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# Code of Practice for the prevention and control of rodent infestations on poultry farms



All information contained in this brochure was correct at time of going to press (April 2009).

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This document is also available on the Defra website.

Published by the Department for Environment, Food and Rural Affairs.

Printed in the UK, March 2009, on material that contains a minimum of 100% recycled fibre for uncoated paper and 75% recycled fibre for coated paper.

PB13233 amended and reprinted April 2009

This voluntary Code of Practice is issued by the Department for Environment, Food and Rural Affairs. It has been drawn up in consultation with the Scottish Government, the Welsh Assembly Government, the Department of Agriculture and Rural Development (Northern Ireland), the Food Standards Agency, the British Egg Industry Council, the British Poultry Council, the British Veterinary Poultry Association, the National Farmers' Union, Natural England and the Veterinary Laboratories Agency.

All Defra Codes of Practice are available from Defra Publications, Admail 6000, London SW1A 2XX, telephone (0645 556000). The Code of Practice for the Prevention and Control of rodent infestations in poultry flocks is also available on the Defra website, together with Codes of Practice for the prevention and control of *Salmonella* in Commercial Egg Laying Flocks and in flocks of chickens reared for meat.

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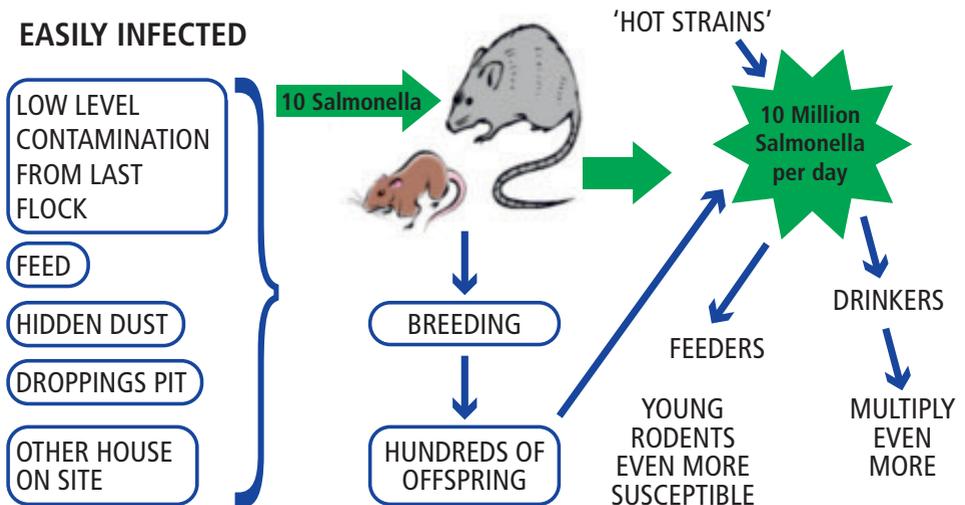
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# Introduction

Rats and/or mice are commonly found in or around poultry units. They pose a number of problems including a threat to *Salmonella* control. There are many reasons why controlling rodents on poultry farms is important including:

- Rodents can carry other diseases relevant to poultry health such as fowl cholera and erysipelas.
- Rodents can also carry zoonotic<sup>1</sup> diseases such as leptospirosis and hantavirus which pose a risk to the health of farm staff.
- Rodents cause damage to farm buildings and poultry houses, including damage to electrical installations resulting in fire risk,
- Rodent populations consume the poultry food and large infestations can cause feed spoilage.

## The importance of rodents



[NB Free-living rodents in the wild very rarely carry *Salmonella* – they get infected on the farm by birds]

1 Zoonotic diseases are diseases transmissible from animals to humans

Research findings in several countries, especially the UK and USA, have confirmed that rodents play a major part in the maintenance of *Salmonella* Enteritidis and Typhimurium on poultry farms.

Rodents are important in *Salmonella* control because they can act as the main driver of infection on a poultry unit – in fact on many units *Salmonella* will clear from flocks if rodent infestations are eliminated. This is a much better option than waiting until the end of lay before trying to eliminate *Salmonella* as new birds placed in a contaminated house just before point of lay are very susceptible to infection.

Rodents can be infected with a very low dose of *Salmonella* and then multiply it up so as to be excreting millions of organisms per day at the peak of infection. They can also remain infected for months. Because rodents can excrete so much *Salmonella*, the protective effect of vaccination may be overwhelmed so even well managed flocks, which have been properly vaccinated, may still succumb.

Adopting a systematic and organised approach to rodent eradication and prevention of infestations should be included as a major part of the unit and flock management and, if the strategy is to be successful, it must be carefully planned and have adequate resources committed to it.

**When *Salmonella* is known to be present on a poultry site, it will be necessary to virtually eradicate all rodents from positive houses and ensure that there are no breeding populations if control of infection is to be successful.**

## Aims of the Code

The Code of Practice provides information and guidance for flock owners, managers, farm staff and their advisers, with the information necessary to:

# Introduction

- **Quantify the significance of rodent infestation problems.**
- **Enable the planning of control strategies.**
- **Assist with the implementation of control action.**
- **Identify the need for preventative measures.**
- **Ensure compliance with the relevant pesticide and other legislation.**

The overall aim should be to prevent rodent infestations becoming established by linking a treatment programme to regular monitoring. The control strategy will vary according to whether action is needed whilst the birds are occupying the buildings or at the end of the cycle when depopulation, cleaning and disinfection is carried out. A combination of good management, hygiene and proofing measures will make a valuable contribution to the long-term prevention of rodent infestations.

Two rodent species are likely to cause problems in poultry units – the house mouse, *Mus domesticus* and the brown or Norway rat, *Rattus norvegicus*.

In the context of *Salmonella* control, both the house mouse and the brown rat are important due to their habit of living in close proximity to poultry flocks and an ability to move within and between buildings and structures. The favourable environment found in poultry units encourages breeding populations of rodents and can lead to high population levels if not adequately controlled.

The two species vary considerably in their physical characteristics and behaviour and, where appropriate, these are dealt with separately when this is relevant to the choice and application of control measures.

## 2. Significance of infestation

### 2.1 Transmission of disease

Rodents are capable of transmitting diseases to both humans and livestock. They are easily infected by *Salmonella* and can carry and excrete high numbers of organisms, particularly in droppings, and may therefore be an important means of spread of bacteria and persistence of infection within units.

Although free-living rodents rarely carry *Salmonella*, their main involvement is to maintain infection acquired from an infected flock during the depopulation period and spread it to replacement birds and in some cases to other houses on the site. At the end of the lifespan of an infected flock it is normal to clean and disinfect the house to eliminate *Salmonella*, but if infected rodents are present they will rapidly recontaminate disinfected surfaces and equipment and the replacement birds coming into the house will then become infected. Rodents may also disperse into other houses on site during clean out.

Mice may become infected after exposure to low levels of contamination in feed or dust in inaccessible places inside or around the house, which would not normally infect the birds but because of the ability of rodents to multiply *Salmonella* – this may then lead to infection in the flock. Some strains of *Salmonella* Enteritidis (SE) that have originated from mice have also been shown to be more infectious for birds and more likely to be found in the contents of eggs, not just on the shell.

Rodent nests in bedding or rodent droppings can cause contamination of equipment. Movement of this equipment can spread infection to other units and farms.

## 2. Significance of infestation

### 2.2 Damage to buildings and equipment

The gnawing abilities of rodents will threaten the structure of buildings, thermal insulation and any other vulnerable materials. Damage to cable insulation can lead to electrocution risks, fire hazards and may contribute to equipment breakdown including ventilation systems and feed-handling facilities.

### 2.3 Contamination of feedstuffs

Rodents can consume significant quantities of expensive compound feedstuffs when high populations are present. Contamination by rodent urine and droppings may reduce feed palatability and increase the risk of disease.

### 2.4 Quality standards

The presence of rodents may compromise quality standards demanded by customers, particularly where pest-free status is a contractual requirement. It is also a requirement of the food hygiene legislation<sup>2</sup> that keepers of poultry take measures to prevent pests as far as possible from causing contamination.

2 The Food Hygiene (England) Regulation 2006 SI 2006/14 (as amended). Equivalent legislation in other countries in UK.

## 3. Biology and characteristics

### 3.1 Basic requirements

A number of factors affect the successful establishment of rodent populations and influence the level of infestations.

Rodents need:

- a) Food
- b) A safe environment (i.e. harbourage in areas such as droppings pits, storage areas, wall or roof cavities and other undisturbed locations.)
- c) Breeding sites
- d) Water.

The habitat offered by the typical poultry building often produces optimum conditions for rodents. This includes a constant temperature-controlled environment, freedom from predators and encourages the largely nocturnal activities of rats and mice.

Rodents have virtually unlimited access to high quality, nutritious feedstuffs that can be obtained directly from feeders, conveyors or open hoppers, and as a result of spillages.

Fresh water is also constantly available and although house mice do not require a free moisture source in order to survive, they will exploit such supplies, especially when breeding.

Wall cavities, insulation layers, roof spaces and voids created between floors and other sections of the building structure will generally provide a safe environment. Rats will also often occupy outdoor locations, adjoining buildings and other structures before moving into houses. These include accumulated rubbish, stored materials, patches of vegetation and ditches, banks or hedgerows.

## 3. Biology and characteristics

Droppings pits and slatted areas also provide cover for mice and rats that will burrow and live within these accumulations. A build-up of waste material on other parts of the structure such as beams, ledges and pillars also offer a suitable habitat. The presence of feathers and droppings/litter provides ideal nest materials.

In barn and free-range units it is common for the housing of automated nest boxes to provide protection for mice, which then move around below nest boxes, on egg belts, tops of partitions or ledges or inside conduits.

### 3.2 Living and movement patterns

Rats and mice live in family groups and will defend their territories against intruders. However, there are differences between the two species that need to be understood in the context of controlling infestations.

#### House mice

Mice will generally occupy the structure of the building although they can be also found around perimeter areas, especially if the outside of buildings and storage areas are not kept tidy and/or properly baited. They may also be found, less frequently, in hedgerows or other adjacent habitats.

Mice occupy small territories, which means that a large number of discrete family groups may exist within typical harbourages, such as droppings pits and wall roof spaces, and these will live independently of each other. When the population density is high and food and water are readily available the territory occupied by each individual group is smaller. For example, several family groups may be found in accumulated dry manure on each beam below cages in deep pit houses.

## 3. Biology and characteristics

### Common rat

Rats may be found both indoors and outdoors. They may live within buildings or other structures, in areas around sites and will often excavate burrows around the perimeter of buildings or in nearby ditches, hedgerows and the cover provided by rubbish, equipment or other materials. Drainage systems or other similar structures such as ducting are also used. They will establish regular runs from where they are living to sources of food. These outside areas act as 'staging posts' from which the rats that have initially been attracted by spilled feed and eggs will subsequently move into houses and find harbourage there.

Rats will move into farm buildings in larger numbers in the autumn and winter when the weather is cold and wet and food is less readily available following harvest. This is important with regard to the timing and planning of control measures – which should therefore be intensified and targeted at potential entry points at these times of the year.

Rats and mice will readily move from a location when disturbed and the removal of food sources and cleaning of units will encourage them to seek alternative sites. This may encourage the spread of rodent populations resulting in the possibility that disease could be introduced into previously clear neighbouring units.

Although the objective should be to rapidly eliminate infestations during the life of a flock, which provides a chance of clearing the flock *Salmonella* infection within lay, inadequate emphasis on rodent control during turn-round periods can allow remaining rats and mice to survive, protected within the structure of buildings. They then form the nucleus of future infestations and may be a source of carry-over for *Salmonella* infections. Rats remaining in depopulated houses are also more likely to move to adjacent houses, with a consequent risk of spreading *Salmonella* if the original house was positive.

## 3. Biology and characteristics

### 3.3 Behavioural characteristics

As rats and mice vary considerably in their general behaviour and feeding patterns, a variety of rodenticide baiting techniques is needed, often to be applied simultaneously.

#### Mice:

Mice live in small social groups and their erratic feeding behaviour results in them visiting a number of different food sources during periods of activity. As a result it is necessary to provide an adequate number of bait points in places where rodents are living or moving. It is also important to move the baits regularly within territories to maintain the interest of mice and to make sure that the bait is palatable and being well taken by the rodents as tastes for different baits do vary. Bait should also be kept fresh, free from dust and placed where the rodents are nesting and travelling – not just in set baiting points. This will often involve creating covered access points in walls, roof spaces, mini-pits, etc. in which to place bait. Access points to houses such as the entrances of manure and egg conveyors, doors, drains and low-level vents should also be baited.

#### Rats:

In contrast, rats exhibit behaviour known as 'new object reaction' or neophobia. This makes them suspicious of anything introduced into their territories and as a result it may take a number of days before they are prepared to investigate such items. In practice, this often means that they are slow to explore bait boxes and trays, and to start feeding on rodenticide baits especially when they are established within poultry houses. For this reason, it is best to allow two to three weeks for rats to get used to feeding in bait boxes placed in their environment, before making a decision on whether or not the method being used is working. This should be assessed by regular monitoring of bait consumption and rat activity.

## 3. Biology and characteristics

Both species are capable of gnawing a range of materials including concrete, wood, soft metals and plastics. They are able to climb vertical, relatively smooth surfaces and cross structures such as horizontal wires and cables. Entry to buildings is gained through small gaps and they can jump significant distances and burrow in soil or other materials. They are also able to swim.

### 3.4 Rodenticide resistance

The existence of so called 'super' rats and mice, which are able to survive doses of a particular rodenticide that would normally be expected to kill them, is often quoted as the reason for treatment failure. However, it is more likely that factors such as poor techniques in application, positioning of bait points and monitoring of baiting measures, combined with a lack of intensity are to blame for ineffective control.

Nevertheless, genetic resistance to several anti-coagulant compounds is present in some rat and virtually all mouse populations. It is important to understand that rodents are either born susceptible or resistant and cannot acquire this characteristic during their lifetime.

Resistance to the first generation anti-coagulants such as warfarin is widespread in house mice and so the use of these compounds is not recommended for use against this species.

The situation with regard to rats is less clearly defined and confirmed pockets of resistance have been identified in various parts of the country. Where there are problems with the efficacy of first generation compounds it is recommended that a second generation rodenticide be used, having regard to the approval status and conditions of use of the product. The pattern of resistance is constantly changing and will influence future control strategies.

## 4. Site assessments

### 4.1 Inspections and surveys

Before control action is taken, a full survey of the site should be undertaken with particular attention to vulnerable or potential rodent-infested areas. This needs to be carried out by competent personnel and repeated periodically in order to monitor the situation. It includes asking farm staff about their sightings of rodents and signs of rodent activities and performing a very detailed visual inspection of the premises using a suitable torch. In addition, the performance of existing treatments against current infestations should be checked to enable a prompt response to any new problems. Inspection must include all buildings and structures within the unit and any outdoor locations and habitats such as the surroundings of houses – looking for possible entry points and signs of activity, store-rooms, workshops, stacked materials, boundary hedgerows and ditches. In respect of rats it may also be necessary to check for the possibility of animals moving in from neighbouring properties.

**The objectives of such an inspection are to:**

- **Identify the species of rodents involved.**
- **Assess the distribution and level of infestation.**
- **Identify where rats and mice are living, travelling and feeding.**
- **Identify any factors which might have an influence on control action such as specific risks to non-target animals including stock and wildlife.**
- **Identify deficiencies in proofing and tidiness or hygiene measures.**

The annex at the back of this code provides a simple audit form which may be of assistance in assessing the actual or potential rodent-related problems.

## 4. Site assessments

### 4.2 Inspection procedures

It is valuable to carry out inspections at night, when movement of live rodents particularly rats, is most likely to be seen.

Site staff should be consulted and their observations included as part of the survey. All holdings should maintain a “pest book” in which rodent sightings and other relevant information are recorded. This should be checked whenever an inspection is made.

Each area should be systematically inspected for signs of rodents or any other aspects relevant to control activities and these findings should be noted. A plan of the main buildings and features within the site and a sketch of the internal structure of each unit, will help to ensure that accurate details are recorded. This information can then be used when control treatments are undertaken and baiting points need to be identified. All levels of the building should be considered including: pits, walls, equipment, roofs, service areas, as well as adjacent external or storage areas.

A powerful torch is essential when inspecting buildings to be able to check all areas including pits, voids, and roof spaces and where access is limited, and light levels are low. A smaller torch is useful for occupied buildings where birds may be frightened by the beam of light. In some cases it may be necessary to remove wall or ceiling panels to identify nesting areas.

These activities inevitably involve handling surfaces, which may have been contaminated by rodents, and so suitable, waterproof gloves should be worn in addition to the protective clothing required for bio-security reasons. Other precautions are described in Section 7.

Particular attention should be paid to the following areas and situations:

## 4. Site assessments

### Buildings

- Feed and egg stores.
- Hoppers and feeders.
- The presence of food spillages.
- Storage areas within units which may contain harbourage such as egg trays, boxes and equipment.
- Hollow walls, partitions, roof spaces or any other voids, particularly where thermal insulating materials are present.
- Electrical control panels, junction boxes and conduits for wiring systems.
- Tops of cages, egg belts, beams, ledges, partitions, conduits, and other horizontal surfaces that may harbour rodent droppings or show signs of movement. In some cases such areas may be out of reach, or droppings concealed by dust, but these can usually be identified by close inspection aided by torch light.
- Litter and droppings pits.
- Equipment within areas occupied by birds, such as automatic egg collection equipment and nest boxes, particularly the ends of the units and egg belts or ledges/trays within the outer housing and the floor beneath nest boxes. Chewing damage to plastic flaps is a common sign to look out for.
- Any faults in building structures which might permit rodent access.
- Storage of materials or equipment in and around houses.
- Other access routes such as gaps beneath or around doors, fan housing, manure belts, egg conveyors and service entry points.

## 4. Site assessments

### Outdoor locations

- Accumulations of materials and vegetation, especially those close to buildings.
- Feed bins and hoppers – spilled feed and feed dust.
- External egg conveyors that provide a link between buildings.
- Incinerator and rubbish disposal sites.
- Areas of vegetation or undergrowth.
- Ditches, hedgerows or banks.
- Drainage systems and associated equipment.
- Neighbouring sources of infestation – e.g. other livestock units, woodland, waste disposal sites.

### 4.3 Traces and signs

Both rats and mice leave characteristic evidence of their presence and this is useful for estimating the size and distribution of infestations. Rodents are largely nocturnal and so a combination of these signs has to be employed in the initial assessment of infestation and when evaluating the results of control action.

It is common for rodent populations to be vastly under-estimated when based on rodent sightings alone. Therefore other information is essential to confirm the rodent species involved and the level and distribution of infestation.

#### a) Droppings

Rats will usually deposit droppings at specific locations throughout their territories. These are often found behind structures or objects that provide cover and security and in areas where rats are regularly moving. Droppings are approximately 12mm (1/2 inch) long, elliptical in shape and when fresh, can be distinguished by their moist,

## 4. Site assessments

shiny appearance. Droppings allowed to remain on walkways and other surfaces used by site staff, can be picked up on footwear and transferred to other areas. This can have significance for the spread of disease.

Mice will leave droppings randomly throughout their territory, depositing them on horizontal surfaces over which they are moving such as egg belts, beams, ledges and conduits. Droppings are about three to seven mm ( $\frac{1}{4}$  inch) long and spindle shaped. Areas where there are greater accumulations of droppings are normally those where mice are spending most time or passing through more frequently.

### b) Smear marks

The natural grease on the bodies of rodents attracts dirt that will be deposited at various locations that are used regularly by rats and mice. These appear as dark marks that are commonly found in association with holes in structures, over ledges or along pipes, cables or other obstructions used by rodents. The smears may remain for long periods after they have been deposited so their presence needs to be linked to other signs of infestation to ensure that information obtained on the current status of rodents is accurate.

Mice will urinate at specific locations and the combination of concentrated protein in the urine and dust which settles leads to the formation of small conical pillars that are often found on pipes, cables and ledges that are used regularly. Such signs indicate long-standing, heavy mouse infestations but they may also persist over time and so their presence should also be linked with other signs of infestation when assessing current rodent activity. The waxy nature of urine pillars renders them relatively resistant to disinfection so such areas should be especially well cleaned and disinfected.

## 4. Site assessments

### c) Footprints

Prints or tracks may be found in mud or dust at ground level or in accumulations on structures such as beams and ledges. Such signs can provide useful information on the general location and movement of rodents.

### d) Run and burrows

Rats will create regular, well-worn tracks that are usually found protected by cover such as vegetation or close to walls or other structures. They are often connected to burrows that have been excavated in ditches, banks or in other areas adjacent to buildings.

Mice burrow less commonly, although holes in earth floors and around the perimeter of buildings can indicate their presence. As mice usually live within structures, their activities can be identified by holes gnawed in panels or cladding, often at wall and ceiling intersections. Insulating materials ejected from wall panels can be a useful indicator of activity. Access may be gained via faults in areas such as concrete floors and block work. Expansion joints may provide access points for mice. Particular attention should be paid to wall areas around control panels or other equipment where it may be possible for mice to gain entry through holes cut for cables or other services. Chewed thermal insulation material is often associated with holes in the walls and roofs of buildings. Tunnel entrances in litter or accumulations of droppings may indicate burrowing activity by mice or rats.

### e) Damage

Identifying gnawing of building structures or similar damage to equipment can be useful in locating and quantifying rodent activity. It is also important to locate damage to electrical cabling because of the risks involved (electrocution/fire risk). The discovery of chewed materials found when investigating accumulations of rubbish or other

## 4. Site assessments

vulnerable materials – such as bales of wood shavings, paper sacks or egg trays – can also provide important information on the activities and distribution of rodents.

### f) Nest sites

Rodents will make nests from any available materials. Particular attention should be paid to areas where droppings might accumulate on ledges or other structures and these can often reveal the presence of nests, particularly where mouse infestations are heavy.

### g) Other signs

Reports of rodent sightings or presence can be useful, providing the information source is reliable. Other signs can include the pungent, unique smell that is present with heavy mouse infestations and to a lesser extent, where rats are involved. This is particularly noticeable on initial entry from the fresh outdoor air. In bulk storage areas for cereals there may also be evidence of rat-tail marks on the surface of the grain.

### h) Traps

Live or spring traps may be used to assess changes in rodent populations if they are deployed in an effective and systematic way. Absolute rodent counts depend on the number, type and location of traps and a minimum of 20 well-placed spring traps per house, baited with an attractive bait such as chocolate nut spread, is recommended to monitor progress in mouse control. The aim should be getting down to a level where less than one mouse per house per month is being caught.

# 5. Control strategies and techniques

## 5.1 Treatment options

Rodent eradication and prevention of infestations should be included as a major part of the unit and flock management and, if the strategy is to be successful, it must be carefully planned and have adequate resources committed to it.

Effective control can be achieved by taking one of the following options listed below:

1. Obtaining the services of one of the larger pest control companies or using a local contractor. The main consideration is the ability to agree on a contract that will meet the needs of the enterprise and the demands of current and future rodent problems.
2. An alternative is for farm staff to carry out the control program. Those involved must, as required by the legislation, receive adequate training and instruction and be competent in the use of pesticides. Product label instructions and directions for use should be read, understood and followed. It is therefore essential that individuals undertaking the work are provided with the appropriate equipment and materials, and allowed the time necessary to deal with problems that arise and carry out the other activities that form part of a control programme.
3. It may be appropriate to use a combination of these options with a contractor experienced in dealing with this type of rodent problems, working in conjunction with farm personnel who undertake the day-to-day work.

With the use of a specialist contractor, there still remains a need:

- for unit management and staff to have an understanding of rodent biology and behaviour,
- to make regular inspections and frequently replenish bait,
- liaise with contractors to obtain accurate details of and be familiar with control techniques used.

## 5. Control strategies and techniques

In considering the available options and regardless of the approach adopted, it is essential that sufficient time and resources are allocated to rodent control. This includes the assessment and monitoring of infestations, carrying out control measures using sufficient fresh bait and baiting points, and checking on the progress and success of operations.

The appropriate techniques for controlling most rodent infestations involve the use of toxic rodenticides presented in edible bait formulations. Alternative control methods are described in Section 6.

Such materials have to be approved under the Control of Pesticides Regulations 1986 and must be used according to the approval conditions and label instructions. The selection of products needs to take account of:

- the active ingredient involved
- palatability
- the type of bait presentation
- the differences between rats and mice with regard to susceptibility to the compound involved, behaviour and other relevant variations between the species.
- It is also necessary to be aware of the potential risks of primary and secondary poisoning to other animals that could be exposed to toxic baits or poisoned rodent carcasses.

### 5.2 Rodenticide options

The majority of the products currently available for use against rats and mice are anticoagulant based. These compounds interfere with the metabolism of vitamin K, which is involved with the production of blood clotting factors. If these are absent or below critical concentrations, the blood fails to clot and internal haemorrhaging occurs.

## 5. Control strategies and techniques

Most products require the rodent to take several feeds and death is usually delayed for several days. However, there are some single-feed products that are more toxic which can be used with care within houses with a persistent rodent problem, but not outside the houses.

It is important that adequate fresh bait at a sufficient number of baiting points is present throughout the treatment period. **In houses that have *Salmonella* and rodent problems, it is recommended that there should be a baiting point every three to four metres across the whole house, not just around the walls.** This means anchoring baiting points if dust is blown. Bait should also be carefully placed on any ledges and in any gaps used by rodents. It is particularly beneficial to create ports in wall and roof spaces or minipits to place bait in inaccessible areas in which rodents are nesting or moving.

### First generation anti-coagulants

**These include rodenticides based on: warfarin, chlorphacinone and coumatetralyl.**

These compounds are still effective against susceptible rat populations that are not genetically resistant to such active ingredients. In practice, this means that many rat infestations in this country can be dealt with using products containing these rodenticides. However, because house mice are naturally less susceptible to them, their use against this species is not recommended.

### Second generation anti-coagulants

**These include: difenacoum, bromadiolone, brodifacoum and flocoumafen.**

All four compounds are more potent than the first generation group and are effective against most rat populations that are resistant to first generation anti-coagulants. They are also all suitable for use against

## 5. Control strategies and techniques

house mice. The exceptions are situations where rats and mice are shown to be resistant to difenacoum and bromadiolone.

Difenacoum and bromadiolone formulations may be used in both outdoor and indoor locations whilst brodifacoum and flocoumafen must only be applied indoors because of their greater single-dose toxicity. This is a legal requirement due to the greater potential hazard that such compounds present to non-target animals.

### Other compounds

Currently, the only non-anticoagulant rodenticides approved are alphachloralose, which can only be used indoors against house mice, and powdered corn cob which is suggested for rats, although efficacy data is lacking. Alphachloralose is a non-recovery anaesthetic which has a more rapid action in cool conditions such as when buildings have been depopulated.

### 5.3 Rodenticide formulations and presentations

Whichever formulation or means of presentation is used, great care must be exercised where there is the possibility of feedstuffs, livestock and products such as eggs becoming contaminated.

Edible baits are produced in various formulations including:

- meal or cut cereals
- whole cereals
- pellets
- peanut oil and pasta based paste sachets
- wax-bound cereal blocks
- lards and gels

## 5. Control strategies and techniques

Rodenticides may also be presented as water based bait and as contact products, including gels and dusts.

Dusts and other contact rodenticides rely on the rodent picking up the toxic material on its body and then ingesting small amounts during grooming activity. Accordingly, the formulations are more highly concentrated than bait equivalents and this makes them unsuitable for application where feedstuffs, or products such as eggs could be exposed to such materials with the risk of contamination.

Contact gel rodenticides are only approved for use in the control of mice. Two currently available presentations consist of either a tube containing wicks impregnated with brodifacoum or a difenacoum gel that can be applied in sections of plastic conduit type tubing or to gaps and holes used by mice.

Tubes can be fixed or applied to beams, pipes or ledges and used to good effect as a long-term, preventative control technique. They may also have an application in areas where bait placement is difficult and mice are refusing to consume edible baits, but they must be carefully placed after assessing the routes regularly used by mice.

The use of liquid baits in poultry units is likely to have practical limitations but may be a useful option against rats in dry conditions where rodents do not have ready access to water. Application via drinker bottles – intended for small rodent pets – may be appropriate to avoid the water becoming stale and dusty.

### 5.4 Fumigant use

The use of gassing is limited to the control of rats in outdoor burrows. It is very unlikely that these techniques will have a regular application in dealing with rodent problems on poultry units. Phosphine is a very toxic gas and must not be used near to buildings or in any other structure or situation that might present a hazard. Rat burrows

## 5. Control strategies and techniques

excavated in droppings pits or within three metres of buildings occupied by man or animals must NOT be treated by gassing. Such use also requires specific training and should only be undertaken by suitably instructed operators who must comply with the product label instructions and directions for storage, use and the safe disposal of used containers.

### 5.5 Formulation choice

A number of conditions will influence the choice of which formulation(s) to use and these include:

- rodent species
- location (indoors or outdoors)
- non-target species or other hazards
- adverse site conditions (including damp or dusty environments)
- cost of materials

Palatability is probably the most important issue for successful baiting and rodents will be reluctant to take bait if it is less palatable than the poultry feed that they have access to. Products must therefore be assessed for palatability/uptake and kept fresh and free from dust. It is also very important to place bait close to rodent nesting areas and run routes so they are more likely to travel to the nearby bait than to more distant feed or broken egg material.

Most rodenticides are now purchased as ready-to-use formulations. However, a number of concentrates or master-mixes are available which allow users to formulate their own baits using substrates such as lard or feed mixtures that have been shown to be palatable to local rodent populations.

## 5. Control strategies and techniques

The requirements of the Control of Substances Hazardous to Health Regulations (COSHH) must be considered and concentrates are generally only supplied where their use can be justified on sound technical grounds. These can include the need for fresh or different bait bases in response to palatability or bait acceptance problems and a wish to utilise a liquid bait presentation. Users must satisfy the requirements of COSHH, including the availability of adequate storage, mixing facilities and suitable protective clothing. As with all pesticide use it will be necessary for such users to have made a risk assessment of the compounds that they intend to use.

No hard and fast rules can be given with regard to the choice of formulation and much will depend on the nature and circumstances of the problem including what previous control actions have been taken. There will often be a number of options that will be equally suitable and effective, or combinations of approaches may be most effective.

### 5.6 Baiting techniques

Having carried out a survey of all areas of the site and buildings, and decided upon a suitable rodenticide, it will then be necessary to establish sufficient bait points at appropriate locations that will cover all areas of rodent activity. However, application may have to be restricted due to factors including:

- hazards to poultry or other non-target species
- risks of contaminating feed or sensitive areas
- adverse conditions (e.g. wet floor areas) – during cleaning
- where baits will be regularly disturbed or eliminated.

## 5. Control strategies and techniques

Commercially available bait trays, boxes or containers may be used or boxes can be constructed from wood or other materials such as egg boxes or trays. Where safe to do so, bait can be laid directly behind structures, in holes or gaps within buildings and in droppings pit areas. Sachet formulations can be useful for this. However, as with all bait placement, it must be adequately protected from access by non-target species. Where possible, contamination by dust or moisture should be avoided. Consideration must be given to the risks that bait placed in pits or other areas might be removed from buildings and relocated outdoors such as when a treated manure pit is emptied. This could then become exposed and pose a poisoning threat to other animals so bait containers should be removed before mucking out pits.

Within poultry units there are a number of key areas that are likely to require particular attention including:

- feed and egg storage areas, including areas around open slave hoppers within houses and service areas.
- material and equipment stores.
- droppings pits, including minipits.
- voids in walls, ceilings or at ground level.
- routes used by rodents to move around the house, including ledges, beams, partitions, tops of cages, nest boxes, bases of walls, conduits, false floors and ceilings etc.
- accumulations of materials and vegetation around the perimeter of buildings.
- adjacent hedgerows and ditches.

## 5. Control strategies and techniques

Guidance on the quantities of bait to be laid, the number and frequency of bait points will be specified on the product label. However, as a rule, a larger number of small points are required for mice whilst for rats fewer points will be needed but they must be suitably placed in or close to nesting areas and will contain more bait. Large rodent populations require intensive and frequent treatments to eliminate breeding animals. Baiting points should not be allowed to run out of bait as this may reduce the effectiveness of the treatment. Once effective control has been achieved this can be replaced by a prevention strategy that focuses on reduced baiting focused largely on potential entry points into the house.

The mode of action demands that for most anticoagulant rodenticides the rodent must feed daily on the bait for several days and so it is essential that bait points are regularly checked and topped up as necessary. If bait is allowed to run out, become unpalatable, or there are insufficient bait points, then control is likely to be unsuccessful. For mice, regularly moving the location of bait points may help to maintain rodent interest.

The increased toxicity of brodifacoum and flocoumafen means that they are capable of killing both rats and mice following only one feed on the bait. This will influence the baiting procedures but monitoring and topping up of points will still be necessary. Users are reminded that with regard to poultry units, baits containing these two compounds must only be placed within enclosed and secure buildings and special care must be taken to remove baiting points from pits before mucking out.

### 5.7 Treatment strategies

The aim in poultry units should be to prevent rodent infestations becoming established by combining a baiting programme with regular monitoring and preventative measures.

## 5. Control strategies and techniques

The control strategy will vary according to whether action is being taken whilst the birds are occupying the building or if measures are aimed at the end of the cycle, when depopulation, cleaning and disinfection is carried out.

Bait will become spoiled or contaminated if baiting points are left in place during washing or the application of chemicals, but they should be replaced as soon as possible after completion of these stages. Baiting within wall and roof spaces can continue during washing and is particularly valuable at this time.

Successful control relies on the ability to bait all possible areas of rodent activity and so should include movement and living areas such as beams, ledges, cage structures and insulated wall or roof panels. Entry points cut in walls and ceilings can allow the placement of bait, particularly in paste sachet or gel format, in locations that are otherwise inaccessible. Where mice have gnawed holes or are using other access routes such as gaps around service entry points a useful baiting technique can be to insert pasta or other sachet baits into these holes which will encourage the rodents to eat their way into or out of the structure. If placing bait in holes either within or outside houses these must be covered if outside or in areas to which birds have access, to ensure non-target species do not gain access to the bait.

With regard to pits or areas beneath slats where droppings accumulate, it is recommended that bait points are established when the house is restocked. These should be protected from subsequent contamination by the use of bait boxes or baffles to deflect waste materials and dust. Access ports for servicing the bait points in mini-pits should also be set up. They need to be sited around wall or structure perimeters or at other locations where rodent movement or presence is likely, or has been detected. Ideally, they should be checked regularly but if this is not possible it may still be worthwhile establishing points in these areas by increasing the amount of bait used and providing additional protection to ensure that it remains

## 5. Control strategies and techniques

palatable throughout the flock cycle. In mini-pits, plastic pipes can be set up which run from the side of the pit towards the interior and baiting points can be placed within these. Another approach would be to place the bait in a lightweight paper or plastic bag which can then be put into a bait box or other protected area. If baiting is undertaken in the pit, it is important that where possible, uneaten bait and containers are removed when the pit is emptied and such material disposed of safely. The regular removal of droppings from deep pits will help prevent or reduce infestations by denying rodents long-term harbourage and nesting sites but this will have an influence on the placement of baits. This is a major undertaking whilst the house is occupied but will often be necessary to ensure removal of *Salmonella*-infected rodents in a positive house.

If rodent infestation is identified in areas occupied by the birds and treatment is required, specific measures will be necessary to prevent poultry from gaining access to the rodenticide baits. These will include the use of secure bait containers on beams and areas that are inaccessible to the birds and constructing baffles or tunnels that will allow entry by rodents but deny access to poultry. Where infestations occur in areas beneath slatted floors where there is no access these can be difficult to treat. It may be possible to suspend wax blocks on wires so that they are within reach of rodents or to set up baiting access as mentioned previously. Where mice are present in barn or free-range houses they often occupy spaces in the insulation layers so these areas should be identified and bait introduced into the relevant wall or ceiling spaces. Using a plywood or similar support above baiting points will help to reduce contamination of baits by dust.

Control at depletion will depend on whether routine treatments need to be continued or there has been a build up of infestation that necessitates a major eradication exercise, e.g. in *Salmonella*-positive houses. **If it is necessary to prioritise action due to the number of sites involved or other influencing factors, then control measures should be concentrated in houses where *Salmonella***

## 5. Control strategies and techniques

**infection has been confirmed.** This will reduce the chances of infected rodents displaced from a unit moving into a previously uninfected location.

If continued routine measures are indicated, such efforts should be maintained during the cleaning and site preparation stages and consideration given to increasing the number of bait points in livestock areas and droppings pits prior to restocking. It is important to run down feed supplies and remove any residual feed and spillages immediately once birds are removed to increase the uptake of bait by rodents.

Where rats have been a problem or are likely to be present, perimeter baiting should continue in order to reduce the chances of them moving as a result of the disturbance caused by the routine end of cycle work and then subsequently becoming re-established.

Where mouse or rat populations have built up, it will be necessary to carry out intensive baiting of the area to eliminate the infestation prior to restocking. This will have to be fitted in with cleaning operations and operators should be aware that baits may become unpalatable due to contamination with water, disinfectant, fumigants and other cleaning materials. It is therefore desirable to allow some extra time for baiting before mucking out where rodents have built up during the laying period, ensuring that all feed material has been removed. Baits should be replenished as necessary and must be maintained during the period when the house is empty and clean, awaiting a new batch of birds.

Pit entry sites and unit doors should be kept closed when not attended to prevent entry of other animals and exposure of non-target animals to rodent baits. It is essential that a knowledgeable and responsible person oversees this operation as there is a risk that valuable baiting opportunities may be missed and if *Salmonella*-infected rodents remain

## 5. Control strategies and techniques

in houses after cleaning and disinfection it is almost certain that the next flock placed in the house will become infected, regardless of the vaccination status or standard of cleaning and disinfection.

Continued baiting can help control rats and mice coming in from other areas. For mice, bait will usually be laid indoors at places where there is a high risk of infestation but for rats it may be appropriate to locate well protected bait stations in hedgerows, ditches or other habitat features outside the unit which new rats are likely to encounter when investigating the site. This technique is normally used to greatest effect in the autumn and winter, when such movement is most likely.

Wherever rodenticides are used, it is a requirement that any discovered rodent carcasses are disposed of safely. Unused or discarded bait should be dealt with in a similar manner. Consult the product label for instructions on disposal. Carcasses of poisoned rodents and unused bait are classified as 'controlled waste' and so have to be disposed of either by transfer to a licensed waste disposal facility or by burning or burial on the site.

### 5.8 Other control techniques

The use of methods other than those based on rodenticides have limitations in the control of rodents in poultry units and are unlikely to form a significant part of an overall strategy.

However, there are occasions, such as when toxic compounds are not permitted to be used, or rodents cannot be persuaded to accept baits, where operators may have to resort to other approaches but all of these have limitations.

## 5. Control strategies and techniques

### Traps

These may be live capture cage or other traps or traps that operate by a spring mechanism that are designed to kill the rodents which are captured. It is usually necessary to use a large number of either type of trap but checking, re-siting and setting are time consuming and labour intensive.

Only spring traps approved under the Spring Traps Approval Order may be used although break back traps commonly used against rats and mice are exempt from the requirement to be approved. It is illegal to use any spring traps on outdoor runs or in the open unless they are set in natural or artificial tunnels. Purpose made boxes designed to accept both traps for rats and mice are available.

Traps distributed throughout areas within houses where infestation is likely can be a useful monitoring aid particularly for mice. When used during turn round periods they can help to identify residual or developing rodent populations.

All traps should be checked at least once a day and any rodents caught alive must be killed humanely.

Sticky boards incorporating a substance usually described as rodent glue are sometimes used. These are placed on runs or other rodent movement areas and rely on the rat or mouse becoming entangled and unable to escape from the board. There are humane concerns regarding such use and so this technique should generally be regarded as a "last resort" for use in exceptional circumstances such as during the turnaround period between flocks where there are heavy mouse infestations. When in place these boards should be treated as a live capture trap and must be regularly checked. Any captured rodents should be humanely dispatched.

## 5. Control strategies and techniques

The success of trapping depends largely on the siting of traps and the intensity of trapping, but trapping alone would not be expected to remove more than a small proportion of the rodent population so any mice caught in traps serve as an indication for review of the whole rodent control strategy.

### Cats and dogs

The presence of cats or dogs on a poultry farm may act as a deterrent against reinfestation by rodents once effective baiting has been carried out. However, cats can carry a range of poultry diseases so should not be allowed access to occupied parts of poultry houses or feed or bedding stores. There may be a role for terriers to kill rats during the mucking out process to prevent their wider dispersal on some types of farm but this must be very carefully planned and handled.

### Ultrasonics

Claims are made that high frequency sound can be used to distract rodent populations and drive them away from problem areas. A number of such devices are commercially available. Although the principle may appear attractive and offer benefits, its practical application has generally produced disappointing results and there is a lack of verifiable trials information in support of such use.

## 6. Hygiene and proofing measures

### Hygiene

Two main areas require special attention.

#### a) Feedstuffs

Shortcomings in the storage and handling of feed, particularly where spillages occur and are allowed to remain, can be a significant factor in providing attraction for rodents and reducing the uptake and acceptability of rodenticide baits. Both rats and mice unavoidably have unrestricted access to feed present in feeding troughs. Spilled feed should not be disposed of into droppings pits.

On-farm observations suggest that in some cases acidification of poultry feed may make it less attractive to mice and enhance bait uptake.

Associated risks within poultry units include:

- outdoor bulk hoppers and delivery pipes where spillages or leaks will attract rats moving into or around the unit.
- indoor stores where open hoppers or spillages may attract rats and mice.
- faults in conveyors and other sections of distribution systems which may encourage a build-up of concentrate spillages.
- the presence of spillages, often after sweeping or blowing of the house, in areas such as droppings pits that are frequented by rodents.
- excessive dust accumulations, often comprising a high proportion of feed particles.
- broken egg material beneath egg belts and conveyors.

## 6. Hygiene and proofing measures

### b) Harbourage

Within units and building structures the availability of a wide range of materials will provide habitat for rodents, particularly mice.

The following will encourage the presence of rodents:

- a build-up of rubbish within units.
- the long-term storage of materials such as wood shavings, straw bales and egg trays in areas accessible to rodents.
- stores containing equipment and spare parts.
- poultry droppings and litter including a build-up of dry faeces on beams, fan housings and other structures in pits that can provide living and nesting sites particularly for mice.

Outdoors, rats will utilise:

- rubbish and other materials in the vicinity of units.
- natural vegetation cover.
- ditches, hedges and banks, especially when poorly maintained.
- rubbish dumps, bins for dead birds or waste eggs, and incinerator sites.
- Drainage systems and elevators or gantries that may provide a link between buildings.
- accumulated egg material which has spilled from conveyor systems.

## 6. Hygiene and proofing measures

### Proofing

The aim is to keep rodents out of vulnerable poultry buildings. These objectives need to be realistic and practical and take account of the physical capabilities of rats and mice.

Buildings offering an attractive environment and a source of food are most vulnerable to rats during autumn and winter when they are likely to exploit weaknesses or faults in the structures or associated areas. Mice are less responsive to seasonal changes mainly because they live within the fabric of buildings. However, factors that have a drastic impact on their environment, such as depopulation and cleaning, will influence the movement and distribution of mouse infestations. Their small size means that they can be easily introduced into units via the delivery and movement of materials such as feedstuffs, wood shavings, droppings or any other bulk items that are capable of providing a temporary refuge. Effective proofing of buildings or other structures against mouse entry is often extremely difficult due to their ability to get through very small gaps but efforts to limit entry will have some beneficial effect. For example mortar and wire mesh can be laid at main doors to houses and pits to seal the gaps under doors and act as a deterrent.

## 6. Hygiene and proofing measures

### Outdoor considerations

In free-range units most problems relate to the interior of houses but rats may burrow in from the outside and gain access to houses through pop-holes. There should be well-maintained baiting points around the perimeter of the houses and burrows should be baited and covered to prevent access by non-target animals. In some cases there may be a source of rodents that are coming in from neighbouring woodland or adjacent premises. In such cases it may be necessary to bait strategically in these areas or at the borders of the property and to negotiate joint action with neighbours. Great care should be taken with this to avoid non-target wildlife or other animal species being exposed to bait.

Areas around the perimeter of buildings should be kept clear of vegetation and materials. This will help to discourage rodents establishing on the site and assist with monitoring for signs of infestation. The main entry points are poorly fitting doors or other access routes into units as well as gaps left around conveyors, electrical cabling or other services. Drainage pipes, badly-fitting or damaged covers and grilles can be exploited by rats.

Damage to the exterior of buildings such as cladding or block-work may cause further problems and weaknesses in building foundations may make them vulnerable to the burrowing activities of rodents.

### Within buildings

Both rats and mice will be encouraged by the availability of access to a safe environment such as that provided by:

- entry points created by services such as cables and pipe work.
- faults and gaps in hollow wall spaces, roofs and partitions.
- damage or deterioration to floors or other surfaces that create gaps or holes.

## 6. Hygiene and proofing measures

### Remedial action

A routine of inspection and repair to identified faults or damage should be implemented and may conveniently be incorporated in the work schedule at the cleaning and maintenance phase of the cycle. In most situations it is best to control the rodent infestation before carrying out any proofing work but when this is not practical bait can be added to spaces behind damaged areas that can then be sealed. If this is not done it may result in problems in other sections of the unit. Although there may be some additional cost the improvements will benefit the rodent control and prevention programme.

Metal baffles around services such as cables and pipes and kick plates on the lower edges of doors will prevent them being gnawed by rodents. Door access that is only required during the removal of droppings can be temporarily proofed by adding a concrete fillet or wire mesh to the vulnerable ground level sections.

Depending on the circumstances, drainage pipes or gullies should be proofed by fitting grilles, flaps, crushed wire mesh or other suitable materials.

Farm staff and outside contractors should be made aware of the importance of avoiding the creation of rodent access routes and harbourages when undertaking building works, modifying existing structures and when making changes to the management of the unit.

In the course of structural work it may be appropriate to incorporate access points to allow checks to be made for rodent activity and permit the placement of rodenticide baits.

## 7. Safety considerations

The risks to the health and safety of the unit staff, others, livestock and wildlife must be considered with regard to:

- a) problems created directly by rodent infestations.**
- b) risks involved in the use of rodenticides and control techniques.**

### Infestation problems

Where rodents are present then the following basic disease precaution measures should be adopted:

- When working in infested areas or handling contaminated equipment suitable waterproof gloves should be worn.
- Cuts or grazes should be treated and covered with a waterproof dressing.
- Hands or exposed skin should be thoroughly washed prior to eating, drinking or smoking and before leaving the site.
- Staff or others working on the site should be made aware of the potential risks of zoonotic disease (including Leptospirosis, Hantavirus or *Salmonella*) and the need to inform their doctor if there is the suspicion that illness has been contracted at work. Staff may be issued with contact cards which provide basic information on zoonoses.
- Staff and others on site should be warned about the hazards posed by rodent damage to electrical wiring systems.

### Rodenticide use and control measures

Operators should be trained with regard to the rodenticides that are used and be aware of the potential hazards that they may pose.

The requirements for protective clothing and safe working practices must be understood before treatments are carried out.

Specific measures will be required if baits are mixed and formulated on site. A COSHH assessment must be made for each rodenticide.

## 7. Safety considerations

Planning of control operations should include the action that needs to be taken in the event of accidental poisoning. It is vital that those treating such cases are informed immediately of the specific chemical involved and any relevant information on its mode of action.

Records should be kept of the rodenticides being used and their distribution within the unit.

The protection of non-target species including wildlife, farm stock and domestic pets will need to take account of:

- the formulation and toxicity of the bait used.
- where and how the bait points are to be located.
- the use of bait boxes and containers.
- the disposal of carcasses and unwanted bait.

Rodenticides and treatment equipment must be stored in a safe and secure location, away from other hazardous materials such as fuel and substances such as disinfectants which could taint bait formulations. The exclamation mark '**Hazard Warning**' sign should be displayed in a prominent position on stores containing pesticides.

All containers used for storing or carrying bait must be properly labelled with the appropriate rodenticide information. Toxic materials should never be stored, even temporarily, in food or drink containers. A record should be kept of the type and quantity of rodenticides being stored.

Label instructions and precautions must be read, understood and followed.

## 8. Biosecurity

It is important to consider and introduce appropriate measures that will assist in preventing the introduction of disease to the farm and spread within units and there are several aspects related to rodent problems that should be taken into account.

Rodent droppings, particularly those deposited by rats should be regularly swept up and removed from walkways. As a source of *Salmonella* infection they can be picked up on footwear and transferred between houses.

Contractors visiting the site must observe effective disease prevention procedures that should include appropriate footwear, disposable overalls and gloves and the use of an approved disinfectant both on and off the premises. Wherever possible, keep vehicles outside of risk areas but if it is necessary for them to be taken onto the site they should be clean and spray disinfected as required.

A risk assessment should be undertaken regarding the personnel involved to establish if they visit other farms for pest control purposes. The possibility of disease transmission as a result of such activities needs to be considered.

If bait boxes, containers, traps or other control equipment need to be moved between houses the possibility of transferring infection should be taken into account. If a decision is made that these items need to be cleaned the use of detergents and disinfectants that might impart taint, and therefore act as a deterrent to rodents, should be avoided, or washed off after use.

During cleaning operations particular attention should be paid to urine pillars deposited by mice and grease marks established by both rats and mice. These are often difficult to remove and can act as a reservoir of *Salmonella* and other bacteria.

### Key points

1. Prevent build-up of mice/rats during the production period of the flock – increased response at depopulation IS TOO LATE.
2. Where there is a rodent problem or especially where a flock is *Salmonella* positive, rodent control action must be very intensive.
3. Traps should be used to assess mouse populations and progress of control programs. Use a minimum of 20 traps in each house.
4. Initially, use several different approaches at the same time and then refine based on results.
5. Individual tastes of rodents within the unit may vary and proper positioning of bait is crucial.
6. Ensure bait is protected from non-target species and will not cause contamination. If possible place bait throughout the house and not just around the house walls. Distribute baiting points approximately three to four metres apart. Remember to also place bait in wall and roof spaces.
7. Bait in mini-pits and autonest housing in barn and free range flocks.
8. Use a logical basis for choice of control techniques and bait types taking consideration of the following:
  - Lifecycle and habits of the rodents.
  - Building design and structural condition.
  - Palatability of bait and selection for 'bait-averse' rodents.
  - In house action v. contractor use – timeliness and other issues.
  - Legal restrictions on use of certain bait types.

# Annex 1: Summary checklist

9. Undertake regular monitoring of response to the control/baiting programme and immediately react to a detected increase in rodent numbers and maintain or amend controls as necessary.

## **Rodenticide and bait formulation options**

Mainly restricted to anticoagulant compounds with a wider range of bait products and other formulations:

- First generation (warfarin etc) – resistance considerations
- Difenacoum and bromadiolone – suitable for both indoor and outdoor location.

Indoors only: 'single feed hit' more toxic – but sometimes less palatable:

- Brodifacoum and flocoumafen – for indoor use only with the potential to act as a single feed rodenticide.

## **Checklist to minimise pest populations at depopulation:**

- Ensure adequate downtime.
- High standard of cleaning.
- Plan to maximise baiting during the empty period.
- Prevent reinfestation from adjacent houses.

# Annex 2: Auditing rodent populations

This Annex provides a simple check on rodent populations, potential rodent harbourage, and existing rodent control and monitoring measures in laying houses. It is intended to assist in assessing the actual or potential problems regarding rodents and highlight the areas that should be improved. In order to obtain as objective an assessment as possible, it should be completed by an external auditor or pest specialist. The audit should be carried out on all areas where rodents might be a problem, including laying houses, anterooms, service and feed and manure storage areas.

- Any answer in a red tick box suggests the need for corrective action and provides an indication that specialist advice may be required.
- Any answers in an orange tick box suggest a cause for concern. In cases where *Salmonella* is present in the flock corrective action is essential.

## Auditing potential for rodent harbourage

(to be completed for each laying house)

### Concrete house surroundings

No       Partly       Totally

### Puddles, vegetation and/or residual feed/manure around the house

Abundant       Some       Absent

### Feed spillage in house (including pit)

Abundant       Some       No

### Deep pit, or manure storage

Yes, emptied once a year or less often  
 Yes, emptied 2-3 times a year       No

## Annex 2: Auditing rodent populations

### Situation of laying house regarding other/other laying houses

- Communication through open corridor/egg conveyor
- Shared deep pit
- Other contiguous house/s, No direct communication
- Single house

### Air inlets/outlets

- Not proofed
- Proofed or not accessible

### Sealing of doors/other entry ports

- Very poor
- Proofed or not accessible
- Good seal

### State of repair

- Poor
- Average
- Excellent

### Potential for entry of rodents

- High
- Average
- Low

### Potential for harborage of rodents

- High
- Average
- Low

# Annex 2: Auditing rodent populations

## Auditing rodent control/monitoring programme

### Type of control programme

No control programme  Systematic and written†

Control programme exists, but unsystematic, no records kept

### Monitoring programme

No monitoring programme  Inadequate monitoring

Systematic and written

†Includes plan of baiting/trapping points, type of bait used, dates of baiting replenishment and number of rodents trapped

## Auditing rodent populations and baiting

(to be completed for each house and feed store)

### Signs of mice inside the house (including the pit)<sup>1</sup>

Abundant  Some/few  None

### Signs of rats inside the house (incl. pit)<sup>2</sup>

Abundant  Some/few  None

### Signs of rats outside the house

Abundant  Some/few  None

1 Includes live/dead rodents' faeces, urine pillars, typical smell, grease marks, uptake of bait, structural damage;

2 Includes live/dead rats, burrows, structural damage, uptake of bait.

## Annex 2: Auditing rodent populations

### Level of coverage of baiting inside house (only applicable if rodents present)

Poor       Average       Very good

### Quality of the baiting inside house (only applicable if rodents present)

Poor       Average       Good

### Level of coverage of baiting outside house (if rodents present)

Poor       Average       Very good

### Quality of the baiting outside house

Poor       Average       Very good

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PB13233. April 2009.

