2 The COSHH Regulations provide a framework of actions designed to control the risk from a range of hazardous substances including biological agents.

3 These regulations require employers to assess the risk of infection for both their employees and others who may be affected by the work, for example, waste-disposal workers, service engineers and members of the public. When a risk has been identified, there is a duty to select and properly apply appropriate prevention or control measures. This may include the use of PPE, in which case it must be properly stored, cleaned, maintained and, if found to be defective, repaired or replaced. In addition, employees must receive suitable and sufficient information, instruction and training about the risks they may encounter at work. Subject to assessment, there may also be the need to provide health surveillance for employees and offer them vaccines.

4 The assessment of risk required by COSHH must be reviewed regularly and revised when conditions change, an incident occurs, a deficiency is noted or if for any other reason it is suspected that the assessment is no longer valid.

The Management of Health and Safety at Work Regulations 1992 (MHSWR)

5 The Management of Health and Safety at Work Regulations (MHSWR) entail additional duties beyond COSHH. These include the need for employers to have access to competent help in applying the provision of health and safety law, the need to establish procedures to be followed by any worker if situations presenting serious and imminent danger were to arise, and the need for co-operation and co-ordination where two or more employers or self-employed persons share a workplace.

The Genetically Modified Organisms (Contained Use) Regulations 1992 (as amended in 1996)

6 Some genetically modified organisms (GMOs) which present hazard to human health are within the definition of a biological agent being either micro-organisms, cell cultures or endoparasites. While they are subject to control under the COSHH regulations, other more specific requirements (for example, for risk assessment and notification) also apply and reference must be made to the genetically modified

micro-organisms (GMMs) legislation. Dual notification of intended work with GMOs, ie if work has already been notified under GMM legislation, then notification under COSHH is not required. Unlike COSHH, the GMO (Contained Use) Regulations cover both human health and environmental safety, and risks to *both* must be assessed.

7 The Genetically Modified Organisms (Risk Assessment) (Records and Exemptions) Regulations 1996 replace the GMO (Contained Use) Regulations 1993 and require records on the environmental risk assessment of genetically modified animals and plants to be kept for 10 years. These regulations do not apply to biological agents.

The Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations 1996

8 The transportation of waste infectious substances and waste from the medical treatment of animals and from bio-research is subject to these regulations. They require that biological agents must be classified according to approved criteria as, for example, being an infectious substance (based on the hazard groups of the World Health Organisation), a genetically-modified micro-organism or organism, a biological product, a diagnostic specimen or waste.

9 Clinical waste falls within the scope of these regulations and must be packaged in a sealed container which is itself placed in an outer or secondary container with the space between the two filled with absorbent material. Alternatively, clinical waste may be placed in suitable rigid packages such as intermediate bulk container (IBC) and marked as suitable for liquid. Also, provided there is sufficient absorbent material to absorb the entire amount of liquid present then the waste may be packaged in leakproof packaging (yellow clinical waste bags which have been type approved) or IBCs which are certified and marked as suitable for solids.

The Reporting of Incidents, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR)

10 The current regulations are designed to provide a national record of certain types of injury, diseases and dangerous occurrences that might jeopardise the health and safety of workers. There is a requirement in RIDDOR for employers to report 'acute illness which requires medical treatment where there is reason to believe that this resulted from an exposure to a biological agent or its toxins'.

11 Employers must also report 'any infection reliably attributable to the performance of particular work, specified as being 'work with micro-organisms; work with live or dead human beings in the course of providing any treatment or service or in conducting any investigation involving exposure to blood or body fluids; work with animals or any potentially infected material derived from any of the above'. There is also a duty to report any 'accident or incident which resulted or could have resulted in the release or escape of a biological agent likely to cause severe human infection or illness'.

Animal welfare

Animals (Scientific Procedures) Act 1986

12 While the purpose of this guidance is to protect human health and safety, full account should be taken of animal welfare issues. There need not be any inherent incompatibility between the two but there may be areas where conflicts could arise.

13 The 1986 Act regulates 'any experimental or other scientific procedure applied to a protected animal which may have the effect of causing that animal pain,

suffering, distress or lasting harm'. It is administered by the Home Office and covers the breeding and supply of certain species and use of all vertebrate animals and *Octopus vulgaris* for regulated procedures. All places where regulated scientific procedures are carried out or where certain species (Schedule 2) are bred or supplied for use in regulated procedures must be designated by the Home Office in the Certificate of Designation. The Act requires that a veterinary surgeon who will advise on the health and welfare of the animals kept and the named animal care and welfare officer, responsible for the daily care of the animals, be named on the certificate .

14 The underlying principle of the 1986 Act is that animals bred, supplied and used for scientific procedures should be cared for in accordance with the best standards of modern animal husbandry. A code of practice[15] issued by the Home Office establishes standards for the care of laboratory animals and for the design and construction of animal facilities. Guidance on the operation of the Act is also available.[16]

15 Responsibility for the care of laboratory animals involved in or held for scientific procedures falls to:

(a) the personal licence holder who is responsible for all animals subject to procedures under the terms of their licence;
(b) the project licence holder who is responsible for the direction, management and supervision of the scientific project;
(c) the person named as responsible for the day-to-day care of the animals;
(d) the named veterinary surgeon (or, in exceptional circumstances, another qualified person) who monitors and advises on the health and welfare of the animals;
(e) the certificate holder (certificate of designation).

16 The extent to which the welfare of animals could be compromised in order to comply with health and safety requirements would need to be agreed in consultation with the Home Office, the named veterinary surgeon and the named person in day-to-day care and generally be subject to local ethical review as part of the cost (in terms of animal suffering)/benefit assessment.

Animal health

The Importation of Animal Pathogens Order 1980 (IAPO) (as amended)

17 The IAPO prohibits the importation of an animal pathogen or carrier into Great Britain except under the authority of a licence in writing issued by the appropriate Minister. The conditions attached to that licence stipulate how an imported pathogen or carrier must be transported, handled and kept and how it may be used. The purpose of this Order is to prevent the introduction and spread of disease.

The Specified Animal Pathogens Order 1993 (SAPO)

18 This Order prohibits any person from having in their possession or introducing into animals any of the organisms listed in the Schedule to the Order except under the authority of a licence issued by the appropriate Minister. The purpose of this Order is to prevent the introduction and spread of disease into Great Britain.

Environmental

Controlled Waste Regulations 1992

19 Any waste which consists wholly or partly of animal tissue, blood or other body fluids or excretions, swabs, dressings, syringes, needles and other sharp instruments and any other waste from veterinary or similar practice which may cause infection is defined as clinical waste under the Controlled Waste Regulations 1992. Such waste is to be treated as industrial waste for the purposes of Part 11 of the Environmental Protection Act 1990 and so is controlled waste subject to The Environmental Protection (Duty of Care) Regulations 1991. Waste producers are under a duty to keep the waste safely and to transfer it only to an authorised person, ie one who is registered or licensed as a waste carrier who transports the waste or as a waste manager who processes or disposes of the waste. Waste producers have a duty to provide a proper description of the waste to enable it to be safely transported, packaged, labelled and disposed of and they should know how and where their waste is disposed of or treated if it is consigned to others.

Environmental Protection (Prescribed Processes and Substances) Regulations 1991

20 The incineration of animal remains, excreta and bedding is a prescribed process under these regulations and is subject to local authority air pollution control if the rate of incineration is between 50 kg and 1 tonne per hour. Animal incinerators with an operating capacity of 1 tonne or more per hour are subject to control by the Environment Agency and those with a capacity of 50 kg or less are exempt unless they are used also for clinical, sewage or municipal waste.

Water Industries Act 1991

21 Discharges of liquid waste effluent (other than domestic sewage) to the public sewers from any land or premises used for scientific research or experiment are subject to the Water Industries Act 1991. The discharge of such waste requires the consent of the sewerage undertaker who will generally impose conditions regulating the nature or composition of the discharge, the maximum quantity and rate of discharge, the temperature, pH and the exclusion or control of specified constituents.

Special Waste Regulations 1996

22 These regulations introduce a new system for dealing with the consignment of such wastes. They place duties on consignors and carriers of special waste to notify the Environment Agency of consignments and to keep records of all such movements and disposals. Certain types of clinical waste may fall within the remit of these regulations.

Local safety policies and codes of practice

23 Employers must have a health and safety policy (Section 2(3) HSWA) and undertakings with five or more employees must record their arrangements for health and safety (Regulation 4, MHSWR). While the policy statement may deal in only general terms with an employer's intent to develop and maintain a safe working environment, it could make reference to more specific information on the arrangements for working safely day-to-day which is contained in local codes of practice. Employers have a responsibility to make the policy and codes freely accessible either by putting them on display or by individual issue. All staff, including all newcomers and temporary workers, must be made aware of them.

Information, instruction and training of employees

24 There is the need to ensure a clear understanding by all employees of any identifiable risks to their health arising from work and the actions to be taken in dealing with situations in which exposure may occur. Under COSHH, employees must receive suitable and sufficient information, instruction and training on the risks and precautions to be taken. Under MHSWR, they must receive comprehensive and relevant information on the risks and preventative and protective measures together with adequate health and safety training. The local codes of practice may form part of this process of information, but thorough instruction on their day-to-day application is needed in order to make them work effectively. Further information can be found in Appendix 2.

Consultation with employees

25 Employers have a duty to consult employees on health and safety matters. The Safety Representatives and Safety Committees Regulations (1977), as amended, require employers to consult safety representatives appointed by any trade unions they recognise. Under the Health and Safety (Consultation with Employees) Regulations 1996, employers must consult any employees not covered by the 1977 Regulations. Further information and details of additional guidance can be found in the leaflet *Consulting employees on health and safety: A guide to the law* (IND(G)232L), available free from HSE's InfoLine.[17]

Health surveillance

26 Where it is appropriate for the protection of the health of employees, both MHSWR and COSHH require that employees are under suitable health surveillance. Under MHSWR, health surveillance must be provided as appropriate, having regard to the risks identified by the risk assessment. Under COSHH, health surveillance must be provided where an identifiable disease or adverse health effect may be related to the exposure, and there is a reasonable likelihood that the disease or effect may occur under the particular conditions of work and there are valid techniques for detecting indications of the disease or effect.

27 A health record as defined in the Appendix of the COSHH Regulations should be set up and maintained and where appropriate a list kept of those exposed (see paragraph 11 of Schedule 9 of COSHH). Reference should be made to regulation 11(3), Schedule 9, the general Approved Code of Practice at paragraphs 92, 96 and 97 and paragraphs 23 to 25 of the Approved Code of Practice on biological agents.

Appendix 2 Information, instruction and training

Introduction

1 Adequate information, instruction and training on all relevant aspects of health and safety at work are most important in achieving high standards; their value cannot be over- emphasised.

2 Moreover, the need for a sound understanding of the principles and practice of infection control is not confined to microbiology laboratories ie where biological agents are intentionally propagated or stored. It is just as relevant in many other types of laboratory as material of human, animal or environmental origin may carry a significant risk of infection. The general principles of occupational hygiene and infection control should be included in the syllabus of all professional bodies and teaching establishments concerned with the education and training of medical, veterinary, scientific and technical students.

3 Employers have defined responsibilities under the Health and Safety at Work etc Act 1974 (HSWA) and the Management of Health and Safety at Work Regulations 1992 (MHSWR) to provide information, instruction and training for their employees. The COSHH Regulations 1994 are specific to exposure to biological agents and except where the HSWA and MHSWR go beyond the requirements of COSHH, COSHH would prevail (see regulation 12 and paragraph 10 in Schedule 9). Employees also have a duty in law to provide their employers with information when they have knowledge of any accident and incident that has or may have resulted in the release of a biological agent which could cause severe human disease and thereby pose a threat to health.

4 Information and training provided by the employer should include instruction in the nature of the potential hazards and in the practical use of the procedures, techniques and safety equipment that are required to minimise the risk of infection. But the need for this is not limited to those who work directly with biological agents (ie at the bench); it is also necessary for auxiliary staff (for example, clerks, cleaners and porters) who must also receive comprehensible instruction appropriate to their needs. This will be particularly important where the laboratory manager(s) is not primarily responsible for the recruitment and supervision of such staff, for example, when work is contracted out. In such cases, the two or several employers need to co-operate in supplying what is required to protect those workers.

5 To be of any value, information in whatever form, must be capable of being readily understood by those to whom it is addressed. It should take account of their level of training, knowledge and experience. Special consideration should be given to any employees with language difficulties or with disabilities that may impede their receipt of information. For employees with little or no understanding of English, or who cannot read English, employers may need to make special arrangements. These could include providing translations, using interpreters, or in some cases replacing written notices with clearly understandable symbols or diagrams. Thus, except in certain cases, information can be provided in whatever form is most suitable in the circumstances, so long as it is fully comprehensible.

6 The employer, or the employing body, should appoint a person for the management of health and safety training. This could, for example, form part of the duties of the safety officer who should regularly review the standards required

in consultation with the safety committee. No new member of staff should be permitted to work with biological agents or handle infectious materials (for example in disposal procedures) until they have received suitable instruction. One particularly important feature of instruction that is often neglected is the safe operation of microbiological safety cabinets.

7 In some cases, formal courses may be necessary followed by refresher courses and lectures or other forms of instruction to keep personnel up-to-date with any changes that may have an impact on health and safety, for example, the introduction of new equipment, materials and methods. A variety of audio-visual aids is available and some colleges and health authorities offer comprehensive courses on microbiological safety.

Training for work with infected animals

8 It is a requirement of both the Council of Europe (Convention ETS 123, Article 26), the European Union (Council Directive 86/609/EEC Article 14) and the Animals (Scientific Procedures) Act 1986 that all those engaged in the use of live vertebrate animals for scientific purposes should have appropriate education and training. Workers should have knowledge, experience and understanding of both the microbiological risks and the risks associated with working with animals generally. This would normally be reinforced by formal qualifications commensurate with the animal and organism in question.

9 All staff working with animals should be aware of the appropriate regulations and if they carry out regulated procedures, they must have a Personal Home Office Licence. They must have access to a copy of Guidance of the Operation of the Animals (Scientific Procedures) Act 1986, have a thorough understanding of the Act itself and the Project Licence and be familiar with the Education and Training of Personnel Working Under the Animals (Scientific Procedures) Act 1986. They must have successfully completed an accredited training course.

Where organisms at Hazard Group 2 and higher are being handled it is most important that the worker gain experience of the required techniques using less hazardous organisms.

Appendix 3 Emergency Procedures

1 Those working with animals infected with biological agents must have in place plans for dealing with accidents involving biological agents. Such accidents might include fire in the animal house, escape of infected animals or intruders. It is recommended that such plans are drawn up in consultation with the appropriate local emergency service. Plans might also include arrangements for internal recording/reporting of accidents.

2 Schedule 9 of COSHH (paragraph 10) requires that where workers are exposed to biological agents, the information and instruction given to them should include, in the form of written instructions, the procedure to be followed after an accident or incident which may have resulted or actually did result in the release of a biological agent with the potential to cause severe human disease.

3 Where appropriate the incident should be reported under RIDDOR (see Appendix 1).

Cuts and scratches

4 In the event of being bitten or scratched (including abrasions from cages, etc), the injured person should immediately wash the wound thoroughly with water and, if possible, it should be gently encouraged to bleed. The area should then be cleaned with soap and water. If water is not immediately available, a suitable antiseptic may be used.

Spillages and emergency decontamination

5 Procedures for dealing with spillages or other accidental releases of contaminated material should be laid down in the waste management plan and be included in the written local rules or code of practice. Consideration should be given to the scale of the spill, the biological agent present, its likely route of infection and whether the spill occurs within or outside any animal containment equipment and the likelihood of a release of infected material from the containment area or the premises.

6 Spill kits should be available in the animal unit together with the appropriate personal protective clothing and equipment for use by trained operators. Kits should contain freshly made disinfectants, preferably hypochlorite solution containing not less than 10 000 ppm available chlorine, chlorine-release powder, a gelling agent or absorbent material together with paper towels, scoops, forceps and plastic bags or rigid containers.

7 PPE should include a one- or two-piece overall or garment, medium- or heavy-duty gloves and rubberised or plastic footwear all of which should be considered as disposable items. Where appropriate, RPE should be of the high-efficiency canister type also providing eye protection or closed-circuit breathing apparatus. The disposable protective equipment should be carefully removed after use and placed in a suitable waste container and non-disposable items of clothing or protective equipment completely immersed in disinfectant.

8 Spills of Hazard Group 1 or 2 agents inside flexible film isolators, microbiological safety cabinets, ventilated cage racks and similar equipment used to house experimental animal cages usually present no significant risk to humans or the animals since the latter are already infected although they may be thereby exposed to an excessive dose. The extract fan should be kept running for a minimum interval of 30 minutes to purge the ventilated equipment of contaminated aerosol particles. The cages and animals may then be removed to equivalent containment by staff wearing appropriate personal protective clothing including respiratory equipment or the spill treated *in situ* by covering it with chlorine-releasing powder or paper towels soaked in disinfectant. After an interval of at least 20 minutes, the contaminated towels and other removable items should be carefully placed into a waste disposal bag for autoclaving or incineration and the contaminated area treated with a further disinfectant wash.

9 Where the Hazard Group 1 or 2 agent is spilt or released from a breach of the primary cage containment or from the breakage of any flask or container within the animal accommodation, all persons in the room should leave immediately and then remove any contaminated clothing which should be placed in disinfectant or a waste container. After an interval of at least 30 minutes to allow aerosolised particles to settle or be cleared by the ventilation system, the room may be re-entered by trained staff wearing appropriate protective clothing including, where risk assessment dictates, respiratory protection to begin decontamination. Where practicable, the spill should be treated by wet disinfection using hypochlorite solution or by solid chlorine-release powder or other approved disinfectant, see the Diseases of Animals (Approved Disinfectants) (Amendment) Order 1994. Equipment and items that cannot be chemically disinfected *in situ* should be sealed in plastic bags and removed for autoclaving or equivalent treatment.

10 If decontamination of the spill is to be effected by disinfection within the occupied animal accommodation, the animals should either be removed to an equivalent containment level room for temporary housing or the selected disinfectant and the method of applying it should not have any significant adverse effect on the health of the animals present.

11 A significant risk to the health of humans may exist when a Hazard Group 3 agent has been accidentally spilled in or released from the primary animal containment. Human health may demand that the affected area is disinfected using a gaseous chemical agent such as formaldehyde which will pose a threat to the experimental animals. The animals may be safely and directly transferred to equivalent containment accommodation directly adjoining and accessible from the contaminated area, by staff wearing PPE and self-contained breathing apparatus or the disinfectant applied by a method that does not create a significant risk to the animals or operator. If neither of these options is practicable it may be necessary to terminate the experiment and have the animals humanely killed in order to allow the area to be thoroughly disinfected and cleaned with detergent before any items and materials are removed. The room should be subject to gaseous disinfection before being re-used.

12 Animals may be removed from the Contaminated Level 3 accommodation by placing them in a container and the outside of the container disinfected and then placing them in clean cages or by wiping down the outside surfaces of isolators or cage racks with disinfectant and moving the whole unit into equivalent and adjoining accommodation through a curtain of disinfectant spray.

13 If there is any release of a Hazard Group 4 agent from its primary animal or other containment the procedures for decontamination must place human safety above other considerations. Personal protective clothing including self-contained breathing apparatus must be worn if experienced and trained staff are required to

enter the contaminated area. If possible, any damage to the primary containment equipment should be made good by a temporary repair, for example by the application of sealing tape. The experimental animals must be humanely killed and the whole of the contaminated accommodation subject to gaseous disinfection by agents generated within the affected area or supplied to it by piping from an external generator. The animal carcasses and disposable contents of the room must then be placed in rigid waste disposal containers which are then sealed and removed for on-site incineration.

14 Spills and other releases may result in the exposure of inoculated animals to excessive amounts of biological agents so that they receive more than the intended dose of the same agent or a dose of some other agent. In such cases it may be necessary to abort the experiment if it is not possible to determine the dose received and the scientific validity or outcome of the experiment may be compromised or invalid.

15 Accidental releases of biological agents to the external environment as untreated or inadequately treated gaseous, liquid or solid effluent should be notified immediately to the appropriate authority, for example local Environmental Health Department, Health and Safety Executive area office or Environment Agency.

Appendix 4 Genetic modification

Genetically modified organisms (GMOs)

1 Many biological agents which might be used to infect animals experimentally may also be genetically modified micro-organisms (GMMs). Where this is the case, GMO legislation will apply to the genetically modified biological agent, in *addition* to COSHH.

2 Similarly there may be instances where a genetically modified animal is to be used. Like any other animal these may be infected, deliberately or incidentally, with biological agents. In this case the GMO legislation will apply to the modified animal.

3 Where GMOs or GMMs are being kept and used under contained conditions (that is where there are physical barriers which are used to limit their contact with the general population and the environment) there are two sets of GMO legislation that could apply:

(i) the Genetically Modified Organisms (Contained Use) Regulations 1992 (as amended in 1996); and
(ii) the Genetically Modified Organisms (Risk Assessment) (Records and Exemptions) Regulations 1996. (These apply only to environmental risk assessment of non-micro-organisms, ie genetically modified animals and plants.)

Work with genetically modified micro-organisms (GMMs)

4 The Contained Use Regulations 1992, as amended in 1996, require that all activities involving GMMs be risk assessed for both environmental safety and human health. Note that this is in contrast to COSHH which considers only human health. These regulations also require all premises to be notified to HSE and in certain circumstances that individual activities be notified to HSE before they commence. It is likely that most work which involves GMMs which are also biological agents will require to be prior notified.

5 The Contained Use Regulations 1992 (as amended) also require that suitable and sufficient containment and control measures be applied to protect human health and the environment. In many cases the control measures set out in this guidance will also satisfy the GMO legislation. However, because of the additional need to protect the environment there may be occasions when additional control measures need to be applied over and above what would satisfy COSHH.

Work with genetically modified organisms (GMOs)

6 Genetically modified animals also have to be risk assessed for both human health and environmental protection. In this case, the environmental risk assessment is undertaken under the GMO (Risk Assessment) (Records and Exemptions) Regulations 1996, whilst the human health and safety risk assessment is required by the Contained Use Regulations 1992. As with GMMs all premises undertaking work with modified animals have to be notified to HSE and in some cases (essentially where the modified animal is more hazardous to human health than the unmodified parent) individual activities also have to be notified. Containment and control measures have to be applied. The control measures outlined in this guidance will in many cases fulfil the requirements of the contained

use legislation, but again it is important to consider environmental protection in addition to protection of humans.

7 It should be noted that in order to be 'contained use' it is not necessarily the case that modified animals have to be kept in animal houses or similar accommodation. For larger animals such as sheep and cattle, etc, it is possible for fields with suitable fencing to constitute 'contained use'. (The risk assessment would have to be used to determine if this level of containment is appropriate.)

Additional guidance

8 HSE, on the advice of the Advisory Committee on Genetic Modification (ACGM), produces a compendium of guidance on legislation relating to the contained use of genetically modified organisms, risk assessment and containment measures. These can be obtained from: The ACGM Secretariat, Rose Court, 2 Southwark Bridge, London, SE1 9HS.

Deliberate release

9 GMOs and GMMs are also covered by legislation controlling their release into the wider environment. The Genetically Modified Organisms (Deliberate Release) Regulations 1992 and 1995 together with the Environmental Protection Act 1990, require that any GMO being deliberately released to the environment are released only with the consent of the Secretary of State for the Environment. The deliberate release legislation is administered by the Department of the Environment

10 The production and breeding of genetically modified animals (transgenic animals and harmful mutants) must be done under a Project Licence issued under the Animals (Scientific Procedures) Act and the animals will remain under the control of the Project Licence until used under the 1986 Act or deliberately discharged from its controls for non-regulated scientific use or for export. Permission from the Home Office must be obtained before deliberate release or discharge of genetically modified animals from the control of the Act.

Appendix 5 Containment of invertebrates

1 Many invertebrates are the natural or experimental hosts or vectors for a range of infectious agents. Work with invertebrates may vary from simple species identification to detection of any infectious agents they may be carrying through to their deliberate infection for research purposes.

2 The important invertebrates are:

- Protozoans
- Platyhelminths
- Aschelminths
- Molluscs
- Annelids
- Arthropods
- Echinoderms.

3 Where invertebrates are known to be infected or may be infected with biological agents, the principles of containment described for animal rooms must be applied. If, for example, a wild-caught invertebrate is to be examined for the presence of a human pathogen that it may normally be expected to transmit (for example *Trypanosoma cruzi* in a triatomine bug), then work should be done at the level of containment appropriate to the hazard grouping of the agent concerned.* In adopting the principles used in the containment of animals, the following additional points should be borne in mind.

4 Separate rooms should be used for infected and non-infected invertebrates and they should be contained appropriately according to whether they:

(a) live in water (aquatic);
(b) are amphibious;
(c) crawl or jump;
(d) fly.

5 Aquatic or amphibious invertebrates should be kept in tanks with lids to prevent escape.

Flying, crawling or jumping insects

6 For invertebrates that crawl, jump or fly, the following additional precautions should be taken:

(a) rooms should be insect-proof;
(b) ventilation inlets and outlets should be screened;

* Note that full Containment Level 3 is not always required for work with a Hazard Group 3 agent. Non-infective stages in the life-cycle of a parasite and certain agents for which a derogation has been allowed (see Exemption Certificate with the approved list of biological agents) may not always demand, for example, an inward airflow or use of a safety cabinet.

(c) entry to the rooms/suite should be through an airlock; consideration should be given to placing 'insectocutors' in the airlock;

(d) measures should be taken to enable escaped invertebrates to be easily detected and recaptured or destroyed;
(e) a laboratory sink should be provided with an adequate trap for waste; if there is a possibility that escaped invertebrates could escape through the trap, liquid waste should be treated before disposal (preferably by heat - see below);
(f) solid waste is most effectively treated by heat because it may harbour invertebrates that may not be killed by chemical disinfectants or fumigants;
(g) insecticidal sprays may be necessary in an emergency but it should be remembered that their use in a small room may render the room unfit for accommodating invertebrates for a long period if not permanently; non-residual type insecticides should be chosen. This activity should be carried out safely;
(h) arthropods may be chilled to reduce their activity and minimise the risk of escape;
(i) at Containment Levels 1 and 2, flying or crawling arthropods should be handled on white trays to detect escapees;
(j) for ticks and mites, containers should be kept over trays of oil;
(k) flying insects infected with agents in Hazard Groups 2, 3 or 4 should be kept in double cages (for example, a sleeved netting cage inside a clear substantial plastic bag) and both enclosures should be labelled;
(l) experimental cages/containers should be numbered and labelled or otherwise documented to indicate the hazard;
(m) at Containment Levels 3 and 4, flying or crawling arthropods should be kept in identified lots and each lot accounted for; they should also be handled in an appropriate containment device;
(n) laboratories receiving potentially infected invertebrates for identification or examination, where the specimens are not known to be dead, should ensure that containers are opened in an appropriate safety cabinet or other safe form of enclosure;
(o) a record should be made of the number of individual invertebrates at the earliest practicable time, and each invertebrate should be accounted for as the work proceeds through to final fixation or disposal;
(p) where identification of flying or crawling invertebrates alone is required, the container may be frozen at -20°C, or lower as necessary as some arthropods can withstand prolonged freezing, for 2 hours to kill them.

Bibliography

1 Health and Safety Commission's Advisory Committee on Dangerous Pathogens *Categorisation of pathogens according to hazard and categories of containment* HSE Books 1990 ISBN 0 11 885564 6

2 Health and Safety Commission *Control of Substances Hazardous to Health Regulations 1994 - General COSHH ACOP, Carcinogens ACOP and Biological Agents ACOP* (L5) HSE Books 1995 ISBN 0 7176 0819 0

3 Health and Safety Commission's Advisory Committee on Dangerous Pathogens *Categorisation of biological agents according to hazard and categories of containment* (4th edition) HSE Books 1995 ISBN 0 7176 1038 1

4 Health and Safety Commission's Advisory Committee on Dangerous Pathogens *The management of simians in relation to infection hazards to staff* (in preparation)

5 Health and Safety Commission's Education Services Advisory Committee *Health and safety in animal facilities* HSE Books 1992 ISBN 0 11 886353 3

6 Health and Safety Commission's Education Services Advisory Committee *What you should know about allergy to laboratory animals* HSE Books 1990 ISBN 0 11885527 1

7 *Preventing asthma at work - how to control respiratory sensitisers* HSE Books 1990 ISBN 0 7176 0661 9

8 Medical Research Council *The management of simians in relation to infectious hazards to staff* 1990 A Statement by the Medical Research Council

9 Health and Safety Commission's Advisory Committee on Dangerous Pathogens *Guidance on the use, testing and maintenance of laboratory and animal flexible film isolators* HSE Books 1985

10 The Biological Council Animal Research and Welfare Panel *Guidelines on the handling and training of laboratory animals* UFAW 1992 ISBN 0 900767 77 4

11 Svendsen P and Hau J (Eds)*Handbook of laboratory animal science - Volume 1:Selection and handling of animals in biomedical research* CRC Press 1994 ISBN 0 8493 4378X

12 Tuffery A A (Ed) *Laboratory animals: an introduction for experimenters* John Wiley and Sons 1994 ISBN 0 4719 5257 5

13 Wolfensohn S and Lloyd M *A handbook of laboratory animal management and welfare* Oxford University Press 1994 ISBN 0 19 854832 X

14 Health and Safety Commission's Advisory Committee on Dangerous *Pathogens Precautions for work with human and animal transmissible spongiform encephalopathies* HMSO 1994 ISBN 0 11 321805 2

15 *Home Office Code of Practice for the housing and care of animals used in scientific procedures* HMSO 1989 ISBN 0 10210789 0

16 Home Office *Guidance on the Operation of the Animals (Scientific Procedures)* Act 1986 HMSO 1990 ISBN 0 10 218290 6

17 *Consulting employees on health and safety: A guide to the law* IND(G)232L HSE Books 1996

Other publications of the Advisory Committee on Dangerous Pathogens are available as follows:

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BSE (bovine spongiform encephalopathy): background and general occupational guidance HSE Books 1996 ISBN 0 7176 1212 0 Price £5.50

Microbiological risk assessment: an interim report HMSO 1996 ISBN 0 11 321990 3 Price £9.95

Advisory Committee on Dangerous Pathogens and Advisory Committee on Genetic Modification *Vaccination of laboratory workers handling vaccinia and related poxviruses infectious for humans* HMSO 1990 ISBN 0 11 885450 X Price £5.50

Guidance on the use, testing and maintenance of laboratory and animal flexible film isolators 1990 Available free of charge from the Health and Safety Executive, Health Directorate, Rose Court, 2 Southwark Bridge, London SE1 9HS

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