



AEPMA's Industry Code of Best Practice for Rodent Management

1st Edition

July 2019

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AEPMA's Industry Code of Best Practice for Rodent Management

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ISBN:

First EDITION: July 2019

Championing Industry Professionalism and Innovation

As the Professional Pest Management industry's peak national body, the Australian Environmental Pest Managers' Association ('AEPMA') is committed to promoting a culture of professionalism and innovation, not only in pest management but also in allied and associated industries. This Code of Best Practice has been prepared, in large part, to help promote increased professionalism and innovation at all levels, across all industries and to recognise and embrace all stakeholders involved in the delivery of rodent management programs.

Importantly, to become more professional and innovative, industry stakeholders need to re-examine how they do things and find new and better ways of achieving superior results. They need also to embrace and commit to continuous improvement in all aspects of animal welfare; enterprise development and planning; business practice; financial management; project management; workforce management; and use of technology.

AEPMA believes technology, particularly information technology, has the potential to be a major driver of change in the pest management industry. Already, we are seeing major growth in, for instance: electronic tendering and documentation; job costing, job tracking and personnel; vehicle and equipment tasking; data communication; virtual design; project data and database sharing across and between disciplines; and energy management. All these innovative technologies are having, and will continue to have, significant impacts on industry practices.

We believe those enterprises and individuals which embrace new technologies into their businesses will become increasingly competitive.

For its part, AEPMA will continue to actively support and promote industry-wide professionalism, ethics-driven innovation, and ever higher standards of performance and behaviour through initiatives such as:

- a 'gold standard' Code of Ethics;
- professional accreditation through PestCert;
- improved standards of training and education for industry practitioners;
- the development of 'National Competency Standards';
- developing, preparing and actively promoting industry 'Codes of Best Practice'; and
- ever increasing investment in cost-effective communication within the industry and between the industry and its stakeholders.

AEPMA Codes of Best Practice

AEPMA is committed to developing, preparing and promoting definitive 'Codes of Best Practice' describing and providing expert guidance on best practice across an increasing range of key pest management areas.

Codes of Best Practice which have already been published and which, as 'living documents', are continually being reviewed and updated include:

- A Code of Best Practice for the Control of Bed Bug Infestations in Australia
- A Code of Best Practice for Pest Management in the Food Industry in Australia and New Zealand
- A Code of Best Practice for Prior To Purchase Specialist Timber Pest Inspections
- AEPMA's Industry Code of Best Practice for Termite Management
- AEPMA's Industry Code of Best Practice for Termite Management During Constructions

Other Codes of Best Practice under development include:

- AEPMA's Code of Best Practice for Training in the Pest Management Industry

Version currency

A Code of Best Practice is a *living document* and it is therefore important that the latest version is read and relied on. If in doubt, check with AEPMA to ascertain if a Code of Best Practice is the latest version.

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Acknowledgements

AEPMA gratefully acknowledges the contribution and support of people and organisations who have helped prepare this Code of Best Practice.

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Special Thanks

The committee would like to thank the following organisations and persons who provided comment during the drafting of this document:

Agriculture Victoria

Department of Agriculture and Water Resources – Queensland

Department of Biodiversity, Conservation and Attractions – Western Australia

Department of the Environment and Energy

Department of Environment, Land, Water and Planning – Victoria

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Document Administration, Consultation, and Review

This *Code of Best Practice for Rodent Management* (elsewhere referred to as ‘this Code’, and/or ‘this Code of Best Practice’) was initiated on behalf of the professional pest management industry by the Australian Environmental Pest Managers’ Association (AEPMA), the peak professional association for pest management in Australia.

To develop and prepare the Code of Best Practice, AEPMA appointed a working party comprising:

- Leading Professional Pest Managers
- Representatives of companies responsible for the production and/or distribution of rodent management products
- Other relevant stakeholders

The working party is responsible for developing, administering, and ongoing review of this Code of Best Practice in accordance with guidelines agreed by the AEPMA National Board.

In developing this Code, AEPMA has consulted with regulatory, Government, and advisory bodies, and other relevant organisations, including:

- Australian Pesticides and Veterinary Medicines Authority (APVMA)
- Centre for Invasive Species
- Australian Competition and Consumer Commission (ACCC)

The ACCC has provided guidelines for developing effective industry codes of conduct to improve industry compliance with the Trade Practices Act and to promote self-regulated best practice market behaviour. This Code has been developed using the ACCC’s guideline framework.

Please note: this Code of Best Practice is not intended to contradict any legislated requirements and cannot be read as opposing any such requirements.

Ethical Considerations

The AEPMA ***Code of Ethics*** underpins and provides an ethos for all aspects of professional pest management. In particular, the AEPMA Code of Ethics:

- Underpins best-practice by pest management professionals and pest management industry (‘industry’) stakeholders; and
- Obliges all industry stakeholders to oppose and call out unethical behaviour by others in the industry; and
- Requires all industry stakeholders operating at all levels to adopt ethical principles and practices consistent with the industry’s Codes of Best Practice and Australian Standards; and
- Requires all industry stakeholders who adopt this Code of Best Practice to deal only with industry parties whose standards of performance and behaviour conform to those expected by this Code.

The AEPMA *Code of Ethics* can be viewed in full on the AEPMA website: www.aepma.com.au.

1 Introduction

Rodents have been closely associated with humans for several millennia, to the extent that three species of rodent, the Norway (or brown) rat, *Rattus norvegicus*; the black (or roof) rat, *Rattus rattus*; and the house mouse, *Mus musculus*; are regarded as being 'commensal rodents' that exist primarily in association with people [1]. As a consequence of this association, commensal rodents have become a major global pest with diverse impacts across human health, food production, our buildings and social activities, and the natural environment.

The economic impact of commensal rodents varies across countries and can be difficult to measure directly in nations not primarily involved in agricultural production. However, it is conservatively estimated that the economic damage from rodent activity on field, post-harvest, and finished goods exceeds US\$19 billion dollars annually in the United States [2, 3]. Similarly, in Asia, losses of rice from rodent activity have been estimated to be the equivalent amount required to feed between 180-200 million people every year [4, 5], and elsewhere total annualised product losses of between 5-40% (and up to 50-90% during outbreak years) have been routinely reported [5-8]. In Australia, the 1993/94 mouse plague is estimated to have cost up to \$96 million dollars in lost crops and damage to livestock industries and rural communities [9, 10], with a similar plague in 2010/11 causing comparable levels of damage [10].

In addition to food destruction and contamination, structural damage from commensal rodents can also be one of the most obvious and troubling factors associated with their presence. Both rats and mice are known to cause damage through gnawing of insulation, PVC pipework, timber, plastics, stonework, and even metal [11]. Rats may also cause structural damage and undermine buildings, floors, and walls through their extensive burrowing [11-14]. Gnawing through electrical wires is common, and potentially highly hazardous, and has been linked to both power and telecommunications blackouts, and even building fires [11, 15-17]. Repairs are often expensive and inherently fall to home and building owners and other municipality or commercial entities to cover the cost [18].

Data associated with the economic cost of professional pest management services for rodent control by businesses and homeowners is similarly rare, although some insights could be gained from data from the United States. In particular, a survey of businesses in the Chinatown district of New York found that, on average, each business was spending over US\$1000 per annum on a combination of professional pest services for rodent management and 'do-it-yourself' (DIY) traps and proofing [18]. A separate study in 1993/94 of the approximate annual cost associated with pest management services across the United States found that rodents accounted for over \$337 million, and rodent retail (presumably DIY products) a further US\$70 million [11].

Given their close association to urban environments, commensal rodents can also be involved in the transmission, both directly and indirectly, of numerous infectious diseases [19-22]. This includes (but is not limited to) several viral or bacterial infections, such as: Salmonellosis, Leptospirosis (Weil's disease), *Escherichia coli*, and Hantavirus. Additionally, rodents may act as reservoirs for several clinically important protozoal diseases, including: Cryptosporidiosis, Toxoplasmosis, Leishmaniasis, and the causative agent of Chagas' disease, *Trypanosoma cruzi* [19-22].

Bites from rodents are not an especially common risk in Australia [23].

The control of rodents continues to be a slowly evolving area, with many of the same technologies and derivative rodenticides employed today as they were 20 (or more) years ago [24]. This is despite significant resources being invested into research, development, and improvement of tools, practices, and products aimed at rodent eradication. However, at the same time, the rodents themselves have continued to evolve, with issues such as resistance to rodenticides, and aversion to baits and bait stations emerging, and complicating control efforts [25-29].

In addition to this, society's expectations as to what constitutes safe and humane rodent control has changed dramatically [30-34], with regulation on the use of both 'chemical' and 'non-chemical' strategies becoming more stringent as a result. In Australia, this has been reflected in increased restriction, or prohibition in some instances, of the use of rodent glueboards in Victoria [35, 36], Tasmania [37], and the Australian Capital Territory [38]. Similarly, confinement (live-capture) traps now require daily inspection in Victoria [36, 39], and serrated or metal-toothed break-back traps may be prohibited for sale or use in some States [36, 38].

As a consequence of these expectations and the fact that animal welfare is a continually evolving concern, there is an obvious need to define best practice rodent management procedures for Codes of Best Practices in Australia.

2 Aims

The overriding aim of this Code of Best Practice is to provide a document that benchmarks and describes 'best practice' for rodent management. In developing and documenting best practice, consideration has been given to both current and future challenges that the professional pest management industry may face when implementing rodent management programs. More specific aims for this Code of Best Practice are to:

- Improve rodent monitoring and management practices throughout Australia for the benefit of public health, food security, and the protection of the environment
- Establish a Risk Hierarchy relevant to rodent prevention and management strategies
- Develop responsible practices for the use of rodenticides, including strategies to minimise the potential development or spread of rodenticide resistance
- Define and promote the adoption of safe and humane rodent management practices

3 Key Stakeholders and Scope of the Code

3.1 Key Stakeholders

For this Code of Best Practice, key stakeholders include:

- Professional Pest Managers, and;
- Commercial and Environmental Health Officers, and;
- Regulators – APVMA & other Government agencies, and;

- Food safety auditors, and;
- Government and public interest conservation and animal welfare groups, and;
- Consumers of rodent management services.

3.2 Scope of this Code of Best Practice:

- Professional pest management of rodents in and around buildings and structures.
- Rodent management in crop situations is not covered by this Code.

4 The Regulatory Environment

State and Territory Governments legislate specific responsibilities for the management of pest species. Governments or industry bodies may endorse Codes of Best Practice, Standard Operating Procedures, and Guidelines as a provision for communicating specific aspects of rodent management.

Methods used to manage rodents must comply with relevant State or Territory legislation.

5 Requirements for Professional Pest Managers

Under this Code, Professional Pest Managers seeking to comply are required to:

- Hold a current pest control licence issued by the relevant State or Territory authority, and;
- Have attained the relevant National Pest Management Units of Competency, and;
- Comply with all National and relevant State regulations that apply to pest management, and;
- Be able to identify the difference between native and pest species, and;
- Apply rodenticides in accordance with the product label directions and Government or industry approvals and permits, and;
- Use rodent traps in accordance with Government or industry approvals and permits, and;
- Keep records of rodenticides applied in accordance with relevant State or Territory requirements, and;
- Apply humane euthanasia methods for any captured or trapped pest rodents, and;
- Carry appropriate insurance cover.

6 The Client

In the context of this Code, clients are considered to be anyone engaging a Professional Pest Manager to carry out rodent management work on premises under their control. This includes all residential clients, commercial clients, and Government bodies requiring rodent management.

For rodent management at food management sites please also refer to *AEPMA's Code of Best Practice for Pest Management in the Food Industry in Australia and New Zealand*.

7 Relationship Between Professional Pest Manager and the Client

The establishment of an effective Client-Professional Pest Manager relationship is critical to the success of any rodent management program. The client is integral to the development of the program as they will often have first-hand knowledge of the current pest situation. Integrated Pest Management principles also support the need for the client to play an active role in the management program through implementing cultural control methods e.g. sanitation and hygiene (reducing rodent food sources) and physical control methods (rodent proofing of access points) aimed at excluding rodents from structures.

This Client-Professional Pest Manager relationship begins with the first contact and continues until completion of the rodent management program. At the first meeting, the Professional Pest Manager should:

- Clarify with the client their perception of the current rodent situation. This information will help to initiate the development of a rodent management plan;
- Establish what the client's expectations are in relation to the management process. If this is not done, then it may be impossible to ever meet their expectations.

Throughout the management process, it is essential to maintain clear, open lines of communication and documentation ensuring that the rodent management program runs smoothly. Ongoing client feedback will assist the Professional Pest Manager to make any adjustments to the program if required. At the completion, the Professional Pest Manager should document and explain to the client the results of the program and of the need for ongoing program maintenance work to ensure that re-infestation does not occur.

8 Rodent Management Strategy

Professional pest managers should consider all available management strategies and not simply rely on the use of rodenticides. Relying on rodenticides alone does not guarantee that the infestation will always be eradicated and, if employed by default, may omit other control measures with a greater likelihood of success. Rodent populations may rebound after treatment so it is important that improvements to environmental factors at the site are always implemented to provide an effective long-term solution.

Each site is different and will require a different set of measures, either to prevent rodent infestation or to remove an infestation. A considered management measure may present a low

risk at one site, but a higher risk at another. Therefore, an important procedure in a rodent management program is the development of this Rodent Management Strategy.

9 Risk Hierarchy

The concept of a 'Risk Hierarchy' should be at the forefront when planning a rodent management program. The concept is to implement effective control measures with the lowest risk first. It is not necessary that all options in the Risk Hierarchy are implemented sequentially, or at all, before an effective solution is reached, but all methods must be considered. An effective rodent management strategy must also determine how success will be measured.

9.1 Exclusion

Measures to prevent the ingress of rodents into buildings provide a long-term solution to rodent problems and are usually without adverse impacts. Such measures should always be implemented.

9.2 Removal of Food and Water

Denying rodents access to food and water will greatly impact on the success of a rodent management program and should always be implemented. The effect is two-fold, lack of available food will help to deter rodents from a site, and it will encourage them to take up any baits that are introduced.

9.3 Harbourage Reduction

In order to deter rodent infestations, sites should be cleared of all debris, rubbish, old machinery and equipment, etc. Vegetation should be cleared around buildings and where possible, the immediate surrounds of buildings should be concreted or paved to prevent rodent burrowing. Such measures should always be implemented.

9.4 Trapping

The humane trapping of rodents provides many benefits. Traps can be selected to target the pest species and provide for the animals to be removed from the premises without the use of rodenticides. Care must be taken to ensure traps do not pose a risk to non-target species, especially when placing traps outside of buildings. Where a risk to non-target species exists, traps should be set in natural or artificial tunnels or purpose-made stations.

When selecting lethal-traps, only those traps meeting the highest humane standard (as detailed in Section 17 of this Code) should be considered.

Rodent glueboards must only be used as an option of 'last resort' due to rodent welfare concerns (see Section 17 of this Code) and must only be used in States or Territories where their use is permitted (or where a relevant Ministerial exemption exists).

9.5 Rodenticides

The use of rodenticides presents the greatest risk to people, non-target animals and the environment [40]. There is evidence that they may cause the deaths of non-target animals and, in Australia, they have been found at “small, but significant, percentages” in the bodies of predatory birds [41]. As such, rodenticides should be used only after other methods of achieving rodent management have been considered.

All rodenticides are poisonous and must be used strictly in accordance with the APVMA-approved product label. Where practicable, rodenticides should be contained within locked, tamper-resistant stations that are secured in place. It should not be assumed that first-generation anti-coagulant rodenticides or pro-hormone rodenticides (cholecalciferol) pose any less risk than second-generation anti-coagulant rodenticides from the perspective of primary or secondary poisoning risk.

In situations where rodenticides are being employed, special attention must be taken to ensure that bait and bait containers do not contaminate dams, streams, rivers, watercourses or drains.

Additional guidance on poison baiting strategies can be found in Section 16.

10 Risk Management Plan

A Risk Management Plan is a fundamental part of an effective rodent management program. The elimination of hazards where possible, and the evaluation of Safety, Health and Environment (SHE) risks is the basis of proactive management and effective incident prevention.

10.1 Risk Assessment

A Risk Assessment involves considering what could happen if a person is exposed to a hazard and the likelihood of it happening. A Risk Assessment can help determine:

- The severity of a risk, and;
- Whether any existing control measures are effective, and;
- What action you should take to manage the risk, and;
- How urgently the action needs to be taken.

A Risk Assessment should be completed for:

- A new piece of equipment, or;
- A new management method, or;
- A task – routine and non-routine work activities carried out at a client’s premises.

10.2 Site Specific Risk Assessment

Risk Assessments that are specific to the site in which work is to be carried out are designed to ensure a safe working environment for pest managers and members of the general public that

may come into contact with the Professional Pest Manager during the course of the control program, and because each individual site may have risks unique to that site.

10.3 Work Instructions

A *Safe Work Method Statement (SWMS)* must be prepared for any activity identified in the site-specific risk assessment. It should be as detailed as is necessary to describe the activity to be carried out and the method of controlling the risk. Generally, the higher the risk the more detail that will be required. Work instructions based on the findings of the risk assessments must be:

- Communicated to employees and other interested parties, as required, and;
- Communicated in a language that can be understood by each employee or interested party, and;
- Documented in writing.

Examples of Safe Work Method Statements applicable to rodent management can be viewed on the AEPMA website: <https://aepma.com.au/Codes-of-Practice>.

11 Environmental Assessment

An environmental assessment must be conducted prior to implementing a rodent management program. This assessment should consider the following:

- If protected species may be present in or near the treatment site, and;
- If any risks to non-target species are identifiable, and;
- What preventions may be employed to mitigate the risk to wildlife and the environment, and;
- What facilities and procedures must be employed for the safe disposal of dead rodents and unused rodenticides, and;
- If streams, ponds, creeks or other watercourses are present that must be avoided if rodenticides are to be used, and;
- What, if any, actions are expected from the persons responsible for the infested site, and;
- What follow-up measures are required once the infestation has been eradicated to make the site less conducive to rodents in future?

11.1 Removal of dead or dying rodents

When undertaking a rodent management program, ensure time is allocated during each site visit to search for any rodenticide (bait)-affected rodents or carcasses. If affected rodents are found, they must be humanely euthanased (see Section 17).

Remove rodent carcasses and dispose of them in accordance with the APVMA-approved product label. This is particularly important to reduce the risk of secondary poisoning, especially in areas where birds of prey and other predators or scavengers are known or suspected to be active, or where populations of outdoor rodents are being controlled.

11.2 Possible pollutants

Ensure all unused bait and bait containers are disposed of in accordance with the APVMA-approved product label. Do not dispose of any unused bait or bait containers at client sites.

11.3 Bait Movement by Rodents

Rodents may carry bait away and hoard it or drop it in areas where humans or non-target animals can come into contact with it. Consider whether hoarding may be a problem and, if required, search for any bait caches and dispose of safely. Bait blocks must be secured to minimise the potential for bait movement.

12 Required Rodent Management Documentation

12.1 Scope of Works

The Scope of Works should include, but not be limited to, the following:

- Rodent management strategy, and;
- Rodents species covered, and;
- A description or estimate of any infestation, and;
- Recommended (or if different, agreed) frequency of service, and;
- Areas of service, and;
- Times of service, and;
- Method(s) of treatment, and;
- Approved products, and;
- Agreed response times, and;
- External notification of treatments (if required).

12.2 Service Report

In addition to the minimum compliance requirements for service reports (refer to legislation in Appendix A), service reports dealing with rodent management should include the following:

- Species and number of rodents caught or sighted, and;
- Recommendations to the client for cleaning, proofing, or habitat modification specific to rodent prevention or infestation abatement, and;
- Any changes recommended to the monitoring or treatment frequency following the detection or cessation of rodent activity, and;
- Any changes recommended to the Rodent Management Strategy.

All service reports should be supplied to the client within 24 hours.

12.3 Location Maps

Location maps are to be maintained, documenting the uniquely identified rodent management devices; and must be reviewed, dated and signed, at least every twelve months or when site conditions change (e.g. additional temporary trap placements).

12.4 Pest/Rodent Sighting Register

Commercial clients should maintain an accurate record of rodent sightings, and any sightings considered urgent or that pose an immediate risk to health or food safety should also be directly communicated to the Professional Pest Manager. Any rodent-associated client complaints should also be recorded in the Pest/Rodent Sighting Register.

Client Pest/Rodent Sighting Register(s) must be checked by the Professional Pest Manager as part of every service.

An example of important information to be included on the Pest/Rodent Sighting Register:

- Date and time, and;
- Rodent species (if known) or description (e.g. size), and;
- Specific area where observed, and;
- Person making the report/observation, and;
- Any action taken by client (e.g. maintenance contacted), and;
- Corrective action taken by the Professional Pest Manager, and;
- Date completed, and;
- Professional Pest Manager's name and initials.

The Client Pest/Rodent Sighting Register must be checked and signed during each service visit by the Professional Pest Manager, even if there is no reporting entered into the register. This serves as evidence that the register has been checked by the pest management company as part of a regular service.

13 Rodent Prevention & Integrated Pest Management

13.1 Introduction

Integrated Pest Management ('IPM') implies a combination approach to pest management that:

- Relies on an understanding of the ecology of the pest (in particular, those factors which favour its development), and;
- Draws from this knowledge non-pesticidal approaches that will make the environment less suited to the development of the pest population, and;
- The judicious and sensitive use of pesticides [42].

In a practical sense, IPM as it relates to rodent management uses a combination of practices and control measures, with consideration given to factors such as;

- The Risk Hierarchy, and;
- Client responsibilities and constraints, and;
- The area(s) to be treated and any surrounding environment (including awareness of the potential presence of native species and predatory birds, etc.), and;
- Methods to prevent problems from occurring rather than dealing with them after they have happened, and;
- The prioritisation at all times of safe and humane control methods.

Before taking any Professional Pest Management action, an action threshold should be set, which is a point at which pest pressure (population) or environmental conditions indicate pest management action must be carried out. Sightings of a single pest don't always mean immediate corrective action is needed, nor that a rodenticide should be used in this first instance. The level at which a pest or pests will become an economic, health (hygiene), or environmental threat is critical for directing future pest management decisions and programs. This should be further determined and supported with a thorough and comprehensive site inspection.

13.2 Inspection

A thorough site inspection is essential in identifying the area and extent of the rodent problem in the environment that the issue has been reported or detected.

Identifying the species of rodent, areas affected by the rodent/s, and any food and/or water sources will be essential indicators for any proposed monitoring or treatment plan.

This can be achieved by locating and quantifying the following during the inspection.

- Any rodents observed, and;
- Droppings: shape, size and colour, and;
- Tracking (footprints), or rub marks, urine stains or pillars, and;
- Burrows or holes in and around both natural and fabricated areas, internal and external, and;
- Gnaw marks, and;
- Whether rodents are using the area for transit or harbourage, or if there is loss of food or spoilage of food stuffs and other stored items, and;
- Smells, sounds, and previous observations, and;
- Hair left in tight spaces, and;
- Nesting materials.

13.2.1 Tools Used During the Inspection

The following list of tools and equipment are useful for carrying out an effective inspection.

- Torch (including a 'black-light' ultraviolet torch), and;
- Access aids – a variety of tools (e.g. screwdrivers, saw, hammer, pliers), and;
- Ladder, and;
- Appropriate protective clothing and equipment (e.g. overalls, gloves, bump-hat, knee pads), and;
- Non-toxic tracking powder, and;
- Camera, and;
- Remote camera extension arm for reaching difficult to access areas, and;
- Infrared/motion cameras.

13.3 Exclusion

Methods of exclusion can include, but are not limited to, the below methods:

- Removal of overgrown vegetation and possible harbourage material and stored items, and;
- Physical barriers, such as mortar replacement, capping, wire mesh, door sweeps and weather seals to exclude pests from area of ingress, and;
- Waste water traps and gate valves to deter subterranean ingress, and;
- Clearing areas which will expose pests to predation or destroying their food, shelter and breeding environment.

All of these methods should be considered in a thorough site inspection.

13.4 Removal of Food and Water

This may include:

- Regular and frequent removal of rubbish, food waste, and excess or out of date stock, and;
- Regular cleaning of food production zones at the end of each shift and/or production run, and;
- Adoption of a 'first in, first out' ('FIFO') approach to the storage and handling of both raw materials and finished products in food manufacturing facilities, and;
- Containment and good storage practices of all food and water sources that are an attractant to the area of activity. (e.g. food bowls, BBQ's, rubbish bins, bird-feeders etc.), and;

All of these methods should be considered in a thorough site inspection.

13.5 Harbourage Reduction

Harbourage identification and reduction will aid in the efficiency of any implemented exclusion, baiting or trapping plan.

Harbourage reduction can include, but is not limited to:

- Removal of rubbish and clutter, and;
- Tidying equipment piles and rotation or removal of long-term stored goods and boxes and;
- Limiting the presence of subfloor areas with little or no access, and;
- Sealing voids and excavations made by rodents and;
- Trimming surrounding bushland, long-grassed fields, and vegetation along fencelines, and;
- Keeping outbuildings and sheds and well maintained, and;
- Ensuring roof voids, crawl spaces or service voids are accessible, and;
- Regularly clearing or flushing drains, gutters, sewers and septic tanks.

All of these areas should be considered in a thorough site inspection.

13.6 Monitoring Rodent Activity

The monitoring of rodent activity is critical to the design and implementation of an effective rodent management program. In many cases the inspection process is the first step in monitoring activity, and many of the activities will overlap from one to the other. In addition to routine inspections, monitoring rodent activity can be achieved through the use of:

- Non-toxic rodent monitoring blocks, and;
- Electronic remote monitoring digital systems ('ERMDS'), and;
- Non-toxic tracking powders, and;
- Trail cameras or motion-sensor activated cameras, and;
- Confinement (live-capture) or lethal traps.

Non-toxic monitoring baits or lures offer an environmentally preferred option for rodent monitoring or maintenance programs since, only once rodent activity is detected are rodenticide baits put in place. Non-toxic baits or lures can also integrate with control programs using lethal traps, glueboard traps or restraining traps. Several non-toxic baits have a UV-A dye included. This allows for the tracking of rodent activity after consumption as the rodent's faeces and urine will glow when observed using a UV torch (black-light).

13.6.1 Electronic Remote Monitoring Digital Systems

ERMDS combine various types of sensors to detect and monitor rodent activity and send real-time, digital reports to a base location or designated person [29, 43-45]. Action reports can then be sent electronically to enable prompt servicing of an infestation.

This technology has been developed in response to increased demands from clients, particularly in the food industry, for more timely and accurate information on the status of rodent activity and management programs [29].

Most electronic remote monitoring digital systems give a real-time indication of rodent activity pinpointing the moment the activity occurs. This enables the Professional Pest Manager to

provide a focused solution whilst minimising the potential for rodent ingress to escalate into a major infestation.

Some purported benefits of this technology include:

- Real-time monitoring of rodent station activity, and;
- Improved reporting – data is documented automatically and can be tailored to the client's quality assurance needs, and;
- Validation that a device has been pest-free in between normal service visits, and;
- Improved rodent welfare through an immediate alert of activity and therefore prompt checking of traps in line with animal welfare requirements, and;
- Potential mitigation of the need to inspect confinement traps (live-capture) every 24 hours.

As with many new technologies, ERMDS continue to develop rapidly and increase their penetration and acceptance in the professional pest management market. However, some limitations to the technology are well known, and must be considered in assessing whether a technology is right for both the Professional Pest Manager and their client. Such issues include:

- A high cost of both initial hardware acquisition and ongoing maintenance (unit and battery replacements etc.), and;
- The general dependence on both an uninterrupted power source and internet connection (either by ethernet, Wi-Fi, or a telecommunications link) for the system to operate, and;
- A potential high rate of false positives (an alert when no rodent is present) due to device damage, water, or debris ingress, insect activity, rapid temperature changes, or intentional misuse, and;
- Potential false negatives (no alert when a rodent is present), and;
- Concerns regarding data security for sensitive clients given many systems are leased or operated under license from third parties.

Such factors must be considered and discussed with the client prior to the installation of electronic remote monitoring digital systems as part of, or in addition to, an existing rodent management system.

14 Rodent Control – Traps & Other Non-Toxic Tools

With an increasing focus on integrated pest management and a trend to minimise the use of rodenticides, non-chemical tools for rodent management are becoming more important. There are several cost-effective non-toxic approaches available to monitor and control rodents. Trapping has several advantages, in that rodents can be easily removed from the site without leaving chemical residues, success is immediately evident, counts of trapped rodents can be readily tracked, and in many instances may facilitate the eradication of an infestation without resorting to the use of rodenticides.

14.1 Break-back Traps

Break-back traps ('snap traps' and 'spin traps') come in various sizes and designs for both mice and rats, and when applied appropriately, may be a method of both humane [46] and efficacious infestation reduction [47], when compared to other trapping methods. Professional Pest Managers must only use devices intended for the type of rodent being targeted (i.e. mouse traps must not be used for rats, and vice versa).

This Code requires that Professional Pest Managers must only employ the most humane approved traps provided by the Voluntary Trap Approval (VTA) scheme, as detailed in Section 17 (Rodent Welfare).

In order to be effective, break-back traps must be used in suitable numbers and positioned correctly in areas of rodent activity. Care must be taken to protect children and other non-target species from break-back traps. Where possible, break-back traps should be placed inside a lockable, tamper-resistant station that includes an indicator to show if the trap has been activated. Several stations are available that are designed to hold such traps.

In instances where placement of the trap inside a tamper-resistant station would impede trap placement or function (e.g. for direct placement of a break-back trap along pipes, conduits, or pallet-racking beams, columns or braces) traps should instead be anchored by screws or cable-ties.

The recommended frequency of inspection for break-back traps varies around the world, with intervals of between daily to twice-daily common [46, 48-50], however, there is no legislated minimum inspection frequency in Australia.

In line with the British Pest Control Association [48], this Code recommends that, in the first instance, the frequency of trap checking should be in accordance with the site visit frequency as determined by Rodent Management Strategy (Section 8) and Environmental Assessment (Section 11). In areas where a high frequency of inspection is recommended, the Professional Pest Manager may train one or more on-site personnel to check the traps; however, ultimate responsibility for compliant and humane use remains at all times with the Professional Pest Manager.

The location of traps should be noted and recorded on a site map to facilitate follow-up instructions.

14.2 Glueboards

Rodent glueboards have long been an important tool for Professional Pest Managers in the eradication of rat and mouse infestations [12-14]. However, recognition of the animal welfare impacts on trapped rodents has been an increasing area of attention. This is due to knowledge of the affects suffered by trapped rodents, which may include: severe eye irritation, faecal and urine soiling, potential suffocation, and self-harm in the course of attempting to escape [46, 51]. The collective understanding associated with regard to rodent welfare has consequently meant that rodent glueboards are now generally regarded as inhumane [46, 52].

In Australia, these devices are either restricted in Victoria and Tasmania [35-37], and prohibited in the Australian Capital Territory [38]. In Victoria and Tasmania, a Ministerial Exemption exists

for Professional Pest Managers, with rodent glueboards which are otherwise prohibited for use by the public [35, 53].

In support of this, this Code requires that rodent glueboards must be used only:

- As an absolute 'last resort' method of trapping-based control.
- By Professional Pest Managers, and;
- Where the integrity of food safety, biosecurity, or public and animal health is threatened.

In practice, this requires that rodent glueboards must only be used:

- If food production, biosecurity, or public and animal health is at immediate risk of being compromised by rodent activity (or further damaged if the initial event has already happened), and;
- All other trapping options as identified in the Risk Hierarchy have been considered and either discounted (for stated reasons) or implemented without success, and;
- For as long as necessary to achieve the desired result, or until success through their continued use becomes unlikely, at which point all devices must be removed.

In the event that rodent glueboards must be applied for the eradication of activity or an infestation their selection, placement, and use must be carefully planned in order to maximise trapping potential and efficacy over the shortest possible time. This should include identification of rodent entry points or runways, with glueboards targeted in substantial numbers to such areas. Ideally, glueboards should be positioned immediately next to and parallel to a wall or runway, or in such a manner that makes it impossible for a rodent to enter the affected area without encountering the glueboard(s). In preventing a rodent from accessing a critical area, the combined use of rodent break-back traps and glueboards in a densely populated matrix as a means to create a 'lethal barrier' may be an effective solution.

Significant care must to be taken to protect children, pets and non-target animals. Rodent glueboards must only be used on the interior of a building, should be anchored (where practicable), and only rodent glueboards with a rigid plastic or thick cardboard backing should be used. The location of glueboards must be noted on a site map. Upon completion, the gel adhesive of every glueboard must be completely covered (or otherwise made completely ineffectual, e.g. by folding in half) prior to the device being disposed of.

In the event a person or non-target animal could be caught (even on the inside of a building) or where dusty, wet, debris-prone, greasy, or excessively cold conditions may interfere with the trapping ability of a rodent glueboard, consideration should be given to enclosing the glueboard in a lockable, tamper-resistant rodent station or dedicated rodent glueboard tunnel. However, the use of such protective devices should be balanced against the immediate need for rodent glueboards to be used only for rapid eradication, and the fact that all four legs of a rodent are typically required to contact the glueboard for the animal to be securely trapped [51]. Given the inherent need for use of the rodent glueboard in the first instance, priority should be given to a suitable number of open glueboards being placed such that a rodent can approach from any angle and be trapped in a quick and secure manner.

In the event that a non-target species is trapped, a freeing agent (e.g. a suitable food-grade oil or similar emollient) must be applied to the animal for removal. If the trapped animal is injured in such a way that release would result in unnecessary suffering, it must be humanely euthanised. Non-target species must only be released near their site of capture, and only if they appear to be physically unharmed and their release is not prohibited by law. Ensure when using rodent glueboards that a suitable freeing-agent, as recommended by the manufacturer, is always available.

The inspection frequency applied to rodent glueboards is a highly debated (and often emotive) topic. Internationally, recommended inspection intervals range significantly from 'at least hourly' [52], to 'every 12 hours' [50, 54, 55], or 'within 12 hours of sunrise' [56], and 'every 24 hours' [51, 57, 58]. Within Australia, 24 hours remains the minimum legislated interval, applicable only to those States and Territories with relevant legislation [36-38].

In balancing the minimum requirements from both national and international bodies, and in consideration for the proposed scope of permitted use, this Code provides that inspection of glueboards should be undertaken **within 12 hours of sunrise** every day that they continue to be set. As with other traps and devices that require frequent inspection, the Professional Pest Manager may train one or more on-site personnel to check the glueboards; however, responsibility for compliant and humane use remains at all times with the Professional Pest Manager.

14.3 Confinement (Live-capture) Traps

The use of confinement, wire mesh, or box traps is a popular and highly effective trapping method applicable primarily to mice but with niche application to rats.

Most confinement traps take advantage of the inquisitive and curious nature of mice and comprise a pivoting entrance that permits entry, but which limits escape. Some wire mesh cages may also utilise a touchpad trigger that closes the trap with a suspended door.

Due to the neophobic tendencies of rats, such devices are less commonly applied, with break-back traps or a glueboard often preferentially selected. However, in instances where time allows for a rodent to become accustomed to the device, or where other traps cannot be used, confinement traps for rats may still have some limited application.

Welfare concerns have been raised regarding confinement traps, focussed primarily on the potential for a rodent to experience starvation if food is not provided or trap inspection is left over too long an interval [13, 46, 50], to endure cold stress if nesting material is not supplied [46], and to experience poor application of humane euthanasia once the trapped rodent(s) require culling [46, 50, 59]. Conversely, a substantive benefit of confinement traps is that animals are less likely to injure themselves, and non-target animals can be released if trapped [50].

In Victoria, confinement traps must be inspected every 48 hours if food, water and shelter are provided, or 24 hours in all other circumstances [36, 39].

This Code provides that confinement trap inspection intervals should be as follows:

- Every 24 hours if used without the provision of food, water and nesting material, or;

- Every 48 hours if applied in conjunction with the provision of food, water and nesting material.

14.4 Drowning Traps

Traps that employ drowning are not permitted for use under this Code due to animal welfare concerns.

14.5 Other Types of Traps

There are a wide variety of confinement (live-capture) traps and other mechanical (e.g. carbon dioxide asphyxiant traps, blunt force trauma traps, and traps that kill by electrocution) available on the market. Most of the principles stated above that pertain to the use of break-back traps are relevant to the use of these devices.

Under the terms of this Code of Best Practice, Professional Pest Managers should only use these alternative trap types where they have been proven to conform to Welfare Category A (See Section 17).

14.6 Ultrasonic Devices

Ultrasonic/electromagnetic devices are widely sold, though it is reported in several peer-reviewed, scientific papers that there is “little or no success” when using these devices [14, 46, 60]. In 2001, the US Federal Trade Commission advised over 400 retailers of the risks of making fraudulent claims about ultrasonic/electromagnetic devices having any effect on rodents [61]. This Code does not recommend use of these devices.

14.7 Shooting

In some difficult situations, either where the population is very large, or more probably where there is a particularly hard to control rat, shooting may be an option as a small part of an integrated approach. Air rifles fitted with accurate sights for an effective head shot are the preferred option.

Shooting requires State or Territory licensing, particularly when carried out for business purposes.

Note that rats will learn very quickly to avoid a shooter, so this method of control may only be effective for one or two consecutive days, or very sporadically. Shooting will realistically only be effective in population control if it is the last one or two rats that are the target.

15 Rodent Control – Rodenticides

Always refer to APVMA-approved product labels for full directions of use and precautions.

15.1 Selecting a Rodenticide

There are many factors that should be taken into consideration when choosing which rodenticide to use on any particular site or location. The first of those is the law – as designated and approved on all APVMA-approved product labels.

When selecting a bait for use in and around buildings, several criteria should to be considered:

- Which rodent species are present (Norway rat, black rat or house mouse)?
- How large is the rodent population?
- Where are the rodents' harbourages and runways?
- Are there foodstuffs stored or manufactured nearby?
- Are non-target animals or children at risk?
- What is the possibility of secondary poisoning on the site (animals eating poisoned rodents)?
- What is the relative toxicity of the various baiting options?
- What is likely to be the most attractive (smell) and palatable (taste) rodent bait available, considering what the rodents are consuming on-site?
- Are there any Federal, State or local legislative requirements that may limit or prohibit the use of rodenticides in a particular area?

The first four criteria should be dealt with during the initial inspection and discussion with the client.

For any areas where human or animal foodstuff is stored or prepared, rodenticide tracking powder should not be used. Depending on the client or the auditor, rodenticide baiting may not be allowed in food facilities where the food is used for human consumption. Note that most rodenticide labels do permit baiting in these areas, but the client may choose NOT to use rodenticides in such locations.

Where either primary or secondary toxicity is a concern, non-toxic eradication strategies must be considered first (refer to the Risk Hierarchy in Section 9) before rodenticide baiting is considered. If rodenticide baiting is required to achieve eradication, further consideration must be given to the baiting strategy (see Section 16. It should not be assumed that first-generation anti-coagulant rodenticides, second-generation anti-coagulant rodenticides, or pro-hormone rodenticides (cholecalciferol) pose any less risk than each other from the perspective of primary or secondary poisoning risk.

The attractiveness of rodenticide baits will vary from population to population and may even change during the course of the year in response to the feeding habits of the population being targeted. Professional Pest Managers should use their preferred rodenticide bait option but, in situations where this is not being eaten, alternative measures must be considered.

Rodenticide baits should be secured inside locked, anchored, tamper-resistant bait stations. This predisposes the use of securable baits, either wax-based or soft, over other formulation options as these are the easiest and most effective to secure on a bait rod.

All rodent baits should be monitored for activity as per manufacturer's labels, with the baits being replaced according to the level of consumption. Monitoring frequency may be increased depending on client expectation and level of rodent activity.

15.2 Types of Rodenticides

15.2.1 Acute

Worldwide there are various acute poisons available.

In Australia the active constituent cholecalciferol is currently registered under two formulations; pellets in sachets and soft bait. It can be used in and around buildings and along perimeter fences for rats and mice. There is no effective antidote for this compound if primary poisoning should occur. Cholecalciferol products must be used within lockable tamper-resistant bait stations. It is classified as a Schedule 7 Dangerous Poison according to the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) No. 16 (Poisons Standard February 2017).

Zinc Phosphide (ZP) is another Schedule 7 Dangerous Poison that is registered in Australia for crop use. It is a very fast-acting rodenticide primarily used during mouse plagues as broadcast application in grain, legume, canola, safflower, nut tree crops, and pastures during mouse plagues.

15.2.2 Anticoagulants

Anticoagulant rodenticides are the most commonly used rodenticides, and work by blocking the vitamin K cycle which leads to internal haemorrhaging, anaemia, and eventual death. Anticoagulant rodenticides act with a delayed effect which may mitigate the development of bait shyness or bait aversion.

If poisoning of non-target vertebrates should occur – either primary or secondary – the emergency administration of vitamin K1 may be an effective antidote.

15.2.2.1 *First-Generation Anticoagulant (FGAR)*

First-generation anticoagulant rodenticides, also called 'multiple-feed' rodenticides, are a group of anticoagulants that were developed before 1970. Examples of FGARs available in Australia include warfarin, diphacinone and coumatetralyl. These compounds are much more toxic to rodents when feeding occurs on several successive days rather than on one day only. They generally have shorter elimination half-lives [62] but usually take longer to control infestations.

15.2.2.2 *Second-Generation Anticoagulant (SGAR)*

The second-generation anticoagulant rodenticides were developed during the 1970s to control rodents that had developed resistance to first generation anticoagulant rodenticides. Examples of SGARs available in Australia include brodifacoum, bromadiolone, difethialone, difenacoum and flocoumafen.

SGARs are more likely than FGARs to be able to achieve a lethal dose after only a single feeding, although a delayed action still occurs, with death occurring 3-5 days after ingestion. This delayed effect greatly reduces the risk of bait aversion within a population and maximises effective control of infestations.

Whilst SGARs may kill over a similar course of time to FGARs, SGARs tend to remain in the animal tissue longer. To date there is very little evidence, either anecdotal or scientific, of genetic resistance to SGARs in Australia.

15.3 Rodenticide Formulations

Different rodenticide formulations are available. The choice of which rodenticide formulation to use can be informed and determined by:

- The nature of the site (e.g. whether a loose grain or pellet formulation can be used or if a securable formulation is required), and;
- The dietary requirements and/or feeding preferences of the rodent population present.

Rodenticide block baits and soft 'sachet' baits are the most commonly used formulations since they can be secured inside lockable, tamper-resistant bait stations.

Liquid formulations are generally recommended where other formulations have provided insufficient control or in exceedingly dry environments where the availability of water (or high-water content foods) is limited. Liquid rodenticides must be used in liquid dispensers secured inside lockable, tamper-resistant bait stations.

Rodenticide tracking powders are available that adhere to the rodents' feet and fur, leading to ingestion of the toxicant during grooming. Care is required to place tracking powders in areas accessible to rodents, but inaccessible to non-target animals and humans. Due to the hazards associated with these powders, tracking powders must not be used in or near ventilation ducts or in areas where they may contaminate food items or food preparation surfaces. Application of rodenticide tracking powders in areas of moisture, airflow or where disturbance by non-target species or occupants may occur, must also be avoided.

15.4 Fumigation

The use of fumigants for rodent management has decreased dramatically in recent years. Today, fumigants are used in situations where other techniques are ineffective or not practical, or where they might be mandated for use. Please refer to individual product labels for full directions of use and precautions.

Fumigants are used in large scale rodent infestations (e.g. on poultry farms, in stored product warehouses) and for other circumstances where rapid elimination is required. Fumigants can also be useful against Norway rats with direct burrow fumigation in outdoor situations.

The fumigants registered in Australia for rodent management include;

- Phosphine (PH_3) present as aluminium phosphide, and;
- Methyl bromide (CH_3Br) used to treat imported and exported goods only.

Fumigation is a high-risk work activity and a specialised area that must only be carried out by an experienced and licensed fumigator.

16 Poison Baiting Strategies

16.1 General Baiting Instructions

The site conditions, available food sources and the rodent species targeted will often determine the choice of rodenticide and bait formulation to be used (e.g. block, soft bait, pellet, paste, liquid, powder). Rodent bait stations containing rodenticides should always be placed in compliance with the product label instructions.

16.2 Use of Bait Stations

This Code recommends the use of lockable, tamper-resistant bait stations whenever rodenticides are to be utilised. Bait stations fulfil several functions in effective rodent management, namely they:

- Protect bait from moisture and dust, and;
- Allow rodents to feel more secure, and;
- Help keep non-target species, including pets, livestock, wildlife, and children, away from rodenticides, and;
- Help prevent accidental spillage, and;
- Offer Professional Pest Managers easy access, making it simpler to determine the amount of bait consumed, and need to refill.

All rodent bait stations should be labelled and numbered for ease of identification, secured in place and, for commercial clients or properties, documented on a site map. When placing rodent bait stations in an environment where surface water may enter the station, it is best practice to raise the station 25-50 mm off the horizontal surface.

In Australia there are no specific performance guidelines as to the effectiveness of bait stations. However, the United States Environmental Protection Agency provides criteria for tamper-resistant bait stations [63], requiring that they are:

- Resistant to destruction or weakening by elements of typical non-catastrophic weather (e.g., snow, rain, extremes of temperature and humidity, direct sunshine, etc.), and;
- Strong enough to prohibit entry or destruction by dogs and by children under six years of age using their hands, their feet, or objects commonly found in the use environment (e.g. sticks, stones, broken glass, etc.), and;
- Capable of being locked or sealed so that children and non-target animals cannot gain access through the opening or procedures used to fill the bait compartment(s), and;
- Equipped with rodent entrances which readily allow target animals access to baits, but deny such access to other animals larger than adults of the target species, and discourage entry by birds, and;
- Capable of being anchored securely to resist efforts to move the station or to displace its contents, or equipped with a mechanism which virtually prevents bait from being shaken out of the station after it has been moved, and;

- Equipped with internal structures for containing baits and minimising spillage and tracking of bait outside of the station or into readily accessible parts of the station, and;
- Made of a design and colour that is not especially attractive to children, and;
- Capable of displaying precautionary statements in a prominent location.

There are many bait station options readily available on the Australian market, and many criteria can be used in selecting the best option for any particular situation including: capacity, discreetness, size, durability, security, serviceability and price.

16.3 Clean-Out Treatments (Pulse Baiting)

Clean-out treatments are used to remove existing infestations of rats and mice. Baits are placed in accordance with the APVMA-approved product label.

Baits need to be inspected frequently, particularly in the first ten days and any bait that has been consumed, together with any contaminated or spoiled bait, replaced.

Baiting is performed for at least 2 weeks (3 to 4 pulses), and it is usually necessary to reduce rat or mouse numbers to a low level. Although heavy infestations may require longer treatments to achieve complete eradication.

Treatment is discontinued when effective control has been achieved and all baits should be removed, unless a maintenance treatment is to be undertaken (see below).

This strategy will ensure that after the dominant rodents have been eliminated, bait is still available for the less dominant individuals.

The use of multiple, different, actives in the one station is not recommended under this Code of Best Practice.

16.4 Monitoring and/or Maintenance Treatments

The use of rodenticide baits at sites where there is no current rodent infestation is not recommended under this Code. In these situations, the use of non-toxic monitoring baits and/or traps is recommended to monitor for the early presence of rodents.

Where the prevention of rodent infestation is considered essential to maintaining the integrity of safe food production or the prevention of risks to human health, permanent placement of rodenticides may be warranted. However, continued rodenticide use must comply with the conditions of the APVMA-approved product label.

If rodent numbers escalate, revert to pulse baiting. This may mean increasing the number of rodent bait stations on a temporary basis and/or increasing the bait available in each station.

16.5 Bait Placements

All rodenticide bait placement must comply with the conditions of the APVMA-approved product label. Additionally, the deployment of rodent bait stations should be based on the Rodent Management Strategy (see Section 8) and Environmental Assessment (see Section 11), with bait

placements increased, decreased, or ceased, based on an assessment and the perceived level of rodent activity.

APVMA-approved rodenticide labels generally stipulate that bait placements:

- Must not exceed 3 m between bait stations for mice, or 9 m for rats, for “Clean-Out Treatments” only. (For maintenance baiting, extended intervals may apply), and;
- Must not be applied to crops, and;
- Must not be used for the control of protected native rodents, or other native animals, and;
- Must be restricted to use in and around buildings (within 2 m) or enclosed spaces (e.g. drains), with the exception of selected FGARs or acute rodenticides (e.g. cholecalciferol) which may be used along fencelines.

16.6 Burrow Baiting

Rodent baits and tracking powders can be placed deep into burrows to avoid access by non-target species. It is recommended to leave the burrow open to allow the rodents to enter/exit with regularity. After 2-3 weeks, seal the hole with crumpled paper, leaves, or other light debris as a means to assess the level of rodent activity.

16.7 Off Building/Fenceline Baiting

All rodenticide baits must be placed in lockable, tamper-resistant bait stations and secured to prevent removal or dislodgement and/or access to the stations by unauthorised persons or non-target species. Rodenticides placed off a building structure or on a fenceline must only be used when approved by the manufacturer and listed on the label for use in this situation.

16.8 Checking Baits

All rodent baits should be checked for activity in compliance with the APVMA-approved label, with the baits being replaced according to the level of bait consumption or rodent activity. The frequency may be increased depending on client expectations or the level of rodent activity.

16.9 Replacement of Rodent Baits

Rodenticide baits are made with fresh, food grade ingredients which will diminish in palatability and attractiveness over time.

There are no formal guidelines for the routine replacement of baits, as their deterioration will vary under different environmental conditions. For instance, in warm, damp environments, high humidity levels may significantly shorten the life of rodent baits leading to a requirement for more frequent replacement. Whereas in cool, dry locations field effectiveness may be prolonged. Thus, it is difficult to define a standardised timeline of bait replacement.

It is critical therefore, that if rodenticides are being used to eliminate a rodent population that fresh and palatable bait is made continuously available to the rodents. Professional Pest Managers should inspect bait placement at least monthly and subjectively assess if the bait requires replacement. In the absence of any consumption or gnawing by rodents, other signs that the bait requires replacement may include:

- The presence of mould, or;
- Cockroach, beetle, or other insect-related damage, or;
- Slug or snail damage, or;
- Evidence of water submersion or damage, or;
- Discolouration or physical disintegration of the bait, or;
- Evidence of heat exposure or melting, or;
- Regular exposure or contamination from on-site sources (e.g. chemical spills, fumes).

It is useful to note that the level of active ingredient, particularly with anticoagulants, does not decrease significantly over time. It is rather the deterioration of the food ingredients that affects the palatability and attractiveness of the bait.

16.10 Food Safety & Baiting

Where a site is governed by a food safety management system (e.g. HACCP and/or regulatory import/export requirements), baiting strategies must adhere to these requirements and the contractual arrangements of the client's business.

Rodenticide baits must not be placed where they may come into contact with or contaminate food and/or food preparation surfaces.

Please also refer to the *AEPMA Code of Best Practice for Pest Management in the Food Industry in Australia and New Zealand*, or the AEPMA website for further details.

16.11 Baiting Internal Areas

All rodent baits should be placed in lockable, tamper-resistant bait stations including when used in ceiling void and sub-floor areas. Bait stations must be placed in a secured area and/or secured to a surface to prevent removal and/or access to the stations by unauthorised persons or non-target species.

17 Rodent Welfare

The three commensal species of rodents in Australia are not protected animals and can be humanely controlled by Professional Pest Managers and other persons. However, changing societal attitudes toward animal welfare and concerns that previously commonly used management actions are inhumane or ineffective must be addressed when performing management programs under this Code.

As an over-riding guideline, a rodent management program should have clear and achievable outcome-based objectives that cause the least suffering to the target rodent pests, consider community values, include long-term systematic management outcomes, and only utilise management options based on the specifics of the situation.

A principal strategy when choosing methods for the management of rodents is to employ a method (or methods) that, in the prevailing circumstances, minimise the welfare impact on the target species.

Care must also be exercised to ensure the chosen management approaches do not have inadvertent effects on non-target native species and ecosystems.

Some control methods may cause direct harm to the target animals including acute stress and injury from confinement traps (live-capture), and pain and suffering before loss of consciousness. Management programs must reduce unnecessary pain, distress and suffering of animals as much as is technically possible.

The principal strategy when determining a control strategy is to employ a method(s) that has the least potential to catch non-target animals, minimises the welfare impact on the target species and is effective in the prevailing circumstances.

17.1 Code Requirements for the Use of Lethal Traps

Currently there is no legislation in place to require the approval of lethal traps. The most commonly used traps in Australia are break-back traps.

When selecting lethal traps, persons conforming to this Code must use the most humane traps available. Traps that crush the skull are considered the most efficient and humane, since damage to the skull or upper cervical vertebrae is more likely to result in immediate loss of consciousness.

In line with the above guidance, this Code recommends a Voluntary Trap Approval (VTA) scheme be established, with manufacturers to submit their traps for approval testing [64].

Traps shall be tested to meet one of three Welfare Categories (A, B or C), that differ in the 'Time to Irreversible Unconsciousness' (TIU) of animals caught in the trap. This follows standards established in New Zealand, through the National Animal Welfare and Advisory Committee [65] and recommended by the expert committee commissioned by the European Union Food and Environment Research Agency [66, 67].

- **Welfare Category A** requires that at least 80% of trapped animals have a TIU not exceeding 30 seconds, and that at least 90% have a TIU not exceeding 180 seconds (both at 90% confidence).
- **Welfare Category B** requires that at least 80% of trapped animals have a TIU not exceeding 180 seconds, and that at least 90% have a TIU not exceeding 300 seconds (both at 90% confidence).
- **Traps in Welfare Category C** must produce a TIU in the trapped animal not exceeding 300 seconds for at least 80% of a minimum of 12 animals tested.

Professional Pest Managers must only use the most humane trap available. Where lethal traps of different Welfare Categories are available to control the same species, only those traps of the highest welfare category shall be used.

In practice, this requires that:

- Only rodent traps conforming to Category A should be used for routine rodent monitoring and control, and;
- Only where reactive control of a rodent infestation is required and a Category A device is not available, a Category B device may be temporarily used until a suitable Category A device becomes available, at which point the Category B device should be removed, and;
- Devices that conform to Category C must only be used as an option of last resort, must be inspected every 24 hours, and must be replaced by a higher category device within 3 days (72 hours).

Devices that have not been tested and proven to meet the above criteria must not be used by signatories to this Code.

17.2 Humane Euthanasia

The humane killing of captured, poisoned, or trapped rodents is an important responsibility of Professional Pest Managers and, regardless of a rodent's pest status, is a task that must be undertaken with due responsibility and care for the animal. To this end, Professional Pest Managers should familiarise themselves with the current best practices in Australia for humane euthanasia of rats and mice, as defined by the National Health & Medical Research Council (NHMRC) *Guidelines to Promote the Wellbeing of Animals Used for Scientific* [68] and the Centre for Invasive Species Solutions *Standard Operation Procedure. GEN001: Methods of Euthanasia* [69].

It is important to note, however, that under field conditions; the optimal or normally preferred methods of euthanasia may not always be available or suitable, and thus awareness of (and the ability to expertly undertake) alternative methods may be critical to ensuring the prompt but humane death of a pest rodent.

Under field service conditions, any rodents found captured, trapped, or under the influence of rodenticide poisoning must be humanely euthanised in a timely manner and prior to the completion of the service. However, if the animal is exhibiting signs of discomfort, pain, self-harm, or distress it must be euthanised immediately.

Several methods can be applied to confirm death has occurred [69-73], including:

- The palpebral reflex, which is elicited when the eyelids are gently stroked or lightly blown with air. The eye should remain open and the eyelid should not move, or;
- The corneal reflex, which is elicited when the eyeball is gently touched. The eye should remain open and the eyelid should not move, or;
- The pupillary response, which is elicited by shining a bright light into the eye, causing pupil constriction (narrowing). The pupil should not constrict, or;
- Absence of a heartbeat, which can be assessed through palpation (holding and feeling) of the chest, or;
- Glazing of the eyes, which will occur rapidly after death has occurred.

Professional Pest Managers should be knowledgeable in the execution of the above methods and must assess at least two 'signs of death' before an animal is presumed dead. Professional Pest

Managers must not assume an animal is dead just because it is not moving or apparently not breathing.

This Code should be provided to the client to make them aware of the standards to which the Professional Pest Manager is working.

17.2.1 Blunt Force Trauma

The most practical and humane in-field method of euthanasia in commensal rodents is fatal concussion using blunt force trauma.

The affected rodent should be placed in a bag and, using a suitable heavy/blunt instrument (e.g. a hammer), a single, powerful, and accurate blow should be directed to the base of the head.

Death must be confirmed immediately by assessing **at least two** of the above 'signs of death'. Any reaction by the animal may signify ongoing neurological activity, indicating further action is required to achieve death. If necessary, repeat the blow to the head and monitor again until death is confirmed.

17.2.2 Stunning Plus Cervical Dislocation

An alternative method to blunt force trauma is to first stun the animal and then euthanise with cervical dislocation.

Mice should be held by the tail and swung in an arc so that the back of the head contacts a hard, solid object. Small rats should be held by the hindquarters and similarly brought downwards quickly so as to strike the back of the head on a hard, solid object.

Once the animal is stunned, apply firm pressure at the base of the skull, sharply pinching and twisting between thumb and forefinger. At the same time, pull backward on the base of the tail.

Death must be confirmed immediately by assessing **at least two** of the above 'signs of death'. Any reaction by the animal may signify ongoing neurological activity, indicating further action is required to achieve death. If necessary, follow the directions for blunt force trauma if further lethal effect is required and monitor again until death is confirmed.

Important Note: Stunning and cervical dislocation must not be performed on rodents heavier than 150 g i.e. only use on juvenile/sub-adult rats. If there is doubt regarding the appropriateness of cervical dislocation for a rodent an alternative method must be applied.

17.2.3 Inhalation of Carbon Dioxide

Gassing with carbon dioxide (CO₂) is the preferred method of small animal euthanasia in Australia due to the minimal handling required and the possibility of euthanising several animals at the same time [69, 72, 73].

Animals should either be removed from the trap and placed into a container to be filled with CO₂, or remain in holding traps and on glueboards, which are then enclosed within an impervious container or plastic sack.

Only CO₂ delivered from a compressed gas cylinder must be used. Gas flow should be delivered using a gradual-fill method and must be maintained for at least one minute. The rodent(s) must be left in the gas-filled container for a minimum of ten minutes for effective euthanasia to occur.

Death must be confirmed after ten minutes by assessing **at least two** of the above 'signs of death'. Any reaction by the animal may signify ongoing neurological activity, indicating further action is required to achieve death. If necessary, follow the directions for blunt force trauma if further lethal effect is required and monitor again until death is confirmed.

17.3 Non-Endorsed Methods of Euthanasia

The following methods of euthanasia must not be used by signatories to this Code:

- Crushing (i.e. stomping)
- Drowning
- Exsanguination
- Electrocution
- Pithing
- Gassing with carbon monoxide (delivered by compressed cylinder, dry ice, or vehicle exhaust)
- Gassing with other inhalants (e.g. ether, nitrogen)
- Decapitation
- Freezing

18 Non-Target Species Protection

The use of rodenticides presents risks to non-target species from consuming rodenticide baits directly (primary poisoning) or by consuming rodents that have consumed rodenticides (secondary poisoning).

Traps if not properly designed or placed may also capture non-target species.

18.1 Domestic Situations

People, particularly children, are at risk from accessing incorrectly placed rodenticides. Domestic pets such as dogs, cats, rabbits and guinea pigs, and production animals such as pigs and poultry are also potentially subject to primary poisoning. It is therefore important that bait is deployed in locked and secured bait stations or in such a way to prevent access by non-target species. Unused bait should also be removed from the site and disposed of according to label instructions.

Dogs, cats, pigs, poultry and native wildlife will also all potentially feed on rodents and/or carcasses that have consumed and/or died as a result of rodenticide baiting. It is therefore important to collect and properly dispose of any rodent carcasses that result from the use of

rodenticides, in urban as well as farm animal housing situations. Dispose of carcasses by burning or burying.

18.2 Protection of Native Species

Use of rodenticides may negatively impact non-target native species from either primary or secondary poisoning. Various native species, such as native rodents and marsupials, may find rodenticide baits palatable and are therefore subject to primary poisoning. Native rodent species are not generally considered pests in urban situations, although some species e.g. native *Rattus* spp. and the giant mosaic-tailed rat (*Uromys caudimaculatus*), may occur in houses and farm buildings in rural areas, and other species, such as the climbing rat (*Melomys burtoni*) and ground rat (*Rattus sordidus*) are crop pests. Unless specifically included on the label or approved for use under permit, rodenticides must not be used to target native rodent species.

Secondary poisoning of predatory animals, notably birds of prey, can arise from them feeding on rodents that have consumed rodenticides. It is therefore important to search for and remove any dead rodents resulting from a baiting program, and dispose of them safely, in line with product label recommendations. Dispose of carcasses by burning or burying.

18.3 Care in Using Traps

The use of rodent traps, both lethal and live traps, may also lead to inadvertent trapping of non-target species. Care should therefore be taken in use and placement of traps to avoid impact on non-target species. In the case of break-back traps or glueboards this may mean placing traps in lockable, tamper-resistant bait stations or in areas inaccessible to non-target species.

18.4 Legislation – Misuse of Rodenticides

Australian Legislation (some examples are listed in Appendix A) exists to protect non-target species from the misuse of rodenticides. Where misuse has occurred and the offence is proven heavy fines may be imposed on those persons and/or corporations found responsible for these offences. Exemptions to these offences and due diligence clauses exist in the legislation that may be applicable to certain circumstances. Many States also require notification of rodenticide poisoning incidents involving non-target species (in particular humans) to the relevant Government agency. These incidents are commonly described in legislation as an exposure of a pesticide that adversely affects a person's health.

19 Glossary

This code is written in plain English. The meaning of any words not included in this glossary can be found in any standard Australian dictionary.

APVMA	<u>Australian Pesticides and Veterinary Medicines Authority.</u>
AEPMA	The Australian Environmental Pest Managers' Association Limited. AEPMA is the national peak body for Professional Pest Managers.
Best Practice	<p>A Best Practice is a method or technique that has been generally accepted as superior to any alternatives because it produces results that are superior to those achieved by other means or because it has become a standard way of doing things: for instance, a standard way of complying with legal or ethical requirements.</p> <p>Best Practices may be used to maintain quality as an alternative to mandatory legislated standards and can be based on self-assessment or benchmarking. Best Practice is a feature of accredited management standards such as ISO 9000 and ISO 14001.</p>
Client	A person or entity that engages and pays for a service provided by a Professional Pest Manager.
Code of Best Practice (Pest Management Industry)	Document commissioned by AEPMA for and on behalf of the Australian professional pest management industry setting out prescriptive requirements for best practice and guidelines for how best practice should be achieved and delivered.
Compliance (with Code of Best Practice)	A signed agreement to abide by all the Code's requirements and stipulations and a recorded proof of actually observing and adhering to the Code's requirements and stipulations.
Appropriate Insurance Cover	Professional Pest Managers are required under this Code to acquire sufficient insurance cover to protect both themselves and their clients in the event of misadventure, mishap, or underperformance. All AEPMA members are required to carry adequate professional indemnity and public liability insurance.

Manufacturers' Guidelines	Installation, use, monitoring and maintenance guidelines and instructions provided by product or system manufacturers.
National Competency Standards	National industry-specific standards prescribing minimum knowledge and skill levels for individuals wishing to prove competency in carrying out specified roles or tasks within specific industries, trades or professions. See: http://training.gov.au .
Pesticide	A substance used to manage pests and required to be registered by the Australian Pesticides and Veterinary Medicines Authority.
Pest Management Industry ('Industry')	All facets, including people and businesses, of professional pest management including Professional Pest Managers (individuals, and professional pest management companies and partnerships); manufacturers, retailers and distributors of pest management materials and technologies; and specialist consultants, researchers, and advisors.
Professional Pest Manager(s)	Professional Pest Managers are trained, experienced and qualified to carry out a range of pest management services for home, building and property owners (private and public) on a fee-for-service basis. Professional Pest Managers who are members of AEPMA maintain public liability and professional indemnity insurance cover and are bound by AEPMA's Code of Ethics.
Registered/Currently Registered	Pesticidal products that are approved and registered by the Agricultural Pesticides and Veterinary Medicines Authority (APVMA) for use according to label directions.
Regulatory Bodies/Regulators	Government (federal, State and local) agencies and their employees/officers responsible for developing, communicating and enforcing rules, regulations, and both mandatory and non-mandatory standards, processes and procedures.
Rodenticide	A substance used to kill rodents and required to be registered by the Australian Pesticides and Veterinary Medicines Authority.
SDS	Safety Data Sheet (previously Material Safety Data Sheet).

Units of Competency	Individual, industry-specific elements of the national competency standards. A unit of competency defines the minimum knowledge and skill levels required by an individual to be competent at performing a specific task or role. See http://www.training.gov.au .
Working Party(ies)	Group(s) of individuals from, attached to, or affiliated with, the Australian professional pest management industry, who have volunteered to develop, design and write pest management industry Codes of Best Practice.

20 References

1. Macdonald, D.W., M.G.P. Fenn, and M. Gelling. (2015). The natural history of rodents: Preadaptations to pestilence. In A. Buckle and R. Smith (Eds.), *Rodent Pests and their Control* (2nd ed., pp. 1-18). CABI: Wallingford, UK.
2. Pimentel, D. (2005). Environmental consequences and economic costs of alien species. *Invasive Plants: Ecological and Agricultural Aspects* (pp. 269-276). Birkhäuser Verlag: Basel, Switzerland.
3. Pimentel, D., et al. (2000). Environmental and economic costs of nonindigenous species in the United States. *BioScience*, 50(1), 53-65.
4. Singleton, G.R. (2003). Impacts of rodents on rice production in Asia. *IRRI Discussion Paper Series* (Vol. 45).
5. Stenseth, N.C., et al. (2003). Mice, rats, and people: the bio-economics of agricultural rodent pests. *Frontiers in Ecology and the Environment*, 1(7), 367-375.
6. Lund, M. (2015). Commensal rodents. In A. Buckle and R. Smith (Eds.), *Rodent Pests and their Control* (2nd ed., pp. 19-32). CABI: Wallingford, UK.
7. Meerburg, B.G., G.R. Singleton, and A. Kijlstra. (2009). Rodent-borne diseases and their risks for public health. *Critical Reviews in Microbiology*, 35(3), 221-270.
8. Meerburg, B.G., G.R. Singleton, and H. Leirs. (2009). The year of the rat ends—time to fight hunger! *Pest Management Science*, 65(4), 351-352.
9. Brown, P.R. and G.R. Singleton. (2000). Impacts of house mice on crops in Australia: Costs and damage. In L. Clark (Ed.), *Human Conflicts with Wildlife: Economic Considerations* (pp. 48-58). United States Department of Agriculture: Fort Collins, USA.
10. CSIRO. (2019). *Case Study: Tracking Australia's Mice*. Commonwealth Scientific and Industrial Research Organisation: Canberra, Australia.
11. Corrigan, R.F. (2001). The pest significance of commensal rodents. In D. Moreland (Ed.), *Rodent Control: A Practical Guide for Pest Management Professionals* (pp. 13-26). GIE Media: Cleveland, USA.
12. Marsh, R.E. (1994). Roof rats. In S.E. Hygnstrom, R.M. Timm, and L.G. E. (Eds.), *The Handbook: Prevention and Control of Wildlife Damage* (pp. B125-B132). University of Nebraska - Lincoln: California, USA.
13. Timm, R.M. (1994). House mice. In S.E. Hygnstrom, R.M. Timm, and L.G. E. (Eds.), *The Handbook: Prevention and Control of Wildlife Damage* (pp. B31-B46). University of Nebraska: Lincoln, USA.
14. Timm, R.M. (1994). Norway rats. In S.E. Hygnstrom, R.M. Timm, and L.G. E. (Eds.), *The Handbook: Prevention and Control of Wildlife Damage* (pp. B105-B120). University of Nebraska: Lincoln, USA.
15. Cogelia, N.J., G.K. LaVoie, and J.F. Glahn. (1976). Rodent biting pressure and chewing action and their effects on wire and cable sheath. *Proceedings of the 25th International Wire and Cable Symposium* (Vol. 25, pp. 117-124). NTIS Operations Division: Cherry Hill, NJ.
16. Shumake, S.A., R.T. Sterner, and S.E. Gaddis. (2000). Repellents to reduce cable gnawing by wild Norway rats. *Journal of Wildlife Management*, 64(4), 1009-1013.
17. Walcott, R.M. and B.W. Vincent. (1975). Rats, fires, and inner-city solid waste storage practices: A current report on solid waste management (Vol. EPA/530/SW/150). Environmental Protection Agency: Cincinnati, USA.
18. Almeida, A., R.F. Corrigan, and R. Sarno. (2013). The economic impact of commensal rodents on small businesses in Manhattan's Chinatown: Trends and possible causes. *Suburban Sustainability*, 1(1), Article 2.
19. Battersby, S., B.R. Hirschhorn, and R.B. Amman. (2008). Commensal rodents. In X. Bonnefoy, H. Kampen, and K. Sweeney (Eds.), *Public Health Significance of Urban Pests* (pp. 387-419). World Health Organization: Copenhagen, Denmark.
20. Battersby, S.A. (2015). Rodents as carriers of disease. In A. Buckle and R. Smith (Eds.), *Rodent Pests and their Control* (2nd ed., pp. 81-100). CABI: Wallingford, UK.

21. Battersby, S.A., R. Parsons, and J.P. Webster. (2002). Urban rat infestations and the risk to public health. *Journal of Environmental Health Research*, 1, 57-65.
22. Strand, T.M. and Å. Lundkvist. (2019). Rat-borne diseases at the horizon. A systematic review on infectious agents carried by rats in Europe 1995-2016. *Infection Ecology and Epidemiology*, 9(1), 1553461.
23. Dendle, C. and D. Looke. (2008). Review article: Animal bites: An update for management with a focus on infections. *Emergency Medicine Australasia*, 20(6), 458-467.
24. Buckle, A.P. and R.H. Smith. (2015). Rodent control: back to the future (the sequel). In A. Buckle and R. Smith (Eds.), *Rodent Pests and their Control* (2nd ed., pp. 397-402). CABI: Wallingford, UK.
25. Dilley, R., *I hate cunning super mieces to pieces*, in *BBC News Online*. 2002, BBC: Monday, 28 January.
26. Humphries, R.E., A.P. Meehan, and R.M. Sibly. (1992). The characteristics and history of behavioural resistance in inner-city house mouse (*Mus domesticus*) in the U.K. In J.E. Borrecco and R.E. Marsh (Eds.), *Proceedings of the Fifteenth Vertebrate Pest Conference*, August 1992 (pp. 161-184). University of California: Davis, USA.
27. Humphries, R.E., R.M. Sibly, and A.P. Meehan. (2000). Cereal aversion in behaviourally resistant house mice in Birmingham, UK. *Applied Animal Behaviour Science*, 66(4), 323-333.
28. Pelz, H.J. and C.V. Prescott. (2015). Resistance to anticoagulant rodenticides. In A. Buckle and R. Smith (Eds.), *Rodent Pests and their Control* (2nd ed., pp. 187-208). CABI: Wallingford, UK.
29. Simmons, J. and C. Swindells. (2017). Controlling house mice in the food industry. In M.P. Davies, C. Pfeiffer, and W.H. Robinson (Eds.), *Proceedings of the Ninth International Conference on Urban Pests*, Birmingham, United Kingdom, 9-12 July 2017 (pp. 133-137). Pureprint Group: Uckfield, UK.
30. Dubois, S., et al. (2017). International consensus principles for ethical wildlife control. *Conservation Biology*, 31(4), 753-760.
31. Krijger, I.M., et al. (2017). The need to implement the landscape of fear within rodent pest management strategies. *Pest Management Science*, 73(12), 2397-2402.
32. Meerburg, B.G., F.W.A. Brom, and A. Kijlstra. (2008). The ethics of rodent control. *Pest Management Science*, 64(12), 1205-1211.
33. Smit, F.J.L. (2015). Ethics in rodent control. In A. Buckle and R. Smith (Eds.), *Rodent Pests and their Control* (2nd ed., pp. 315-329). CABI: Wallingford, UK.
34. Smith, R.H. and A.N. Meyer. (2015). Rodent control methods: non-chemical and non-lethal chemical, with special reference to food stores. In A. Buckle and R. Smith (Eds.), *Rodent Pests and their Control* (2nd ed., pp. 101-122). CABI: Wallingford, UK.
35. DPI. (2009). *Glue Traps*. Department of Primary Industries, Bureau of Animal Welfare: Melbourne, Australia.
36. *Prevention of Cruelty to Animals Regulation 2008 [VIC]*. S.R. No. 162/2008. Part 2. div. 9. reg 53. State Government of Victoria: Melbourne, Australia.
37. *Animal Welfare Act 1993 [TAS]*. Part 2, reg. 12, cl. 1. The State of Tasmania: Hobart, Tasmania.
38. *Animal Welfare Regulation 2001 [ACT]*. SL2001-26. Part 5, sec. 7C, cl. 1. ACT Parliamentary Counsel: Canberra, Australia.
39. DPI. (2009). *Confinement Traps*. Department of Primary Industries, Bureau of Animal Welfare: Melbourne, Australia.
40. Elliott, J.E., et al. (2016). Paying the pipers: Mitigating the impact of anticoagulant rodenticides on predators and scavengers. *BioScience*, 66(5), 401-407.
41. Hawes, M. (2018). *Investigation into increased deaths in predatory birds*. Agriculture Victoria Research & Wildlife Health Australia: Attwood, Australia.
42. Gerozisis, J., P. Hadlington, and I. Staunton. (2008). Introduction to urban pest management in Australia. In J. Gerozisis, P. Hadlington, and I. Staunton (Eds.), *Urban Pest Management in Australia* (5th ed.). University of NSW Press Ltd: Sydney, Australia.

43. Corrigan, R.F. (2017). Electronic pro-active rodent monitoring: A new era in urban rodent control begins. Abstract presented at the NPMA Pestworld, 24th-27th October, 2017. National Pest Management Association: Baltimore, Maryland.
44. Corrigan, R.F. (2018). Urban rodents: A public health priority. *Pest*, 59, 25-28.
45. Swindells, C. (2012). Remote rodent monitoring. *Pest*, 22, 31-33.
46. Mason, G. and K.E. Littin. (2003). The humaneness of rodent pest control. *Animal Welfare*, 12(1), 1-37.
47. Drickamer, L.C. and D.G. Mikesic. (1993). Differences in trapping and killing efficiency of Sherman, Victor and Museum Special traps for house mice. *American Midland Naturalist*, 130(2), 397-401.
48. BPCA. (2017). Code of Best Practice: The Use of Break Back Traps/Snap Traps. British Pest Control Association: Pride Park, UK.
49. Mitchell, B. and S. Balogh. (2007). Monitoring Techniques for Vertebrate Pests: Mice NSW Department of Primary Industries: Orange, Australia.
50. UFAW. (2017). Guiding Principles in the Humane Control of Rats and Mice. Universities Federation for Animal Welfare: Available: <http://www.ufaw.org.uk/rodents.php>.
51. Frantz, S.C. and C.M. Padula. (1983). A laboratory test method for evaluating the efficacy of glueboards for trapping house mice. In D.E. Kaukeinen (Ed.), *Vertebrate Pest Control and Management Materials: Fourth Symposium* (pp. 209-225). American Society for Testing and Materials: Philadelphia, USA.
52. BVA. (2016). Policy: Rodent Glue Traps. British Veterinary Association: London, UK.
53. Llewellyn, D. (2008). Animal Welfare Act 1993. Exemption to use Glueboard Traps. The State of Tasmania: Hobart, Tasmania.
54. BPCA/NPTA. (2009). Pest Management Industry - Code of Practice: Humane Use of Rodent Glue Boards. National Pest Technicians Association and British Pest Control Association: Nottingham & Derby, UK.
55. TPMA. (2017). Code of Best Practice: Humane Use of Rodent Glueboards. The Pest Management Alliance: Eastwood, UK.
56. PMANZ. (2014). Standard Operating Procedure to use Glueboard Traps for Rodents in Compliance with Conditions of Ministerial Approval. Pest Management Association of New Zealand: Wellington, New Zealand.
57. AEPMA. (2008). Guidelines for the Use of Rodent Glueboards in Australia by the Pest Management Industry. Australian Environmental Pest Managers Association: Sydney, NSW.
58. PMANZ. (2014). Code of Practice for Operational Procedures for the Humane Use of Rodent Glue Board Traps. Pest Management Association of New Zealand: Wellington, New Zealand.
59. Cowan, P. and S. Brown. (2015). Review of Rodent Monitoring and Control Methods as Alternatives to Glueboard Traps. Ministry for Primary Industries: Wellington, New Zealand.
60. Meehan, A.P. (1984). Rats and Mice. Their Biology and Control. Rentokil Ltd: East Grinstead, UK.
61. Federal Trade Commission. (2001). FTC warns manufacturers and retailers of ultrasonic pest control devices. Federal Trade Commission: Washington, USA.
62. Vandenbroucke, V., et al. (2008). Pharmacokinetics of eight anticoagulant rodenticides in mice after single oral administration. *Journal of Veterinary Pharmacology and Therapeutics*, 31(5), 437-445.
63. EPA. (1994). PRN 94-7: Label Improvement Program for the Revision of Use Directions for Commensal Rodenticides and Statement of the Agency's Policies on the Use of Rodenticide Bait Stations. United States Environmental Protection Agency: Washington DC, USA.
64. Baker, S.E. (2017). A voluntary trap approval scheme to end trap welfare inequality in the UK. *Animal Welfare*, 26(1), 131-133.
65. NAWAC. (2011). Guideline 09: Assessing the Welfare Performance of Restraining and Kill Traps. National Animal Welfare Advisory Committee, Ministry of Agriculture and Forestry: Wellington, New Zealand.

66. ISO. (1999). TC191. Animal (Mammal) Traps: Part 4. Methods for Testing Killing Trap Systems Used on Land or Underwater (International Standard ISO/DIS 10990-4). International Organization for Standardization: Geneva, Switzerland.
67. Talling, J.C. and I.R. Inglis. (2009). Improvements to trapping standards. DG ENV, http://ec.europa.eu/environment/biodiversity/animal_welfare/hts/pdf/final_report.pdf.
68. NHMRC. (2013). Australian Code for the Care and Use of Animals for Scientific Purposes (8th ed.). Australian Government National Health Medical Research Council: Canberra, Australia.
69. Sharp, T. (2016). Standard Operation Procedure. GEN001: Methods of Euthanasia. Centre for Invasive Species Solutions: Canberra, Australia.
70. ANZCCART. (2001). Euthanasia of Animals Used for Scientific Purposes. Australian and New Zealand Council for the Care of Animals in Research and Teaching: Adelaide, South Australia.
71. Leary, S., et al. (2013). AVMA Guidelines for the Euthanasia of Animals: 2013 Edition. American Veterinary Medical Association Schaumburg, IL.
72. NHMRC. (2008). Guidelines to Promote the Wellbeing of Animals Used for Scientific Purposes: The Assessment and Alleviation of Pain and Distress in Research Animals. Australian Government National Health Medical Research Council: Canberra, Australia.
73. NIH. (2017). Guidelines for Euthanasia of Rodents Using Carbon Dioxide. National Institutes of Health: Bethesda, USA.

Appendix A - State and Territory Legislation& Strategies

Each of Australia's States and Territories have their own legislation for managing pest animals.

Table 1: Relevant State and Territory legislation and strategies related to pest animal management.

State/Territory	Relevant legislation and strategies	
Commonwealth	<u><i>Environmental Protection and Biodiversity Conservation Act 1999</i></u>	<u><i>Australian Pest Animal Strategy</i></u>
	<u><i>Biosecurity Act 2015</i></u>	<u><i>AUSVETPLAN (Australian Veterinary Emergency Plan)</i></u>
	<u><i>Agricultural and Veterinary Chemicals Code Act 1994</i></u>	<u><i>InterGovernmental Agreement on Biosecurity (IGAB)</i></u>
	<u><i>Biological Control Act 1984</i></u>	
Australian Capital Territory	<u><i>Pest Plants and Animals Act 2005</i></u>	<u><i>Firearms Act 1996</i></u>
	<u><i>Nature Conservation Act 2014</i></u>	<u><i>Environment Protection Act 1997</i></u>
	<u><i>Animal Welfare Act 1992</i></u>	<u><i>ACT Pest Animal Management Strategy 2012-2022</i></u>
	<u><i>Prohibited Weapons Act 1996</i></u>	<u><i>Biological Control Act 1984</i></u>

New South Wales	<u><i>Local Land Services Act 2013</i></u>	<u><i>Game and Feral Animal Control Act 2002</i></u>
	<u><i>National Parks and Wildlife Act 1974</i></u>	<u><i>Prevention of Cruelty to Animals Act 1979</i></u>
	<u><i>Wild Dog Destruction Act 1921</i></u>	<u><i>NSW Invasive Species Plan 2008-2015</i></u>
	<u><i>Threatened Species Conservation Act 1995</i></u>	<u><i>NSW Biosecurity Strategy 2013-2021</i></u>
	<u><i>Pesticides Act 1999</i></u>	
Victoria	<u><i>Catchment and Land Protection Act 1994</i></u>	<u><i>Wildlife Act 1975</i></u>
	<u><i>Flora and Fauna Guarantee Act 1988</i></u>	<u><i>National Parks Act 1975</i></u>
	<u><i>Prevention of Cruelty to Animals Act 1986</i></u>	<u><i>Biosecurity Strategy for Victoria</i></u>
	<u><i>Drugs, Poisons and Controlled Substances Act 1981</i></u>	<u><i>Invasive Plants and Animals Policy Framework (IPAPF)</i></u>
	Agricultural and Veterinary Chemicals (Control of Use) Act 1992	
Queensland	<u><i>Land Protection (Pest and Stock Route Management Act) 2002</i></u>	<u><i>Health (Drugs and Poisons) Regulation 1996</i></u>

	<u><i>Animal Care and Protection Act 2001</i></u>	<u><i>Queensland Pest Animal Strategy 2002 (under review)</i></u>
	<u><i>Nature Conservation Act 1992</i></u>	Pest Management Act 2001 (Section 123 Notifiable Incidents)
Tasmania	<u><i>Vermin Control Act 2000</i></u>	<u><i>Poisons Act 1971</i></u>
	<u><i>Cat Management Act 2009</i></u>	<u><i>Agricultural and Veterinary Chemical (Control of Use) Act 1995</i></u>
	<u><i>Animal Welfare Act 1993</i></u>	<u><i>Nature Conservation Act 2002</i></u>
Northern Territory	<u><i>Territory Parks and Wildlife Conservation Act 2006</i></u>	<u><i>Animal Welfare Act</i></u>
	Agricultural and Veterinary Chemicals (Control of Use) Act (Section 13 General Duties – Duty to ensure harm does not result from use of chemical products)	
South Australia	<u><i>Natural Resources Management Act 2004</i></u>	<u><i>National Parks and Wildlife Act 1972</i></u>
	<u><i>Animal Welfare Act 1985</i></u>	<u><i>Dog Fence Act 1946</i></u>
	<u><i>Controlled Substances Act 1984</i></u>	<u><i>State Natural Resources Management Plan South Australia 2012-2017</i></u>

Western Australia	<u><i>Agriculture and Related Resources Protection Act 1976</i></u>	<u><i>Poisons Act 1964</i></u>
	<u><i>Animal Welfare Act 2002</i></u>	<u><i>Biological Control Act 1986</i></u>
	<u><i>Biosecurity and Agriculture Management Act 2007</i></u>	<u><i>Wildlife Conservation Act 1950</i></u>
	Health (Pesticides) Regulations 2011 (Section 80 Notification of Accidents)	

*Complementary biological control legislation exists in all States and the Northern Territory

Local and regional strategies

Local and regional management of pest animals is guided by formal pest management plans and strategies. These plans are usually administered by natural resource management (NRM) agencies, catchment management authorities, Government pest agencies or local Government authorities, with assistance and input from key stakeholders and the local community.

Examples of local and regional pest strategies

- *ACT Pest Animal Management Strategy 2012-2022 (ACT)*.
- In NSW, the National Parks and Wildlife Service (part of Office of Environment and Heritage) have 14 regional pest strategies.
- *South East Regional Pest Management Strategy (SA)*.
- *Townsville Local Government Area Pest Management Plan 2010-2014 (Qld)* (under review).

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