



Chartered
Institute of
Environmental
Health



Pest control procedures in the housing sector

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Contents

1	Introduction	3	9	Nuisance pests	28
2	Public health and housing	4	10	Birds and other vertebrates	32
	2.1 Overview			10.1 Birds	
	2.2 Legal consideration			10.2 Other vertebrates	
	2.3 Pest awareness and house management				
	2.4 Reporting and record keeping		11	Pest prevention	34
3	Rodents	10		11.1 Overview - The principle of Exclusion-Restriction-Destruction (E-R-D)	
	3.1 Rats			11.2 Building design and pest proofing	
	3.2 Mice			11.3 Building structure	
	3.3 Squirrels			11.4 Hygiene	
	3.4 General biology and behaviour			11.5 Waste management	
4	Cockroaches	12		11.6 Environmental management	
	4.1 Common cockroach species			11.7 Fly-Tipping	
	4.2 General biology and behaviour		12	Control and treatment strategies	40
5	Flying insects	14		12.1 Integrated control strategies and housing	
	5.1 Common fly species			12.2 Inspection	
	5.2 General biology and behaviour		13	Control methods	46
6	Blood feeding and stinging insects	18		13.1 Non-chemical control methods	
	6.1 Fleas			13.2 Chemical control methods	
	6.2 Bedbug		14	Pest control contracts	54
	6.3 Lice			14.1 Requirements in selecting a contractor	
	6.4 Delusory parasitosis and phantom biters			14.2 Training and qualifications	
	6.5 Wasps			14.3 Call out service	
	6.6 Bees			14.4 Contract service	
7	Ants	22		14.5 Quality assurance	
	7.1 Significant species and habits		15	Appendix	58
	7.2 Pest status of ants		16	Useful addresses	63
8	Stored product and textile pests	24			
	8.1 Categories and common types of stored product pests				

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1 Introduction

The presence of pests in dwellings has a considerable impact on the lives of inhabitants, particularly the more vulnerable members of the community – specifically the old, the very young, the disabled and those with health problems.

These guidelines have been drawn up by the CIEH National Pest Advisory Panel (NPAP) after consultation with local authorities, the British Property Federation, the Accreditation Network UK (ANUK), Housing Associations, the Chartered Institute of Housing, the pest management industry and enforcement agencies. Advice has also been sought from government agencies involved in research and enforcement, as well as other bodies which lay down auditing standards.

The CIEH would like to thank all those who have contributed to the preparation of these guidelines.

Dr Stephen Battersby
CIEH President

“Health is a state of complete physical, mental and social wellbeing, not merely the absence of disease or infirmity.”

The World Health Organization definition

2 Public health and housing



2.1 OVERVIEW

In 2002, the World Health Organization carried out a major survey, known as the LARES survey, into the relationship between health and housing. This involved investigating the housing conditions of 8,400 inhabitants in 3,800 dwellings in eight European cities.

The survey showed that 60 percent of premises had been infested by at least one pest in the previous year and that living in pest infested premises can seriously affect the health of residents.

In particular, it showed that there is a clear association between pest infested premises and allergies and asthma. It also provided clear evidence that people are more likely to suffer from migraine, headaches and depression if they live in pest infested homes.

Dwellings include houses, flats (self-contained and non self-contained), bedsits and rooms in halls of residence or similar residential buildings. The presence of pests in premises used as accommodation by people can lead to a considerable risk to public health. The risks posed by pests include:

- The spread of disease or pathogens transferred from the gut or external surface of the pest
- Allergies
- Bites
- Psycho/social stresses
- Damage to property
- Contamination of work surfaces and foodstuffs
- Loss of income from tenants
- Prosecution and closure

To overcome these problems a pest management programme should be implemented to prevent, as far as practicable, the introduction of pests into the premises and to reduce the conditions that may encourage and support their presence.

2.2 LEGAL CONSIDERATIONS

2.2.1 Prevention of Damage by Pests Act

The Prevention of Damage by Pests Act 1949 places a local authority under a duty to ensure, as far as is practicable, that a district is kept free from rats and mice and in particular:

- To carry out periodical inspections of areas, including agricultural land
- To destroy rats and mice on land occupied by the authority, and keep that land free, so far as is practicable, from rats and mice
- To enforce the duties under the Act of owners and occupiers

In addition, occupiers of non-agricultural land must notify the local authority if rats or mice are living on or resorting to the land in substantial numbers.

If it appears to a local authority that steps should be taken to get rid of rats and mice on any land, the authority may serve notice on the owner or occupier requiring such action to be taken within a specified reasonable period.

If an owner or occupier fails to take steps to get rid of an infestation within the time specified by the local authority, the authority may itself undertake the work and recover the expense incurred.

2.2.2 Building Act 1984

The Building Act 1984 is the enabling Act under which the Building Regulations have been made. The sections relevant to pest control are:

- To secure the health, safety, welfare and convenience of persons in or about buildings and of others who may be affected by buildings or matters connected with buildings
- To prevent waste, undue consumption, misuse or contamination of water and to further the protection or enhancement of the environment
- To make regulations with respect to the design and construction of buildings, demolition of buildings, and the provision of services, fittings and equipment in or in connection with buildings

2.2.3 Public Health Acts 1936 and 1961

Under the Public Health Act 1936, sections 83 to 85 deal with premises which are filthy and verminous. The term verminous refers to eggs, larvae, and pupae (or nymphal stages) of insects and parasites.

Under section 83 of the Public Health Act 1936 local authorities are given the power to serve notice on the owner or occupier specifying the works required to eradicate the vermin and the conditions conducive to infestation. This work can be carried out in default.



Where there are verminous articles, such as the bed or other furniture, notice under section 84 can be served requiring these to be disinfested or removed from the premises and destroyed. There is also a provision in the legislation for persons to be disinfested at a cleansing station.

Section 37 of the Public Health Act 1961 prohibits the sale of any household article known to be verminous.

Section 74 of this Act also gives local authorities the power to deal with nuisance or damage caused by house doves, feral pigeons, starlings and sparrows in built-up areas. Precautions must be taken to ensure birds are destroyed humanely and no action is taken which is contrary to the Wildlife and Countryside Act 1981 (as amended).

2.2.4 Environmental Protection Act 1990 (as amended)

The Environmental Protection Act 1990 provides legislation on statutory nuisance for poor living accommodation covering “any premises in such a state as to be prejudicial to health or a nuisance”.

The statutory nuisance may result from one or several defects, which may result in injury to health. In this context, odour and insect nuisance can pose potential risks to public health.

Under this Act, it is an offence to treat, keep or dispose of ‘controlled waste’ in a way likely to pollute the environment or harm people. It is also an offence to keep, treat or dispose of ‘controlled waste’ without a waste management licence, unless the activity in question is ‘exempt’ under the Waste Management Licensing Regulations 1994. Under the Act, people who produce waste must make sure that it is passed only to an authorised person who can transport, recycle or dispose of it safely.

2.2.5 Clean Neighbourhoods and Environment Act 2005

The Act deals with certain problems affecting the quality of the local environment. It provides local authorities, parish and community councils and the Environment Agency with more effective powers to deal with poor environmental quality, including nuisance from litter, insects and dogs. All its provisions are now in force.

Section 101 amends section 79 of the Environmental Protection Act 1990 and as a result the statutory nuisances listed in that section now include “insects emanating from relevant industrial, trade or business premises and being prejudicial to health or a nuisance”.

The insects covered by section 101 include species which can cause a nuisance in sufficient quantities, such as mosquitoes, house flies, lesser house flies and blow flies.

Likely sources of nuisance will include pig and poultry houses and farms, sewage treatment works, landfill sites and transfer stations, animal housing, trade or business premises and used tyre recycling businesses.

The Act also gives additional powers to control stray dogs and litter.

2.2.6 Housing Act 2004 including the HHSRS and Management Regulations for HMOs

Regulations made under the Housing Act 2004 establishes the Housing Health and Safety Rating System (HHSRS) as the prescribed means whereby local authorities in England and Wales assess the seriousness of hazards to health and safety arising from deficiencies in the dwelling¹. It therefore also helps to identify the appropriate remedial action, and also forms the basis for enforcement action.

There are 29 potential hazards that can be assessed under the HHSRS, some are quite common others relatively rarely encountered. After a full inspection of the dwelling, including common parts and associated land such as the garden, the inspector identifies those hazards arising, and is expected to “rate” those hazards that are worse than the average using the HHSRS scoring system. In practice this means those where the likelihood of an occurrence that could cause harm over the next 12 months. National averages for the likelihood are given for each hazard in the statutory Operating Guidance issued by the government and to which local authorities have to have regard. This guidance also includes detailed definitions of the terminology. Examples of hazard ratings are also given in Worked Examples for each hazard published by the Department for Communities and Local Government.

The likelihood of an occurrence is judged in reference to the age group and their vulnerability, rather than regarding the actual occupants. The basis being that a dwelling safe for the vulnerable age group will be safe for all ages. The hazard score not only takes account of the likelihood, but the possible spread of harms, that would justify medical attention. There are four classes of harm as not all occurrences lead to the same health outcomes. These harm outcomes range from extreme to moderate, and ‘health’ under the Act includes mental health, and so possible severe stress resulting from a hazard can be taken into account. The Guidance sets out the average spread of harms from occurrences, and in most cases the surveyor will be largely concerned with the likelihood or probability of an occurrence, and will use the average spread of harms in producing the rating, unless there are obvious factors in the dwelling that justify changing these.

The system recognises that some hazards are





unavoidable, but the aim is to minimise risks as far as is practicable. The hazard rating is only the starting point and it is only after the rating of the hazard that other factors such as whether the current occupier is a member of the vulnerable age group, are taken into account in deciding on the course of action.

Under the Housing Act 2004, where the local housing authority identifies the existence of a Category 1 hazard, there is a duty to take one of the courses of action available under the Act. For Category 2 hazards as identified using the HHSRS there is a discretionary power to use one of the courses of action. A Category 1 hazard is one scoring 1000 or more using the HHSRS. Category 2 hazards are those scoring 999 and below. In addition for a dwelling to meet the Decent Home standard it has to be free from any Category 1 hazards.

Authorities need to have due regard to the guidance that is available on enforcement issues. Options include Hazard Awareness Notice (which is largely informatory), Improvement Notices requiring owners to carry out remedial action, Prohibition Orders to close all or part of a building or Demolition Orders and Clearance Areas.

Authorised officers also have powers to take immediate Emergency Remedial Action or to make an Emergency Prohibition Order to prohibit occupation where there is an imminent risk of serious harm.

2.2.7 Assessing hazards from pests

Pest related matters fall under category 15 – Domestic Hygiene, Pests and Refuse. These encompass:

- Health hazards due to poor design, layout and construction to the point where the dwelling cannot be readily kept clean and hygienic

- Access into, and harbourage within, the dwelling for pests
- Inadequate and unhygienic provision for storage and disposal of household waste

In deciding the severity of the hazard each case has to be decided on its merits. The following guidance has been drawn up by the National Pest Advisory Panel, based on sound scientific evidence, as a guide for housing officers.

The presence of rats around the premises poses an immediate risk of contracting Leptospirosis. Left unchecked an outdoor infestation will increase in size and extent. Once established the security provided by a safe harbourage will allow the rats to explore their surroundings with enhanced confidence. The risk of the infestation spreading to inside the dwelling increases proportionately.

The presence of pests such as rats, mice or cockroaches within the actual dwelling would increase the likelihood of an occurrence to nearer the 1 in 1 end of the likelihood scale. This would mean a hazard score at or approaching that which would be a Category 1 hazard, and certainly the risks would be substantially greater than for the average dwelling

The presence of rats, their droppings and urine within the premises poses an immediate risk of contracting a range of diseases associated with rats. This and the added risks of being bitten (particularly young children) and stress caused by their physical presence renders the property unfit for habitation. The activity of rats within the dwelling would aggravate the building defects and poor hygiene which allowed the infestation to become established in the first place.

The presence of mice, their droppings and urine within the premises poses an immediate risk of contracting diseases such as Salmonellosis and Toxoplasmosis. Mice will also cause considerable damage to stored foodstuffs, clothing and furnishings. Associated medical conditions such as headaches, migraine and depression can also be attributed to a mouse infestation.

Cockroaches within the dwelling can lead to an increased risk of disease transmission. Heavy and well established infestations present the additional risks of frequent headaches, migraine, allergies and asthma.

Flies within the premises may indicate the presence of a carcass in a loft or wall cavity or they may be entering via a window from an adjacent source. If the infestation persists there is a potential risk of disease transmission. If the breeding site can be traced to within the dwelling there may be underlying issues of hygiene which must be addressed.

The impact of bedbugs is normally classed as an irritant, although large numbers of bites can be debilitating and secondary infections occur. Loss of sleep can result where the host is conscious of the presence of the bedbugs or is not anaesthetised to their bites. There is also a high risk that the infestation will spread to adjacent rooms or neighbours residences where their presence would constitute a statutory nuisance.

Where fleas are present in large numbers and the infestation persists despite treatment being carried out, there may be hygiene and animal welfare issues which must be addressed. Long-term exposure to flea bites may result in elevated stress levels, disturbed sleep and secondary infection due to persistent scratching of the affected area.

While the prevention of disease is the main consideration in cases where pests are present, the effect that pests may have on the quality of life should form a part of the risk evaluation.

2.2.8 HMO Management Regulations

There is an association between multi-occupied dwellings and buildings and pest infestations, particularly rodent pests. The HMO Management Regulations made under the 2004 Act apply to all houses in multiple occupation as defined by the 2004 Act². Although pests are not specifically mentioned, there are aspects of the requirements that can help reduce the risk of infestations.

For example the manager must ensure that the drainage system serving the HMO is maintained in good, clean and working condition. There is also a requirement to ensure that outbuildings, yards and forecourts which are used in common are maintained in repair, clean condition and good order and any garden belonging to the HMO is kept in a safe and tidy condition.

In addition the manager must ensure that sufficient bins or other suitable receptacles are provided that are adequate for the requirements of each household occupying the HMO for the storage of refuse and litter pending collection and disposal. The manager has to make any other arrangements for the disposal of refuse and litter from the HMO as may be necessary if the local authority domestic collection regime is not sufficient.

There are duties on occupiers too. Every HMO occupier is required not to do anything that will hinder manager compliance with the obligations under the Regulations. Failure to comply with the Regulations is an offence. There are not "notice" requirements so far as these Regulations are concerned.

2.3 PEST AWARENESS AND HOUSING MANAGEMENT

Training should be given appropriate to the personnel concerned, in the management of the property. For example:

- Wardens
- Caretakers
- Housing officers
- Housing maintenance and development managers
- Tenants association members
- Sheltered accommodation managers
- Housing association managers
- Local authority inspectors

As a minimum, all maintenance and hygiene personnel should be aware of the pests that they are likely to encounter in their areas of operation and the importance of pest prevention. Particular attention should be given to the awareness of anyone responsible for receiving incoming goods such as furniture or furnishings.

Pests and their habits

Training on the identification and habits of the more common pests of the housing sector can be given by the pest control contractor or through independent consultants. This is best achieved in the form of a brief presentation rather than distribution of literature, and where appropriate can be tailored to particular industry segments. For example local authority housing estates, student accommodation, sheltered accommodation.

Pest prevention

The importance of pest prevention through good hygiene, management and exclusion practices should be emphasised. Personnel in charge of a site have the day to day responsibility of ensuring a pest management programme is maintained.

Information posters

In addition to training sessions the posting of information at sensitive locations such as waste disposal and amenity areas can act as a reminder of the requirements of the pest management programme. These can remind staff of pest related risks and preventive measures such as:





- Keeping refuse areas clean
- Correct methods of bird and pet feeding
- Good building maintenance
- Tidy gardens

2.4 REPORTING AND RECORD KEEPING

The organisation of a reporting system and maintenance of records is essential if pest free status is to be achieved.

Records must be kept:

- To monitor pest management processes
- To demonstrate compliance with legislation
- To coordinate block treatments
- To liaise with tenant groups

2.4.1 Pest sightings log

A record should be kept of any pest sightings made by personnel other than those involved in pest management. This can be in the form of a book or a folder where the following information can be logged:

- Name of person making report
- Date and time
- Location
- Pest seen
- Any other relevant information

In addition to entering the sighting in the book, the sighting must be reported to the appointed manager in charge of pest management who will decide on further action.

Where a pest control contractor is employed the sighting will normally result in a request for service. In the case of an on-going riddance programme the reports will provide information on the success of the treatment.

The pest sightings record should be checked by each contractor when they visit the site. The contents of the pest sightings record should be part of a management review process.

2.4.2 Pest control report

Inspection reports must be concise and legible and stored in an easily accessible binder.

The report should identify any adjacent premises either immediately above or below or immediately to either side that may be "at risk" and whether these have also been inspected.

A typical pest control report will contain as a minimum:

- Treatment date
- Details of the pest control contractor and name of technician servicing the site
- Details of the customer and name of the contact person on site
- Type of visit: routine, follow-up, callout, etc
- Pests found
- Action taken
- Pesticide used
- Location of baits and monitors (this may be in the form of a checklist or plan)
- Quantities used
- Risk assessment
- Post treatment precautions
- Recommendations on proofing, hygiene and storage
- Details of follow-up inspections
- Confirmation that all accessible baits have been removed at the end of the treatment.
- In the case of failure to gain access to collect baits, a letter advising the occupier that the responsibility for the protection of the baits has transferred to them

The report must be signed by the pest control operator and the site contact.

Where anticoagulant rodenticides are used outdoors the following additional records should be kept:

- A site plan identifying areas where bait has been laid
- Details of the active ingredient, formulation and quantities used
- Inspection reports, which demonstrate the treatment frequency to check and replace baits and to search for and remove dead rodent bodies where appropriate
- Reports of any effect on non-target species and action taken to reduce risk
- Reports of any interference or removal of baits
- Reports on conditions, which may adversely affect treatment and remedial actions
- Evidence that control has been achieved within the prescribed timescales

2.4.3 Other records

- Manufacturers Safety Data Sheets (MSDS) for pesticides used on site
- COSHH Risk Assessments*
- Site Risk Assessments*
- Environmental Risk Assessments*

*These may not be relevant for each site or may be in a combined form.

3 Rodents



Black rat, ship rat
(*Rattus rattus*)



Brown rat, common rat,
Norway rat, sewer rat
(*Rattus norvegicus*)



House mouse
(*Mus domesticus*)



North American grey squirrel
(*Sciurus carolinensis*)

3.1 RATS

In Britain, there are two species of rat; the Norway or brown rat (*Rattus norvegicus*) and the ship or black rat (*Rattus rattus*). The Norway rat has largely replaced the ship rat over the past 100 years.

Norway rats eat on an average one tenth of their body weight each day. They are considered omnivorous but if available cereals are preferred. Rats must drink water daily unless the food source is extremely moist. Due to their water requirements, runs to a water source may be evident and give an indication of harbourages.

They explore locations quite freely but have a fear of new objects. This is known as neophobia and should be taken into account when baits are checked initially after a treatment.

On farms, stored animal feed and crops, bedding, even animal waste will present an ideal environment to support rodent infestations. Rats living and feeding outside may enter buildings with the onset of the winter months.

Ship rats are very good climbers and are usually found indoors, often high up. Although they are rare in the UK, they are still found in some port areas.

Because of their larger body size, access to buildings by rats is usually either via faulty drainage or service ducts or by means of structural defects such as broken vents and damaged building fabric.

3.2 MICE

The house mouse (*Mus domesticus*) is the common pest in urban environments, although field mice (wood mice and yellow necked mice, *Apodemus* spp) can be a problem in autumn and winter. Where these enter premises, control is the same as for house mice.

Mice will drink water if available but can survive on food with moisture content of 15 percent. They are omnivorous; feeding from a

number of different points during the course of a night's feed. Whole wheat, which has been partly eaten by mice, has a kibbled appearance while whole grain, partly eaten by rats, has a cut or chopped appearance.

In domestic premises, areas favoured by mice are food storage and preparation areas such as kitchens and pantries. Airing cupboards, sub floor areas, enclosed pipes, baths and loft areas are also favoured locations.

3.3 SQUIRRELS

In the UK the grey squirrel (*Sciurus carolinensis*) is regarded as a pest species. The red squirrel (*Sciurus vulgaris*) is fully protected.

The grey squirrel was introduced into the UK in the mid 19th century and has now become a major pest of forestry. In addition they may enter buildings in search of food and shelter resulting in damage to products and structures. Under the Destructive Imported Animals Act 1932 and the Wildlife and Countryside Act 1981 it is illegal to release the grey squirrel into the wild.

3.4 GENERAL BIOLOGY AND BEHAVIOUR

Rodents have the ability to adapt themselves to almost any environment. Their great reproductive potential, natural cunning and survivability puts them among the most successful animals on earth.

Rodents use the five senses of smell, touch, hearing, sight and taste in order to survive.

The sense of touch is considered the most highly developed of the rodents' senses using the vibrissae or whiskers on the muzzle and guard hairs that are found among the fur. These organs help rodents orientate in the dark and help them judge shapes and sizes of objects. After a short learning period on the whereabouts of objects in the immediate environment, runs become well established. Smell will also play a part in the forming of the runs. When danger threatens, automatic use of this information allows rapid escape from predators.



3.4.1 Problems associated with rats and mice

The main reasons for control are to reduce or eliminate:

- Spread of disease
- Contamination of food and surfaces
- Damage to furnishings and building fabric
- Stress and fear
- Social embarrassment
- Financial loss

Rodents can cause damage to food intended for humans, by consumption, contamination with faeces and urine, as well as other physical and microbiological contaminants.

Rodents have the capability to spread many human pathogens, such as *Salmonella* spp, *Listeria* spp, *Escherichia coli*, *Cryptosporidium parvum*, *Yersinia enterocolitica*, *Leptospira* spp, *Toxoplasma gondii*, Hantaviruses and Bubonic plague.

In a recent survey by Salford University, 53 percent of the mice studied were infected with the pathogen that causes toxoplasmosis. This is a disease which could lead to miscarriages and deformed births in pregnant women.

Mice are often seen as a nuisance pest whereas rats are seen as a public health pest. This is dangerously wrong since mice are as capable of transmitting disease as rats.

The presence of rats or mice within a dwelling will also trigger psycho/social stresses in people of all ages and backgrounds. The risk to the health of occupants is therefore greater than the risk of disease alone.

All rodents have a pair of incisor teeth in their upper and lower jaws. These teeth continue to grow throughout their life to make good the wear caused by gnawing. Almost every type of food commodity is subject to rodent attack.

Damage is also caused to the fabric of buildings, to electric wiring and plumbing.

Rats can therefore cause fires and flooding in houses and individual premises.

3.4.2 Problems associated with grey squirrels

Grey squirrels are less cautious than rats and will readily enter buildings during daylight. They are physically larger and stronger and are capable of breaking through poorly fitted proofing materials.

As with rats and mice considerable damage can be caused by their powerful jaws and sharp incisor teeth.

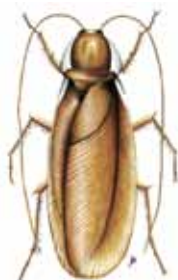
4 Cockroaches



Oriental cockroach
(*Blatta orientalis*)



German cockroach
(*Blattella germanica*)



Brown-banded cockroach
(*Supella longipalpa*)



American cockroach
(*Periplaneta americana*)

Based on fossil records, cockroaches have remained little changed for 200 million years.

There are over 4,000 different species of cockroaches worldwide but not all are regarded as pests. Those species, which are now classed as pests, originated in tropical climates but have now become cosmopolitan in temperate zones, having been distributed by commercial activities.

4.1 COMMON COCKROACH SPECIES

The cockroach species commonly found in the UK are:

Oriental cockroach (*Blatta orientalis*)

Males are approximately 25mm long, females approximately 32mm long; shiny and very dark brown, nearly black in appearance, nymphs (immatures) may be reddish brown; they are poor climbers on smooth surfaces, which may limit their distribution within a building; they appear to be cold tolerant in that they are often found outside buildings, in drains, gardens, sewers, external brickwork etc, a factor which should be remembered when controlling them.

German cockroach (*Blattella germanica*)

Adult size 13–16mm; the adult is light brown in colour with two dark almost parallel longitudinal stripes on their pronotal shield; they are found throughout buildings but show a preference for warm humid areas; they are good climbers, being able to climb vertical glass or tiled surfaces; an infestation of these cockroaches can be quickly established once they have entered any premises.

Brown-banded cockroach (*Supella longipalpa*)

Adult size 11–15mm; this cockroach is small, light brown in colour and is often mistaken for the German cockroach; this cockroach needs hot conditions to survive, it prefers 27°C and over but it is becoming more common as a pest in the UK; it is typically found in light switches, electrical appliances, motor housings, etc.

American cockroach (*Periplaneta americana*)

Adult size 34–53mm; the adult is reddish brown in colour and is fully winged. Male wings extend beyond the tip of the abdomen;

female wings do not. There is a pale brown to yellowish band around the edges of the pronotum. This species is not well established in Britain yet.

It is not as cold tolerant as *Blatta orientalis* and *Blattella germanica*. Typical infestations in the United Kingdom are port areas, where it is introduced via ships. Infestation areas include food premises, greenhouses, zoos, large centrally heated humid environments, etc.

Australian cockroach (*Periplaneta australasiae*)

Adult size 25–35mm; Adults are reddish brown, fully winged with a yellow to pale brown band around the pronotum and a yellow streak on the outer edge of the base of the front wings. Late instar nymphs have pale yellow markings on the lateral margins of the thorax and abdomen. This species closely resembles *Periplaneta americana*. Not yet widely established in the United Kingdom.

It requires hot, moist conditions. It is found in greenhouses; therefore potted plants may be a source of infestation. Pet shops, particularly those with large numbers of heated fish tanks, can also be a source of infestation for this species.

4.1.1 Ootheca development in cockroaches

Oriental cockroach (*Blatta orientalis*)

The female Oriental cockroaches carry their egg case (ootheca) for about 30 hours, after which time she deposits them, dropping or attaching them near to a food source.

Oothecae hatch in approximately six weeks, but this period may be greatly extended in cool conditions. In this situation the egg case represents a biological time bomb waiting to hatch and continue an infestation.

German cockroach (*Blattella germanica*)

The ootheca is carried by the female until it is within one to two days of hatching. Small first instar nymphs emerge from the ootheca and easily infest tiny cracks and crevices in the immediate area.

Brown-banded cockroach (*Supella longipalpa*)

The female carries the ootheca for approximately 18 hours while it develops. The ootheca is then fastened to furniture, walls and ceilings. The first instar nymphs start to emerge from the oothecae after approximately 40 days.



Australian cockroach
(*Periplaneta australasiae*)

American cockroach (*Periplaneta americana*)

The female deposits oothecae a few hours or up to four days before the first instars emerge.

The ootheca is dropped or glued to a suitable surface, usually in a pocket of high humidity near a food source.

Australian cockroach (*Periplaneta australasiae*)

The female cockroach deposits the egg case containing around 15 nymphs, which emerge after a period of approximately 80 days.

4.2 GENERAL BIOLOGY AND BEHAVIOUR

Cockroaches are omnivorous. In addition to conventional foodstuffs, they will feed on a wide range of organic matter including faeces and other cockroaches. Their activity peaks during hours of darkness.

They exhibit incomplete metamorphosis; the juvenile stages or nymphs resemble the adults. Each cockroach moults several times in its life cycle producing a larger nymph and eventually moulting to the adult stage. Some species are fully winged in the adults, others may have reduced wings or wing buds. When wings are present, they are leathery and veined.

The females of those cockroaches classed as pests all produce egg cases or oothecae. The enclosed eggs hatch inside the case from which nymphal cockroaches emerge.

During the daytime, cockroaches spend most of their time in harbourages grouped together. This behaviour is influenced by them finding the same suitable harbourage and also by them producing an aggregation pheromone, which is a chemical messenger to other cockroaches of the same species, who respond by being attracted to the source of the pheromone. As this pheromone is present in cockroach faeces, cockroaches will also be attracted to areas previously contaminated by cockroaches.

The development of cockroaches is affected by food quality, humidity, temperature, and day length.

4.2.1 Food contamination problem

Cockroaches foul their environment with faeces, regurgitated food and they taint materials with their characteristic smell. The air in infested premises may contain fragments of their exoskeletons and cockroach excrement which can trigger an allergic reaction in susceptible people. Because residual allergens can remain as active contaminants for some time after a treatment, a thorough cleaning regime should be carried out afterwards. Cockroaches also contaminate food directly as they move from filth to food indiscriminately and are therefore implicated in the mechanical transmission of many pathogens, such as those causing food poisoning and wound infections.

5 Flying insects



Common housefly
(*Musca domestica*)



Lesser housefly
(*Fannia canicularis*)



Blowflies
(*Calliphora* spp)



Cluster fly
(*Pollenia rudis*)

5.1 COMMON FLY SPECIES

Common housefly (*Musca domestica*)

Adults are 6–8mm long, with a wingspan of 13–15mm; the thorax is grey with four longitudinal dark stripes; the sides of the abdomen are yellowish and may be transparent; the larva is a typical maggot – it undergoes larval moults, gradually increasing in size and changing colour from white to cream; pupa is about 6mm long and may be yellow, brown or black. Houseflies are potential vectors of a wide range of diseases such as dysentery, gastroenteritis and tuberculosis and can also transmit intestinal worms. These flies move from filth to food indiscriminately and may therefore move pathogens from dirty to clean areas. Fly spotting is produced when feeding and defecating.

Lesser housefly (*Fannia canicularis*)

Adults are 5–6mm long, with a wingspan of 10–12mm and with a grey thorax, which has three indistinct longitudinal stripes on it; the abdomen has an extensive area of yellow at its base. Potential vectors of a wide range of diseases, such as dysentery, gastroenteritis and tuberculosis, and can also transmit intestinal worms. They move from filth to food indiscriminately and may therefore move pathogens from dirty to clean areas. Fly spotting is produced when feeding and defecating.

Blowflies (*Calliphora* spp)

Adults are 9–13mm long with a wingspan of 18–20mm; adults are large robust flies with a stout abdomen; the thorax and abdomen are black/blue and dusky in colour. Blowflies are attracted to rotting animal remains on which they lay their eggs. In their search, they can mistake stored meat as a suitable host. The possibility of disease spread is similar to the housefly.

Cluster fly (*Pollenia rudis*)

Adults are up to 10mm in length with a wingspan of up to 20mm. The thorax has a distinctive dark greyish/olive colour and is covered in golden hairs. The abdomen has a checkered pattern. The female fly lays eggs in soil or leaf litter. When the larvae hatch they seek out an earthworm. They enter the body of the earthworm and develop within it until leaving to pupate. The adults are known to over-winter in buildings in large numbers, often thousands.

Flesh fly (*Sarcophaga carnaria*)

Adults are 10–18mm long with a wingspan of about 22mm; they are bristly grey with three distinct black stripes on the thorax; the abdomen has checkered patterning, which changes according to the angle of view; the larvae are typical maggots but the hind end is rounded and the posterior spiracles are sunk into a deep pit surrounded by fleshy lobes. Flesh flies exploit decaying organic matter for larval feeding sites, for example rotten meat, open wounds, dung and carrion and they will also parasite insect larvae and molluscs. They can also utilise stored meat as a larviposition site. Carcasses of birds and rodents are used by these flies as food sources for their larvae and therefore adults may be encountered as a nuisance in houses, though they are rarely found indoors in normal circumstances.

Fruit flies (*Drosophila* spp)

Adult fruit flies are small, yellowish/brown with a darkly striped abdomen; they have prominent compound eyes that are generally red in colour, although darker variants occur; the wings have two clear notches in the front border, which can clearly be seen with a hand lens. Fruit flies are commonly associated with human food preparation and storage areas. They are a source of annoyance in many kitchens, restaurants, etc. They are attracted to alcohol and waste fruit, and can build up to very large numbers when these food/breeding materials are present.





Moth flies
(Psychodid flies,
family Psychodidae)



Fruit flies
(*Drosophila* spp)



Phorid or drain flies
(Scuttle flies, family Phoridae)



Biting midges
(*Culicoides* spp)



Mosquitoes
(family Culicidae)

Moth flies

(Psychodid flies, family Psychodidae)

Adults are 3–4mm long with a wingspan of 10–12mm; they are greyish/brown in colour with wings covered in scales, as is the whole body, giving the fly the appearance of a small moth; the antennae of the moth flies are hairy in appearance with large hairs emanating from the intersegmental junctions. The adult flies are frequently abundant in sewage works and may enter neighbouring houses. Females lay their eggs in a suitable medium, typically the wet organic matter found in drains. As moth flies are found breeding in such areas, there is always the chance that they are carrying bacterial particles. These flies are really only a nuisance pest and not of any great public health significance.

Phorid or drain flies

(Scuttle flies, family Phoridae)

Adults are 3–4mm long with a wingspan of 9–10mm; the thorax is usually dark brown/tan in colour with a distinctive humped appearance. Phorid flies are found in association with moist decaying organic matter. They are often indicative of blocked or broken drainage systems. The adult flies have a characteristic habit of scuttling in a fast run instead of immediately taking to wing when disturbed, hence their name 'scuttle flies'. Because they frequent unsanitary sites, there is always the potential of these insects carrying disease-causing bacteria.

Biting midges

(*Culicoides* spp)

Adult midges are dark brown/black in colour and are around 1.2–1.5mm long, with a wingspan of around 3–4mm. The wings have sparse venation with a number of darkly pigmented areas. There are prominent Y-shaped cells in the centre and rear of the wings. The flies breed in waterlogged soil particularly in peaty areas. The whole life cycle can be as little as one month in warm conditions but could last six months in colder climates. In tropical countries *Culicoides* can be vectors of significant diseases, while in the UK they are a major problem due to their habit of swarming in large numbers and inflicting many bites on humans.

The bites can be extremely troublesome and can lead to secondary infections since they are frequently scratched to rawness by the person inflicted with the bites.

Mosquitoes

(family Culicidae)

The adult mosquito is a slender, long-legged insect with forward-pointing piercing and sucking mouthparts. The adults are between 7–15mm long with a wingspan much the same as the body length. The wings have well-developed venation and in some cases the wings have a fringed hind margin and the veins also have scales associated with them. The larvae are totally aquatic, feeding off biological material in the water. The larvae obtain their oxygen from the air via a breathing tube and therefore have to continually return to the surface of the water to breathe. Adult females are invariably blood feeding while the males obtain their food from nectar, if at all. The mosquitoes that are encountered in the UK do not transmit any serious diseases, although in some cases there can be a severe reaction to the bite. Secondary infection may result in quite significant wounds.

5.2 GENERAL BIOLOGY AND BEHAVIOUR

Flies develop through complete metamorphosis, consisting of four main stages – egg, larva, pupa and adult stages. The duration of each developmental stage is very much dependent on temperature and food/moisture availability.

All true flies (adult stage) can only ingest liquid food. Should they land on a solid food source, they produce large quantities of saliva together with regurgitated gut contents. The mixture, rich in digestive enzymes, is vomited onto the food together with any living bacteria, viruses and protozoa. The resulting liquid food is then sucked back into the fly's gut. This process may be repeated several times during which time the fly may defaecate to reduce the overall body weight in readiness for flight. This feeding mechanism underlies the principle mode of food contamination with disease pathogens and spoilage organisms.

5.2.1 Pest status of flies

The fly is a highly mobile pest, able to fly from filth to food carrying with it a wide range of disease-causing organisms on its body. There are many thousands of species of flies; however, relatively few interact with humans. Those that do are among the most destructive of pest species, spreading diseases to man and domesticated animals as well as contaminating food and packaging.

The increase and ease of international travel in the air and on the oceans means that there are very few barriers left to stop the spread of insects worldwide.

The mobility of flying insects is the primary reason why their status as pests is so important. This allows them to visit many diverse and contaminated habitats within the course of their relatively short life span.



6 Blood feeding and stinging insects



Cat flea
(*Ctenocephalides felis*)

6.1 FLEAS

Order Siphonaptera

Fleas occur in dwellings where pets are kept and in areas where there is a population of feral cats. The fleas most commonly encountered are the cat flea (*Ctenocephalides felis*) and the bird flea (*Ceratophyllus gallinae*). The human flea (*Pulex irritans*) is now rare in Britain.

The adult is red to brown, 2–3mm long. Their body is flattened from side-to-side with well developed spines and jumping legs.

Eggs are 0.5mm long, oval; laid singly in the vicinity of the host. Several hundred eggs may be laid by a female in groups of four to eight. The eggs hatch into pinkish or almost transparent legless larvae which grow to a length of 5mm.

The larvae feed on organic matter and on the partly digested blood excreted by adult fleas.

Pupation takes place in a silk cocoon. Adult fleas do not emerge immediately from the cocoon, but may be stimulated to do so by the vibrations and CO₂ produced by a nearby host. This is why hordes of fleas sometimes attack people entering houses which have been empty for a long time.

Adult fleas can live for many weeks without a blood meal; although feeding is necessary to stimulate egg production. Different species of fleas usually prefer to attack the range of species to which they are adapted; nevertheless, cat, dog and bird fleas often bite humans. However, they cannot breed on a diet of human blood alone.

Fleas act as the intermediate host of the dog tapeworm (*Dipylidium caninum*), which can also infect man. Cat fleas are found on both cats and dogs.

6.2 BEDBUGS

(Order Hemiptera)

Previously a common pest in slum and other poorly maintained properties; it is now found also in the cleanest of homes and hotels through insects being brought in with infested furniture, baggage or clothing.

The adult is red to brown, 4–5mm long, oval, flattened from back to underside and possesses an objectionable smell. It has well developed legs, but wings are absent.

Its mouthparts are adapted for piercing skin. Eggs are 1mm long, white and elongated. The female lays 200 to 500 eggs over a two month period in batches of 10 to 50, which she cements into cracks and crevices in the vicinity of a host. The complete life cycle can take two to four months. This insect undergoes incomplete metamorphosis.

One feed of blood is taken between each nymphal stage, but the adult feeds many times. If no host is available, adults may live for up to a year without food. During the day the flat-bodied bedbugs hide in narrow crevices; they emerge at night to feed on humans.

6.3 LICE

Order Anolpura

There are two species of sucking lice which feed exclusively on humans.

The head louse and body louse belong to the same species (*Pediculus humanus*) but are of different varieties according to where they occur on the body.

The crab louse (*Phthirus pubis*) is usually found on pubic hair but when infestation is heavy, they may be found on other coarse hair such as eyelashes, eyebrows and hair of the armpits.

Head and body lice are, 2.5–3.0mm long; crab louse 1.5mm long. Body flattened with well developed legs; the claws on crab lice are very prominent.

Eggs are cemented to the hairs and are commonly known as “nits”. Nymphs and adults feed by piercing the skin and sucking blood. The insects usually stay on the hairs or on inner clothing (body louse only).

Where infestations are heavy, the lice may fall off and can then be found in toilets and bedrooms. Head lice are short-lived, and most which fall off are injured or dying.



Bedbug
(*Cimex lectularius*)



Head louse
(*Pediculus humanus capitis*)



6.4 DELUSORY PARASITOSIS AND PHANTOM BITERS

People suffering from “delusory parasitosis” are convinced that they or their homes are infested by insects or mites. This should not be confused with “entomophobia”, which is a fear of insects that are actually present.

The symptoms of delusory parasitosis include:–

- The person either telephones or brings in “specimens” for identification
- Specimens are usually wrapped in tissue, stuck on adhesive tape, or placed in a small jar. When examined, they are found to be hairs, fibres, or debris from the floor. Occasionally they may be insects or insect

fragments

- The “bugs” jump
- The “bugs” infest the person’s hair or bite the skin, or even burrow under it. The person then scratches, or tries to dig them out with a pin, causing sores that are blamed on the “bugs”

The person may be so positive about the problem that other members of the family or friends will support their claims, and even believe themselves to be attacked as well. In extreme circumstances the supposed infestation may have caused the person to move home, but the problem has arisen again in the new house.



6.5 WASPS

Most people have a fear of wasps because of the risk of stings. Some people become sensitised to stings and may suffer severe, occasionally life threatening reactions.

6.5.1 Characteristics and distinguishing features of wasps

Wasps belong to the order Hymenoptera which includes some of the most highly evolved insects.

Distinguishing features include:

- Black and yellow colouring
- Elbowed antennae
- A narrow waist
- Powerful mandibles
- Fore and hind wings linked by minute hooks
- An ovipositor modified into a sting

They are social insects and have a caste system by which nest construction and maintenance, tending the young and foraging for food is undertaken by workers (sterile females). Fertile females (queens) are responsible for egg laying following fertilisation by males.

There are only two species of importance, the common wasp, *Vespula vulgaris*, and the German wasp, *Vespula germanica*.

The hornet (*Vespa crabro*) is larger than the common wasp at 20-35 cms and has yellow and brown stripes. Presently restricted to the south of the UK the hornet is not aggressive and control is rarely required.

6.5.2 Life history and habits

The queen emerges from hibernation in spring and starts to build a golf ball sized nest and lays the first eggs. Nests can be excavated in dry soil, in an old mouse burrow, or constructed in roof voids, etc. The first workers emerge a few weeks later and take over the nest organisation.

Workers continue nest construction throughout the summer. The queen continues to lay eggs and numbers of workers increase (5,000 or more). New Queens and males are produced. Mating of new queens and males takes place in the autumn. The social structure of the nest breaks down and workers, having no larvae to feed, switch to a sweet diet and may not return to nest.

Queens hibernate in protected areas during the winter while all males and workers die. The old nest is never re-used.

The five methods available for wasp control are nest destruction; baiting/trapping; the use of insecticides; flying insect control units and proofing.

6.6 BEES

6.6.1 Honey bees

Honey bees live in highly organised social colonies like wasps and ants. They have three

castes: males (drones), females (queens) and workers (sterile females). Masonry or mining bees are solitary: each female makes her own small nest, and there are no workers.

The honey bee (*Apis mellifera*), and masonry bees (including *Osmia* and *Andrena*) are similar in appearance. The honey bee has a well-developed sting which injects painful venom. Masonry bees, however, are quite harmless - their stings are very weak.

Honey bees build their nest with wax secreted from the abdomens of the worker bees. Larvae are fed on pollen and honey. New nests are created when a queen leaves the nest with a few thousand workers to find a new site. The resultant swarm may cause problems if they settle in close proximity to a dwelling or path but will generally move on without intervention. Where the swarm has to be removed the services of a local bee keeper should be sought. Bee keepers have been reluctant to take wild swarms due to the prevalence of the *Varroa* mite which is responsible for the spread of disease in commercial hives. This risk is balanced against the current value of bees and the offer of a swarm may be attractive to a bee keeper.

6.6.2 Masonry bees

Female masonry bees bore small holes in soft mortar or stone, or in hard sandy banks or lawns. Each hole is extended into a short burrow with a few small cells at the end. Each cell is stocked with pollen and nectar and one egg is laid in each, before the cell or tunnel is sealed up with saliva and mud.

Large numbers of masonry bees may occur at a favoured site; the resulting "swarm" may be mistaken for a swarm of honey bees. The difference can be seen easily: honey bees will all be entering through one, or a few, holes in the building - usually through an airbrick or under tiles; masonry bees will all be entering separate holes, usually in the mortar joints.

6.6.3 Bee control

The control of honey bees is not normally recommended as they are beneficial insects; however, they may be a problem when they nest in a chimney or wall cavity of a house. In these situations, a beekeeper will not be able to retrieve the swarm.

In circumstances where bees become a public hygiene/nuisance pest and their control in and around buildings is necessary, it is possible to use an approved dusting powder or spray in accordance with the label.

Honey bee nests in wall voids may result in seepage of honey from the nest after the bees have been killed. This results in stains on walls and ceilings indoors, which then go mouldy. Care should always be taken to ensure that foraging bees are prevented from gaining access to treated bees' nests by removing combs and blocking nest entrances.

7 Ants



Pharaoh's ant
(*Monomorium pharaonis*)

7.1 SIGNIFICANT SPECIES AND HABITS

Ants belong to the order of insects known as Hymenoptera which includes some of the most highly evolved insects such as wasps and bees. Ants live in colonies founded by a single, fertile female or queen. In some tropical species, several new queens remain in the parent nest. All spend most of their time laying eggs. They have a caste system by which nest building, nursing of young and foraging for food is undertaken by workers (sterile females). Reproduction is performed by fertile females (queens) and males.

All ants possess:

- Elbowed antennae
- Biting mouthparts
- A narrow waist between the abdomen and thorax

Five main species may be encountered in and around domestic premises:

Pharaoh's ant (*Monomorium pharaonis*)

Of tropical origin and has taken advantage of heated premises, notably hospitals and blocks of flats. Pharaoh's ant queens have wings, but rarely fly. They form new colonies by "budding", taking a few workers from the parent nest and moving to a new site a short distance away. Pharaoh's ants lay pheromone trails which are then followed by other worker ants to food sources. Proteins (meat, nuts, cheese, and blood) are the preferred foods of Pharaoh's ants.

Roger's ant (*Hypoponera punctatissima*)

Prefers damp locations, particularly in crevices around drains, and is not confined to heated premises. Roger's ant does not follow scent trails and seems to feed exclusively on protein such as dead insects, also small insect pupae and springtails, which they sting, then drag back to the nest.

Swarming also occurs in the Roger's ant. At such times the winged females (the few males are wingless) may be found in considerable numbers on window sills and in fly killer catch trays.

Black garden ant (*Lasius niger*)

Native of the UK and readily enters buildings in search of food. They lay pheromone trails which are then followed by other worker ants to food sources. There is generally only one queen in colonies of the garden ant. Garden ants feed on foods with high protein content, together with sweet foods. Like some other insects they also collect seeds and nectar and feed on "honeydew" from aphids.

In contrast with most other insects, the larvae of ants are fed until they become adult.

A particular feature of mating in the garden ant is the swarming which usually occurs in late summer, when winged males and females leave the nest. The swarming period of flying ants is of short duration and signifies the beginning of the breakdown of the nest.

Red ant (*Myrmica rubra*)

Colonies of red ants can be found under stones and paving or in rotted tree trunks, in most gardens. Their sting can be painful.

They generally cause no problem although they make mounds of soil as they excavate their nest.

Ghost ant (*Tapinoma melanocephalum*)

Ghost ants are approximately 1.5mm in size and have almost transparent legs and abdomen with a dark brown head and thorax. Smaller and faster than Pharaoh's ants they also have many queens in the nest and follow trails to and from the food source.



Black garden ant
(*Lasius niger*)



Red ant
(*Myrmica rubra*)





7.2 PEST STATUS OF ANTS

Although considered as a nuisance pest, the presence of ants can still have an impact on the safety of food and food handling surfaces.

Pharoah's ants have been shown to carry a wide range of disease causing pathogens.

Contamination of foods

Ants find their way into kitchens and preparation areas and there is a risk that food may become contaminated by ant bodies. Many infectious organisms are present in hospitals and these may be transmitted to patients by ants crawling on infected surfaces and used dressings.

Waste

Food containing ants must be discarded to prevent contaminated product being served. The disposal of waste food may result in a greater chance of rodent infestations.

Lost reputation and employment

Persons involved in the preparation of meals in domestic and commercial catering areas handle foods which are highly attractive to ants. Where this food is prepared for sale, prosecutions by environmental health departments may lead to loss of reputation and financial loss. It will also lead to job losses if premises are closed down.

8

Stored product and textile pests



Flour mite
(*Acarus siro*)



Leather beetle
(*Dermestes maculatus*)



White shouldered house moth
(*Endrosis sarcitrella*)

Stored product insects (SPI) are significant pests as they spend the majority of their time, including breeding, hidden in their chosen food type. Inspection and early detection can therefore prove difficult. The group known as SPI in this context includes mites. Commodities attacked include cereals, nuts, dried fruit and pulses.

8.1 CATEGORIES AND COMMON TYPES OF STORED PRODUCT PESTS

SPI fall into three main categories according to their ability to infest product:

- **Primary** – those having the ability to penetrate whole grains. These are further sub-divided into:
 - **Internal** – those species whose life cycle is completed within the grain or bean. The hole left by the exiting adult is characteristic
 - **External** – those whose life cycle is completed outside the grain
- **Secondary** – tend to feed on the fungus present in poorly stored product
- **Scavengers** – able to feed only on damaged grains

Particular species of SPI normally, but not always, infest each type of product. Please see Figure 1 below:

8.1.1 Identification of commonly encountered species

Flour mite (*Acarus siro*)

Acarus siro is around 0.5–0.7mm in length. It is white in colour with a pearly iridescence; its legs often have a brown or pink colouration. Its body is divided into two clear sections with a distinct line between the two sections known as the proterosoma (the anterior end) and the hysterosoma (the posterior section). This mite has two pairs of long setae protruding from the posterior end of the hysterosoma.

Leather beetle (*Dermestes maculatus*)

The adult is an oval-shaped beetle, approximately 6–10mm long. The antennae are short and clubbed. The colour is black with patches of white hairs on the sides of the thorax and underside of the body. The larvae have six legs, and a pair of curved projections, urogomphi, on the penultimate abdominal segment. They are hairy and are known as woolly bears.

White shouldered house moth (*Endrosis sarcitrella*)

Open wingspan 10–23mm. readily distinguished from other stored product moths by the covering of white scales on the head and thorax. The shining buff upper side of the forewing is speckled with dark brown.

Figure 1

Beans, peas and similar foods	Bruchid beetles
Coffee, cocoa	Flour beetles, Merchant grain beetles, Warehouse moths
Cheese	Mites, Larder beetle, Copra beetle
Dried fruit	Indian meal moth, Merchant grain beetles, Tobacco beetle, Dried fruit beetle, Mites
Dried vegetables	Indian meal moth, miscellaneous general feeders
Flour & milled cereal products	Flour beetles, Mill moth, Indian meal moth, Cadelle, Flat grain beetle, Mites
Grain (Wheat, rice, corn & other cereals)	Rice weevil, Grain weevil, Lesser grain borer, Saw-toothed grain beetle, Cadelle, Flour beetle, Indian meal moth, and Mites
Macaroni & spaghetti	Rice and grain weevils, Milled cereal pests
Nuts & confectionery	Indian meal moth, Merchant grain beetle, Mites
Animal materials	Dermeid beetles, Clothes and scavenging moths





Brown house moth
(*Hofmannophila pseudospretella*)



Merchant grain beetle
(*Oryzaephilus mercator*)



Indian meal moth
(*Plodia interpunctella*)



Biscuit beetle
(*Stegobium paniceum*)



Confused flour beetle
(*Tribolium confusum*)

Brown house moth (*Hofmannophila pseudospretella*)

Open wing span 15–25mm. Upper side of forewing bronze–brown in colour with several dark brown to black flecks or spots.

Merchant grain beetle (*Oryzaephilus mercator*)

The adult is an active, slim-bodied, dull reddish brown beetle between 2.5 and 3.5mm in length. The thorax has six distinct teeth on each margin, giving a saw-like edge. Wings are well developed; adults can fly and are attracted to light. It resembles the saw toothed grain beetle, *Oryzaephilus surinamensis* – care is needed in differentiating the two species.

Indian meal moth (*Plodia interpunctella*)

Open wing span about 16mm. The forewing has a broad grey band across the bronze brown wings.

Biscuit beetle (*Stegobium paniceum*)

Length 2–3mm. Reddish brown, oval beetles, with a dense covering of yellowish hairs. The head is hidden under the hood-like prothorax. Easily mistaken for the common furniture beetle, *Anobium punctatum*, or the cigarette beetle, *Lasioderma serricorne*. The larvae are active initially but become fat, sluggish and eventually incapable of movement. A fully-grown larva is about 5mm long.

Furniture beetle (*Anobium punctatum*)

Length 4–6mm. The adult beetles are uniformly brown in colour and have a humped thorax when viewed from the side.

Confused flour beetle (*Tribolium confusum*)

The adult length is 3–4.5mm. The shape is elongated; the antennae have a gradual five-segmented club. Easily mistaken for *Tribolium castaneum*, the rust-red flour beetle.

The cylindrical wiry larva is 4–5mm long when fully grown and is white tinged with yellow. It has a pair of immovable projections, urogomphi, on the final abdominal segment.

Common clothes moth (*Tineola bisselliella*)

Open wing span 9–16mm. The upper side of the fore wings is golden in colour. Both pairs of wings have fringed margins.

Adults are rarely seen in flight, mostly only the males, and the females after they have deposited their eggs.

Case-bearing clothes moth (*Tinea pellionella*)

Open wing span 10 to 15 mm. The upper side of the fore wings is pale brown in colour with three darker spots on the wings. Both pairs of wings have fringed margins.

The larva carries a silken tube that gives the moth its common name. The larva constructs the tube of silk and often attached to it are particles of wool, fibres, etc from the surrounding area.

8.1.2 Preventive measures

Due to their close relationship with the product, an infestation of stored product insects can often remain undetected in the initial stages. In order to prevent spread of SPI the following steps should be taken:

- All dried fruit and cereal products should be checked regularly particularly rarely used or old items
- Stored foodstuffs should be rotated – use older items first
- Thorough cleaning is required to prevent accumulation of residues on ledges and in corners
- Accurate identification is essential in order to pinpoint the likely source of the infestation



9 Nuisance pests



Silverfish and Firebrats
(Order Thysanura)

Silverfish and Firebrats (Order Thysanura)

Silverfish, and to a lesser extent, firebrats, are minor pests of kitchens, pantries and bathrooms. The common species are *Lepisma saccharina* (the silverfish) and *Thermobia domestica* (the firebrat).

Size: 12mm long. The body is torpedo-shaped with three long bristles at the end of the abdomen, no wings and long antennae. Both species can run quickly.

Colour: the silverfish is silver-grey; the firebrat is mottled brown and cream.

Biology and habits

Oval eggs, about 1mm long, laid singly or in groups in crevices. Up to 100 may be laid. Incubation takes three to six weeks. Nymphs reach sexual maturity in one to three months. Adults may live from one to three years and will choose warm, moist conditions, about 27°C. Firebrats prefer warmer conditions (38°C) and are found around ovens and in boiler houses. Firebrats and silverfish feed on the food debris that accumulates in cracks; they also feed on the starches and gums used in book bindings and wallpaper and may be found on the plaster of newly-built houses.

Treatment

In houses the infestation is most likely to develop in kitchens, larders or bathrooms. In very damp locations remedial measures to remove the cause of dampness i.e. ventilation, damp-proofing, heating are required. Spray crevices behind skirting boards, architraves, cupboard units and under loose wall coverings.

House or furniture mite, House dust mite (Class Arachnida, Subclass Acari)

The house mite, *Glycyphagus domesticus*, is a pest of minor importance in damp homes, often found on furniture from which it may spread to infest stored foodstuffs. Heavy infestations are capable of producing skin irritation and respiratory irritation in asthmatics.

The house dust mite, *Dermatophagoides* spp, is present in most homes, feeding on house dust (mostly skin scales), and is even more important in causing allergic reactions.

Size: 0.3–0.75mm long; female longer than the male. The body is ovoid in shape, bearing numerous long hairs and with long, slender legs. **Colour:** white.

Biology and habits

Eggs hatch in about five days. There are three nymphal stages, adults being produced in about two to three weeks. There may be a resting stage (hypopus) which is very resistant to adverse climatic conditions and to insecticidal treatment. The house mite thrives under damp conditions and is commonly associated with stored clothing, bedding (particularly pillows), carpets and furniture.

Treatment

As with most mite infestations the preferred treatment strategy is to raise the temperature and lower the humidity in conjunction with thorough cleaning particularly of the bedding. In rare circumstances it may be appropriate to spray with an approved acaricide.

Ground beetles (Family Carabidae)

Beneficial outdoors as predators on many garden pests. There are nearly 500 species in the UK.

Size: 3 to 30mm long.

- Colour: black, brown, green or violet; sometimes with metallic lustre
- Often confused with the yellow mealworm beetle, *Tenebrio molitor*. Ground beetles have longer antennae, larger eyes and longer legs

Biology and habits

Ground beetles are harmless and not known to breed indoors. Larvae and adults are very active and voracious predators, feeding on caterpillars, slugs and snails. They may also feed on vegetable matter. Small numbers of adults may invade buildings over a few weeks in the year, accidentally or due to disturbance of the area surrounding the building.

Treatment

Not normally necessary; the occasional intruder may be picked up and placed outside. If persistent, dust under skirting boards and spray points of entry and wall/floor junctions.

Garden weevils, Clover weevils (Family Curculionidae)

Usually occur in gardens, where plants may be attacked. Common pest species include the garden weevil (*Otiorhynchus sulcatus*) and various species of clover weevil (*Sitona*).

Size: 8mm long, recognised by short, thick snout (rostrum) in front of the eyes and elbowed antennae.



House dust mite
(*Dermatophagoides pteronyssinus*)



Ground beetles
(Family Carabidae)



Garden weevils, Clover weevils
(Family Curculionidae)



Earwigs
(Order Dermaptera)



Woodlice
(Class Crustacea; Order Isopoda)

Colour: black with patches of minute, yellow scales (*O. sulcatus*), or dark reddish-brown without scales (*O. rugostriatus*). Sitona are variously coloured and 5mm in length.

Biology and habits

Harmless; do not bite or sting. White, fleshy, legless larvae feed inside plant tissues. Small numbers of adults may invade houses, especially in the autumn for shelter. Some *Otiorhynchus* are residents, breeding in pot plants (in offices and homes).

Treatment

Not normally necessary; the occasional intruder may be picked up and placed outside.

Earwigs (Order Dermaptera)

Frequently enter houses from the garden, or are carried in with cut flowers, occasionally in very large numbers. New housing estates are often troubled. The only common species is *Forficula auricularia*.

Size: 14 to 23mm long, with characteristic forceps at the hind end. The forceps are curved in the male but straight in the female. Short elytra completely cover the much-folded hind-wings.

Colour: brown.

Biology and habits

Harmless, but forceps are able to give a slight nip. The female lays about 30 eggs, usually in the soil. They are oval and about 1mm long. An unusual feature of the female is that she looks after the eggs until they hatch and young nymphs disperse. There is one generation per year. Adults are nocturnal and seek crevices and cavities for harbourage e.g. under skirting boards, beneath stairs and suspended floors and in wooden fencing.

Treatment

Where heavy infestations are encountered, dust harbourages. In cellars, spray the walls. Recommend the removal of vegetation and shrubs close to the building which may be the source of the infestation.

Woodlice

(Class Crustacea; Order Isopoda)

Common outdoors, but occasionally infest rotten timbers in damp locations indoors. A common species is *Porcellio scaber*.

Size: 15mm long. The body is rounded and oval with obvious antennae. The thorax has seven pairs of legs and the abdomen six pairs of leg-like appendages. One species of woodlouse rolls up into a tight ball when disturbed (*Armadillidium vulgare*).

Colour: usually dark grey.

Biology and habits

Woodlice are harmless. In damp properties woodlice breed in decaying timbers and other organic debris. Outdoors, they live under stones and in other cool, damp locations. They may cause a problem by entering houses in autumn and winter. Females carry the eggs attached to the underside of the body until the young hatch. In common with many other Crustacea, woodlice continue to moult after they have become sexually mature. Adults may live up to two years.

Treatment

For woodlice breeding indoors, e.g. under baths and in cellars, remove decaying timbers or organic matter and dry out area. Remove vegetation and debris from around house walls.



Millipedes
(Order *Diplopoda*)

Millipedes (Order *Diplopoda*)

Millipedes normally live outdoors feeding on plants and on damp and decaying wood and vegetable matter. They may give off an unpleasant odour when disturbed. A common millipede is *Tachypodoiulus niger*.

Size: 7–50mm long. Narrow and cylindrical with many segments, each segment having two pairs of legs.

Colour: blue–grey or brown.

Biology and habits

Eggs are deposited in clusters in the soil. After hatching, the young stages pass through a series of moults, the life cycle lasting about two years. Millipedes roll into a spiral when disturbed.

Treatment

Treatment is rarely necessary as it is usually sufficient to dry out the area, but apply dust if large numbers are found indoors.

Centipedes (Order *Chilopoda*)

Live outdoors in damp situations, but may crawl indoors for shelter. A common species is *Lithobius forficatus*.

Size: 5–75mm long, body flattened with many segments, each segment having one pair of legs. A pair of poison claws on the first body segment is used to inject venom into its prey.

Colour: orange–brown.

Biology and habits

Eggs are laid in batches and are tended by the female until they hatch. Centipedes lack a waxy coating over the cuticle, and thus inhabit moist situations to prevent water loss. Adults run rapidly and may crawl into the house and conceal themselves beneath skirting boards and behind sinks and baths.

Centipedes are predators, feeding on insects and other small animals.

Treatment

Rarely necessary, but apply dust if large numbers are found.

Booklice or Psocids (Order *Psocoptera*)

Booklice are pests in libraries, houses, warehouses and stored foods.

Size: 1–2mm long. They are soft bodied with relatively small thorax and long, thin antennae. The three most common species are: *Liposcelis bostrychophilus* – pale yellow–brown; nymphs almost transparent. No wings. Small projection on front edge of first section (femur) of hind legs, just visible with x 10 lens.

Lepinotus patruelis – females dark brown; males and nymphs lighter. Small, almost circular wings which break off easily.

Trogium pulsatorium – transparent; white with reddish or brownish marks on the abdomen.

Tiny wings sometimes present.

A high–power microscope is required for positive identification of the species of *Liposcelis* species.

Biology and habits

Eggs 0.3–0.5mm long, 1 or 2 laid per day: they are sticky and adhere to food. The female covers the eggs with food fragments. There are three to eight nymphal stages according to the species. The life cycle may be as short as 25 days, especially at the preferred humidity of 80 to 95 percent RH. The peak time for booklouse activity is August to November. Adults may live for six months.

Psocids feed largely on dry materials of plant origin which support moulds e.g. glues, size, books, paper, cardboard packaging, and plaster. They also feed on stored foods, particularly yeast, powdered egg, milk powder. *L. bostrychophilus* is able to breed without mould and is common in flour, semolina, etc. in domestic kitchens: it is the usual species in goods returned to manufacturers by customers. *T. pulsatorium* can be found in all types of buildings, usually in small numbers. *L. patruelis* is most common in cool, damp areas: often in manufacturing premises, sometimes in houses. It is the usual species to find on pallets and pallet boards.

Treatment

- **Inspection** – The possibility of any kind of building being free from psocids is extremely small; but finding them can be difficult. In homes, look under insulation between joists in the roof space; inside airing cupboards where pipes pass into the roof space; under the bath; at cracks and crevices in all rooms; and in all cupboards in the kitchen
- **Preventive measures** – Booklice do not breed in dry conditions. Ventilation and drying will prevent growth of moulds and thus help to control the infestation. An electric kettle boiling under fitted cupboards is a common way that humidity is increased, resite in the open
- **Control in domestic premises** – The best form of treatment is to reduce the humidity. Small localised infestations may be treated by means of a light residual spray using an approved product

Fungus beetles, Plaster beetles (Families *Cryptophagidae* and *Lathridiidae*)

Fungus and plaster beetles are minor pests on damp plaster, particularly in newly–built houses, mills and warehouses where they may infest damp foodstuffs. Two common species are *Aridius nodifer* (a plaster beetle) and *Cryptophagus acutangulus* (a fungus beetle).

Size: about 1.5mm (plaster beetle) and 3.5mm (fungus beetle).

Colour: brown or black.



Booklice or Psocids
(Order *Psocoptera*)



Plaster beetles
(Family *Lathridiidae*)

Biology and habits

Plaster beetles do not damage property since they feed exclusively on moulds and exist only under damp conditions conducive to mould growth. Fungus beetles may carry moulds from one commodity to another in damp warehouses. Both species may contaminate food.

Treatment

Measures should be taken to dry out the building by ventilation, heating or damp-proofing. These measures provide the ultimate solution to the problem, since moulds will not grow on dry walls. In homes damp foodstuffs should be destroyed. For short term control of the infestation, spray with an approved insecticide.



Spiders
(Class *Arachnida*)

Spiders

(Class *Arachnida*)

Spiders are disliked for their presence and their habit of spinning webs, but are beneficial as predators. A common house spider is *Tegenaria domestica*.

Size: body soft and small; 8mm in length, but the eight legs are long and may span up to 50mm.

Colour: greyish-brown.

Biology and habits

Eggs are laid in large batches in small silk cocoons (6 to 8mm long). The eggs hatch and the young spiders remain in the cocoon for two to three days. The young are fed by the female for the first few days; the young spiders then begin to snare food like the adults. There are four moults, occurring at intervals of one to four weeks. Adults may live for two years, and feed on insects.

Treatment

Good housekeeping. Insecticidal measures are not normally required. Thorough and regular vacuum-cleaning may give a measure of control by removing spiders and webs.



Brown-tail moth
(Family *Lymantriidae*)

Brown-tail moth

(Family *Lymantriidae*)

The brown-tail moth, *Euproctis chrysorrhoea*, is a pest of outdoor plants. The larvae may occur in very large numbers, stripping trees and shrubs of leaves and causing skin irritation.

Appearance of adult

Size: wingspan 32–38mm

Appearance: white wings, head and thorax. Dark brown abdomen tipped with a tuft of dark brown hairs.

Biology and habits

Eggs are laid in late July to early August in long batches covered with brown hairs on stems or beneath leaves of food plants (e.g. roses, ornamental shrubs, fruit trees, elm, oak, poplar, sycamore and willow trees). Eggs hatch in

August and September.

Larvae are nearly black. Abdominal segments have a row of red marks along the back and a row of downy white scales along the upper part of each side. Body is clothed in tufts of yellowish-brown hairs arising from brownish warts. Larvae are 25mm when fully grown. The larvae live and feed together in large groups; each group spins a tough silken tent suspended between twigs in which the larvae rest during cold weather. On warm, sunny days they emerge, feeding and damaging leaves around the tent. These feeding areas eventually become large, conspicuous bare or brown patches. Towards the end of October feeding stops and the larvae hibernate inside their tent from November to March. In April they re-emerge to feed again, causing their worst damage during May. The larvae pupate from late June onwards, in silken cocoons spun between leaves. The adults emerge in mid July.

Pest status

The larvae damage plants by stripping them of leaves. Due to their habit of shedding their irritating hairs, they are also a serious public health pest. Blown on the wind, these tiny hairs collect on washing lines, clothing etc. in gardens, caravan parks or holiday sites. Skin contact with these hairs results in very painful rashes and acute discomfort lasting several days.

Slugs and snails

(Class *Mollusca*)

Slugs and snails belong to the class Mollusca which include many familiar marine creatures. The Garden Snail (*Helix aspersa*) and the Garden Slug (*Arion hortensis*) are serious pests in the garden where they damage growing plants particularly delicate seedlings. The Large Black Slug (*Arion ater*) is less of a problem preferring rotting vegetation. Indoors their presence is usually indicated by silvery trails left by the mucous secreted by the "foot" to aid travel.

Biology and habits

Slugs and snails are hermaphrodite, so all have the potential to lay eggs. Garden snails lay about 80 spherical, pearly white eggs in the soil, up to six times a year. It takes about two years for snails to mature. Slugs lay up to forty clear, oval eggs in batches under leaves and in soil and reach maturity after about three to six months, depending on species.

Pest status

The slimy trails and faecal pellets can deface furnishings and the rasping tongue will remove paper labels from tins and damage packaging. As slugs and snails rarely exist away from damp locations efforts should be made to dry out areas below sink units, fitted cupboards and baths. Vegetation should be cleared from around entry points where possible, although both slugs and snails are capable of crossing cleared areas when active during the hours of darkness.

10 Birds and other vertebrates



Starling
Sturnus vulgaris



House sparrow
Passer domesticus



Feral pigeon
Columba livia var

10.1 BIRDS

Under the European Wild Birds directive 1979, all wild birds, including their nests and habitat, are protected. However, birds that are recognised as pests can have that protection removed and are listed on the General Licences, issued by Natural England each year. Equivalent licences are issued in Scotland, Wales and Northern Ireland.

The General licences list the birds that can be controlled, for specific reasons (e.g. for the purpose of preserving public health and public safety) and by specific methods. It is a condition of the Licences that all non-lethal methods must be considered first.

The main species of interest in the housing sector are:

- The feral pigeon and collared dove
- The house sparrow and starling, although these are presently removed from the General Licence in England
- The three species of large gull; herring gull, greater black-backed gull and lesser black-backed gull

The remaining species of pest bird on the General Licence are predominantly pests of agriculture.

10.1.1 Distinguishing features of common pest birds

The feral pigeon (*Columba livia*) is of medium size (32cm long); normally blue grey in colour with a white rump and black wing bars.

The collared dove (*Streptopelia decaocto*), is about 27cm long, fawn-grey in colour with a narrow black band at the back of the neck and a white tail tip.

The male house sparrow is 14.5cm and recognised by its grey crown, black bib, light grey cheeks and under parts, and brown wings with black streaks. The female is dull brown.

The starling is 22cm and has a summer plumage of glossy black with metallic purple and green tints. Generally found in large flocks, the numbers of starlings has decreased over the last few decades.

The only gulls, which may be killed, are the greater black-backed, the lesser black-backed and the herring gull. All three are large – in excess of 50cm long, but as gulls can be difficult to identify expert opinion should be sought.

10.1.2 Problems associated with pest birds

Maintenance costs

Nests and droppings block gutters and down spouts. The resulting overflowing water leads to timber decay, broken rendering, ruined decorations and even structural damage.

Spread of disease agents

The close association of birds with humans gives rise to the possibility of disease transmission. Sparrows, pigeons and gulls may carry bacteria causing Salmonellosis. Pigeons carry Ornithosis, a disease similar to viral pneumonia that can be transmitted to humans through infected droppings or respiratory droplets.

Ornithosis is often mistaken for flu in humans and so is possibly far more common than is realised.

Unsafe conditions

Droppings from pigeons on foot paths can cause them to become very slippery and pose a real risk to persons using the paths.

Sources of insect infestation

Birds' nests harbour insects and mites which live as scavengers on the nest material or droppings or as external parasites on the birds. Prevention of nest building on premises reduces this damage. The following insects and mites are known to occur in birds' nests. Carpet beetle; fur beetle; case-bearing clothes moth; brown house moth; white shouldered house moth; Dermestid beetles; yellow mealworm beetle, biscuit beetle, Australian spider beetle; cheese mite, flour mite, dust mites; lesser housefly; blowflies and bird mites.



10.2 OTHER VERTEBRATES

Most British mammals apart from rats and mice pose insignificant risk to public safety. Several such as all bat species, water voles, red squirrels and badgers are fully protected and must not be harmed.

Foxes and rabbits, through their burrowing, may cause structural problems to buildings and the former may be drawn to the food opportunities presented by waste areas.

Moles are generally considered a pest of agriculture and amenity sites where their tunnels and spoil heaps can damage growing crops and machinery and may pose a risk of injury to livestock and horses. When present in gardens the impact is generally aesthetic.

The grey squirrel may be a regular visitor to bird feeding stations and is capable of causing considerable structural damage to insulation, wiring and the fabric of a building. The first indications are often the noise heard as they move around in loft areas.

American mink and edible dormice may also enter buildings in search of food and shelter.

Control of the above requires specialist knowledge of available control techniques and should only be undertaken by persons with the necessary experience of this type of work.

Foxes have also been known to attack pets but incidents are relatively uncommon.

11 Pest prevention

11.1 OVERVIEW – THE PRINCIPLE OF EXCLUSION-RESTRICTION-DESTRUCTION (E-R-D)

The objective of the pest management programme is the maintenance of pest-free conditions in all areas of the site. The following systematic approach should be taken to all pest control and pest prevention issues:

- **Exclusion** – refers to the methods adopted in preventing pest entry into a building. Exclusion is often neglected until infestation has occurred, with reliance being placed on destruction. The use of pesticides may then fail to achieve the desired result because building structure and conditions continue to be attractive and sympathetic to pests
- **Restriction** – refers to the methods used in creating unfavourable conditions for pests to harbour and breed. Food, warmth, secure cover and ready access to a supply of water are the main features which make premises attractive to pests
- **Destruction** – refers to the physical and chemical methods that are commonly used to control pests

Based on the principle that no building can be rendered entirely pest-proof, the following building best practices will reduce the risk of infestation and aid in the eradication of pests as early as possible should they occur.

11.2 BUILDING DESIGN AND PEST PROOFING

Building design should, where possible, deny access and harbourage to pests.

11.2.1 The requirements of pests

Most buildings provide three main attractions for pests:

- **Food** – Most pests actually require very small amounts of food – an adult mouse for example, can survive on as little as three grams a day. The amount of food material required in order to provide adequate conditions for survival and breeding of insects can generally be met by less than scrupulous cleaning
- **Warmth** – A few degrees increase in temperature may be sufficient to encourage infestation, particularly in winter months. Conversely, ultra low temperatures are no insurance against pests. Inadequate heating and ventilation allied with the damp conditions found in some sub-standard housing are ideal for providing the high humidity which sustains pests such as

house dust mites. With most species of pests an increase in temperature generates a corresponding increase in breeding frequency and numbers

- **Shelter** – All buildings provide some degree of shelter or harbourage for pests. It is commonly assumed that older buildings are more prone to infestation, but new buildings with enclosed roof spaces, suspended ceilings, wall cavities, paneling, raised floors, service ducts and lift shafts provide a myriad of harbourages – many interconnecting – allowing a wide range of internal movement for pests

11.2.2 Location

Where a new build is being considered, an assessment of activities and the environment in proximity to the proposed site must be made. Landfill sites, watercourses, marshlands, derelict sites, farms and railway lines are examples of activities that often generate regular pest activity.

Consider the previous use of the site and the pest history (if any). Where an existing building is being renovated consider what the building was used for previously since pests may still be resident. Buildings that have previously been used for activities associated with the food industry are most likely to have a pest history.

11.2.3 Choice of vegetation

See section 11.6 - environmental management.

11.2.4 Water

The introduction of ornamental ponds should be carefully considered. Standing water may give rise to insects such as mosquitoes and midges that rely on water to breed. Water butts, buckets, children's toys and any similar receptacle should be regularly checked and emptied if found to contain mosquito larvae.

Good drainage of land is required to avoid waterlogged soil. A readily available source of water is an essential requirement for many pests.

Piscivorous wildlife (gulls, etc.) may be attracted to the site and then later roost or nest on the building. This will then lead to problems with fouling and eventually problems with insects as the two are often linked.

11.2.5 Lighting





Type of lighting

Many insects are attracted to ultra violet (UV) light: some may be brought in from as far away as 100 metres (especially night flying species); others may be attracted to light when they are only a few metres away (day flying species).

Night flying moths have been found to fly actively only an hour or two either side of sunset, and again (to a lesser extent) in the morning twilight. Many other insects also fly at dusk.

The type of lighting at premises will, to a certain extent, determine the attractiveness of the site to flying insects.

Most attractive are mercury-vapour lamps and special fluorescent lamps used for perfect colour rendition.

Next are “ordinary” commercial and household fluorescent tubes. These all emit some UV light.

Incandescent (tungsten filament) bulbs emit a large amount of infrared (IR) light and are therefore good sources of warmth. The warmth of IR light is also attractive to insects, although the area of attraction surrounding the source will probably extend only for a few metres. High-pressure sodium-vapour lamps, however, emit very little UV or IR and are currently thought to be the least attractive to insects. Unfortunately, these lamps give an orange

light and cannot be used where the recognition of colours is important. However, they are perfectly adequate for general lighting of parking areas, amenity sites, etc.

Siting of lights

It is recommended that an absolute minimum amount of lighting is physically attached to the building, instead, position lights 5 or 6 metres away and direct lighting towards doorways. Apart from the obvious benefits of attracting insects away from the building, there are also benefits to be obtained in making the building less attractive to birds that often roost and nest on such lighting structures due to their warmth.

Lighting just inside doorways should be high-pressure sodium-vapour or low wattage incandescent bulbs. Several small bulbs placed at intervals are better than one large one because the warmth produced is spread over a larger area.

Mercury-vapour lamps could, however, be used as decoy lighting around the extreme perimeter of a site (ideally 60 metres from the building). A lighting technique such as this would effectively attract flying insects away from a building that has localised low UV emitting lamps to it to an area of high UV.

The power conduit for external lights must be designed so that it does not provide roosting or nesting sites for nuisance birds.



The design of the external light fixture can be significant in pest activity. Overhead lights with a flat upper surface can provide a nesting or roosting site for birds.

11.2.6 Building perimeter

Perimeter pathways should be concrete and have a gradient away from the building fabric to allow rainwater run-off.

Concrete pathways are preferable to gravel pathways as gravel could be burrowed into by rodents despite the ability of gravel to back fill on itself. Pea gravel could be considered since it can back fill more readily. Concrete is more easily cleaned and weeds are less likely to grow on them.

Paving slabs are often laid on sand, which is conducive to infestation by ants. If solid foundations are used for laying slabs consideration must be taken of rainwater drainage to avoid standing water.

11.2.7 Waste areas

Waste areas should ideally be sited over ten metres from the main residential buildings in order that any pests that may be attracted are kept at a distance.

Waste area flooring should be recessed to create a bunded effect and should have a sufficient gradient to allow good run off of water to drainage points.

Waste drainage channels should not be fitted with grids that do not allow waste to pass through and consequently clog

Pooling water from overflow will encourage various pests, particularly flies.

Underground drainage should be configured so that it does not pass directly beneath areas of excess weight i.e. directly below where delivery or waste disposal vehicles may park.

Excess weight may damage the drainage pipes and allow rats to exit the sewerage system. Phorid flies may also breed in the effluent resulting in an infestation above ground, which will prove time consuming and costly to eradicate.

11.2.8 Ancillary buildings

Compounds such as sub stations often accumulate leaf litter and rubbish as a result of their locations. Restricted access due to safety means that they are rarely included in cleaning programmes.

Garages, sheds and greenhouses should be kept clear of any accumulations of unwanted items.

Insect and rodent pests may take advantage of leaf litter and rubbish accumulations and these areas should therefore feature on

cleaning schedules, especially during autumn when leaf fall is high.

11.2.9 Timber decking

The trend in covering areas of garden or patio with raised timber decking provides pests, particularly rats, with a secure, concealed location from which they can access food dropped between the boards or placed nearby for pets or wild birds. Decking should be constructed either with adequate space below to allow inspection or with side boards flush with the ground to allow early detection of any burrowing activity.

Access to the area below should always be possible to allow baiting in the event of an infestation.

11.3 BUILDING STRUCTURE

11.3.1 Walls

External walls should be constructed to ensure that no gaps of more than 5mm exist.

Wall foundations must be taken down to a solid bottom at least 900mm below ground level and concrete laid between the walls to prevent rodents burrowing into the building.

The addition of a concrete curtain wall to a depth of 600mm in the shape of an L with the bottom member turned out for a distance of 300mm will protect old foundations against rodent ingress.

It may be appropriate to apply a band of “non-friction” material one meter high above ground level to prevent rodents climbing external walls.

Airbricks supply ventilation to floor cavities but may allow mice and insect pests access. They should therefore have no holes larger than 5mm or be protected with a stainless steel mesh to 4mm mesh size.

Vertical external expansion joints should be sealed against pest entry into the wall cavity. Weep holes to the base of external walls allow any moisture within cavities to drain to the external, but may allow mice or insect pests access. They should therefore have no holes larger than 5mm or may be protected with plastic inserts incorporating a vermin screen.

Vertical external expansion joints should be sealed against pest entry into the wall cavity.

The external surface of walling should have no ledges. Ledges may provide suitable day or night time roosts for pest bird species. For the same reason over developed external wall fascia should be avoided. Where ledges cannot be avoided a slope of 45° will deter birds from roosting.

Internal walls should prevent movement of rodents between sections of the building. This should be extended to the sub floor and loft areas.

Gaps behind and below skirting boards, fitted cupboard units, and panels provide harbourage



for mice, cockroaches and other crawling insects in addition to allowing access into the room from cavity walls and sub-floor areas. Skirting should be removed and the gap filled by extending the plaster to the floor though care must be taken within ground floor rooms that any damp proof course is not bridged by the plaster.

11.3.2 Services

Pipe and cable ducting are potential pest harbourages and act as communication highways between areas. Ducts can be subdivided to prevent rodents gaining access along their length. Fire barriers may provide this feature but must be of non-flexible nature and pipes and cables tightly sealed where they pass through the barrier. Inspection hatches will be required for each compartment. Sub floor ducting should be made accessible.

Supply pipes and cables, i.e. gas, electric and water must be tightly sealed where they pass through walls and floors as rodents may gain entry via this route. Heating and hot water pipes will require special sleeves to allow for expansion. External meter boxes must be close fitting and should be kept locked.

Unused pipe and cable cut-outs in fitted cupboard units provide access to the inside storage area. These should be sealed. Hinged covers in pipe ducting, particularly the swing variety, providing access to stop cocks should be sufficiently tight fitting to prevent rats pushing them aside.

All drains should be accessible and facilitate flushing and rodding. Drains that pass under the foundations of the building should be suitably reinforced so that they may not fracture due to subsidence. Rat activity in drains is commonplace and fracturing of drains may lead to rats gaining access to wall cavities. Prior to a building being demolished the drainage system should be temporarily sealed if it is to be re-connected. Disused connections from demolished properties should be capped off and filled with a concrete plug.

Special attention must be given to vertical ducts that pass between floors. Ducting may allow rodent and insect pests free movement between floors. These should be proofed at each level to limit the points of entry. Lift shafts should be drained. High water tables may lead to water build up in lift shafts, which may in turn lead to fly problems. Regular access into lift shaft pits should be catered for to enable regular cleaning and inspection.

11.3.3 Flooring

Materials should be carefully selected to provide a smooth, impervious surface. All existing cracks and crevices should be sealed to prevent the accumulation of product residues that provide insect breeding sites.

Flooring under cupboard units and equipment should be completely smooth to allow thorough removal of waste material.

Fractures in tiling, perhaps due to heavy objects falling on them, allow moisture to collect below them, again creating areas where insect infestation may develop.

11.3.4 Doorways

Fire exit and waste area doors should be constructed of metal, or have sheet metal over their outward facing surface to a height of 300mm. Rats and mice are easily able to gnaw through the bases of wooden doors and therefore gain access. The threshold clearance of external doors should be no greater than 5mm.

Rats and mice can move around within a building via gaps that exist below doors. All internal doors should have a working clearance of 3mm (1/8").

Louvered vent doors to sub stations, etc. should be avoided where possible and other methods of ventilation sought. Rodents gaining access to sub stations may then be able to access the main building via pipe and cable routes.

Where louvered doors are fitted to boiler cupboards they should be fitted with a weldmesh screen having holes no larger than 5mm.

11.3.5 Windows

Design out window ledges. Pest birds may use window ledges as day or night time roosts.

If plant room windows are to be left open, they should be fitted with 25mm mesh to prevent ingress of birds.

11.3.6 Roofing

Rainwater down pipes should be fitted externally to the building and be suitably guarded against vehicular damage. Rodent entry into a down pipe from the ground can be prevented by the use of a back inlet gully. Rats can be prevented from accessing the roof via the inside of the rain water pipe or soil vent pipes by fitting a wire balloon guard to the top of the pipe.

Rainwater run-off from the roof can attract and support pests around the building exterior. Design down spouting so that it is sealed where it passes through into underground drains.

Certain flying insects require stagnating water to breed in. Guttering should have sufficient fall to allow good run off of rainwater.

11.3.7 Ceilings

Avoid creating ceilings that are enclosed. Ceiling voids are potential harbourages for pests. Enclosed voids can also make inspection for pests difficult.

Suspended ceilings have the benefit of being aesthetically pleasing; however, access into them is difficult in the event of pest infestation in the void. Where suspended ceilings are used then comprehensive access for pest inspection should be present.



11.4 HYGIENE

Effective cleaning is essential if pest activity is to be minimised.

The following lists management practice that can be deployed to prevent pest infestation. The attention of all should be drawn to the importance of cleanliness and hygiene and to the benefits of adhering to these recommendations.

11.4.1 Attraction of pests due to poor hygiene

The following can provide a food source or breeding site:

- Food, including uneaten pet food, exposed for long periods, particularly overnight
- Unwashed food containers left overnight
- Accumulated food debris. (High-risk areas include spaces under shelves or behind cookers and refrigerators)
- Used or empty packing materials including bottles and cans
- Spillages around waste bins and rubbish chutes

11.4.2 Minimising pest attraction

Pets – The presence of pets can provide a source of food and suitable breeding site for pests.

Uneaten pet food will provide a food source for cockroaches, and attract flies which may lay their eggs in the residues. Even if this is subsequently removed the eggs may hatch and develop within the waste bin.

Rodents will be attracted to un-eaten food, particularly if left overnight, and also to bird seed which may be discarded by cage birds. Sleeping and resting areas used by pets should be regularly vacuumed and the bedding washed to prevent fleas becoming established.

Wildlife – Feeding wild birds should be carried out sparingly, providing only enough food for their needs. Suspended bird feeders should be used where possible and regularly re-

positioned to avoid the buildup of residues and bacteria on the ground below. No food should be thrown on the ground as this will attract rats.

Composting – If garden waste and green food scraps are to be composted an enclosed receptacle of wood or plastic should be used. To prevent rats burrowing from below a solid base or weld mesh floor should be provided. Only materials of a vegetable nature should be placed in the composter. Drainage in the base and a cover on top will reduce the attractiveness to flies.

11.4.3 Storage areas

Keep storage areas tidy, using only close-fitting containers. Ensure that any infrequently used food items or ingredients are inspected regularly, as these will be more likely to harbour pests.

11.4.4 Kitchen utensils and food handling equipment

Food deposits should be removed and items washed as soon as possible to avoid attracting insects such as flies and wasps.

11.4.5 Drains and water

As most rodents and birds rely on a supply of drinking water, sources of free water should be avoided.

Seal off any disused water supplies and be aware of any roof leaks or rising damp. Remove any pools on concrete bases or on flat roofs. Ensure gutters are free flowing and water cisterns are covered.

Avoid the introduction of fats, oil and grease (FOG) into the drainage system in order to reduce the likelihood of blockages.

As far as practicable do not dispose of excess food in the sewers as this will increase the risk of rat infestation.

11.5 WASTE MANAGEMENT

Waste materials, particularly foodstuffs, provide a ready source of shelter and sustenance for a wide range of pests. In many cases the pest infestation begins in the waste disposal or collection areas from where they spread into neighbouring areas. Improvement in the maintenance and hygiene at waste collection areas can measurably reduce the attraction of the site to pests.

11.5.1 Location and design of waste collection areas

Where practicable, waste areas should be sited more than 10 metres away from the main building in order that any pests that may be attracted are kept at a distance.

If individual bins or skips are not covered then the area should be enclosed within a mesh cage to prevent access by birds.

11.5.2 Waste containers

Unclean bin areas will attract many pest species to their freely available food sources.





Waste skips should be placed on a concrete pad to prevent rats burrowing underneath and be situated on rails of a height that will allow for thorough cleaning below. The concrete should be capable of carrying rainwater and run-off from cleaning to a drain.

Wheelie bins should have securely fitting, undamaged lids which should be kept closed. Any damaged bins should be replaced as soon as possible. Large plastic wheeled bins should either have a water permeable bung installed or galvanised expanded metal plaster lath glued to the bin frame around the drainage hole to prevent rodent access.

Where small refuse bins are used they should be lined with strong polythene liners. The area between the bin and the liner should be cleaned regularly to remove residues.

11.6 ENVIRONMENTAL MANAGEMENT

Denial of suitable harbourage will assist in the control of pests should they be attracted to the site. Aesthetic measures such as landscaping can provide suitable conditions for sustaining pests if not undertaken with fore-thought and attention to detail.

11.6.1 Types of plants and design

Plants that are known to have a history of pest problems should be avoided.

- *Berberis spp.*
Numerous thorns collect litter, and the spines can make treatment dangerous
- *Cotoneaster spp.*
Flowers encourage queen wasps
- *Potentilla spp.*
Flowers encourage Varied Carpet Beetle (*Anthrenus spp.*)
- *Spiraea spp.*
Flowers encourage Varied Carpet Beetle (*Anthrenus spp.*)
- *Salix spp.*
Prone to aphids that attract wasps

11.6.2 Trees and shrubbery

Preference should be given to plants that shed the least seeds and fruits. Seeds and fruit may initially attract and then support insects, rats and mice and various pest birds.

Shrubs and trees should be of a coniferous type.

Leaf fall from deciduous trees that accumulates in guttering will restrict the run-off of rainwater and may give rise to localised infestations of insects that rely on standing water to breed. For example midges and mosquitoes.

Leaves that accumulate along external wall/ground junctions provide harbourage and sheltered runs for rats and mice.

Overhanging branches might provide vertebrate pests access to buildings. Tree limbs and branches should be least six feet away from building exteriors (ten feet if squirrels are a problem).

Very occasionally, some species of ants will enter a building along a branch that touches the building.

Where possible, shrub planting should be through weld mesh in order to limit burrowing by rats and rabbits.

11.6.3 Ground cover

Plants should not be planted too densely. Dense ground cover will provide cover and harbourage for rodent pests.

Access in between shrubs is important for pest control inspection.

The landscape to aim for is a parkland type, made up of various trees and shrubs that have an upright habit. These plants should not be cut down to keep them low, but maintained in such a way as to keep the ground area open. The ground underneath should be mulched with bark gravel or shingle.

11.6.4 Landscaping materials

Avoid the use of materials that may be a source of food or provide cover for pests.

If paving slabs are laid on a sand foundation they are likely to be colonised by ants.

Piles of rocks, dry stone walls and poorly constructed decking will provide harbourage for rats.

11.6.5 Location adjacent to buildings

Vegetation should not encroach within five metres from any outside wall of a building.

Climbing plants should not be planted against the walls of buildings. These could create entry routes for pest rodents, harbourage for pest bird species and entry routes for some insect pests.

Grass should be kept closely cut at all times. Long grass will offer cover and harbourage for rodent pests.

11.7 FLY - TIPPING

Fly-tipping is waste illegally deposited on public land or private land without the owner's permission and is an offence under Section 33 of the Environmental Protection Act (1990). This can take the form of plastic bin liners containing domestic refuse; garden waste such as grass cuttings and shrub clippings; discarded furniture and soft furnishings; waste DIY materials; demolition and building materials; or the product of house clearances. Pests such as rats and mice will find food and harbourage in fly-tips. Foxes, feral cats and domestic pets will be attracted to the site by the presence of these pests and may exacerbate the situation by dispersing the waste.

Flies will breed in wet food residues and mosquitoes may find breeding sites in any water accumulated in the debris.

12 Control and treatment strategies

Integrated pest management (IPM) is a systematic approach to pest management, which comprises:

- Building and materials design
- Building maintenance and exclusion practices
- Advice on good housekeeping practices
- Inspections and monitoring
- Physical control methods
- Chemical control methods
- Habitat/environmental management

Early detection of pest activity is essential if the impact of corrective control measures is to be optimised. A combination of thorough regular inspections and ongoing monitoring using a variety of detectors will provide the information upon which to build control strategies.

Early detection of pest activity is essential if the impact of corrective control measures is to be optimised

12.1 INTEGRATED CONTROL STRATEGIES AND HOUSING

When dealing with pest infestations in domestic premises it may be necessary to consider areas outside of the original source of the request for service. Rats, mice, birds and insect pests can readily move from one premises to another using loft spaces, risers, cavity walls and sub-floor voids.

To effectively control infestation occurring in several properties within a block, for example mice or cockroach infestation in a row of terraced houses or a high rise block of premises, a block treatment strategy will be required.

The strategy involves carrying out a comprehensive survey to establish the extent of the infestation within the blocks, followed by treatments to all the premises within the infested block where there has been evidence of infestation, or where there is likely to be activity. It is essential that the treatment programme includes treatment of the service ducting (vertical or horizontal) containing gas,

water and electricity cables which may supply a number of premises on the block and which provide a common link for the infestation to spread. Roof spaces also require surveying and treatments carried out as required, particularly if the local housing scheme is district heated and heating pipes linking the properties are located within the roof space.

An essential element of the block control programme is gaining control by integrating chemical and physical control i.e. the success of the programme will not rely purely on the use of pesticides. Conditions which may encourage or exacerbate pest activity such as poor housekeeping, fly-tipping in adjoining vacant premises etc must be addressed.

The local authority environmental health dept can assist in the effective implementation of a block control programme by securing access through legal means to vacant premises or by gaining access to premises occupied by residents (who may either be uncooperative/ obstructive etc), in order to carry out the required treatment. The local residents association and elected ward councillors can prove invaluable in encouraging and promoting community buy in and support.

At the conclusion of the block control programme, the success of the initiative should finally be measured by placing monitoring stations throughout the premises within the block, and carrying out any additional treatment should localised pest activity be detected.

To help minimise any future infestations any structural issues such as proofing, particularly with respects to mice e.g. by sealing gaps which may provide harbourage in the building fabric etc. and by ensuring the occupier is observing good housekeeping practices should be addressed.

12.2 INSPECTION

In addition to pest activity the inspection should identify anything that might cause an infestation or allow pests to multiply.

12.2.1 Inspection techniques and equipment

Proper pest identification

For good pest control, accurate identification is essential. Correct identification of pest species



and a practical knowledge of pest behaviour will determine the source and therefore the target area for control.

The more common pests can usually be identified from books. In some cases however, particularly relating to flies or stored product/textile pests, more specialised identification may be required.

Use of generic or historical information

Where present, the pest control report book, job sheet or electronic report should be examined prior to commencing the inspection. On large projects a site plan and the last report should be carried during the survey. Reference to reports covering the previous 12 months may be useful in determining seasonal variations in pest activity or focal points of infestations.

Pest sightings or complaints

Pest sightings or complaints made by persons other than those involved in Pest Management should be investigated.

See section 2.4.1 Pest Sightings Log

Thorough inspection

The extent of the inspection and the areas included should cover the entire site including grounds within the perimeter, all structures and all areas within buildings.

Types of information gathered on-site

The information gathered can be divided into two areas.

Information on the pests:

- Species present
- Location
- Numbers
- Extent of infestation
- Risk to public health
- Proposed control methods

Information on the premises:

- Potential entry routes of pests
- Exclusion recommendations
- Hygiene and housekeeping requirements
- Storage and waste disposal processes
- Risk assessments

Sources of information

Information can be collected from four sources during the inspection:

From any previous information on the property – this is likely to be historical, as the reported sighting would in most cases have resulted in a call out to address the problem.

From residents or site management staff – while this is a worthwhile source, any information should be confirmed by a thorough inspection of the area. Third party reports may not be accurate concerning the type of pest, numbers seen or timescale due to the vagaries of the human memory.

From evidence found on detectors – this source of evidence is of lesser importance in the

housing sector than in the food industry. Sticky traps may be used to assess the extent of a cockroach infestation prior to a treatment and pheromone traps can monitor the success of a treatment against clothes moths when fitted with the appropriate lure.

From visible evidence – while detectors can provide evidence of pest activity, they rely in the main on the pest coming to them. The information may not be defined whereas an experienced inspector has the knowledge of pest behaviour and biology to find and identify the source of an infestation. A physical inspection also allows a risk assessment on any proposed treatment to be carried out in addition to fulfilling a quality control function on the pest management programme.

Surveillance of adjacent properties and land

Adjacent properties whether occupied or open sites should be monitored as possible sources of infestation. Both insects and rodents have the ability to migrate from adjacent sites – in the case of flying insects this can involve movement over considerable distances.

Due to environmental considerations the use of permanent perimeter bait stations containing toxic rodenticide baits can no longer be justified. Inspection and the use of a non-toxic monitoring system should be preferred with toxic bait being used only when signs of rats are found.

Suggested inspection tools

- **Torch (with spare battery and bulb)** – pests are by nature secretive and may be deep within recesses or below fixtures where natural light may not penetrate
- **x10 lens** – many pest insects are small and the distinguishing features not apparent to the naked eye
- **Supply of specimen tubes** – where identification cannot be made at the time of inspection, samples can be labeled and removed either for identification at a later date or to send for professional advice
- **Bait box keys** – where a pest control contractor is undertaking the pest management access to bait stations may be required for monitoring purposes between scheduled calls. Care must be taken when handling bait stations and rodenticides and all baits must be re-sealed to prevent unauthorised access
- **Supply of cable ties** – where bait stations are secured by means of cable ties replacement ties are required to re-secure the bait station lids
- **Tools** – a set of screwdrivers, inspection cover lifting keys, a claw hammer and a socket set may be required where access is required to cavities or drainage systems

Other items may include a folding ladder for access to overhead areas, loft hatches, false ceilings, electric fly killers, etc.



12.2.2 Inspecting for rodents

The following clues can be used to identify the species and location of both mice and rats.

Droppings

The shape and size of droppings will help you to identify the species. Rat droppings are approximately 10-12mm long, up to 5mm in diameter and spindle shaped. The droppings produced by mice are approximately 4mm long and much thinner at around 1mm.

Are they soft and glistening? This will tell you that live rodents are still present. The presence of large droppings (from adults) and small droppings (from young) indicates a breeding population.

How are the droppings distributed (scattered or in groups)? Norway rats regularly use latrine areas to deposit droppings. This will indicate the species and whether the rodents are moving extensively.

How many fresh droppings are there? This will indicate the size of the infestation. Rats produce about 40 droppings each day and mice about 80.

Live/dead rodents

Both rats and mice are in the main nocturnal. If you see live rodents during the daytime then they are short of food, or there is a heavy infestation or a harbourage has been disturbed. Large numbers of rodents, particularly mice, have a characteristic smell.

Smears

The smears left by rodents are formed when the animal's fur deposits a dark, greasy film on surfaces with which it makes regular contact. In heavy infestations, grease from the body, combined with dirt and urine may even build up into "urine pillars". These may remain on surfaces indefinitely and may not indicate a current infestation.

Tracks

Footprints and tail swipes can be found in deposits of dust and in soft mud. Apart from size there is little to distinguish between rat and mouse footprints.

The size and appearance of the footprints may not allow an accurate assessment to be made of current infestation. Footprints and tail marks may remain visible for many months in undisturbed dust and it can be difficult to distinguish between fresh tracks and old ones.

Gnawing damage

Damage to wood may be caused by both rats and mice when trying to gain access to a building. They will also gnaw as a means of keeping their continuously growing incisors worn down and sharp. Freshly-gnawed wood is generally light in colour. Damage to stored goods can give information on the duration and size of an infestation. Paper including labels is often shredded by mice for nesting purposes.

Runs and burrows

Rats may feed within a building and live outside. Frequently used runs can be seen where they are travelling between areas. These runs may terminate in a hole, often with a fresh soil heap outside. Dust and cobwebs over the entrance to a harbourage show that it is unused.

12.2.3 Inspecting sewers for rodents

This is an essential part of any IPM programme because rats use sewers to move around a town or city in a safe, uninterrupted environment with an ample supply of food, water and an ambient temperature that rarely moves more than 1 degree all year round.

Old Victorian brick barrel sewers offer an excellent opportunity for breeding especially when mortar joints fail and bricks become dislodged. This allows rats to gain access into voids behind the wall of the sewer for breeding.

Many surface rat infestations can be contributed to defects in the drainage system. It is therefore good practice to have an integrated sewer monitoring and baiting programme. Best practice requires sewers to be baited via manholes linked to drainage catchment areas.

As this process requires working on roads full compliance with health and safety is paramount.

12.2.4 Inspecting for insects

Cockroach marks

Large infestations of cockroaches may be completely hidden during the day but the marks left by cockroaches are evident on surfaces. These brown, irregular streaks are liquid excreta produced by cockroaches when water is readily available. They are usually most noticeable near cockroach harbourages.

Harbourages

German cockroaches especially favour the following locations:

- In kitchens, behind and under cookers, sinks and kitchen units
- Around water pipes and radiators, particularly where pipes pass through walls; inside cupboards; under tables; behind wall tiles. In kitchens and catering areas they can be found inside plugs and the sockets into which three pin plugs fit
- Ventilation and service ducts

Oriental cockroaches especially favour the following locations:

- Cellars, pipe ducts, store rooms, boiler houses and floor cavities
- Brickwork and cracks in concrete
- Outbuildings, drains, rough ground and rubbish tips

Live cockroaches

- Live cockroaches can be detected using a torch shone into harbourages or flushed using an aerosol spray. Care must be taken to avoid contact of the propellant with any naked flames
- A night inspection may identify areas where cockroaches are foraging
- Sticky traps placed overnight may produce better results than a visual night inspection

Adult flies

A localised congregation of adults often indicates the presence of a nearby breeding site.

Water

The larval food of flies must be moist.

Thoroughly inspect all drainage channels and gully traps. Where floors are washed, look for places where residues collect: under cookers, refrigerators and cupboards.

Debris

Examine all possible locations where animal or vegetable waste tends to accumulate. Inspect rubbish chutes, the bottom of lift shafts, and in dustbin and waste disposal areas including drains.

Check whether dustbins and waste skips are clean, or if a soggy residue is left on the sides and the bottom when emptied.

Marks

Favoured alighting surfaces can be identified by fly marks left on fluorescent lights, lampshades, windows and doorframes, picture rails, beadings, pipes and pipe chasings, and projecting corners of walls.

Ants

Garden ants

In domestic premises the presence of ants is indicated by trails formed by worker ants of the garden ant. These are often found around door thresholds, and around sinks and cupboards. The nests can be located by following the trails to the source, perhaps through the brickwork or airbricks, to the outside. The soil around nest exit holes is usually finely powdered. The nest may be located under slabs outside or inside under the floor.

Roger's ants

Roger's ants are found in damp debris, around floor drains and gullies, in crevices behind tiles, and in cracks along wall/floor junctions.

Tropical ants

Although Pharaoh's ants and ghost ants follow trails to and from the food source it is unlikely that the nest will be located.

Fleas

Adult fleas will be found on or off the host animal but may be more numerous in areas where the pet sleeps or rests. Larvae will be feeding on debris and adult flea faeces in and around the animals bedding. Particular attention should be paid to carpet edges and undisturbed areas such as below furniture. Search for, and remove birds' nests if bird fleas are found.

Bedbugs

A thorough inspection of the headboard; bed frame; mattress' buttons and seams on both sides of the mattress; cracks and crevices near the bed; broken plaster; peeling wallpaper; gaps in floor boards; carpet edges; skirting boards; inside light switches; ceiling roses; light fittings; in joints in furniture; behind pictures, picture rails and architraves is required in order



to detect the presence of live insects, eggs or cast nymphal skins. Any clothing in the room should be checked, particularly seams.

Fresh blood, from the host or squashed bedbugs, and circular excreta marks, may be found on bed linen and around harbourages.

Prior to the commencement of treatment to control fleas or bedbugs it is essential that the property is fully prepared in accordance with the recommendations made by the pest control operator. If the areas have not been prepared, treatment cannot take place at that time.

Wasps

The existence of a wasp nest is generally indicated by the presence of large numbers of wasps actively flying in and out of a hole or holes in the house wall, soffit or roof tiles. The nest may be visible from within the loft. A constant buzzing noise can often be heard in a room adjacent to the nest.

Stored product insects

Identification

Most insects of stored products are small and require a lens (x 10 magnification) to see identifying characteristics.

Biology

Once identified, knowledge of the insect's biology will help to locate the source of infestation. Leather beetles and larder beetles infest materials of animal origin, and if they are found in a domestic premises they are likely to be feeding on dried meat scraps or on dead rodents or birds. Webbing indicates an infestation of one of the moth species.

Damage

Many insects of stored products infest a range of commodities, but others confine their attack to particular foods.

Beetles

Adult beetles and the tracks left by their movement through dust may be seen outside of the stored product. The larvae of beetles are often within the commodity and not easily visible.

Moths

Look for free-flying adults; these fly mostly at dusk and in the early morning and for larvae, which may be wandering on the walls and on the produce.

Mites

Mites usually occur where foods are stored under damp conditions or where the moisture content of the product is high. Mites are very small; a x10 lens is needed to detect them. Mites are not usually noticed until an infestation reaches a high level. A first indication of mites is a fine layer of dust on the surface of goods. If this dust is gathered into a small pile, the heap will quite quickly collapse as the result of the movement of the mites. If the dust is pinched between the fingers, or

the surface of a sack is struck with the open palm, the presence of flour mites can be recognised by the 'minty' smell.

12.2.5 Monitoring

The use of the electronic fly killers as an effective pest monitoring tool

Where electric fly killers are present, catch tray or adhesive film analysis of fly killing units can provide information on:

- The species of insect present
- Numbers – particularly increases which should trigger a change in control strategy
- Seasonal fluctuations
- Likely foci of infestations
- Related hygiene or process shortcomings

The use and limitations of adhesive traps

Adhesive detectors are the most cost effective method of remote detection of insects throughout all areas of a site. If the full benefit of their deployment is to be achieved they must be checked regularly and replaced when rendered ineffective through dust or damp.

They must be employed in sufficient numbers to give adequate cover as most insects have a relatively small range.

Rodent monitoring using non-toxic bait blocks

Where there is no current infestation of rodents and there may be a risk to non-target species through the use of toxic bait, non-toxic bait blocks (or grain) can be placed in bait stations. This has the advantage that any rats foraging in the area will become accustomed to feeding from the bait station and may more readily take subsequent toxic bait.

Regular inspection of monitoring blocks is essential as any subsequent baiting programme must be commenced as soon as possible after detection.

The disadvantage may be that, when used outdoors, non-target species such as field mice may have become conditioned to feeding from these sites.

Rodent monitoring using tracking dust

Tracking dust can be used to determine the presence and direction of travel of rats and mice. When either walks over the smooth surface, a clear imprint of feet and occasionally tails can be seen. The material used should be finely ground and unscented. Flour can be used but a non-food alternative such as china clay would be preferable.

A fluorescent version of tracking powder is available. Traces of the dust carried by the feet of the rodent leave a trace, which is illuminated when exposed to ultra-violet light from a special lamp.

13 Control methods

13.1 NON-CHEMICAL CONTROL METHODS

13.1.1 Physical control overview

In certain situations the use of chemical methods in controlling pests is not permitted or not advisable.

The use pesticides may be unacceptable where young children or pets are present if they cannot be excluded from the treated area.

The use of pesticides, particularly rodenticide baits, in outdoor areas may present a risk of secondary poisoning to non-target species. In areas where there are protected species of animal or plant life, the use of physical methods of control may be selected in preference to pesticides.

13.1.2 Rodent and other vertebrate trapping

Mammal traps

Spring traps, which are designed to kill the rodent, as well as live traps, are available for rats and mice. Sticky or glue board traps are also available for both rats and mice, although their sale and use is covered by an industry code of practice. Traps are extremely useful in areas where it is not possible or advisable to use rodenticides, for example, where rodents may cause a smell should they die and their

Spring traps can be used within bait boxes where the use of rodenticide is not advisable or to control foraging rodents quickly.

Cage traps

Cage traps which catch the target animal live are of limited use as a control measure but may be employed when there is a risk to protected species from other methods. Any animal caught, if not to be released must be despatched humanely.

Glue (rodent) boards

The use of glue boards can be useful in removing survivors following a rodenticide treatment or individuals in high-risk locations. Their use is subject to an industry Code of Practice which is designed to ensure trapped animals are not subjected to unnecessary suffering.

The main points of the Code of Practice are:

- All other options for rodent control should be considered before using glue/rodent boards
- Where rodent boards are laid these must be inspected at least once daily
- Boards must be placed in such a manner that they do not present a hazard to non-target species
- Records should be kept of all boards laid to ensure traceability
- Rodents trapped on rodent boards must be despatched quickly and humanely. Drowning is not an acceptable method of despatch.
- Boards must be retrieved and removed at the end of the exercise
- Technicians must be given adequate training and be competent in the effective and humane use of this technique
- Any third party delegated to check boards on behalf of the pest control company should be similarly trained and competent
- Under the Animal Welfare Act 2006 such delegation does not absolve the pest control company from responsibility for the welfare of the trapped animal

Bird traps

Cage traps are usually constructed from wire mesh, into which birds are enticed using a decoy, or suitable bait. Once inside, the bird is prevented from leaving by a cone entrance, bob wires or non-return door.

Traditional anti-perching systems consist of sprung wire or spike systems and are designed to prevent birds from alighting on ledges or similar surfaces

bodies cannot be retrieved.

Spring traps

Only traps approved under the Pests Act 1954 may be used for killing and taking animals. These are listed in Spring Traps Approval Orders issued by Defra and details are available on their website. Such traps must be used in accordance with their conditions of approval in order to avoid risk to non-target wildlife and persons, particularly children.

Break-back traps commonly used for the destruction of rats, mice and other small ground vermin and spring traps of the kind commonly used for catching moles in their runs are exempted from the requirement to be approved.



It is a legal requirement that birds are caught alive; non-pest species can then be released and the remaining birds can be humanely dispatched. Traps must be visited at least daily to release or dispatch birds. Food and water must be available in the trap to prevent undue stress.

Other (non-lethal) bird control methods

Traditional anti-perching systems consist of sprung wire or spike systems and are designed to prevent birds from alighting on ledges or similar surfaces. Electronic wire systems are also available.

UV stable polyethylene or polypropylene netting with an appropriate mesh size for the species concerned will provide permanent exclusion from areas such as loading bay canopies:

- 19mm for house sparrows
- 28mm for starlings
- 50mm for pigeons
- 75mm for gulls

Bird scaring can be effective against gulls and starlings using digitally produced warning and distress calls or birds of prey may be successful in deterring most species of birds from open areas.

13.1.3 Insect Trapping

The use of insect traps can rarely be relied on as a method of control but can provide evidence of the presence of insect pests and may in some cases reduce numbers.

Insect traps

The main types of insect traps are:

Electric Fly Control Units (EFK)

Flying insects are attracted to the Ultra-violet light emitted by the unit and are either trapped on an adhesive board or killed by means of a high voltage electric charge.

As UV emission from the unit degrades rapidly lamps should be replaced at between 6-12 months, preferably in spring.

EFK units should not be placed:

- Outside or by open windows and doors where they will catch non-target species and may attract pests to the site
- Beside windows or fluorescent lighting where they will compete with UV emission
- Over food preparation surfaces where there will be a risk of fall-out from the unit

Adhesive traps

The term “detector” better describes the function of adhesive traps. Insects are encouraged to enter the trap by either a food source attractant or pheromone lure and are held on the adhesive surface.

Pheromone traps

As with adhesive traps the male insect is attracted by the pheromone released by the lure. Once in the trap the insect may be trapped with an adhesive insert or simply be unable to find its way out. The pheromone is specific to one or a number of related species and acts as an indicator rather than a control method. In the residential sector the pheromone traps specific to clothes moths are those most likely to be used.

Fly and wasp traps

Included in this group are various fly and wasp traps, which attract the insects by means of liquid bait. Having entered the trap the insects are then unable to escape and drown.

13.1.4 Other physical control methods

Temperature control

- **Heat treatment** – Raising the core temperature of a space or product above 55°C will result in the death of all insect life cycle stages. Care must be taken to prevent structural or commodity damage while attempting to achieve a uniform temperature throughout.
- **Freezing** – Tests have shown that freezing of insects to -35°C is an effective method of control. Increasing the cooling rate reduces the temperature at which the insect will die.



13.2 CHEMICAL CONTROL METHODS

13.2.1 Pesticides in the housing sector overview

While the aim of an integrated pest management programme is to minimise pest risk through proofing, hygiene and environmental management, there will be occasions when pesticides will be employed to eradicate an infestation in and around the premises.

The use of pesticides has the potential to present risks to the health of users and third parties and a risk to the environment. For these reasons the use of pesticides will be a last resort and their use will strictly adhere to the requirements of current legislation, in particular:

- The Control of Pesticides Regulations 1986 (as amended) (COPR)
- The Control of Substances Hazardous to Health 2002 (COSHH)

Where possible pesticides should not be stored on site as the following risks may be present:

- The handling and use of pesticides by untrained people
- Pesticides being handled or misused by unauthorised people, children, domestic or other animals
- Pesticides being stolen and dispersed due to forced entry to stores
- Continued storing of pesticides that have become unapproved by government for storage and use
- Storage of excessive quantities which may

be inherently hazardous to staff using the store

- Storage of different chemicals that could become hazardous by interaction
- Lack of segregation for example of flammable materials or of pesticides, which could taint pesticide baits

Where pesticides are stored on site, the store should be located away from residential areas, kept securely locked and accessed only by authorised personnel.

13.2.2 Insecticides

Chemical control of arthropods involves the use of insecticides or acaricides. These are chemicals that kill insects and mites or prevent their development, thus preventing the production of the next generation.

Many insecticides and acaricides are poisons. Therefore their use in public health should be as a last resort after all other methods have been considered. A full risk assessment should be carried out and a COSHH assessment undertaken before using insecticides or acaricides.

Mode of action

Most modern insecticides work on contact with the target organism. The insects have either to be exposed to the pesticide in the air or as a deposit on the substrate. Some insecticides, often those used as baits, need to be ingested by the insect.

Insecticides can be classified by their mode of action. Most insecticides affect one of five biological systems in insects. These include:

- The nervous system
- The production of energy
- The production of cuticle
- The endocrine system
- Water balance

This method of classification is preferred among scientists.

Insecticides that affect the nervous system

Most traditional insecticides, such as organochlorines, organophosphates, pyrethroids and carbamates fit into this category. However, of these groups only pyrethroid and carbamate insecticides are used in public health pest control today.

Insecticides that affect the nervous system can be divided into two groups; axonal poisons, which adversely affect the nerve fibre; and synaptic poisons that disrupt the synapse, which is the junction between two nerve connection points

Pyrethroids are synthetic chemicals whose structures mimic the natural insecticide pyrethrin. Pyrethrins are found in the flower heads of plants belonging to the family Compositae (for example: chrysanthemums). These insecticides have a unique ability to



knock down insects quickly.

Synthetic pyrethrins (also known as pyrethroids) have been chemically altered to make them more stable. Examples of pyrethroids are alpha-cypermethrin, bifenthrin, cypermethrin, deltamethrin, d-phenothrin, lambda-cyhalothrin, permethrin, and tetramethrin. Pyrethroids are axonal poisons.

Carbamate insecticides also affect the nervous system. They are moderately residual and relatively more effective at higher temperatures. They are also readily broken down especially in situations of high alkalinity. The most common of this group used in the EU is bendiocarb. Carbamates are synaptic poisons.

Avermectins belong to a group of chemicals called macrolactones. These chemicals are derived from a fungus and acts on insects by interfering with neural and neuromuscular transmission. Abamectin is an example of one of the Avermectins. Avermectins are axonal poisons.

Imidacloprid belongs to the chloronicotinyl chemical class of insecticides. Imidacloprid is also a synaptic poison but is more specific for insect nervous tissue than mammalian nervous tissue.

Fipronil is a phenylpyrazole chemical class insecticide. These chemicals are axonic poisons.

Indoxacarb belongs to the oxadiazine chemical family and is considered a reduced-risk organophosphate replacement. It disrupts the nervous system by blocking the sodium channels.

Insecticides that inhibit energy production

The most well known energy inhibiting insecticide is hydramethylnon. Insects that ingest this compound literally run out of the energy needed to maintain life.

Insecticides that affect the insect endocrine system

These chemicals are typically referred to as insect growth regulators or IGRs. IGRs act on the endocrine or hormone system of insects. These insecticides are specific for insects, have very low mammalian toxicity, are non-persistent in the environment and cause death slowly.

Most of the currently registered IGRs mimic the juvenile hormone produced in the insect brain. Juvenile hormone tells the insect to remain in the immature state. When sufficient growth has occurred, the juvenile hormone production ceases triggering the moult to the adult stage. IGR chemicals, such as S-methoprene and pyriproxyfen, mimic the action of juvenile hormone and keep the insect in the immature state. Insects treated with these chemicals are unable to moult successfully to the adult stage

and cannot reproduce normally.

Insecticides that inhibit cuticle production

These chemicals are known as chitin synthesis inhibitors or CSIs. They are often grouped with the IGRs. The most notable chemical being used as a CSI is benzoylureas. This class of insecticides includes flufenoxuron. These chemicals inhibit the production of chitin. Chitin is a major component of the insect exoskeleton. Insects poisoned with CSIs are unable to synthesize new cuticle, thereby preventing them from moulting successfully to the next stage.

Insecticides affecting water balance

Insecticides with this mode of action include diatomaceous earth and certain aromatic oils. Insects have a thin covering of wax on their body that helps to prevent water loss from the cuticular surface. Diatomaceous earth is very effective at absorbing oils. Therefore, when an insect contacts one of these chemicals, it absorbs the protective waxy covering on the insect, resulting in rapid water loss from the cuticle and eventually death from dessication. Unfortunately, insects that live in environments with high relative humidity or that have ready access to a water source show an increased tolerance to diatomaceous earth. This is because water loss can be minimised by either of these conditions and the insect may survive despite the absence of a wax layer.

Inorganic insecticides

The inorganic insecticides are some of the earliest to have been developed and, in many cases; they have been superseded by organic equivalents. The most common inorganic compound still used is aluminium phosphide.

Formulation

Insecticides are formulated in a carrier material that serves to keep the active ingredient (the ingredient that kills the pest) stable and sometimes aids in the distribution of the active ingredient in the pests' environment. There are a number of different ways to formulate insecticides and acaricides. The most appropriate formulation is determined by the method of application and the chemical characteristics of the insecticide.

Typical formulations are:

Wettable Powders (WP) and Water Dispersible Powders (WDP)

WPs consist of an inert powder impregnated with the active ingredient and usually incorporating a wetting agent to aid dispersion in water. WPs can be used on all surfaces but are particularly useful on absorbent surfaces where the insecticide particles remain on the surface, making it available to insects walking over it.

Suspension Concentrates / Flowables (SC)

The active ingredient is ground to a fine form in a liquid base and when diluted with water forms a fine suspension of particles. This formulation combines the ease of liquids with

the efficacy of powder-based formulations.

Emulsion Concentrates (EC)

These are oily liquids in a solvent. When diluted with water a milky emulsion forms in which the oily droplets of insecticide are finely dispersed. They should not be used on absorbent surfaces.

Dusts

These contain a low concentration of active ingredient mixed with an inert powder. In domestic and food premises they should be applied only to inaccessible places.

Ultra low volume (ULV)

ULV formulations use much less chemical than other formulations. They are intended for space spraying large areas e.g. roof voids. They must be applied with specialist ULV application equipment.

Smokes

The active ingredient is formulated with pyrotechnic compounds which when ignited burn to produce smoke which carries the insecticide through space. Smoke generators are a useful method of applying insecticide in confined spaces where other methods are not practical.

Baits

The active ingredient is formulated in edible bait that is consumed by the target pest.

Application techniques

The most appropriate application technique must be chosen to achieve a good kill of the target organism while minimising the effect on non-target organisms and the environment.

Spraying

Spraying is usually the chosen application method where a surface treatment is required.

Spraying is also the chosen technique for crack and crevice treatments. Many insects spend the daytime in harbourages, such as cracks and crevices in the fabric of buildings, away from the light. Spraying into these areas takes small but effective doses of insecticide direct to the insects.

Dusting

An insecticide dust can be used to give a long (residual) period of control in areas not usually entered by humans, such as basements and roof spaces, ducts, cavities and electrical conduits etc.

Space treatment

The use of insecticidal smoke, misting or fogging all fill the space to be treated with small particles of insecticide on a carrier or in the case of a thermal fogger, vaporized insecticide.

Ultra low volume (ULV) applications

Ultra-low volume (ULV) dispersal systems use insecticides more efficiently by presenting

them in optimum-sized particles. True ULV applicators should produce over 90 percent of their droplets at under 50 microns with the volume median diameter (VDM) being between 10 and 15 microns.

Space and ULV applicators provide limited penetration of insecticides into harbourages and cracks and crevices. As the droplets are carried on air currents and insects may flushed out into contact with more insecticide.

Baits

The use of insecticide baits is becoming increasingly common especially against cockroaches and ants.

Insecticide baits have a very low mammalian toxicity, making them safer to use where humans and other non-target organisms are present.

Some insects will return to their harbourages having ingested bait and after they have died their carcasses will be consumed by other insects, which are also subsequently poisoned (a domino or cascade effect).

Baits are not suitable where a quick kill is required and are therefore usually used combined with other treatments.

13.2.3 Rodenticides

Rodenticides usually need to be ingested, that is either eaten in the form of bait or taken into the body via the mouth while grooming. Rodenticides fall into two categories; acute: these are quick acting and effective but often painful in their action, and chronic: these are slow acting, often multi-feed baits that generally cause minimal pain in their action.

At present the only acute rodenticide bait available in the EU is alphachloralose which acts by lowering the body temperature of the target animal causing death by hypothermia. Currently this product is only effective against and approved for use against mice.

A tablet formulation containing aluminium phosphide for the control of rats outdoor is also available for application to rat holes.

The chronic rodenticides are almost wholly represented by the anticoagulants. They work by interfering with the blood clotting mechanism in the body. When used as a rodenticide the rodents die of internal haemorrhages (blood loss) resulting from minor damage to blood vessels caused as a result of their daily activities.

The success of these anticoagulants is that they have a chronic effect. When eaten by rodents at low concentrations in baits, symptoms of illness develop slowly and so the animals do not associate the symptoms with the bait. The symptoms, and death, appear to be relatively painless and so feeding continues until a lethal dose has been consumed which



may take several days.

There are now two generations of anticoagulant baits:

- **First generation** – Warfarin, chlorophacinone, and coumatetralyl. It is generally accepted that a wide degree of resistance has built up against these baits
- **Second generation** – Includes brodifacoum, bromadiolone, difenacoum, difethialone and flocoumafen. The second generation anticoagulant baits are very effective, even against warfarin-resistant rodents. They are very potent and a single feed can be sufficient to provide a lethal dose but they still have the chronic anticoagulant action

Rodenticide formulations

Formulations are the ways in which the rodenticide is presented to the target animal. Knowledge of the advantages and disadvantages of different formulations is important when selecting a rodenticide for a particular species and habitat.

Baits are the most common way to present a rodenticide. They can either be edible or drinkable. Both edible and drinkable baits frequently contain coloured dyes. This is principally a safety measure used to indicate when a non-target organism has eaten bait. Anticoagulant rodenticides are usually coloured red, blue, purple, grey or green.

Rats and mice have very wide-ranging tastes, feeding on whatever is available. However, they do have a general preference for cereal-based foodstuffs and so these usually form the

base of edible baits.

Edible baits

Edible baits come as loose cereals, blocks, extruded bait, pellets, pastes or gels. These are still cereal-based and usually also contain a mould inhibitor (paranitrophenol or dehydroacetic acid). Certain formulations appear to be more palatable than others with whole grain baits being preferred to blocks.

Liquid baits

Liquid bait is particularly useful in dry and dusty conditions or where water supply is limited. Whilst mice can under some circumstances gain sufficient moisture from their food alone, all rodents, particularly rats, require regular access to water.

Contact dusts

Rodents spend up to 20 percent of their waking time grooming. By placing an inert dust mixed with a rodenticide preparation in areas where rodents are active, the rodent running through the dust will collect it on its fur and later ingest it whilst grooming. If the runs are not obvious in the first place, tracking dust (an inert preparation containing no rodenticide) should be used.

Rodenticide wicks

This system uses fibre wicks impregnated with rodenticide. These are incorporated into a tube, which can be placed in the runs. The system works by the mouse brushing against the wick that transfers rodenticide onto the mouse's fur. This is then ingested by

subsequent grooming.

Gassing

This technique is only available for use outdoors at a minimum distance of three metres from buildings. Tablets containing aluminium phosphide are applied to the rodent burrows, which are then sealed.

Phosphine gas is liberated from the tablet on contact with moisture and, unable to escape through the blocked entrance, travels through the burrow system, asphyxiating the rodents. Operators using this technique must have received full and specific product training and know and observe the necessary safety precautions.

The use of gas-liberating tablets should be avoided in wet weather.

Electronic deterrents

A number are available on the market but great care should be taken when using them because they have rarely been found to be effective over a period of time.

13.2.4 Environmental considerations

The use of permanent rodenticide bait points has been an essential part of rodent control strategy since the introduction of anticoagulants in the early 1950s. On farms, and around the perimeter of food factories, these permanent baits using natural cover provided a ready source of food for incoming rodents especially rats, often killing them before they could become well established. In the 80s the introduction of external bait boxes saw increased use of permanent baits in areas previously thought to be unsuitable for reasons of safety.

There has been an increasing focus during the last decade on the impact on wildlife of anticoagulant rodenticide use.

The two main factors resulting from the continued use of anticoagulant rodenticides outdoors, particularly in rural and suburban areas are:

- Direct poisoning of non-target species through spilled or exposed bait
- Secondary poisoning through dead or dying rats and mice being eaten by birds of prey such as owls and red kites, and mammals such as foxes, stoats and weasels

In line with their environmental responsibility the pest control industry is committed to the development of products and techniques that reduce the impact of pest control activities on the environment.

It is therefore important, where possible to reduce the availability of these compounds where there is a risk to non-target species.

There may be occasions when permanent baiting is unavoidable for example where there is a continuous threat of infestations from uncontrolled rodent populations on neighbouring property. However, there is an obligation to minimise the threat of primary

and secondary poisoning of non-target species.

In the UK, this obligation is a legal requirement under the consents for use of pesticides.

Schedule 3 of the consents under the Control of Pesticides Regulations 1986 and 1987 state that any person who uses a pesticide shall take all reasonable precautions to protect the health of human beings, creatures and plants and safeguard the environment.

The future strategy for outside rat control should be by a system of programmed baiting instead of permanent baiting.

The first consideration for the control of outdoor rat infestation should no longer be the automatic installation of tamper resistant bait stations around buildings. Permanent baiting neither takes account of the actual source of the infestation nor attempts to identify the quickest means of controlling the problem.

Improved training, management and discipline are required to provide a knowledgeable and professional approach to rat control outdoors.

For example, rodent baiting should be carried out where the rodents are most likely to be found i.e. in shrubberies and wasteland surrounding buildings, which can be determined by a thorough inspection.

Furthermore, research has shown that hole or burrow baiting, where loose bait is applied directly into holes or burrows, can give the best results in encouraging bait uptake, resulting in quicker control.

Ethical pest control should at all times consider the humaneness of control methods and maintain the balance between the need to poison an animal and the opportunity to achieve the same result by other means such as habitat management.

Environmental management

Any vegetation in direct contact with the building, which would provide harbourage for rodents, should be removed.

Any trees or shrubs that lean over and make high level contact providing rodents with a bridge into the building should be cut back. Any ivy or other creepers growing up the walls should be removed, as these would provide an access route for rodents.

Select ground cover plants carefully. The use of ground-hugging or thorny plants and shrubs should be avoided because they inhibit access for inspection and treatment.

As far as possible all available sources of food and water should be removed.

Gassing

Where burrows outdoors are beyond the minimum distance of three metres from buildings, the use of aluminium phosphide tablets can provide a rapid reduction in rat numbers. This will also reduce the quantity





of anticoagulant required to control an infestation.

Environmental assessment

In order to ensure that toxic baits, when used outdoors, are available only where essential, an assessment should be carried out to determine:

- The history of rat infestation around the site
- The location and seasonal differences of infestations
- Possible routes of re-infestation from adjacent areas
- The most effective means of monitoring activity. In the majority of boxes on site, non-toxic indicator blocks could replace toxic baits, which will serve two purposes
- To record any rodent activity between visits to encourage the rats to eat from the bait station – when anticoagulant rodenticide replaces the non-toxic blocks, the rats will feed confidently, resulting in a shorter control period. This will reduce the neophobic reaction of the rats

Where non-target species may be encouraged to feed from bait stations containing non-toxic bait, these bait stations should be emptied and left in situ.

The use of enclosed break-back or spring traps may provide a means of monitoring infestation and a first line of defence between contracted service visits. Care must be taken to ensure

the traps are correctly set to ensure a clean kill and in locations where the risk to non-target species is minimised.

Presently there is no legal requirement to visit traps daily – good practice and humaneness however suggest that this may be adopted in the future. This would have implications for the use of this technique.

The most environmentally acceptable methods of controlling future infestations

Visits must be made to check for exposed/spilled bait and to search for and dispose of any rodent bodies. When no further signs of activity are found the treatment is deemed to have been completed and all remaining bait should be removed as far as is practicably possible.

The checking of bait stations as a major part of the service would be replaced by thorough inspection of the site. As the emptied bait stations remain on site between toxic baiting programmes rats will more readily accept toxic bait placed in the event of an infestation being found. A greater emphasis on providing advice on preventive measures and habitat management will be required.

14 Pest control contracts

Where the site does not carry out pest control in-house, the services of a local authority (LA) or commercial pest control contractor are engaged, either on a call-out basis or by means of an ongoing contract.

A local authority is responsible for the provision of pest control services to tenants of LA housing. This may be through direct labour or contracted out to a commercial contractor. Treatments carried out by LA pest control departments may be free of charge or subject to a fee – often dependent on the pest involved.

Private housing pest control is generally provided by commercial pest control contractors although some LAs are also offering a commercial service to householders and businesses.

Where a large contract is in place it is important that responsibility for pest control and related matters is not abdicated entirely to the provider. A senior manager from the customer's management team should be appointed to work with the contractor in ensuring that the terms of the contract and any service level agreements (SLAs) are met and that recommendations on proofing and hygiene are carried out.

Where the responsibility for ensuring that the premises remains pest free is being delegated to an outside contractor certain criteria should be met.

14.1 REQUIREMENTS IN SELECTING A CONTRACTOR

When selecting a contractor the decision must not be based on price alone. The aim is to appoint a contractor with a commitment to quality service, at a competitive price based on the level of customer specification.

There are several prerequisites to the appointment of a contractor:

- The pest control company should be able to demonstrate that they can provide a service to the level required in the site specification. Geographical coverage, number and stability of work force and experience of carrying out similar work in the housing sector are factors which should be considered
- The pest control company should have staff qualified to the required level
- The pest control company should carry adequate insurance cover, such as Employers Liability Insurance, and Public and Products Liability Insurance

- The pest control company should be a member of a recognised Trade Association or body

14.2 TRAINING AND QUALIFICATIONS

In addition to formal qualifications, the pest control technicians attending the site should possess the following abilities:

- Knowledge of the particular pest risk associated with residential sites, housing stock and domestic premises
- Good inspection technique and equipment
- Ability, using evidence and information, to detect the source of an infestation
- Ability to identify or arrange for identification of insects
- Problem solving skills
- Confidence to follow intuition
- Good verbal and written communication skills
- Customer care skills

The formal qualifications required will depend upon the work to be carried out and the country in which the premises are situated.

In the UK, there is no statutory certification scheme governing the application of pesticides for public health use. However, it is a requirement under the Control of Pesticides Regulations 1986 and 1987 (as amended) (COPR) that:

1. All employers must ensure that persons in their employment who may be required during the course of their employment to use pesticides are provided with such instruction, training and guidance as is necessary to enable those persons to comply with any requirements provided in and under these Regulations; and
2. No person in the course of his business or employment shall use a pesticide, or give an instruction to others on the use of a pesticide, unless that person (a) has received adequate instruction, training and guidance in the safe, efficient and humane use of pesticides; and (b) is competent for the duties for which that person is called upon to perform.

All staff involved in the application of pesticides that are not under direct supervision, must therefore be adequately trained. The recognised industry entry-level qualification includes the BPCA/RSPH Level 2 Certificate in Pest Control, the BPC Diploma Part 1, the RSPH Certificate in Pest Control and the NVQ in Pest Control.





Additional qualifications exist for specialist work such as fumigation, i.e. the use of gassing compounds, and licences may be required for specific aspects of bird control.

The application by contractors of agricultural pesticides, such as herbicides used to control grass and bushes around buildings, requires a qualification issued by the National Proficiency Test Council.

In some other EU countries, it is a legal requirement that pest control technicians have a particular qualification. Details are available from the relevant competent authorities or trade associations in these countries.

14.3 CALL OUT SERVICE

In many situations the provision of pest control to domestic premises is adequately satisfied by means of a call out service reacting to requests from householders or occupants. In these cases the infestation would generally be small and localised – the exception being block work where a more coordinated approach is required.

14.3.1 Insects

It is unlikely that reported sightings can be dealt with by a single visit. Whether insect infestations have been dealt with by means of a spray treatment or by laying bait, as a minimum, one follow up visit will be required to monitor the success of the treatment and where necessary remove the bait.

The recommended minimum number and frequency of visits for insect pests is:

Cockroaches

Initial treatment; follow up within seven days, follow up after two months.

Garden ants

Initial treatment; follow up within seven days.

Pharaoh's ants

A dedicated control programme is required which may extend over several months.

Flies

Initial treatment; follow up within seven days,

Mosquitoes

A dedicated control programme is required.

Fleas

Initial treatment; follow up within seven days.

Bedbugs

Initial treatment; second treatment two to three weeks, follow up after two weeks to check if eradication complete.

For heavy or persistent infestations, or where there is a potential risk to the environment, additional visits may be required.

14.3.2 Rodents

Even when no visible evidence of rodents can be found bait may be laid as a precaution. If the report concerns rats outdoors the bait laid may be a non-toxic indicator to reduce the risk to wildlife and other non-target species. This bait would be inspected on a follow up visit to check for signs and replaced with a rodenticide if required.

The recommended minimum number and frequency of visits for rodent pests is, rats or mice indoors: Initial treatment; follow up within seven days; follow up within seven days to remove baits. Where traps or glue boards are used daily follow ups will be required. Rats outdoors: Initial treatment; follow up within seven days; regular and frequent follow ups to check for spilt bait and search for and remove rodent bodies. When no further evidence of activity is found all toxic baits should be removed.



14.4 CONTRACT SERVICE

14.4.1 Service Level Agreement (SLA) - objective

The agreement should represent the commitment between the pest control company and the customer in order to:

- Promote a full understanding of what is required to make the partnership successful and beneficial to both parties
- Establish and maintain pest free conditions

There should also be:

- Regular reviews of contract and performance trends
- Regular reporting of management information
- Defined response to service requests

14.4.2 Contract structure

The core pests covered by the agreement should be:

- Rodents - Rats and mice
- Insects - Public health and food storage

Generally the following services would be excluded from the agreement, unless by specific inclusion:

- Birds - control of pest species subject to the provisions of the Wildlife and Countryside Act 1981
- Bird proofing materials and equipment
- Bird scaring equipment
- Wildlife management
- Access equipment
- Fly screens
- Supply of electronic fly control units
- Fumigation

14.4.3 Key personnel and contact information

The following contact information should be held:

Contractor head office	Local or branch office
Address	Address
Postcode	Postcode
Telephone number	Telephone number
Fax No	Fax No
E-mail	E-mail
Website if appropriate	Branch normal opening hours

Key Personnel and Out of Hours contact numbers are required for all contractors' personnel who attend the site. It is up to both parties to maintain up to date information on the identity of all key contacts for the SLA.

14.4.4 Site assessments

The contract should cover the entire site including grounds within the perimeter, all buildings and all areas within buildings. The contract will include at least eight scheduled site inspections per annum by trained Technicians and, where appropriate, additional inspections by a Field Biologist or senior member of staff.

The number and frequency of site inspections should be agreed for the following areas:

Internal and high risk areas

Areas where there is a greater risk to public health due to pest activity or where the conditions within and around the building are particularly attractive to pests, more frequent visits may be required. These should be identified in the Contract Service Specification.

External buildings and peripheral areas

All areas within the site should be inspected at agreed intervals of not less than eight per annum. These should be identified in the Contract Service Specification.

Site inspections

Where necessary the contract should include a minimum of two scheduled site inspections by a qualified field biologist or senior member of staff. These will not be combined with the regular technician inspection and will produce a comprehensive report on pest status, remedial action taken and action required to address potential risks.

14.4.5 Issue resolution and escalation procedures

In the event that any elements within the SLA fail to meet the specified timescales, an escalation process should be implemented. The levels of escalation, responsible individuals and associated action periods should be agreed with the contractor.

14.4.6 Review meetings

A review meeting should take place at agreed intervals. This may be quarterly, six monthly or annually depending on the type of site or public health exposure risk.

The review meetings should as a minimum incorporate the following agenda items:

- Action points from the last review
- SLA review
- Escalations
- Additional services

14.5 QUALITY ASSURANCE

The pest control provider should have in place a quality assurance system which monitors the work carried out on site.

The quality check should ensure that:

- Work on site is carried out in a safe manner
- Pests are identified, reported and eliminated within the required timescales
- Inspections, treatments and follow up visits meet the terms of the specification
- Inspections, treatments and follow up visits are carried out in compliance with label requirements
- Rodent and insect monitoring stations are clean, adequately serviced and correctly sited
- Rodent monitoring stations are securely fixed and locked where necessary
- Additional baits/traps are laid when an infestation is identified
- The report folder is well organised and up-to-date
- Necessary recommendations on preventive action are significant and legible

Further monitoring of the contract should be undertaken by a nominated member of site management or, where deemed necessary, by an independent auditor.



15 Appendix

The information in this appendix is based on presentations given by Xavier Bonnefoy, formerly the Regional Adviser at the WHO Regional Office for Environment and Health, Bonn, at seminars in St Helens, UK, in May 2006 and Warsaw, Poland, in May 2007.



DEFINITION OF HEALTH

Introduction

The World Health Organization defines health as 'a state of complete physical, mental and social wellbeing, not merely the absence of disease or infirmity.'

This means that we should be concerned about all public health pests which deny consumers a state of complete physical, mental and social wellbeing, as well as those that cause disease or infirmity.

Environmental health is concerned with all aspects of our living environment. It involves assessing, correcting and preventing the impact of environmental stressors on health. These stressors might be biological, chemical, physical, social, and psycho-social. Only by having a good understanding of the living environment and how these stressors act upon it can we determine good intervention strategies.

Unfortunately, today's society has caused many of our current environmental health problems. If present and future generations are to enjoy a healthy and satisfying life, we need to identify the broad range of environmental health problems that face us and address them before they become unmanageable.

By improving the conditions in which we live and work, we can move forward with our aim of reducing the incidence of disease and enhancing wellbeing by better environmental health.

However, we also need to ensure that adequate tools and techniques are available to make possible these aims.

THE LARES SURVEY

Life expectancy in Europe has generally increased by 30 years during the past 100 years but our housing stock has not changed in the same way. This means that many of us will spend 30 years of our life in a dwelling that was not designed for modern living.

Our way of life has changed too. One hundred years ago, after spending minimal time at school, we went to work on a farm or in a factory during the day and went back home in the evening to eat and sleep. This we did day in and day out. Neither leisure time nor holidays played any major part in our lives. The home was a place to sleep and to eat and that was it.

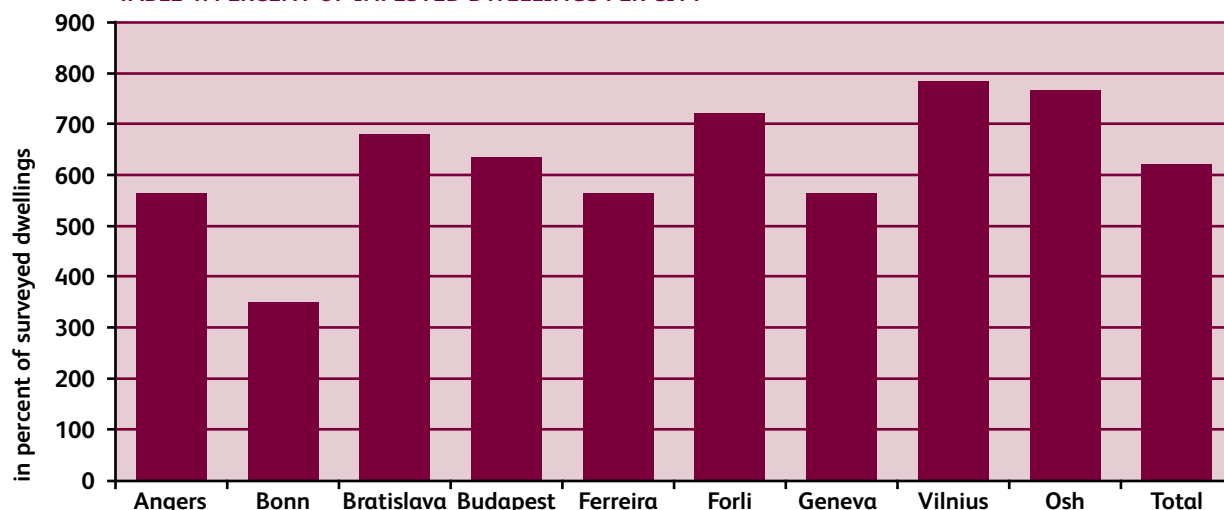
Over time, our way of life and our length of life have changed considerably but the environment in which we live has not changed as significantly. This has had a major impact on our contact with urban pests.

Because of modern health care systems, more people with physical limitations, illnesses or medical conditions survive and, as a result, populations are becoming more fragile and more prone to the diseases which can be transmitted by pests.

Following a meeting of European Environment Ministers in 2002 and to study this further, the World Health Organization instigated the LARES survey. LARES stands for Large Analysis and Review of European Housing and Health Status.

The basis of the survey was an initial questionnaire followed by an interview and a site inspection. The data were analysed according to the impact of allergies, respiratory disease, obesity, mental health, quality of life, noise, sociology and psychology.

TABLE 1: PERCENT OF INFESTED DWELLINGS PER CITY



Participating cities

The survey covered 8,400 residents from eight European Union cities and the Central Asian city of Osh in Kryrgyzstan.

The eight European cities were Angers in France; Bonn in Germany; Bratislava in Slovakia; Budapest in Hungary; Forli in Italy; Ferreira in Portugal; Geneva in Switzerland and Vilnius in Lithuania.

Findings

WHO surveyed 3,800 households and the health of 8,400 inhabitants in these cities in a very detailed study. The purpose was to establish whether there is a relationship between housing conditions and health. LARES generated a very significant amount of data, including a great deal which is interesting for pest managers.

As can be seen from Table 1, LARES found that six out of ten dwellings had been infested in the year prior to the survey. At 35 percent, Bonn has the lowest infestation rate of the cities surveyed. All the other cities are in the range of 50-80 percent with a mean average of 62 percent.

Significance of pests in infested dwellings

Further analysis, as set out in Table 2, shows which pests were present in the dwellings that reported the infestations and the extent of those infestations.

The presence of cockroach infestations at 20 percent is significant, as are ants at 26 percent and flies at 24 percent. Whilst the number of other arthropod infestations was less, at ten percent for mites, 2.4 percent for fleas and three percent for bedbugs, these are still significant levels of infestation.

Of the rodents, it is of great concern that some 2.4 percent of dwellings reported the presence of rats indoors, while at 11.5 percent the level of mouse infestations in dwellings is a significantly high proportion.

Since some of the LARES cities are in Southern Europe, it is not surprising that the level of "other", which includes mosquitoes, is so high.

Significance of pests per city

Table 3 shows which pests are primary problems in which cities.

TABLE 2: PERCENT IN LAST 12 MONTHS ACROSS THE SURVEYED CITIES

Six dwellings in ten are or have been infested in the past year by 1 pest at least ...with some differences between the cities

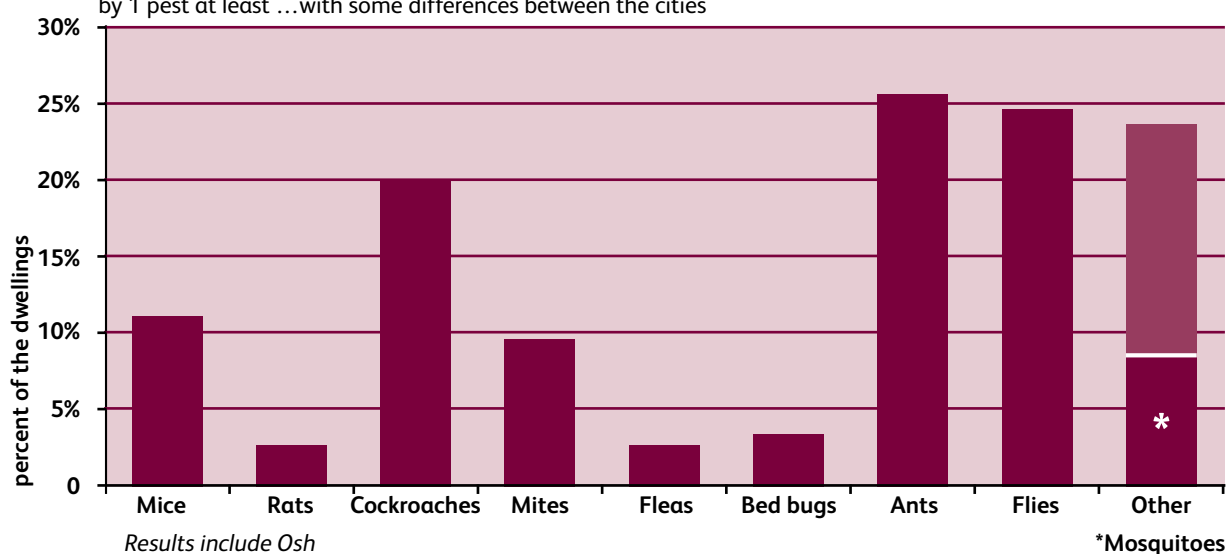
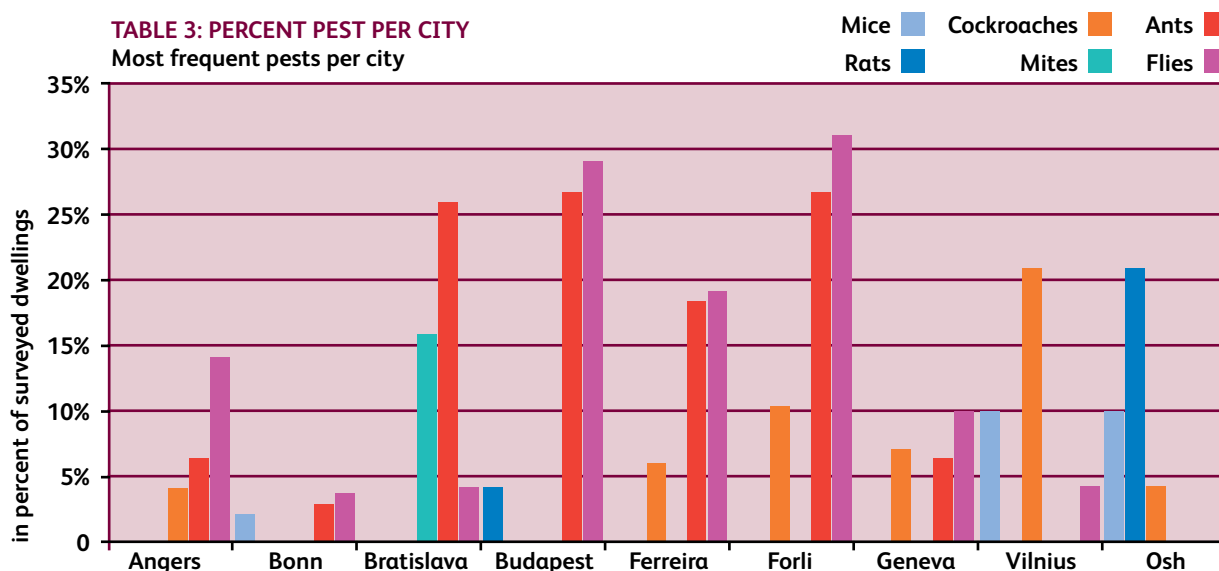


TABLE 3: PERCENT PEST PER CITY

Most frequent pests per city



Osh presents a particularly interesting profile but one that gives rise to a major concern. It is in Kurdistan, which borders on China, Uzbekistan and Afghanistan in Central Asia. It is a city with low economic income per head of population but major rat and mouse populations. This could easily lead to an outbreak of typhus or plague.

In the other cities, cockroach, ant and fly infestations are the major problems.

Part of the LARES survey was designed to see what the health implications are to residents in European cities and so it concentrated on allergies, asthma and migraine (see Table 4).

Chronic allergies

In all the cities, the statistics showed that approximately eight -14 percent of the residents suffered from chronic allergies. This reflects known levels from other studies in Europe.

Asthma

Asthma is a major problem since it is a condition which seriously affects the lives of sufferers. The population of the surveyed cities showed that between three-five percent of the residents suffered from asthma.

Migraine

With regard to migraine, it becomes very important when the level of sufferers goes above ten percent. In this respect, at 21 percent Ferreira is especially high. Ferreira is a rural city in central Portugal, where many local residents are farmers. With younger people leaving for other areas, its population is ageing and therefore is more susceptible to diseases or conditions, which primarily affects the old, such as migraines.

Prevalence of allergic symptoms

With regard to the prevalence of allergies according to age, the survey has shown that of the total population, 28 percent of the children; 24 percent of the adults under 60 and 34 percent of the adults over 60 have at least one allergic symptom. In each group at least one-third exhibit more than one allergy symptom. (See Table 5)

TABLE 4: PERCENT OF HEALTH IMPLICATIONS PER CITY

Migraines, chronic allergies, asthma

Diagnosed by physician within the general population

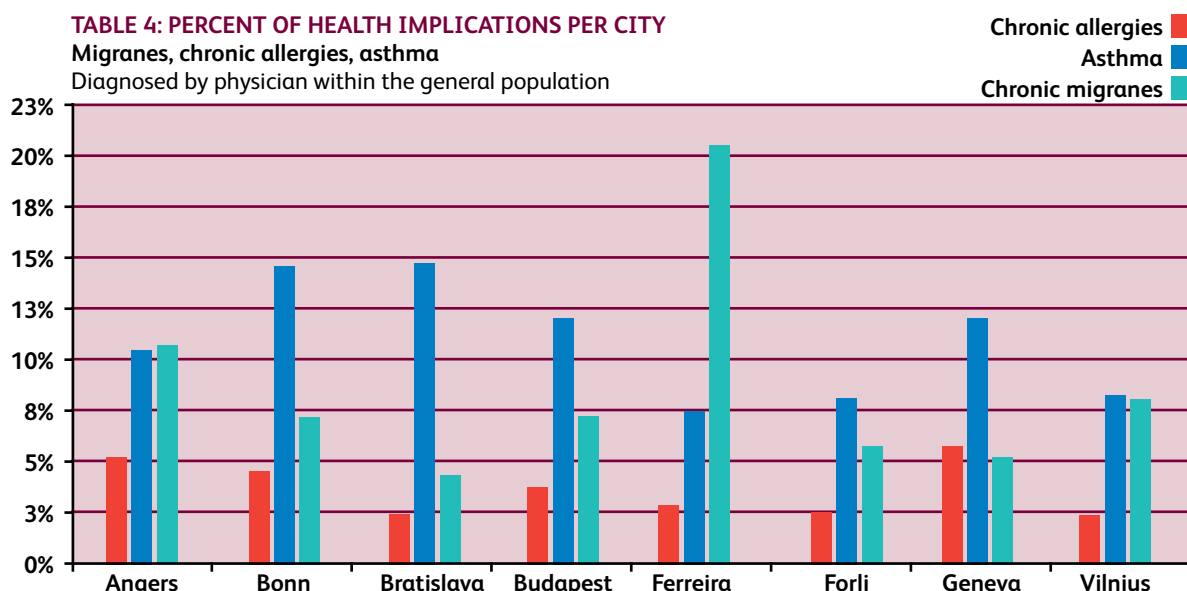
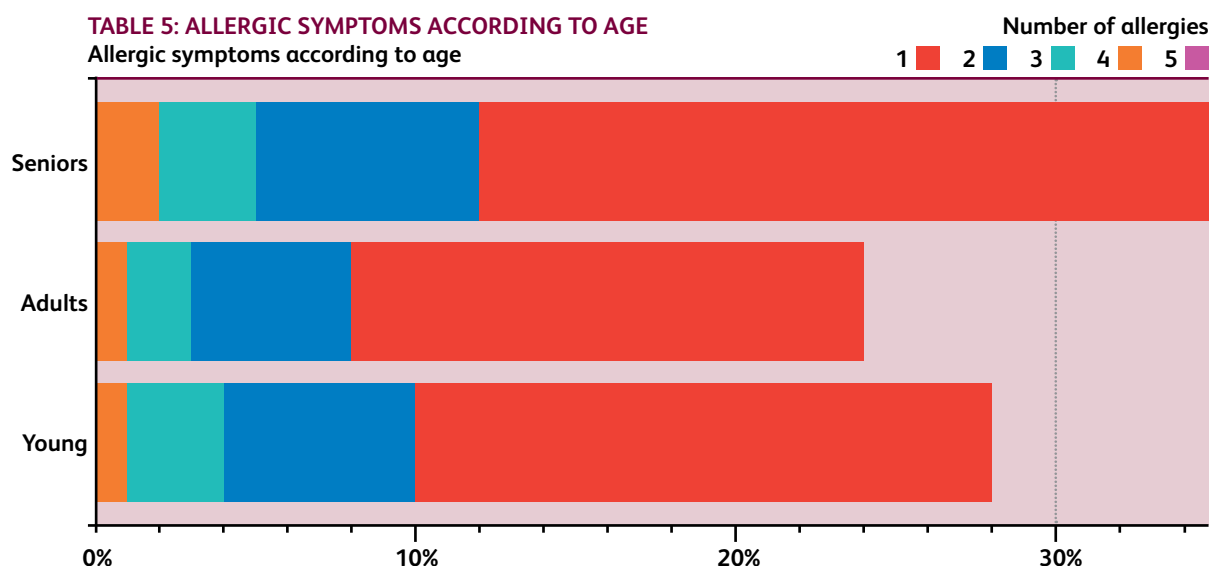


TABLE 5: ALLERGIC SYMPTOMS ACCORDING TO AGE

Allergic symptoms according to age



28% of the children

24% of the adults

34% of people over 60 have 1 allergic symptom at least

The survey also shows that in each of the city studies one-two percent of the population suffers from more than four different allergies, which is traumatic.

In all cities, the distribution is remarkably even - there are no major differences in any of the cities. (See Table 6)

Depression

It could be asked, what do pests have to do with public health? Why would pests affect mental health? As any psychiatrist will explain, the home is the place where people find their identity; are protected from the outside world; and are able to enjoy their privacy. If something is able to invade the home, it breaks this privacy and sense of security. For people with a tendency to mental health problems, such as anxiety or depression and who have cockroaches in the kitchen and mice in the living room, the house, which should be the one place they feel protected, becomes a further source of depression.

In fact the impact of pests on mental health is so tremendous that it is probably more important than the impact of pests on allergic people in the home. If one looks at the number of people suffering from depression in Europe (the accepted figure of people in Europe with some kind of depression is 18 percent of the population – see table seven) the extent of the problem becomes obvious.

TABLE 6: PERCENT OF POPULATION SUFFERING FROM ONE TO VARIOUS NUMBERS OF ALLERGIES

Allergy.

Allergic people / multiple allergies

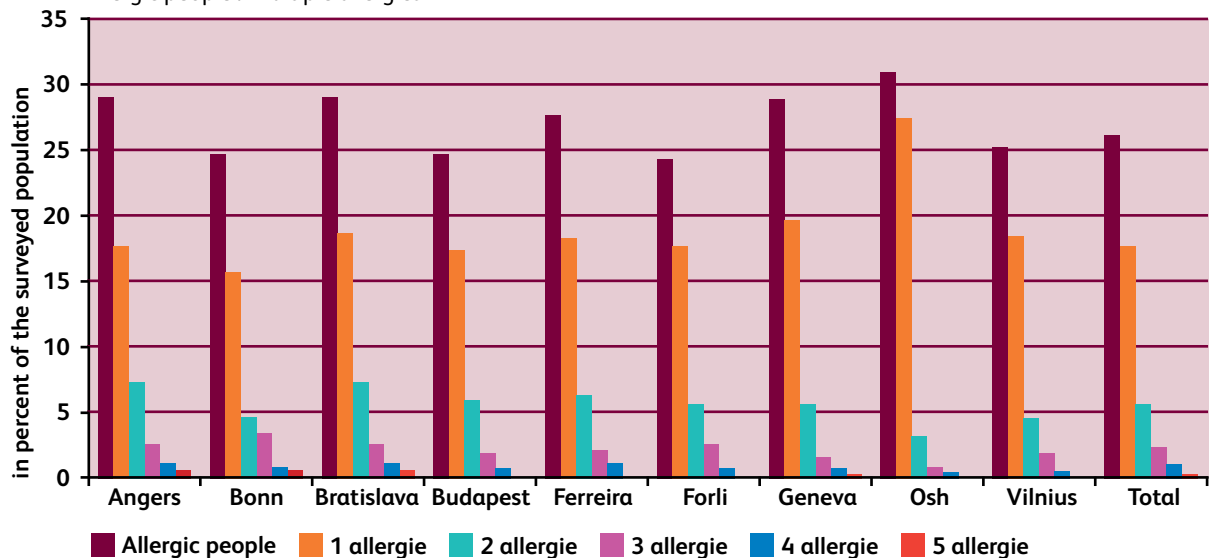
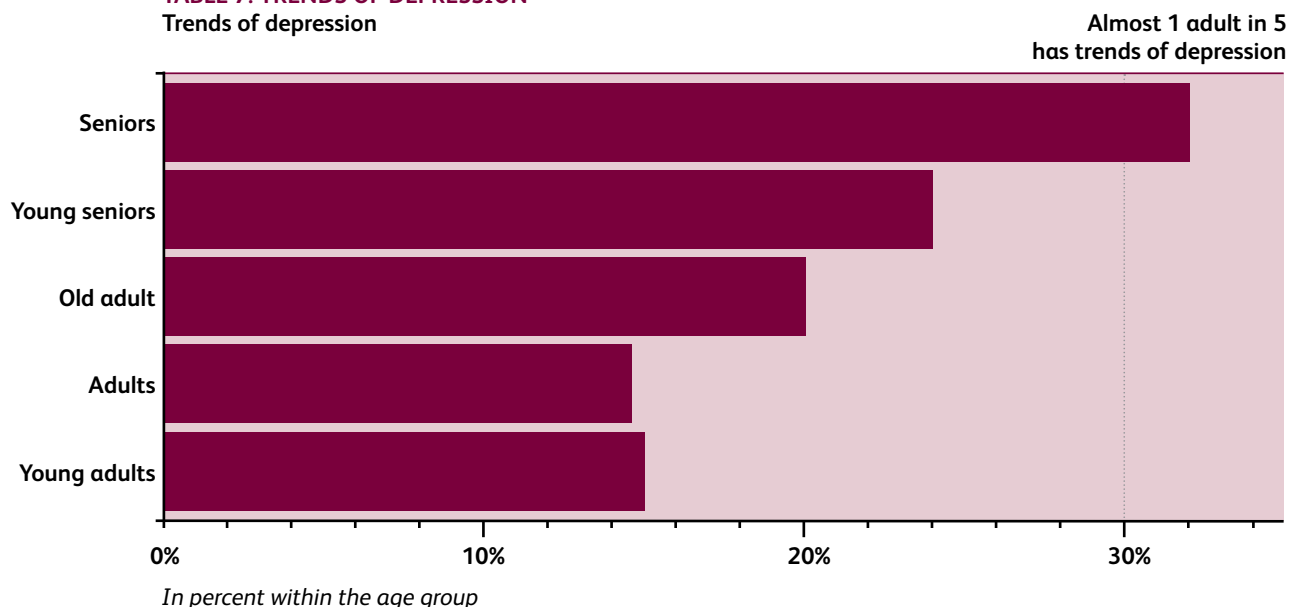


TABLE 7: TRENDS OF DEPRESSION

Trends of depression



The importance of the odds ratio

The odds ratio is a term used to describe likely odds of something happening. For example, if there is a group exposed to a factor and a group not exposed to this factor, the likely risk of having a disease is increased in the exposed group by the odds ratio. (See table 8). Where there is a problem with mice in a building, the residents are 2.21 times more likely to suffer from depression. This means that among the people who have mice in their home, they are twice as likely to become depressed as those who don't have mice. Even if the number of people who have mice is not that big, the impact on the house is significant.

The same applies in the case of migraine for people with mice in their home.

They are nearly twice as likely to suffer from migraine. People with cockroaches in the home are 3.26 times more likely to suffer from migraine or frequent headaches.

The residents were 2.33 times more likely also to be suffering from asthma in premises infested with mites and 1.73 times more likely in premises infested with flies. This latter is particularly strange as there is no explanation for it.

Amateur insecticide usage

The figures also show that use of insecticide sprays causes problems (See table 9). This is because it is not only the pests that cause disease but also the way people treat their dwellings. In fact it is possible that

when homeowners treat the pests themselves, they usually create more problems than they solve.

The odds ratio shows that in general homeowners who treat their own homes for pests are 17 percent more likely to have allergies, 27 percent more likely to suffer from wheezing, 30 percent more likely to suffer from watery or inflamed eyes and 39 percent more likely to have headaches. (See Table 9).

In those of the population under 20, they are 38 percent more likely to suffer from sneezing or runny noses and twice as likely to suffer from headaches. This means that where pest control is carried out in people's homes, it should be done professionally if we don't want to reduce people to a poorer state of health than they were in previously.

Conclusion

Globally, six houses out of ten are colonised by some kind of pest. Mostly people do not do anything about this and if they do, it's to use a spray or a contact poison. They are unlikely to use the correct form of pest control techniques and therefore expose themselves to other risks to their health.

The LARES survey has shown a clear association between pest-infested premises and depression and migraine. This is not to say that rats, mice, cockroaches, mites, ants and flies cause depression and migraine. However, it does present clear evidence that people are more likely to suffer from these conditions if they live in pest-infested homes.

TABLE 8: HEALTH AND PESTS

	Value	95 % confidence interval	
		Lower	Upper
Odds ratio for problems when mice are present in a dwelling			
Trends of depression	2.21	1.3	3.75
Reported migraine and frequent headache	1.97	1.17	3.34
Odds ratio for problems when mice are present if the dwelling is a flat			
Migraine and frequent headache	8.06	4.05	16.04
Odds ratio for problems with cockroaches when present in dwelling			
Migraine and frequent headache related to flat	3.26	1.78	5.96
Odds ratio for problems with mites when present in dwelling			
Asthma - diagnosed by physician	2.33	1.01	5.53
Asthma - taking prescribed medicine	2.39	1.03	5.41
Odds ratio for problems with flies when present in a dwelling			
Asthma - diaagnosed by physician	1.73	1.03	2.90

TABLE 9: AMATEUR INSECTICIDE USAGE

	Value	95 % confidence interval	
		Lower	Upper
Odds ratio for use of insecticidal spray or contact poison by general population			
Allergies = 1 through to 5 allergies	1.17	1.06	1.30
Wheezing or whistling in chest	1.27	1.10	1.47
Sneezing or runny or blocked nose	1.14	1.03	1.26
Headache	1.39	1.26	1.53
Watery eyes or eye inflammations	1.30	1.15	1.48
Odds ratio for use of insecticidal spray or contact poison in people of 20 or younger			
Sneezing or runny or blocked nose	1.38	1.05	1.83
Headache related to flat	2.02	1.16	3.53

Useful addresses

Chartered Institute of Environmental Health

Chadwick Court
15 Hatfields
London
SE1 8DJ
Tel: 020 7928 6006
www.cieh.org

British Pest Control Association

1 Gleneagles House
Vernongate
South Street
Derby
DE1 1UP
Tel: 01332 294288
www.bpca.org.uk

CIEH National Pest Advisory Panel

c/o PO Box 2
Ossett
West Yorkshire
WF5 9NA
Tel: 01924 268433
www.cieh.org/npap

Chartered Institute of Housing

Octavia House
Westwood Way
Coventry
CV4 8JP
Tel: 024 7685 1700
www.cih.org

Department for Environment, Food & Rural Affairs

Nobel House
17 Smith Square
London
SW1P 3JR
Tel: 08459 335577
www.defra.gov.uk

Environment Agency

National Customer Contact Centre,
P.O. Box 544
Rotherham
S60 1BY
Tel: 08708 506506
www.environment-agency.gov.uk

Environment Planning and Countryside

Welsh Assembly Government
Cathays Park
Cardiff
CF10 3NQ
Tel: 0845 0103300 (English)
or 0845 0104400 (Welsh).
www.countryside.wales.gov.uk

Health and Safety Executive

London Headquarters
Rose Court
2 Southwark Bridge
London
SE1 9HS
Tel: 020 7556 2100
www.hse.gov.uk

Chemicals Regulation Directorate

2.3 Redgrave Court
Merton Road
Bootle
Merseyside
L20 7HS
Tel: 0151 951 3219
www.hse.gov.uk/biocides

Homes and Communities Agency

110 Buckingham Palace Road
London
SW1W 9SA
Tel: 020 7881 1600
www.englishpartnerships.co.uk

National Housing Federation

Lion Court
25 Procter Street
London
WC1V 6NY
Tel: 020 7067 1010
www.housing.org.uk

National Pest Technicians Association

NPTA House
Hall Lane
Kinoulton
Nottingham
NG12 3EF
Tel: 01949 81133
www.npta.org.uk

Natural England

Enquiries:
Natural England
Northminster House,
Peterborough,
PE1 1UA
Tel: 01733 455000
www.naturalengland.org.uk

Northern Ireland Department of Environment

Department of Environment Headquarters
Clarence Court
10 - 18 Adelaide Street
Belfast
BT2 8GB
Tel: 028 90540540
www.doeni.gov.uk
Alternatively, please contact
your local council

Northern Ireland Environmental Agency

Klondyke Building, Cromac Avenue,
Gasworks Business Park,
Lower Ormeau Road
Belfast BT7 2JA
Tel: 0845 3020008
www.ni-environment.gov.uk

Royal Society for Public Health

3rd Floor, Market Towers
1 Nine Elms Lane
London
SW8 5NQ
Tel: 020 3177 1600
www.rsph.org

Scottish Environment Protection Agency

SEPA Corporate Office, Erskine Court,
Castle Business Park, Stirling
FK9 4TR
Tel: 01786 457700
www.sepa.org.uk
See web site for Regional SEPA offices

Scottish Natural Heritage

Great Glen House
Leachkin Road
Inverness
IV3 8NW
Tel: 01463 725000
www.snh.org.uk



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Health