

Rats: options for controlling infestations

Rats live successfully throughout the UK in both urban and rural environments. The brown or Norway rat *Rattus norvegicus* is most commonly found in the UK and is the subject of this note. The black rat *Rattus rattus* is rare in this country and is confined to a few port towns and small offshore islands. This note is intended primarily for farm and other commercial premises. It provides general information on brown rats and describes how to control infestations.

Why are rats a problem?

- Rats consume 25-30 g of food on average per day and they contaminate everything they encounter with droppings, urine and hairs.
- On farms, assurance scheme accreditation is at risk if rat contamination is evident.
- In food premises contamination could result in prosecution under food safety legislation.
- The economic costs of losing foodstuffs through both consumption and contamination can be substantial.

Rats carry a wide range of diseases and parasites that are potentially harmful to humans and animals. Leptospirosis (Weil's disease) can be fatal to humans. Other diseases, such as Toxoplasmosis and Salmonella, affect both humans and animals, and parasites can present a further hazard.

Biology and behaviour

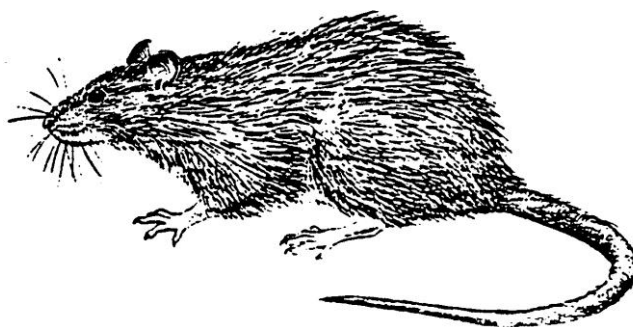
Habitat

Rats inhabit refuse tips and urban areas. They are also found on farms, in crops and field margins and at pheasant rearing pens. Within these habitats, rats burrow into earth banks, compost or muckheaps and into the structure of buildings and sewers. They also inhabit undisturbed storage areas such as haystacks and tyre heaps or pallets, especially if these areas are close to food.

Range size and population

The range size of rats is typically 12-400 m², but rats can easily travel 1 km or more on a routine basis to reach food sources. Infestations can build up if resources are abundant.

Large infestations consist of a number of smaller social units that have their own territories within the larger area. Rat colonies are governed by a complex social structure. A dominance hierarchy determines the social status of all rats in the unit. Territories are fiercely defended and intruders are attacked.



Brown rat

Rats often move to buildings in autumn and winter for shelter and food, and return to the open countryside in the summer to feed on growing vegetation. However, this seasonality is not found where food is available at a site all year round, such as on intensive rearing farms or at urban refuse tips.

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In these situations rats will attempt to stay on site permanently. Moreover, if the rats that live there are killed, other rats are likely to immigrate from surrounding areas as the territories become available.

Behaviour

Rats are mainly nocturnal with activity peaks before dawn and after dusk. However, they can be active by day if predation risks are greater at night, or where there is a great pressure on available resources, as is often the case with large infestations.

To minimise predation, rats tend to move along well-defined runs in close contact to cover, such as hedgerows, walls and banks. They mostly travel at ground level, but they can climb and jump well and they are capable swimmers. You can expect to find rats in more or less any location that provides food, water and shelter.

Rats are opportunistic and they will rapidly discover new food sources and suitable living areas (harbourage). Equally, they can be expelled by disturbance and removal of the food and harbourage. They are wary of new objects and new foods (neophobia) and will sample small quantities of new food until they are confident it is harmless.

Rats communicate by sound (including ultrasound) and smell. They navigate using touch and smell as well as memory. They have excellent night vision and hearing.

Diet

Rats are omnivorous and eat a wide range of foods, depending on what is available. They favour protein or cereals, but they also scavenge slugs, eggs or vegetable remains. They are capable of preying on small vertebrates such as birds or frogs and can be cannibalistic.

Rats can communicate their aversions to poisonous foods, so unless all rats in an infestation are targeted simultaneously, control efforts can fail to achieve complete control as the colony learns to avoid poison baits.

Rats have a tendency to carry food to safety. Thus it is common to find bait hoarded in

burrows and for individual bait items to be moved unless fixed in place.

Breeding

Rats can live to three years of age, but they rarely survive beyond two years. In mild conditions, or if living indoors, rats can breed all year round. Otherwise breeding peaks occur in spring and autumn. Females reach sexual maturity at 8-12 weeks old. Gestation lasts around 21 days and the litter size is usually 7-9. Young are weaned after three weeks, but female rats usually have no more than five litters per year.

Predators

Owls, weasels, stoats, polecats, foxes and occasionally badgers will predate rats. Cats are the main predators in urban situations and farms. Dogs and many different species of wildlife will scavenge on dead rats.

Avoiding infestations

Rats require food, water and shelter in order to survive. If one or more of these requirements can be denied, then the likelihood of an infestation can be significantly reduced and an existing problem more easily resolved.

Before attempting to deal with a rodent problem it is essential to carry out a survey to identify where rats are living, feeding and drinking and the routes they take between these areas.

Survey the premises

The main signs to look for are:

Holes or burrows Burrows are 6-9 cm in diameter and can be located anywhere that is relatively undisturbed and near to food.

Runs and tracks Runs are typically 5-10 cm wide and appear as continuous, well-used routes through vegetation or alongside walls and other linear features. Greasy smear marks may be seen where rats make contact with stone, wood and metal, such as on steps and around gate posts.

Droppings Droppings are 15-20 mm long, cylindrical, flat at one end and often pointed at the other. They are moist when fresh, but dry within hours to give a dull appearance.

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Damage Gnawed or chewed materials show that rats are using an area. Look particularly at doorways and wooden cladding near to where food is stored and check electrical wiring.

Footprints and other marks The existence of footprints and tail marks in soft mud, dust or bulk grain shows that rats are in an area.

Other signs These include sightings of live and dead rats and a musky smell that some people can detect.

It is essential to identify all areas of activity. Any that are missed may act as a source of re-invasion. All buildings and their surrounding areas, including adjoining hedgerows and ditches, should be inspected.

The site survey should also be used to:

- identify any specific hazards or potential treatment problems;
- provide information on non-target animal risks; and
- confirm hygiene deficiencies or structural faults.

On large sites, a map showing the areas of infestation should be made.

Clean-up...

Accumulations of rubbish and stored materials can be used by rats as harbourage. Rubbish should be removed and stored materials should, wherever possible, be tidied up and removed from food areas. Spilled food and animal matter should be disposed of. Vegetation around buildings and ditches should be cut back to expose rat runs and burrows, thus making the rats more vulnerable to predation.

...and proof

Where practical, structures should be proofed to prevent rats gaining access. Block holes in walls, floors and doors, repair or replace damaged drain covers, and fill in gaps around entry points of services. Baffles can be fitted to rainwater down-pipes and cables.

Foodstuffs should be stored in bulk bins or other proofed structures, and bagged feed should be stacked on pallets and regularly moved around

to prevent rats taking up residence. Wherever possible, food should be stored well away from likely harbourage.

Encouraging predators, particularly cats, may provide additional protection.

Planning a rat control programme

Despite good standards of hygiene and proofing, infestations will sometimes occur. In such circumstances, it will be necessary to take action to control the rats.

Methods of control may include trapping, shooting or chemical control using fumigants or rodenticide baits. It is likely that a combination of measures will provide the most effective control strategy and one should be prepared to consider all the options available.

There is no 'season' for rat control and it is essential that control be undertaken as soon as a problem is identified. Leaving a small infestation untreated and allowing it to develop not only increases the risk of damage and disease, but also makes subsequent control more costly and difficult.

Control should always be carried out in conjunction with preventative measures, otherwise the underlying causes of the infestation remain and re-infestation will inevitably occur.

Which control method to use

Your decision will be based on many things, including:

- The scale of the infestation.
- The resources available.
- The competence and experience of the person doing the job.
- Risks to non-target wildlife, pets, livestock and humans.

Using rat poison

The Campaign for Responsible Rodenticide Use (CRRU) has produced a code of good practice known as *Think wildlife* to enable effective rodent control to be done with minimal exposure to all non-target animals.

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This should be followed whenever poison is used. The seven point code can be seen at the end of this note and further information is available from the *Think wildlife* website www.thinkwildlife.org.uk/

An environmental assessment to consider the possible threats to wildlife and domestic animals should be undertaken whenever rodenticides are used, particularly in outdoor locations. This must include any specific risks identified and the measures that are being taken to minimise adverse effects on non-target species. A record of the assessment should be retained.

The bait

Most widely available are the anti-coagulant rodenticides, which include the first generation compounds Warfarin, Diphacinone, Chlorophacinone and Coumatetralyl, and the second generation, more toxic, compounds Difenacoum, Bromadiolone, Brodifacoum and Flocoumafen.

All these rodenticides typically result in a reduction of the rat infestation within 2-4 weeks. The poisons affect a rat's blood clotting response, so after a few days rats will die as a result of internal haemorrhage, or bleeding from external wounds. The response is delayed, so for the first few days the rat feels fine and eats normally. Hence a lethal amount of poison is ingested before the first symptoms of illness set in. In this way, bait aversion is avoided.

Anti-coagulant rodenticides are available in a range of formulations, including whole and cut wheat bases, pellets, wax blocks, place packs and as liquid concentrate or contact dust.

In most situations any of the anti-coagulants can be used with good effect. However, where resistance exists it might be necessary to use a more toxic compound (see Resistance). It is important to be aware that both Brodifacoum and Flocoumafen **must not be used out of doors** and this restriction places significant limitations on their use in dealing with typical rat infestations.

Pre-baiting is required in order to achieve effective control of rats.

Cellulose-based products (which interfere with rodents' water absorption, thus causing dehydration) are also available.

Baiting procedures

Before embarking on a baiting programme, read the product label carefully to ensure that the correct, legal and safe procedure for that specific product is followed.

The bait should be placed in areas where rat activity has been identified during the survey. Ensure that the whole infestation is targeted at once by using adequate bait points located around the whole of the infested area. Wherever possible make use of available materials on site to cover over bait points. Place bait directly into rat burrows and then heel in or cover over the hole. Alternatively, bait can be placed in a bait box or container that excludes other animals. Bait sachets and wax blocks should be secured so they are not carried into the open by the rats.

Alternative food sources should be removed or placed in inaccessible areas or containers. This will ensure maximum bait uptake.

Frequent visits will be necessary to keep the bait points topped up. Bait must be available to the rodents throughout the treatment period to prevent bait aversion developing. The only exception is when using Brodifacoum and Flocoumafen, when a 'pulsed', or intermittent, baiting regime is the accepted strategy.

During site visits, any bait spillage should be cleared up and rodent bodies disposed of safely. If there is any indication that non-target animals have accessed baits, the bait point should be removed. Similarly, if the bait has become weathered or contaminated the bait point should be relocated.

The quantity of bait required will vary with the different products and the number of rats present. If all the bait is consumed, this is an indication that insufficient bait has been used at each point, so the amount of bait should be increased. It may also be necessary to increase the number of baiting points.

Amateur users, including householders, should double bag spent bait and rodent carcasses, put

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these plastic bags in a rigid container and then place the package in a bin or sack for collection as refuse. The Environment Agency's preferred method for the disposal of poisoned rat carcasses by farmers and gamekeepers in order of preference is:

- disposal via on-farm small carcass incinerators (regulated under the Animal By-product Regulations);
- removal along with other waste as part of the domestic waste collection round (subject to local authority agreement);
- disposal off site at a suitably authorised incinerator or landfill; or where this is not possible,
- the burial on site provided this is done away from sensitive areas and in line with the Code of Practice for the Protection of Water.

If the first three options are not available, the Environment Agency are prepared to allow individual pest control operatives to bury small numbers of rodent carcasses on site provided this is done in line with the Code of Practice.

In situations where re-invasion occurs from neighbouring areas, the use of barrier baiting can be considered. This involves placing bait in protected locations around the perimeter of the site. However, this technique can pose a greater risk of poisoning non-target animals and, if bait is left in place for too long, may encourage the development of resistance to the anti-coagulant compounds. Accordingly, this approach should be restricted to the times of year and the situations where an assessment indicates that such action is necessary.

Operator safety

Rodenticides are poisonous to humans. Always read the product label before use and follow the label instructions.

Rodenticide baits should be kept safely stored in their original containers and any equipment used to mix or dispense bait should be washed after use. Empty containers should also be washed out thoroughly and disposed of safely.

Keep records of the type and quantity of bait used and where it has been placed. A simple

site plan indicating the location of bait points will help for this purpose. Where appropriate, inform site occupiers or users of these details and the action required in case of accidental poisoning.

When handling rodenticide or rodent carcasses always wear waterproof gloves to protect yourself from disease and pesticide contamination. The product label instructions will indicate if additional protective clothing or equipment is necessary. If you think that you have become ill as a result of handling bait or dead rats, seek medical advice immediately.

Environmental hazards

Rodenticides are poisonous to livestock, pets and wildlife. Always read and follow the label instructions. Bait should never be placed in such a way that non-target species can gain access to the bait point. Species such as badgers are particularly strong and capable of overturning bait boxes or digging bait out from burrows. If badgers are known to use the area bait boxes should be fixed to the ground and baited burrows should be covered over.

Predatory and scavenging species can be harmed if they feed on the poisoned rodents. Also bear in mind that if non-target bait feeders, such as wood mice or voles, access the bait, predators and scavengers such as cats, dogs or buzzards might be affected by eating these as much as by eating poisoned rats. It is a legal requirement that regular searches for carcasses should be made and this should include searches for any dead animals, not just rats. Carcasses and any spilled bait should be cleaned up and burned or buried. Avoid contamination of ponds, ditches or waterways when disposing of bait or bait containers.

As mentioned above, further advice is provided by the www.thinkwildlife.org.uk/ Campaign for Responsible Rodenticide Use (Think Wildlife) Code (see Appendix below).

Resistance

Treatment failure is most likely to result from inadequate placement of baits or the failure to replace eaten baits during the treatment. The presence of alternative foods or immigration of rats from outside areas may also prolong control.

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However, anti-coagulant resistance is now a cause of treatment failure in some areas. Resistance is a genetic, inherited characteristic and is not acquired during the rat's lifetime. Resistance can be recognised when baits continue to be eaten into the fifth and sixth weeks of the treatment, with little or no reduction in the population.

In England, anti-coagulant resistant rats are found along the English/Welsh border and surrounding counties and also in large areas of central south and south-east England. However, resistance is not limited to these counties. Information on the status of resistance in the UK can be obtained from the Rodenticide Resistance Action Group website www.bpca.org.uk/RRAG/about.htm

Resistant rats can often be controlled adequately using an alternative product. Where resistance to Warfarin or another first generation product is encountered, try using Bromadiolone or Difenacoum. If problems are encountered when using Difenacoum, Bromadiolone could be tried, and vice versa. No resistance has been recorded from baiting programmes using Brodifacoum or Flocoumafen, but their restriction to indoor use makes them unsuitable for many situations. Furthermore, these products are not available to amateur users.

Where resistance is prevalent it is even more important to manage the site to prevent rats from accessing food sources and harbourage. It is not sensible to continue baiting with an ineffective rodenticide, because the cost will be great and the possible effects on non-target species will be increased. To overcome the resistance it is quite likely that another method of control will need to be used.

Cage traps

This method is time consuming, but is a viable alternative to baiting in situations where resistance is suspected or when high-value crops need protection. A large number of cage traps are required and pre-baiting is necessary to achieve effective control.

When caught in a cage trap an animal is protected under the Animal Welfare Act 2006, making it an offence to cause unnecessary

suffering. Traps should therefore be checked twice a day, in the early morning and late afternoon and be located carefully to protect captured animals from extreme weather conditions or temperatures, and from flooding. Any captured rats must be humanely despatched. This can be effectively achieved by shooting with a suitable air rifle or pistol.

The benefit of using cage traps is that any non-target species that are captured can be released unharmed.

Spring traps

Only spring traps designed to catch and kill rats humanely and listed by the Spring Traps Approval Order 1995 may be used. All these spring traps must be set in a natural or artificial tunnel, which is, in either case, suitable for the purpose. Most traps are set with the treadle plate flush with a rat run. The plate is concealed by covering it lightly with soil and the trap is secured with a chain and peg.

Break back traps may also be used and these are exempt from the Spring Traps Approval Order. However, if used outdoors or in other situations where there might be a threat to non-target species these must still be set in suitable tunnels.

It is recommended that all traps set for the purpose of catching rats should be visited at reasonable intervals and at least once every day between sunrise and sunset. In the event that a trap has captured, but not killed the rat, it should be humanely dispatched. Livestock and pets should be excluded from the area when traps are set.

Shooting

Rats can be shot using an air gun or shotgun. Shooting may be a suitable method of killing rats when they exit their burrows, or when rats are flushed out of harbourage by some means. The Firearms Act 1968 requires any person possessing, purchasing or acquiring a shotgun to obtain a shotgun certificate from the police.

Gassing

Gassing is not a widely used method for rat control, because of safety constraints and the

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training required to use the technique. However, when correctly used under the right conditions, gassing can significantly reduce the rat population.

It is essential that rats be driven to ground before burrows are gassed. Particular attention should be paid to the possible presence of non-target species. It is illegal to gas badgers or foxes, so burrows in or around setts and earths must not be treated. Other protected wildlife, for example reptiles, can inhabit rat burrows, so the possibility of their presence should be considered also.

Cymag, a fumigant based on sodium cyanide lost approval for storage and use in December 2004 and so use of this product would now be illegal. Any remaining stocks must be disposed of through a licensed waste disposal contractor.

The only approved fumigant is aluminium phosphide, which breaks down to produce phosphine gas on contact with moist air. Commercial formulations of aluminium phosphide are in pellet form and are marketed under the names Talunex and Phostoxin.

The pellets should be placed in the rat burrows and sealed in by heeling or covering with turf. A follow-up treatment of new or re-opened holes should be made after a few days. Pellets must not be placed indoors or within 3 metres (10 ft) of human or animal habitation. Rodent bodies must be searched for and be disposed of by burial.

Aluminium phosphide is subject to the Poisons Rules 1982 and Poisons Act 1972. Accordingly, it can only be sold by registered retail pharmacists and registered non-pharmacy businesses (provided sales do not take place on business premises). It cannot be sold to amateur users and it must be kept under lock and key.

All fumigants must be used according to their label instructions.

Other control methods

Sticky boards are legal in the UK. However, due to welfare and non-target capture concerns, they should be used only by trained operators as a

last resort in situations where other methods are not viable.

Dogs, cats and ferrets are sometimes used to assist with controlling rats. However, it is unlikely that such methods employed alone will be effective or practical in dealing with most infestations.

Currently, there are no approved chemical repellents or physical deterrent devices that can be recommended for use in rodent control.

Other legal considerations

Under the Prevention of **Damage by Pests Act 1949**, local authorities are responsible for ensuring that their districts are kept, as far as is practicable, free of rats. In addition, the Act requires that occupiers of non-agricultural land must notify the local authority if 'substantial numbers' of rats are living on or resorting to the land. There is no requirement, however, for occupiers of agricultural land to notify the local authority of the presence of rats. The Act gives local authorities the power to require landowners and occupiers to control rat infestations on their land. Local authorities can also, where necessary, carry out the control work in default and recover the cost of such action from the landowner or occupier.

The Health and Safety at Work Act 1974 places responsibilities on employers for the health and safety of their employees. This has relevance to the risk of rats transmitting disease and on the safe use of rodenticides or other control methods. This Act also places a responsibility on employees to work in a safe manner.

Under the Health & Safety Executive's **Control of Substances Hazardous to Health (COSHH) regulations**, employers must ensure that an assessment is carried out detailing the risks to human health arising from rodent-borne diseases and with regard to the use of pesticides. Suitable precautions must be taken to prevent or control any hazards.

The Control of Pesticides Regulations 1986, as amended, place a general obligation on all users of pesticides to take all reasonable precautions to protect the health of humans, creatures and

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plants, to safeguard the environment and, in particular, to avoid the contamination of water.

These regulations also prohibit the advertisement, sale, supply, storage or use of a pesticide unless it has been approved. All users of pesticides must comply with the statutory conditions of use shown on the product label.

Further information

If you do not wish to control a rodent problem yourself, you may be able to receive help from the local authority Environmental Health Department or you should seek the services of a private pest control company.

In England, further advice on dealing with rat problems, as well as problems caused by other mammals and birds, can be obtained by contacting Natural England's Wildlife Licensing Unit at:

Natural England, Wildlife Licensing Unit,
First Floor, Temple Quay House,
2 The Square, Bristol, BS1 6EB

0845 601 4523 (local rate)
wildlife@naturalengland.org.uk

Natural England Technical Information Notes are available to download from the Natural England website: www.naturalengland.org.uk In particular see:

- TIN058 *Rats: control on livestock units*

For further information contact the Natural England Enquiry Service on 0845 600 3078 or e-mail enquiries@naturalengland.org.uk

This leaflet was produced by Natural England's Wildlife Management & Licensing team.

Appendix

The Campaign for Responsible Rodenticide Use - the seven-point think wildlife code

The **Campaign for Responsible Rodenticide Use** (CRRU) has produced a code of good practice known as *Think wildlife*. The purpose of this is to enable effective rodent control to be

done with minimal exposure to all non-target animals. www.thinkwildlife.org.uk/

Seven-point CRRU Code:

Always have a planned approach

- Before treatment begins, a thorough survey of the infested site is an essential key to success when using any rodenticide.
- Environmental changes which could be made to reduce the attractiveness of the site to rodents should be noted for implementing after the treatment. Usually this will involve rodent proofing and removing rubbish and weeds that provide harbourages and cover. However, the site should not be cleared before treatment since this will disturb the rodent population and make bait acceptance more difficult to achieve.
- Obvious food, such as spilled grain, should be removed as far as possible and any food sources covered.
- Rodenticide baits should only be used for as long as is necessary to achieve satisfactory control.
- In most cases, any anticoagulant bait should have achieved control within 35 days. Should activity continue beyond this time, the likely cause should be determined and documented. If bait continues to be consumed without effect, a more potent anticoagulant should be considered. If bait take is poor, relative to the apparent size of the infestation, consideration should be given to re-siting the bait points and possibly changing to another bait base, as well as making other environment changes.

Always record quantity of bait used & where it is placed

- A simple site plan or location list identifying areas of particular concern pertinent to the site should be drawn up and retained on file.
- A record of all bait points and the amount of bait laid should be maintained during the treatment. Activity should be noted at each bait point, including any missing or disturbed baits, as the treatment progresses.
- By carefully recording the sites of all bait points, responsible users of rodenticides are able to return to these sites at the end of the treatment and remove uneaten bait so that it does not become available to wildlife.

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Always use enough baiting points

- Users should follow the label instructions regarding the size and frequency of bait points and the advice given regarding the frequency and number of visits to the site.
- By using enough bait points the rodent control treatment will be conducted most efficiently and in the shortest possible time. This will restrict the duration of exposure of non-target animals to a minimum.

Always collect and dispose of rodent bodies

- The bodies of dead rodents may carry residues of rodenticides and, if eaten by predators or scavengers, may be a source of wildlife exposure to rodenticides.
- It is essential to carry out regular searches for rodent bodies, both during and after the treatment period. Bodies may be found for several days after rats have eaten the bait and rats may die up to 100 metres or more away from the baited site.
- Any rodent bodies should be removed from the site and disposed of safely using the methods recommended on the label.

Never leave bait exposed to non-target animals and birds

- Care should be taken to ensure that bait is sufficiently protected to avoid accidentally poisoning other mammals and birds. Natural materials should be used where possible.

- Bait stations should be appropriate to the prevailing circumstances. They should provide access to the bait by rodents, while reducing the risks of non-target access and interference by unauthorised persons. They should protect the bait from contamination by dust or rain. Their design, construction and placement should be such that interference is minimised.

Never fail to inspect bait regularly

- Where the risk assessment or treatment records show that multiple visits are required, then those should be made as frequently as is considered necessary. Daily inspection may be required in some circumstances.
- At each visit, baits should be replenished according to the product label and a thorough search made to ensure that bodies and any spilled bait are removed and disposed of safely. Records of such visits should be maintained. Never leave bait down at the end of the treatment.

Never leave bait down at the end of the treatment

- Bait left out at the end of a treatment is a potential source of contamination of wildlife.
- On completion of the treatment, records should be updated to signify that the infestation is controlled and that, as far as reasonably practical, all steps have been taken to ensure that the site is now free of rodenticide bait.