

Commensal Rodent Control Basics



Katie Swift
Chair, Rodenticide Task Force

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Rodenticide Task Force

Education and outreach:

- Maximize effectiveness of rodenticides and minimize non-target impacts
- Maximize public health and food safety

RTF Members:

- BASF
- Bell Laboratories, Inc.
- Central Garden & Pet Co. (Farnum)
- JT Eaton
- Liphatech, Inc.
- Neogen Corporation
- PelGar International Ltd.
- Reckitt Benckiser
- Scimetrics Limited Corp.
- Unichem d.o.o.
- VM Products
- Wilco Distributors
- Woodstream Corporation



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Overview

- ☛ Commensal Rodent Concerns
- ☛ Basic Rodent Traits
- ☛ Species Identification
- ☛ IPM Principles
- ☛ Control Methods



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Disease and Destruction



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Why are rodents in structures not okay?

- ☛ Diseases, parasites, fur, allergens
- ☛ Contamination of food
- ☛ Damage to electrical wiring
- ☛ Damage to communication cables
- ☛ Damage to goods and furniture
- ☛ Damage to structures
- ☛ Damage to vehicles



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Rodent Diseases and Parasites

Rodents are responsible for more human illnesses and death than any other group of mammals.

Known diseases vectored by rodents and their parasites:

- ☛ Hantavirus
- ☛ Avian influenza
- ☛ Salmonellosis
- ☛ Typhus
- ☛ Leptospirosis
- ☛ Plague
- ☛ Lyme Disease





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Rodent-borne Disease Literature

Surveys of diseases in rodents in the US and Asia:

- Wu et al (2018): identified novel viruses in *Rattus* species with high potential for contact with people
- Anglely et al (2018): heterogeneous distribution of parasite and microbial communities in NYC Norway rats
- Peterson et al (2017): *Bartonella* in Norway and roof rats in New Orleans and NYC

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Rodent Biology

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Rodent Biology

General traits:

- High reproductive rate
- Explore their environment
- Able to travel long distances
- Tolerate a wide range of conditions
- Omnivorous (Commensal)
- Gnawing
- Feces, urine, saliva



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Rodent Species

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PHYSICAL ATTRIBUTES

Rodent Species



NORWAY RAT Rattus norvegicus	ROOF RAT Rattus rattus	HOUSE MOUSE Mouse musculus	MEADOW VOLE Microtus pennsylvanicus	DEER MOUSE Peromyscus maniculatus
10" - 17" tall Norway rats can lean better the side of Roof rats	8" - 9" tall	6.75" tall	1 - 3" tall Meadow voles can lean before the side of House mice and Deer mice	6.5" - 1" tall
Blackish-brown fur Small nose, small ears & ears, black body	Pinkish nose Large eyes & ears, tail longer than body	Pinkish nose Large eyes & ears	Blackish-crowded stripes Short tail & ears, black nose	Large black nose White tail, brownish body and white body
10-18" including tail	10-17" including tail 12-18" for head & body	6-7" including tail	1' including tail	4-9" including tail

All rats have a digit on each front paw and 5 on each back paw

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House Mouse (*Mus musculus*)



- Delicate and petite body form
- 0.5 ounces
- An adult is ~ 5-7 inches long (including tail)
- Skull height is ¼ inch
- Light brownish to grey
- Moderately large ears
- Small black eyes
- Almost hairless tail
- Carry harmful diseases (also their fleas)
- Urine can cause allergies in children

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Deer Mouse (*Peromyscus maniculatus*)

- Larger eyes
- White underbelly
- Bicolored and furry tail
- Approx. 7 inches long (including tail)
- Common carrier of Hantavirus (inhalation of airborne feces and urine)



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Vole (*Microtus sp.*)

- Color varies from light to dark
- Eyes, ears & tail smaller than house mouse
- 5-8 inches in length (including tail)
- Prefer to live outdoors in burrows, runways in lawns, eat garden plants



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Distribution of Vole Species







MEADOW VOLE

MEADOW & PINE VOLE

PINE VOLE

LONG-TAILED & MOUNTAIN VOLE

MEADOW & MOUNTAIN VOLE

CALIFORNIA MEADOW VOLE

MOUNTAIN & CA MEADOW VOLE

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House Mouse, Deer Mouse and Vole

- All these rodents can look very similar
- Identification is important
- Is the species on your label?



House mouse



Deer mouse



Vole

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Norway Rat

- Large and robust
- 7-18 ounces
- Adult is ~ 8-10 inches
- Small ears
- Small eyes
- Brownish or reddish gray above, whitish gray on the belly





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Roof Rat

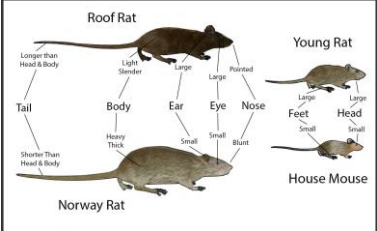
- Sleek and agile
- 5-10 ounces
- An adult is ~ 6-8 inches long
- Tail is longer than head and body
- Uniformly dark tail with fine scales
- Very large ears
- Small, black, beady eyes
- Three coat types: charcoal gray, brownish with white belly, brownish with gray belly





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Norway Rat (*Rattus norvegicus*) and Roof Rat (*Rattus rattus*)





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Droppings ID

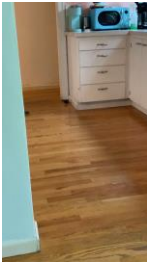




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House Mice - Reproduction

- Breeding peaks in late spring/summer
- Litters
 - 5-6 young
 - 19-21 days after conception
 - Sexually mature at 6-10 weeks
 - 5-10 litters a year



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Roof Rat - Reproduction

- Breeding peaks in summer and early fall
- Litters
 - 5-8 young
 - 21-23 days after conception
 - Sexually mature at 12 weeks
 - 3-5 litters a year

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Norway Rat - Reproduction

- Breeding peaks in summer and early fall
- Litters
 - 6-12 young
 - 21-23 days after conception
 - Sexually mature at 12 weeks
 - 4-6 litters a year



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House Mice - Diet

- Omnivorous
 - Prefer seeds and grain
- Not neophobic about new foods
- May prefer foods that are
 - Fat
 - Protein
 - Sugar
- Survive with very little water



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Rat Diet



- Omnivorous – human food, animals, insects, plants
- In gardens and agriculture, they feed on a wide variety of fruits and nuts
- Consume flowers, stems, and other parts of ornamentals
- Require water
 - May be acquired from food

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House Mice - Behavior

- Make small excursions
- 10-30 ft
- Notorious for squeezing through small spaces



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Roof Rat - Behavior

- Can travel considerable distances for food
- Live in one area and feed in another
 - Husking stations
- Generally solitary
- Neophobic





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Roof Rat Foraging Behavior



- Mean home range sizes:
 - 4.2 hectares (ha) for males
 - 1.8 ha females;
- Maximum range length:
 - 181 - 406 m
 - (Lindsey et al. 1999)

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Norway Rat - Behavior

- Make shorter excursions
- Colonial
- Eat large amounts from small number of food sources
- Neophobic



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Climbing

- Horizontal and vertical wires
- Inside vertical pipes 1.5-4" in diameter
- Outside vertical pipes up to 3" in diameter
- Outside vertical objects within 3" of a wall
- Crawl or run on pipes or conduits



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Jumping

Ship Rat Encounters with suspended Feratox device

June 2006

- Vertically – Up to 36" flat
- Horizontally – 48" flat & 8 ft in a 15 ft drop
- Drop up to 50 feet without serious injury

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Principles and Steps of Integrated Rodent Management

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Infinite Sea of Rodents



Rodent reproduction and reinvasion

- Rodents usually don't disappear on their own
- Reproduction will occur
- New rodents will enter an area

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Principles of IPM Rodent Control

Based on the understanding of the habitat use and population dynamics of the rodent pest:

- Timing of control (breeding cycle, season, availability of other food, continuous)
- Location of control (spot treatment, perimeter, indoor)

Monitoring gives the essential information to feed into your site-specific plan...be adaptable!

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Steps of IPM

- 1) Monitor rodent populations and/or damage;
- 2) Evaluate available control methods, giving consideration to the environment;
- 3) Implement the selected method(s);
- 4) Monitor the target pest, non-target species, and pest damage to determine the effects of the method(s)

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BMPs for Rodent Control



- Accurate identification of species
- Identification of rodent activity hotspots
- Sanitation
- Exclusion
- Non-target presence
- Human element
- Lethal control
 - Mechanical
 - Rodenticide

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Rub Marks

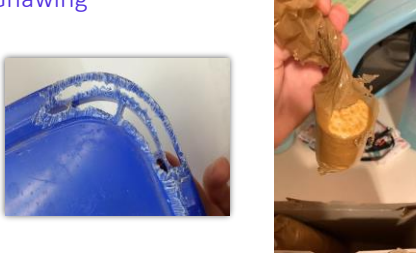


Photo by David L. Harris, Pest Management

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Gnawing



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Trail Cameras

- Species ID is one of the most important steps in rodent management
- Combining technology with traditional methods can be more effective and efficient



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Sanitation



- NO uncovered trash cans of any size at any location
- Secure food storage
- NO outdoor feeding of birds and cats!!
- Keep yards clean
- Enclose compost bins

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Exclusion

- Surround structure with impermeable barriers
- Keep free of vegetation
- Cover all openings to vents, conduits, crawl spaces



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Exclusion



Inspect the site regularly for new entries, overgrown vegetation

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Control Methods

- Live traps
- Snap traps
- Glue boards
- Rodenticides
 - Bait stations
 - Spot-treatment



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Trapping

Have a plan to dispose of dead or live rodents

- ✓ Protect yourself by wearing gloves and a mask
- ✓ NEVER handle a live rodent
- ✓ Humane euthanasia
- ✓ Look up wildlife regulations on where to release



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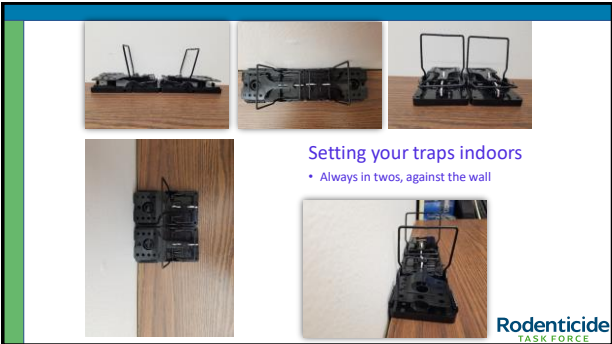
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Components of an Effective IPM Baiting Program

Dynamic process that repeats and adapts based on rodent activity:

- Rodent abundance assessment
- Area covered
- Station spacing
- Station placement
- Frequency of restocking bait

Evaluate and repeat steps as needed

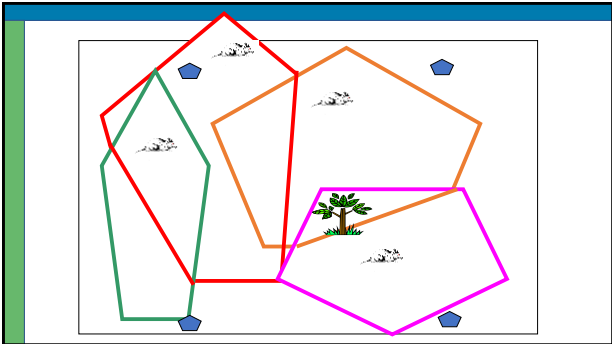
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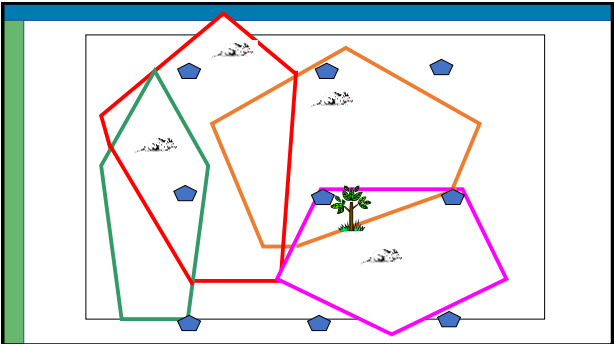
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Inadequate numbers of bait stations will decrease the likelihood that a rodent will encounter a bait station while it is foraging:

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Neophobia

- Rodents may take a while to enter bait stations or take bait from traps
- Some individuals will never enter a bait station
- Roof rats are especially neophobic

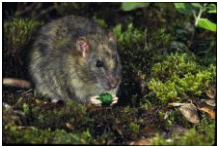


Video Credit: Dr. Quinn UCANR

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Ensure an uninterrupted supply of **fresh** bait so that less dominant and new individuals entering the area will find a palatable and abundant supply of bait.



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Mouse Hunt (the movie)



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When to call a professional

Rodent control can be challenging, gross, frustrating, and time consuming!

- ☛ There are too many
- ☛ Stubborn infestation
- ☛ Continual reinvasion
- ☛ Health and safety
- ☛ Squeamishness



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Minimizing risks to children, pets and wildlife

- How to assess the risks
- Selecting a control method
- Vigilance during and after application
- Emergency support (customer communication – know what to do in the event of an exposure)



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Rodenticide Baits

- Different formulations (pellets, blocks, soft bait) and multiple active ingredients
- Must be used according to label for safety and efficacy
- Categorized as first/second generation anticoagulant OR acute/non-anticoagulant



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Consumer Products

- ☛ General use pesticides
- ☛ Mice, rats, voles, pocket gophers, non-rodents (moles)
- ☛ Re-fillable and single use bait stations, loose pellets
- ☛ Some products may be applied outdoors, within 100 ft of structures



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1st Generation Anticoagulant Rodenticides (FGARs)

Anticoagulants inhibit blood clotting, developed in early 1950s

- Chlorophacinone
- Diphacinone
- Warfarin

➡ Rodents require multiple feedings for a lethal dose

Antidote: Vitamin K₁

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COMMENSAL
RODENTICIDE

FOR INDOOR AND OUTDOOR USE

KILLS NORWAY RATS, ROOF RATS,
HOUSE MICE, AND KILLS OTHER
RODENT SPECIES AS LISTED ON
THIS LABEL

KEEP OUT OF REACH OF
CHILDREN
CAUTION

Example Label

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
READ THIS LABEL and follow all use directions and precautions. Use only for the sites, pests, and application methods described on this label.

IMPORTANT: Do not expose children, pets or other nontarget animals to rodenticides.

1. Store product not in use in a location out of reach of children and pets.

2. Apply bait in locations out of reach of children, pets, domestic animals, and nontarget wildlife, or in tamper-resistant bait stations. These stations must be resistant to destruction by dogs and children under six years of age and must be used in a manner that prevents such children from reaching into bait compartments and obtaining bait. If bait can be shaken from stations when they are lifted, units must be secured or otherwise immobilized. Even stronger bait stations are needed in areas open to hoofed livestock, raccoons, bears, other potentially destructive animals, or in areas prone to vandalism.

3. Dispose of product container, unused, spoiled, and unconsumed bait as specified on this label. Note: Bait stations are mandatory for outdoor, above-ground use. Tamper-resistant bait stations must be used if children, pets, non-target mammals, or birds may access the bait.

APPLICATION DIRECTIONS

Rats: Apply 4 to 16 ounces (113 - 454 grams) of bait per placement, usually spaced 15 to 30 feet apart. Maintain an uninterrupted supply of fresh bait for at least 10 days.

House Mice: Apply 1/4 to 1/2 ounces (7 - 14 grams) of bait per placement, usually spaced 8 to 12 feet apart. Larger placement (up to 2 ounces or 57 grams) may be needed at points of very high mouse activity. Maintain an uninterrupted supply of fresh bait for at least 15 days.

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COMMENSAL RODENTICIDE

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Follow Up: Replace contaminated or spoiled bait immediately. **Collect and dispose of all dead animals and leftover bait properly.** To prevent reinfestation limit sources of rodent food, water, and harborage as much as possible. If reinfestation does occur repeat treatment. Where a continues source of infestation is present, establish permanent bait stations and replenish as needed.

Example Label

Note: Label markings for display only – always read and follow printed label directions.

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COMMENSAL RODENTICIDE

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Image: J. Meyers

Example Label

Note: Label markings for display only – always read and follow printed label directions.

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STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

Storage: Store in original container in a cool, dry place inaccessible to children and pets.

Disposal: Wastes resulting from the use of this product may be disposed of in trash or at an approved waste disposal facility.

Container Handling: Nonrefillable container. Do not reuse or refill this container.

[Plastic:] Completely empty container, then offer for recycling or reconditioning; or puncture and dispose of in a sanitary landfill.

[Paper:] Completely empty container, then dispose of empty container in trash or at an approved waste disposal facility.

Check with local waste services or municipality if they accept used or unused rodenticide; or containers

If allowed, ensure that trash is secured and inaccessible to nontargets

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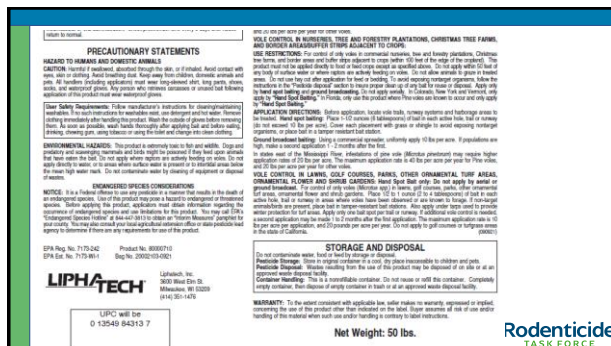
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Rodenticide Field Labels



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Net Weight: 50 lbs.

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Burrow Baiting

- Only some products are labelled for burrow application
- Bulk pellet and meal bait products only; check the label
- Tracking powder – along the periphery of buildings
- NO blocks, place packs, soft bait, liquid



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Best Practices for Burrow Baiting

- Place bait at least 6 inches down the burrow per label instructions
- Do not cave in burrow openings
- Make notes and sketches of the burrow locations
- Check treated areas frequently to make sure the bait has not been pushed out of the burrows
- Remove any rat carcasses on site to minimize secondary exposure
- Monitor for activity; new rats will recolonize the burrows so new applications may be needed



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What To Do and Not Do



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COMMENSAL RODENTICIDE

USE RESTRICTIONS: This product can only be used to control Norway rats, roof rats and house mice in and within 100 feet of man-made structures constructed in a manner so as to be vulnerable to commensal rodent invasions and/or to harboring or attracting rodent infestations. Examples of such structures include homes and other permanent or temporary residences, food processing facilities, industrial and commercial buildings, trash receptacles, agricultural and public buildings, transport vehicles (ships, trains, aircraft), docks and port or terminal buildings, and related structures around and associated with these sites. Fence and perimeter baiting beyond 100 feet from a structure, as defined above, is prohibited. Do not place near or inside ventilation duct openings. Do not contaminate water, food, feed, food or feed handling equipment, or milk or meat handling equipment. Do not apply directly to food or feed crops.

Example Label

Photo: Informational For Rodenticide - always read and follow product label directions

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When applying bait outside of bait stations indoors, remember that "inaccessibility" can change





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DO NOT...



Do not place near ventilation ducts

Do not apply near home gardens

Do not place without easy retrieval

Do not use for burrow baiting, except when on the label

Image: RTF

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Best Management Practices

Minimizing risks to nontarget wildlife for outdoor placements in bait stations



Regularly visit the treatment area to check for issues:

- Bait dragged into the open
- Damaged bait stations
- Dead and dying rodents
 - dispose of in a secure trash receptacle
- Nontarget animals (crows, squirrels, raccoons, possums)



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Secure bait in bait stations (and check them!)





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Steps to Reduce Non-target Risk



- Check area regularly and collect and dispose of any dead rodents found
- Spoiled or uneaten bait and dead rodents should be disposed of in a secured trash receptacle
- Never bury rodents or bait

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Check the site for carcasses





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What not to do...

NEVER abandon bait placements after an account is no longer active.

You are responsible for retrieving all the bait and bait stations that you applied.



Taken outside a "Dog & Child Friendly" brewery in Los Angeles, CA

Images: Niamh Quinn

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Customer Communication

Important part of the professional's job!

- Educate the customer
 - Sanitation
 - Exclusion
- Communicate information to the customer
 - Bait station placement or site map
 - Basic safety information
- When customer needs to notify you
 - Open, broken or displaced stations
 - Bait outside stations



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Poison Call Support



For pet and human exposures:

- National Pesticide Information Center
- Rocky Mountain Poison and Drug Safety
- ASPCA Poison Control Hotline

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Minimizing Risk to Non-Targets and Wildlife

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Exposure Pathways

- Primary exposure
- Secondary exposure
- Tertiary exposure

The diagram illustrates the flow of exposure from a bait station (a small grey box) at the bottom. Arrows point upwards from the bait station to a mouse, then to several intermediate species (a squirrel, a chipmunk, a raccoon, and a bird), and finally to a fox at the top. This represents primary, secondary, and tertiary exposure pathways.

Image: Niamh Quinn

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Minimizing Risks to Wildlife

Monitor the rodent population to assess control effectiveness:

=> inconsistent or poor control increases the risk that nontarget species will consume exposed rodents

The image shows a bird of prey, likely a peregrine falcon, perched on a bare tree branch. It is holding a small rodent in its talons, demonstrating the risk of secondary exposure to wildlife.

© M. Shaw

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Rodent Population Ecology and Control Principles

- Rodents can reach high population densities
- Inadequate control with rodenticides leads to high numbers of exposed rodents
- Rodents are prey for wildlife

The image shows a lynx standing in a field of dry grass and low vegetation, looking directly at the camera. This illustrates the role of rodents as prey for wildlife.

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Questions?

The image is a close-up of a mouse drinking water from a small pool. The mouse's head is in the water, and its long whiskers are visible.

<https://responsiblerodenticides.org>

A square QR code is located in the top right corner of the slide.

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